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TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

BASIC AND ALL CHANGES HAVE BEEN MERGED TO MAKE THIS A COMPLETE PUBLICATION.

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DEPARTMENTS OF THE ARMY
AND THE AIR FORCE

WASHINGTON 25, D. C., *14 November 1958*

TELEPHONE TERMINAL AN/TCC-7 FIELD AND DEPOT MAINTENANCE

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* This manual, together with TM 11-2139-10, 11 March, 1958, and TM 11-2139-20, 1 April 1958, supersedes TM 11-2139, 1 November 1953, including C 1, 29 December 1953; C 2, 2 March 1954; C 3, 19 September 1955; C 4, 11 May 1956; and C 5, 25 November 1957.

CHAPTER 1
INTRODUCTION

1. Scope

a. This manual covers field and depot maintenance for Telephone Terminal AN/TCC–7. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, repairing and alining the equipment, replacing maintenance parts, and repairing specified maintenance parts. It also lists tools, materials, and test equipment for third, fourth, and fifth echelon maintenance. Detailed functions of the equipment are covered in chapter 2.

b. The complete technical instructions for this equipment include two other manuals.

TM 11–2139–10, Telephone Terminal AN/TCC–7, Operator's Manual

TM 11–2139–20, Telephone Terminal AN/TCC–7, Organizational Maintenance

c. The maintenance allocation chart is published in TM 11–2139–20. The repair parts and special tools list will be published separately.

d. 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 11–2139–10.

2. Internal Equipment Differences

The following chart lists the differences incorporated in the circuitry of components of Telephone Terminal AN/TCC–7. The component affected is listed in the *equipment* column. The nature of the equipment difference is summarized in the *differences* column. The serial numbers of the equipment, when applicable, are listed in the *serial No.* column. *The serial numbers listed apply to equipment procured on Order No. 14181–Phila–51 only.*

Item No.	Equipment	Differences	Serial No.
1	CHAN MODEM (figs. 2 and 139)	Shield connected to pin 6 instead of pin 5 on connectors P101, P201, P301, and P401.	1 through 2,056 and 2.058 through 2,107.
2	GROUP PANEL (figs. 7 and 144)	Top of panel not connected to chassis ground.	1 through 749.
3	Regulator and alarm unit Z6 (part of GROUP PANEL) (figs. 15 and 146).	Resistor R38 not included	Some units*.
4	JUNCTION PANEL (figs. 18, 148, and 149)	*a.* Shell of connectors P101 through P105 not connected to chassis ground.	Some units*.
		b. The wiring to the ground bus has been modified.	Some units*.
5	TEST PANEL (figs. 29 and 155)	*a.* Capacitor C22 .27uf, 100 volts instead of .47uf, 400 volts.	1 through 873.
		b. Shield is not grounded on lead connected between standoff E16 and jack J6 not included.	1 through 364.
		c. Leads C and E on connector J3 terminated on pins 3 and 4, respectively, of tube socket XV1.	1 through 419.
		d. Radio Frequency Cable RG–62/U instead of RG–58/U.	1 through 947.

Item No.	Equipment	Differences	Serial No.
6	If amplifier AR1 (part of TEST PANEL) (figs. 30 and 156).	Resistors R6 and R21 connected directly to capacitor C10.	Some units*.
7	Flat amplifier AR2 (part of Test PANEL) (figs. 31 and 15)	Resistors R6 and R21 connected directly to capacitor C10.	Some units*.
8	CARRIER SUPPLY PANEL (figs. 20 and 150)	Shell of connectors P1 through P3 not connected to chassis ground.	1 through 349.
9	200 VOLT POWER SUPPLY (figs. 33 and 158)	Shell of connector P3 not connected to chassis ground.	1 through 799.
10	Power Supply PP–826/U (original units, figs. 39 and 159)	*a.* Resistors R6, R7, R8, R13, R14, and R15 connected directly to components.	1 through 3, 5 through 815, 817 through 859, 861 through 875, 877 through 888, 890 through 909 through 920, 922 through 955, 957 through 960, 963, 965, 966, 968, 969, 971 through 975, 978, 984, 987 through 990, 993 through 995, 997 and 1,006.
		b. Shell of connector P3 not connected to chassis ground.	1 through 1,006.
11	Power Supply PP–826/U (revised units, figs. 40 and 161)	*a.* Resistor R6, R7, R8, R13, R14, and R15 relocated and connected through terminal board to components.	4, 816, 860, 876, 889, 908, 921, 956, 961, 962, 964, 967, 970, 976, 977, 979 through 983, 985, 986, 991, 992, 996, 998 through 1,005, and 1,007 through 1,169.
		b. Shell of connector P3 not connected to chassis ground.	1,007 through 1,074.
		c. Resistor R6, R7, R8, R13, R14, and R15 relocated and connected directly to components.	1,170 through 2.964.
12	Power Supply PP–826A/U (figs. 35 and 163)	*a.* Low-voltage rectifier and alarm Z1 is replaced by Low-voltage rectifier and alarm Z2.	
		b. Main chassis same as that of Power Supply PP–286/U (revised units, item No. 11*c* above). Also shell of connector P3 is connected to chassis ground.	
13	Low-voltage rectifier and alarm Z1 (part of PP–286/U, figs. 34, 160, and 162)	*a.* Resistor R23 replaced by a strap (figs. 39 and 40).	Some units*.
		b. Resistance value of relay *U7* winding 415 ohms instead of 425 ohms (fig. 39).	Some units*.
		c. Variations in relay circuitry (figs. 39 and 40).	Some units*.

CHAPTER 2
UNIT THEORY

Section I. TELEPHONE MODEM TA–219/U

3. Block Diagram Analysis

(fig. 1)

Telephone Modem TA–219/U (CHAN MODEM) consists of a main chassis and four channel plug-in assemblies, CHAN 1, CHAN 2, CHAN 3, and CHAN 4. Voice-frequency (vf) telephone or teletypewriter facilities may be connected to the four channels on a two-wire or four-wire basis. Each channel consists of a transmitting, a receiving, and a test circuit. Facilities are also provided for talking and monitoring from the ORDER WIRE PANEL.

Note. Throughout this section, reference is made to components in channel 1. Its operation is identical to that of the other three channels. The following reference designations have been assigned for identifying the components in each channel:

Channel No.	*Reference Designations*
1	101 through 199.
2	201 through 299.
3	301 through 399.
4	401 through 499.

a. Transmitting Circuit, Two-Wire Operation.

(1) 2W–4W switch S103 arranges the channel for two-wire or four-wire operation. In the 2W position, the switch connects transformer T101 into the circuit. SEND-MEAS switch S102 is used for testing and alinement purposes.

(2) The 8-decibel (db) modulator input pad reduces the vf signal to the proper level for modulation.

(3) Transformer T102 and low-pass filter FL101 prevent frequencies outside the specific vf band from being applied to the modulator circuit.

(4) The vf applied to modulator CR101 modulates the 8-kilocycle (kc) carrier signal applied from the CARRIER SUPPLY PANEL, producing two sidebands. The modem pad compensates for ambient temperature variations which may affect the level of the 8-kc carrier signal applied to modulator CR101 and demodulator CR102.

(5) The 7-db modulator output pad attenuates the sidebands and compensates for ambient temperature variations.

(6) Band-pass filter FL102 selects the lower sideband (4 to 8 kc) from the modulator for transmission to the SUBGROUP PANEL. In CHAN 2, 3, and 4, band-pass filters FL202, FL302, and FL402 select lower sideband frequencies of 8 to 12 kc, 12 to 16 kc, and 16 to 20 kc, respectively.

b. Receiving Circuit, Two-Wire Operation.

(1) The 8-db receive pad attenuates the 4- to 20-kc channel input frequencies from the SUBGROUP PANEL. This pad, with the channel 8-db demodulator input pad ((3) below), provides the proper signal level for demodulation.

(2) Band-pass filter FL103 selects the 4- to 8-kc band of frequencies from the 4- to 20-kc frequency group applied from the SUBGROUP PANEL.

(3) The 8-db demodulator input pad, with the 8-db receive pad ((1) above), provides the proper signal level for demodulation. The demodulator input pad also compensates for ambient temperature variations.

(4) The input signal applied to demodulator CR102 is demodulated by the 8-kc carrier frequency applied from the

CARRIER SUPPLY PANEL, producing two sidebands.

(5) Low-pass filter FL104 selects the lower sideband (vf) from demodulator CR102.

(6) The GAIN control, in conjunction with voice-frequency amplifier V101, provides for adjustment of the desired circuit net loss. The receiving path of the channel is completed through SEND-MEAS switch S102, transformer T101, and 2W–4W switch S103 to the vf equipment.

c. Transmitting and Receiving Circuits, Four-Wire Operation. When 2W–4W switch S103 is operated to the 4W position, transformer T101 is disconnected from the circuit; connecting the associated vf equipment directly into the channel transmitting and receiving branches. All other components of the channel function in the same manner as described in *a* and *b* above.

4. Schematic Analysis, Telephone TA–219/U Transmitting Circuit (fig. 2)

a. General. The carrier frequencies applied to the CHAN MODEM from the CARRIER SUPPLY PANEL are modulated by the signals from the vf equipment. The modulated signal from each of the four channels has a bandwidth of 4 kc, resulting in an overall frequency band from the CHAN MODEM of 4 to 20 kc. The four channels in the CHAN MODEM perform identical functions.

b. 2W–4W Switch S103.

(1) *4W position.* When the channel is arranged for four-wire operation, the transmitting circuit path from the vf equipment is from the 2W 4W–T binding posts, through the contacts of 2W–4W switch S103 and SEND-MEAS switch S102 to the 8-db modulator input pad.

(2) *2W position.* When the channel is arranged for two-wire operation, the circuit path is from 2W 4W–T binding posts E101 and E102, through contacts 1–2 and 15–16 of 2W–4W switch S103 to terminals 7–10 of transformer T101. The circuit is completed from terminals 1–6 of the transformer through contacts 6–7 and 3–4 of 2W–4W switch S103 and contacts 2–3 and 5–6 of SEND-MEAS S102 to the 8-db modulator input pad.

c. Transformer T101. Transformer T101 is connected in a hybrid arrangement. Resistor R101 and capacitors C103 and C104 comprise the hybrid balancing network. Capacitors C101 and C102 block direct current (dc) from transformer T101.

d. SEND-MEAS Switch S102.

(1) *SEND position.* In this position, 1,000 cycles per second (cps) is applied from the TEST PANEL to the input of the modulator input pad for lineup and test purposes.

(2) *MEAS position.* In this position, the received signal (1,000 cps) is applied to the TEST PANEL for measurement and adjustment of the channel net loss.

e. Transformer T102 and Low-Pass Filter FL101. The vf signals from the modulator input pad are applied across transformer T102 and its associated components to low-pass filter FL101.

(1) Transformer T102 and capacitors C105 and C106 comprise a high-pass filter network. The network suppresses any low-frequency (lf) inputs below 300 cps such as 20-cps ringing signals and 60-cps line frequencies.

(2) Low-pass filter FL101 suppresses high-frequency (hf) inputs above 3,500 cps such as carrier frequencies and sideband signals emitted from carrier systems of previous links and multilink connections.

f. Modulator Circuit. The modulator circuit consists of varistor CR101, resistors R110 through R113, and transformers T103 and T104. Vf signals are applied across T104 and modulate the 8-kc carrier frequency which is applied through the modem pad to the center tap of both transformers. The modem pad compensates for the effects of temperature variations on the load characteristics of the modulator and demodulator. Resistors R110

Figure 1. Telephone Modem TA–219/U, block diagram.

(Contained in separate envelope)

through R113 assure uniform performance of the varistors.

g. Modulator Output Pad. The output from the modulator is coupled from transformer T103 to the 7-db modulator output pad. The pad provides for adjustment of the overall loss in the channel transmitting circuit. The pad is also thermistor regulated to compensate for variations in other circuit components with changes in ambient temperature. Resistors R116 and R143 are strapped in or out to allow for slight adjustments in the loss offered by the pad.

h. Modulator Band-Pass Filter FL102. Band-pass filter FL102 selects the lower sideband from the modulator output. Band-pass filter FL102 (CHAN 1) selects the 4-kc to 8-kc sideband, band-pass filter FL202 (CHAN 2) selects the 8- to 12-kc sideband, band-pass filter FL302 (CHAN 3) selects the 12- to 16-kc sideband, and bandpass filter FL402 (CHAN 4) selects the 16- to 20-kc sideband.

i. Channel Output Circuit. The 4- to 8-kc sideband from band-pass filter FL102 is applied to the main chassis of Telephone Modem TA–219/U (fig. 3) through pins 19 and 16 of connectors P101 and J1. The channel sideband frequencies from each channel (*h* above) are connected in parallel in the CHAN MODEM and applied to the SUBGROUP PANEL through pins A and K on TRANS-TEST-TALK jack J5 (fig. 3).

5. Schematic Analysis, Telephone Modem TA–219/U Receiving Circuit
(fig. 2)

a. General. The three separate 4- to 20-kc input frequency bands are applied from the SUBGROUP PANEL to the three CHAN MODEMS. In each CHAN MODEM, four band-pass filters select the proper frequency band (in 4-kc bands) to be applied to each CHAN assembly. The signals selected by the channel band-pass filters are demodulated by different carrier frequencies and applied to vf equipment connected to the channel.

b. Receive Pad. The channel input frequencies from the SUBGROUP PANEL are applied from pins E and P of TRANS-TEST-TALK jack J5 (fig. 3) through the 8-db receive pad to pins 14 and 17 on jacks J1 and P101. The pad provides the correct impedance termination for the channel band-pass filters.

c. Demodulator Band-Pass Filter FL103. The input frequencies are then applied to the channel demodulator band filters (fig. 2). Band-pass filter FL103 (CHAN 1) selects the 4- to 8-kc sideband, band-pass FL203 (CHAN 2) selects the 8- to 12-kc sideband, band-pass filter FL303 (CHAN 3) selects the 12 to 16-kc sideband, and band-pass filter FL403 (CHAN 4) selects the 16- to 20-kc sideband.

d. Demodulator Input Pad. The output of band-pass filter FL103 is applied to the 8-db demodulator input pad. This pad, with the 8-db receive pad (*b* above), provides the proper input level to the demodulator. Thermistors RT105, RT109, RT110, and RT106 regulate the pad loss to compensate for variations in other circuit components with changes in ambient temperature.

e. Demodulator Circuit. The demodulator circuit consists of transformers T105 and T106, varistor CR102, resistors R122 through R125, and demodulator low-pass filter FL104. The 8-kc carrier frequency is applied through the modem pad to the center tap on both transformers. The demodulator output (upper and lower sidebands) is applied from transformer T105 to demodulator low-pass filter FL104 which selects the lower sideband (300 to 3,500 cps).

f. Gain Control Circuit. The signals are then applied to GAIN control R138. The control is part of an attenuator network composed of resistors R138, R140, and R141. GAIN control R138 is a signal level control used to adjust the circuit net loss during system lineup.

g. Voice-Frequency Amplifier V101. Voice-frequency amplifier V101 is arranged as an output amplifier for the demodulated signals. The output of the amplifier is applied to 4W–R, binding posts E103 and E104 through transformer T108 and the contacts of SEND-MEAS switch S102 and 2W–4W switch S103.

(1) *Input circuit.* Transformer T107 couples the signals to the control grid of amplifier V101. Resistor R130 is a terminating resistor for this transformer. Resistor R148 serves as a

Figure 2. Telephone Modem TA–219/U, schematic diagram of CHAN 1.

(Contained in separate envelope)

sing-suppression resistor. Resistor R135 provides a dc return path for the control grid.

(2) *Output circuit.* The amplified signals are developed across the 3–4 and 5–6 windings of transformer T108. Resistor R131 and capacitor C110 reduce the gain of frequencies above 3,500 cps. Resistor R132 is the screen dropping resistor and capacitor C108 serves as a screen bypass. Resistor R139 is the plate dropping resistor.

(3) *Feedback circuit.* Feedback voltage is obtained from winding 3–4 of transformer T108. An alternating-current (ac) voltage divider network, consisting of resistors R133 through R136 and capacitor C109, develops the feedback voltage. The amount of feedback voltage necessary for amplifier stability is applied between the control grid and the cathode of amplifier V101. The series-parallel combination of resistors R135 and R136 and capacitor C109 causes a decrease in the negative feedback voltage at 300 cps to obtain an increase in the net gain of the amplifier. Capacitor C107 blocks the dc cathode voltage (developed by cathode resistor R133) from the control grid. Capacitor C111 and resistor R137 prevent spurious oscillations in the amplifier circuit.

h. Channel Output Circuit.

(1) *Four-wire arrangement.* When the channel is arranged for four-wire operation (switch S103 operated to the 4W position), the output developed across terminals 1–2 of transformer T108 is applied through the contacts of SEND-MEAS switch S102 and switch S103 to the 4W–R binding posts.

(2) *Two-wire arrangement.* When the channel is arranged for two-wire operation (switch S103 operated to the 2W position), the output developed across terminals 1–2 of transformer T108 is applied through contacts 7–8 and 10–11 of SEND-MEAS switch S102 and contacts 10–11 and 13–14 of 2W 4W switch S103 to terminals 3–4 of transformer T101. The circuit is completed from terminals 7–10 of T101 through contacts 1–2 and 15–16 of 2W 4W switch S103 to the 2W 4W–T binding posts.

6. Channel Test and Talk-Monitor Circuits

(figs. 2 and 3)

a. SEND-MEAS Switch S102.

(1) *SEND position.* The 1-kc test signal from the TEST PANEL is applied from pins N and D on TRANS-TEST-TALK jack J5 (fig. 3), through pins 11 and 8 on jacks J1 and P101, to contacts 4 and 1 of switch S102 (fig. 2). When the switch is operated to the SEND position, the signal is applied to the modulator input pad through contacts 1–2 and 4–5.

(2) *MEAS position.* When switch S102 is operated to the MEAS position, the output developed across transformer T108 is applied to pins F and R of TRANS-TEST-TALK jack J5 (fig. 3), though contacts 8–9 and 11–12 of switch S102 and pins 18 and 15 of connectors P101 and J1. The signal path is completed to the TEST PANEL through the SUBGROUP and JUNCTION PANELS.

b. TALK-MON Switch S101.

(1) *TALK position.* Connections to the ORDER WIRE PANEL circuits are available at pins 9 and 12 (transmitting), and 10 and 7 (receiving) on connector P101. When switch S101 is operated to the TALK position, contacts 1 through 8 connect handset HS101 (located on ORDER WIRE PANEL) to the transmitting and receiving branches of CHAN 1 for communicating purposes.

(2) *MON position.* When switch S101 is operated to the MON position, the circuit is the same as (1) above except that contacts 9 through 16 of switch S101 make and volume limiting resistors R102 through R105 are connected into the circuit.

Figure 3. Telephone Modem TA–219/U, schematic diagram of main chassis.

(Contained in separate envelope)

Section II. TELEPHONE MODEM TA–227/U

7. Block Diagram Analysis
(fig. 4)

Telephone Modem TA–227/U (SUBGROUP PANEL) consists of subgroups 1, 2, and 3. Each subgroup has a transmitting and a receiving circuit. A single transmitting amplifier is common to the three subgroups. The 4- to 20-kc output frequency bands from each CHAN MODEM are applied to the transmitting circuit of each subgroup. The 60- to 108-kc output frequency band from the GROUP PANEL is applied to the subgroup receiving circuits.

Note. Throughout this section, reference is made to components in subgroup 1 in that the operation of this circuit is representative of subgroups 2 and 3.

a. Transmitting Circuit.

(1) The 4-db modulator input pad attenuates the CHAN MODEM output frequencies to the proper level for modulation. The input signal is applied through the contacts of SPECIAL SERVICE 1 switch S3 to modulator CR5.

(2) In modulator CR5, the input signals modulate the 56-kc carrier frequency applied from the CARRIER SUPPLY PANEL producing upper and lower sideband frequencies. The carrier frequencies for subgroups 2 and 3 are 72- and 88-kc, respectively.

(3) The modulator output pad is provided for adjusting the output level from the transmitting branch. Band-pass filter FL8 selects the upper sideband from modulator CR5.

(4) Transformer T16 combines the upper sideband outputs of the three subgroups to form the 60- to 108-kc SUBGROUP PANEL frequency band.

(5) Transmitting amplifier V7 amplifies the output of hybrid coil T16 and applies the signal across transformer T17 to the GROUP PANEL.

b. Receiving Circuit.

(1) The band from the GROUP PANEL is applied to the 15-db receive pad. This pad reduces the incoming signal level for application across transformer T18 to the receiving branches of each subgroup.

(2) Band-pass filter FL9 selects the 60- to 76-kc band of frequencies for demodulation in subgroup 1. The frequency bands applied to subgroups 2 and 3 are 76 to 92 kc and 92 to 108 kc, respectively.

(3) The input signal level to demodulator CR6 is set by the 6-db demodulator input pad. A carrier frequency of 56 kc from the CARRIER SUPPLY PANEL demodulates the signals, producing upper and lower sideband frequencies. Carrier frequencies of 72 and 88 kc are applied to subgroups 2 and 3, respectively.

(4) Low-pass filter FL3 selects the 4- to 20-kc lower sideband from the demodulator output.

(5) Demodulator amplifiers V6 and V5 amplify the output of the low-pass filter. SPECIAL SERVICE 1 switch S3 arranges for signal application to CHAN MODEM 1.

8. Schematic Analysis, Telephone Modem TA–227/U Transmitting Circuit
(fig. 5)

a. Modulator Input Pad and SPECIAL SERVICE 1 Switch S3. The 4- to 20-kc frequency band from CHAN MODEM 1 is applied from pins A and K on connector P3, through the 4-db modulator input pad to the contacts of SPECIAL SERVICE 1 switch S3. The pad attenuates the input signal to the proper level to prevent over modulation.

b. SPECIAL SERVICE 1 Switch S3.

(1) *CHAN MODEM position.* Continuity is established through the switch contacts 5–4 and 8–7 to the input of modulator CR5.

(2) *SPL SERV position.* Continuity is established from the special service 1 IN binding posts, through the 39-db pad and contacts 3–4 and 6–7 of switch S3, to the input of modulator

Figure 4. Telephone Modem TA–227/U, block diagram.

(Contained in separate envelope)

CR5. Contacts 1–2 of switch S3 close, lighting SPL SERV indicating lamp I 1.

c. Modulator Circuit. The modulator circuit consists of transformers T11 and T12 and varistor CR5. The 4- to 20-kc input signal modulates the 56-kc carrier frequency. (The input frequencies to subgroups 2 and 3 modulate carrier frequencies of 72 and 88 kc respectively.) The carrier frequency is supplied from the CARRIER SUPPLY PANEL across terminal 2 of transformer T1 and terminal 4 of transformer T12. The output from the modulator is applied through the modulator output pads to band-pass filter FL8.

d. Modulator Output Pads. Two pads are provided at the output of modulator CR5 for adjusting the output level of the transmitting circuit.

(1) The first pad, consisting of resistors R76 through R82, is adjustable by soldered straps in 1-db steps from 3.5 to 7.5 db.

(2) The second pad, consisting of resistors R83 through R85, attenates the signal 2 db. The pad finds its widest application in subgroup 1 which has less signal loss than either of the other subgroups.

e. Band-Pass Filter FL8. The upper sideband of 60 to 76 kc is selected by band-pass filter FL8. Band-pass filter FL6 (subgroup 2) selects the 76- to 92-kc sideband, and band-pass filter FL4 (subgroup 3) selects the 92- to 108-kc sideband.

f. Transformer T16. The output frequencies of subgroups 1, 2, and 3 are applied to the primary windings of transformer T16. The transformer is connected as a hybrid arrangement, permitting the frequency attenuation requirements of the band-pass filters to be less critical. The three subgroup output frequency bands combine to form a band of frequencies from 60 to 108 kc. Resistor R103 and capacitors C34 and C42 comprise the hybrid balancing network.

g. Transmitting Amplifier V7.

(1) Transformer T16 couples the input signals to the control grid through dc blocking capacitor C5 and sing-suppression resistor R127. Resistor R104 is an impedance matching resistor; resistor R107 provides a dc return path for the control grid. Bias for the tube is developed by cathode resistor R108 and bypass capacitor C36. Capacitor C37 bypasses the screen grid to the cathode. Operating voltage for the plate is applied through resistors R114 and R113 and the 5–6 winding of transformer T17. Screen grid voltage is applied through resistors R114 and R110. Capacitor C40 and resistor R114 provide decoupling for the 200-volt supply. The output circuit is connected to transformer T17.

(2) The gain of the amplifier is 13 ± 3 db. It is controlled by varying the amount of feedback voltage by the adjustment of TR AMP GAIN control R106. The feed-back voltage is obtained from the voltage divider network consisting of resistors R111 through R113, and applied to TR AMP GAIN control R106 and resistor R105 through dc blocking capacitor C39. A small amount of dc (determined primarily by resistor R109) through TR AMP GAIN control R106 minimizes its sliding contact resistance.

h. Transformer T17. The amplified subgroup output signals are applied across transformer T17 to terminals A and L, and K and W on connector J9. Resistor R115 is an impedance balancing resistor. Subgroup output frequencies are made available at the 60–108 KC OUT binding posts and the 60–108 KC OUT ALT binding posts.

9. Schematic Analysis, Telephone Modem TA–227/U Receiving Circuit

(fig. 5)

a. Subgroup Input Circuit. Subgroup input frequencies from the GROUP PANEL are applied from terminals H and R of connector J10, through the 15-db receive pad (R117, R119, and R120), to transformer T18. Alter-

Figure 5. Telephone Modem TA–227/U, schematic diagram.

(Contained in separate envelope)

nate input connections are provided at the 60–108 KC IN binding posts.

b. Transformer T18 and Band-Pass Filter FL9. The input signal is applied through transformer T18 to the subgroup band-pass filters. The transformer is connected to form a hybrid arrangement similar to transformer T16 (par. 8*f*). Capacitor C41 and resistor R118 comprise the hybrid balancing network. Band-pass FL9 selects the 60- to 76-kc band from the 60- to 108-kc subgroup input frequencies. Band-pass filters FL7 (subgroup 2) and FL5 (subgroup 3) select the 76- to 92-kc and 92- to 108-kc bands respectively from the subgroup input frequencies.

c. Demodulator Input Pad. The signals selected by band-pass filter FL9 are applied through 6-db demodulator input pad to demodulator CR6. This pad, with the 15-db receive pad (*a* above), attenuates the incoming signal to the proper level for demodulation.

d. Demodulator Circuit. The demodulator circuit is composed of varistor CR6 and transformers T15 and T14. The 60- to 76-kc input signal is coupled to the demodulator by transformer T15. The 56-kc carrier frequency is applied between terminal 2 of transformer T14 and terminal 4 of transformer T15. The signal is demodulated by the 56-kc carrier frequency, producing upper and lower sidebands. The 76- to 92-kc (subgroup 2) and 92- to 108-kc (subgroup 3) frequency bands are demodulated by carrier frequencies of 72- and 88-kc, respectively.

e. Low-Pass Filter FL3. Signals from demodulator CR6 are applied to low-pass filter FL3. The filter selects the lower sideband (4 to 20 kc) of the demodulated signal. Filters FL2 (subgroup 2) and FL1 (subgroup 3) also select 4- to 20-kc sidebands.

f. Demodulator Amplifier (1st Ampl V6). The 4- to 20-kc output from low-pass filter FL3 is applied to demodulator amplifier V6. The input signal is applied to the control grid of amplifier V6 through sing-suppression resistor R126. Resistor R99 provides the proper impedance termination for the filter and also is the dc grid return for the amplifier. Cathode bias is developed by resistor R96 and capacitor C33. Additional biasing is provided by resistors R97 and R98. The output circuit of the amplifier contains plate resistors R93 and R95 and capacitors C30 and C31. Screen grid voltage is applied through resistors R95 and R94. Capacitor C32 is the screen bypass to the cathode. Degenerative feedback is developed by unbypassed resistors R97 and R98. The amplifier output signals are applied to amplifier V5.

g. Demodulator Amplifier (2nd Ampl V5). The circuit arrangement of amplifier V5 is similar to amplifier V6. Resistor R92 is the dc grid return for the amplifier. Resistor R125 is a sing-suppression resistor. Capacitor C28 is part of the resistive-capacitive coupling network, the remainder of which is composed of the plate load and grid input resistors. Degenerative feedback is developed by unbypassed cathode resistor R91. Resistor R89 is the screen-dropping resistor and capacitor C29 bypasses the screen to the cathode. Plate voltage is applied through resistors R90 and R87, inductor L3, and winding 4–5 of transformer T13. Resistor R90 and capacitor C25 comprise the 200-volt supply decoupling network. The amplified output signal appears across output transformer T13. Negative feedback voltage is obtained from winding 3–4 of output transformer T13, resistor R86, and capacitor C24. This voltage is applied through resistor R88 and capacitor C27 to the cathode of amplifier V6. DEM 1 GAIN control R98 varies the gain of the demodulator amplifier circuit by controlling the amount of applied feedback.

h. SPECIAL SERVICE 1 Switch S3.

(1) *CHAN MODEM position.* Continuity is established from output demodulator amplifiers V5 and V6, through contacts 13–12 and 10–9 of switch S3 to pins E and P on connector P3.

(2) *SPL SERV position.* Continuity is established from the output of demodulator amplifiers V5 and V6, through contacts 10–11 and 13–14 of switch S3 to the special service 1 OUT binding posts. Contacts 1–2 of switch S3 close, lighting SPL SERV indicating lamp I 1.

Section III. GROUP PANEL (PART OF AMPLIFIER-PILOT REGULATOR AM–707/TCC–7)

10. Block Diagram Analysis
(fig. 6)

AMPLIFIER-PILOT REGULATOR AM–707/TCC–7 is composed of the GROUP PANEL and the JUNCTION PANEL (pars. 15 and 16). The GROUP PANEL has a transmitting and a receiving circuit. Input signals are applied to the transmitting circuit from the SUBGROUP PANEL, through the JUNCTION PANEL and to the receiving circuit from the JUNCTION PANEL. Facilities are also provided for automatically regulating the power of the received signals and for synchronizing the frequencies from the CARRIER SUPPLY PANEL.

a. Transmitting Circuit.

(1) The 60- to 108-kc output frequencies from the SUBGROUP PANEL are applied through the JUNCTION PANEL to the normal (REGULAR) position of 60–108 KC switch S1 to modem and amplifier AR4. Switch S1 (SPL SERV position) also provides for the connection of 60- to 108-kc external special service equipment to modem and amplifier AR4 through a 42-db impedance matching pad.

(2) In modem and amplifier AR4, the input signals modulate the 120-kc carrier frequency supplied from the CARRIER SUPPLY PANEL.

(3) The modulated signals are applied through the normal (REGULAR) position of 12–60 KC switch S2 to the 4-db modulator output pad. The pad attenuates the signal and improves the input impedance match to low-pass filter FL3. Switch S2 (SPL SERV position) also provides for the connection of 12- to 60-kc external special service equipment to the 4-db modulator output pad through a 48-db impedance matching pad.

(4) Low-pass filter FL3 selects the 12- to 60-kc lower sideband frequencies for application to transmitting amplifier AR3 which amplifies the signal before it is applied to cable building-out network Z1. This network is adjusted to simulate the transmission loss through 0 to 21 reels of cable. The network applies the group output frequencies to the JUNCTION PANEL.

b. Receiving Circuit.

(1) Signals are applied from the JUNCTION PANEL to the receiving branch of the GROUP PANEL. These signals are applied to cable building-out network Z5. This network, like Z1 (*a*(4) above), may be adjusted to simulate the transmission loss through 0 to 21 reels of cable. The output from cable building-out network Z5 is applied to a flat network.

(2) The flat network provides a flat loss to the received signal. The output of the flat network is applied to slope network Z4.

(3) This network provides adjustment to compensate for the slope variation of the line (par. 12*b*(3)). The output of slope network Z4 is applied to bulge network Z3.

(4) This network provides adjustment to compensate for the bulge variation of the line (par. 12*b*(4)). The output of bulge network Z3 is applied to delay equalizer EQ3.

(5) Delay equalizer EQ3 improves the delay distortion in the frequency band from 12 to 45 kc. It also corrects for the distortion of the high-pass sections of the high-pass, low-pass filters in the JUNCTION PANEL. The output of delay equalizer EQ3 is applied to basic equalizer EQ2.

(6) Basic equalizer EQ2 corrects for variations in attenuation for the 12- to 60-kc frequency band through 5¾ miles of spiral-four cable. The equalized signals are applied to receiver amplifier AR1.

(7) The amplified signals are applied through the deviation equalizer and regulator network Z2 to receiving amplifier AR2. The deviation equalizer compensates for deviations from

flat transmission of the transmitting and receiving circuits of the telephone terminal.

(8) Regulator network Z2 is controlled by the output of regulator and alarm Z6 ((10) below). Regulator network Z2 provides a relatively constant input level to receiving amplifier AR2.

(9) Receiving amplifier AR2 applies the output from regulator network Z2 to low-pass filter FL1. A portion of the amplified signal is also applied to regulator and alarm circuit Z6 and to 68-kc band-pass filter FL2.

(10) Regulator and alarm circuit Z6 corrects for changes in the loss characteristics of the spiral-four cable caused by temperature variations.

(11) The pilot frequency passed by 68-kc band-pass filter FL2 is applied to synchronizing amplifier V1. The output of the amplifier is applied to the CARRIER SUPPLY PANEL where it is available for synchronizing the carrier signals generated by the CARRIER SUPPLY PANEL.

(12) Low-pass filter FL1 selects only the 12- to 60-kc group input frequencies and rejects the 68-kc pilot and test frequencies.

(13) The output of low-pass filter FL1 is applied through the normal (REGULAR) position of 12–60 KC switch S2 to modem and amplifier AR4. Switch S2 (SPL SERV position) also provides for connecting the output of low-pass filter FL1 to 12- to 60-kc external special service equipment.

(14) The group input frequencies are demodulated and amplified in modem and amplifier AR4.

(15) The output of modem and amplifier AR4 is applied through the normal (REGULAR) position of 60–108 KC switch S1 to the SUBGROUP PANEL. Switch S1 (SPL SERV position) also provides for connecting the output of modem and amplifier AR4 to external 60- to 108-kc special service equipment.

11. Schematic Analysis, Group Panel Transmitting Circuit

a. General. The 60- to 108-kc transmitting subgroup output frequencies modulate the 120-kc carrier frequency applied to the transmitting circuit. The lower sideband of the modulated signal is amplified and applied to the JUNCTION PANEL.

b. Input Circuit.

(1) Subgroup output frequencies from the SUBGROUP PANEL are applied to the JUNCTION PANEL (fig. 18) through cable W104 to pins A and L on plug P104. The JUNCTION PANEL, the interconnecting unit for the telephone terminal, distributes these frequencies to pins A and L of plug P105. Cable W105 connects the JUNCTION PANEL output circuit to pins A and L of connector J1 on the GROUP PANEL (fig. 7).

(2) From connector J1, the subgroup output frequencies are applied through 60–108 KC special service switch S1 to pins 4 and 5 of connector J2, which is the input to modem and amplifier AR4.

c. Modem and Amplifier AR4 (fig. 8). The transmitting section of modem and amplifier AR4 consists of a lattice-type modulator circuit (varistor unit CR1 and transformers T3 and T4). The primary of transformers T3 is connected to terminals 4 and 5 of connector P1. The secondary of transformer T4 is connected to terminals 2 and 1 of connector P1. The 60- to 108-kc subgroup output frequencies are coupled to the modulator circuit by transformer T3 and modulate the 120-kc carrier frequency. The 120-kc carrier frequency from the CARRIER SUPPLY PANEL is connected to terminal 2 on each transformer. The resulting modulated signals are coupled to the output circuit by repeating coil T4.

d. 4-DB Attenuator Pad (fig. 7). Output signals from modem and amplifier AR4 are

Figure 6. Amplifier-Pilot Regulator AM–707/TCC–7, block diagram.

Figure 7. Amplifier-Pilot Regulator AM–707/TCC–7, schematic diagram.

Figure 8. Modem and amplifier AR4 (part of GROUP PANEL), schematic diagram.

(Contained in separate envelope)

applied through 12–60 KC special service switch S2 and the 4-db pad to low-pass filter FL3.

(1) The 4-db attenuator pad is composed of resistors R11 through R13. This pad improves the input impedance of low-pass filter FL3.

(2) The lower sideband (12- to 60-kc) of the attenuated modulator output is selected by low-pass filter FL3. These frequencies, the group output frequencies, are applied to transmitting amplifier AR3.

e. 12–68 Kc Amplifier AR3 (fig. 9). This amplifier is a two-stage negative feedback amplifier with a nominal gain of 52 db.

Note. Transmitting amplifier AR3 is one of three identical amplifiers assigned the common name of *12- to 68-kc amplifier.* Whenever receiving amplifiers AR1 and AR2 are discussed, reference will be made to this paragraph; however, the differences in each amplifier circuit resulting from external connections will be covered where the amplifiers appear in the circuit.

(1) *Input circuit.* Group output frequencies passed by low-pass filter FL3, are applied to terminals 0 and 1 on connector P1 in transmitting amplifier AR3. These terminals connect to windings 3–4 of hybrid transformer T1. This 600-ohm winding provides the correct impedance termination for low-pass filter FL3. The 68-kc pilot frequency and the 12- and 28-kc test frequencies (supplied by the CARRIER SUPPLY PANEL) and the 65-kc and fault test frequencies (supplied by the TEST PANEL) are applied to winding 1–2 of the hybrid transformer, from pins K and W of TO JUNCTION PANEL connector J1 (fig. 7) through a pad consisting of resistors R46 through R48, to pins 1 and 2 of connectors J4 and P1.

(2) *Amplifier V1.* Amplifier V1 is designed with negative feedback in the input circuit. Input signals are applied through winding 6–5 of hybrid transformer T1 to the control grid of the amplifier through sing-suppression resistor R7. Resistor R5 and capacitor C4 provide the proper impedance termination for the input transformer. Resistors R1 through R3 form a voltage divider network to provide dc voltage for the grid circuit. Resistor R6 and capacitor C5 develop cathode bias for the tube. To overcome the excessively large dc cathode voltage developed by resistor R6, +15 volts dc is applied to the control grid. Capacitor C6 and resistor R8 provide a singing margin at low frequencies. Resistor R1 and capacitor C1 comprise the decoupling network and part of the plate voltage divider network. Resistor R9 is the plate and screen grid voltage-dropping resistor. Capacitor C2 decouples the voltage developed by resistors R2 and R3. The amplified output is applied to interstage network Z1 which assures the proper gain and phase of the signal throughout the 12- to 68-kc range.

(3) *Amplifier V2.* Input signals to amplifier V2 are applied from interstage network Z1 through resistor R10. This resistor prevents spurious oscillations at high frequencies. Positive voltage is furnished to the control grid as described in (2) above. A resistor in the interstage network provides a dc return path for the grid. Cathode bias is developed by resistor R11 and capacitor C10. Resistor R12 and capacitor C8 are the screen-dropping resistor and screen bypass capacitor respectively. Resistor R15 and capacitor C9 provide a singing margin at high frequencies. The amplified output signal is applied to winding 5–6 of transformer T2.

(4) *Feedback circuit.*

(*a*) Feedback voltage is obtained from the 1–2 winding of output transformer T2. This voltage is applied to a voltage divider network (resistors R13 and R14) and phase-shifting capacitor C11. An external network (fig. 7), composed of resistors R15 and R16 and capacitor C6, shunts resistor R13 through terminals 6 and 7 on connector P1. This network establishes a feedback voltage of approximately 30 db.

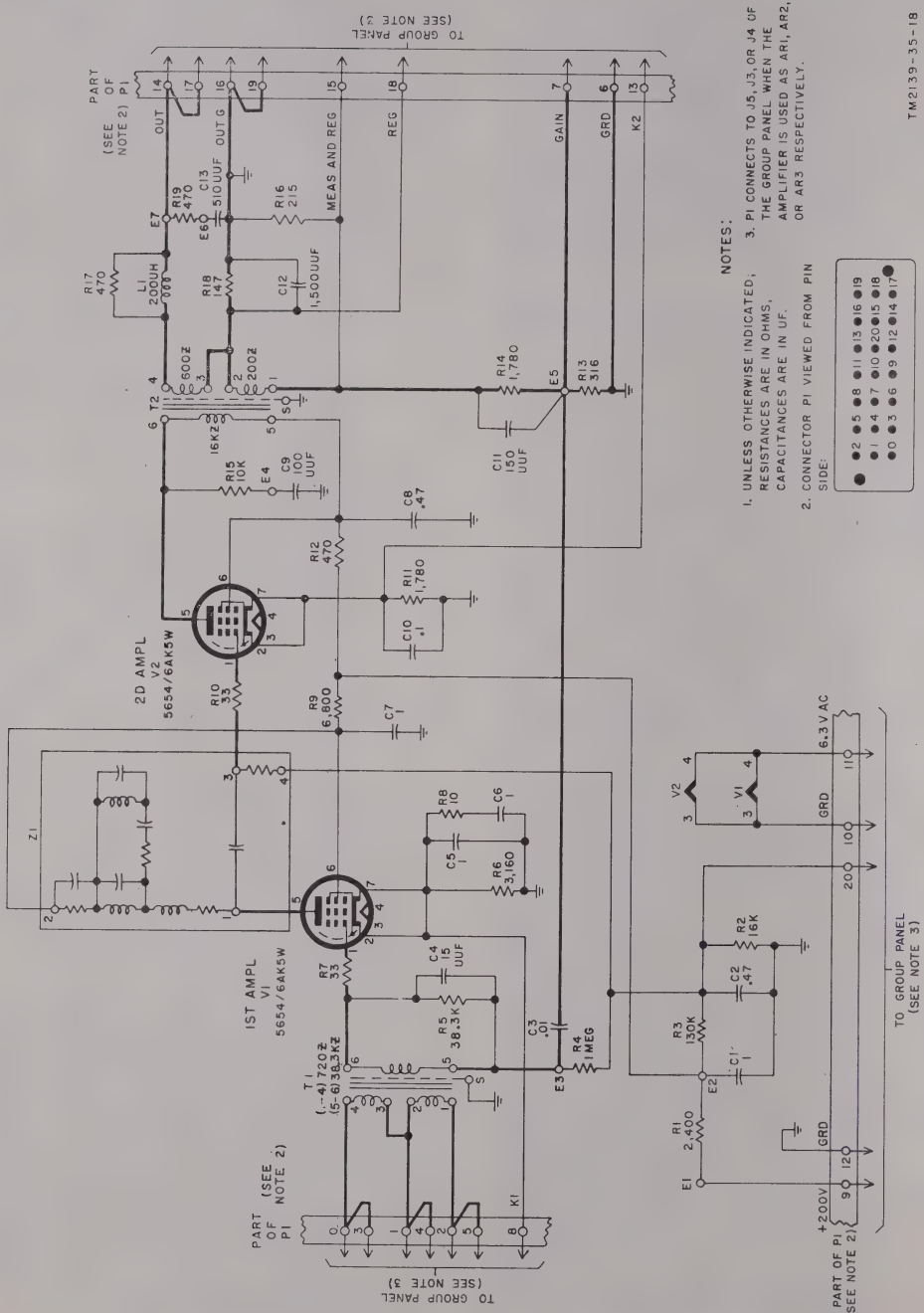


Figure 9. 12-68 KC Amplifier AR1, AR2, or AR3 (parts of GROUP PANEL), schematic diagram.

(*b*) The feedback voltage developed across resistor R13 (fig. 9) is applied to the control grid of amplifier V1 through dc blocking capacitor C3. Resistor R4 develops the feedback voltage in the grid circuit.

(5) *Output circuit.* The 3–4 winding of output transformer T2 is connected to a special terminating network composed of resistors R17 and R19, capacitor C13, and inductor L1. This network prevents spurious oscillations in the amplifier circuit. Resistor R18 and capacitor C12 comprise the balancing network for transformer T2. The amplifier output is applied to pins 14 and 16 of connector P1. TR AMP OUT jack J2 (fig. 7) is connected through an attenuator pad composed of resistors R17 and R18 to the feedback network in the amplifier circuit. TR 62 KC jack J13 and resistor R19 are bridged across the output of transmitting amplifier AR3.

f. Cable Building-Out Network Z1 (fig. 7). The output of transmitting amplifier AR3 is ap-

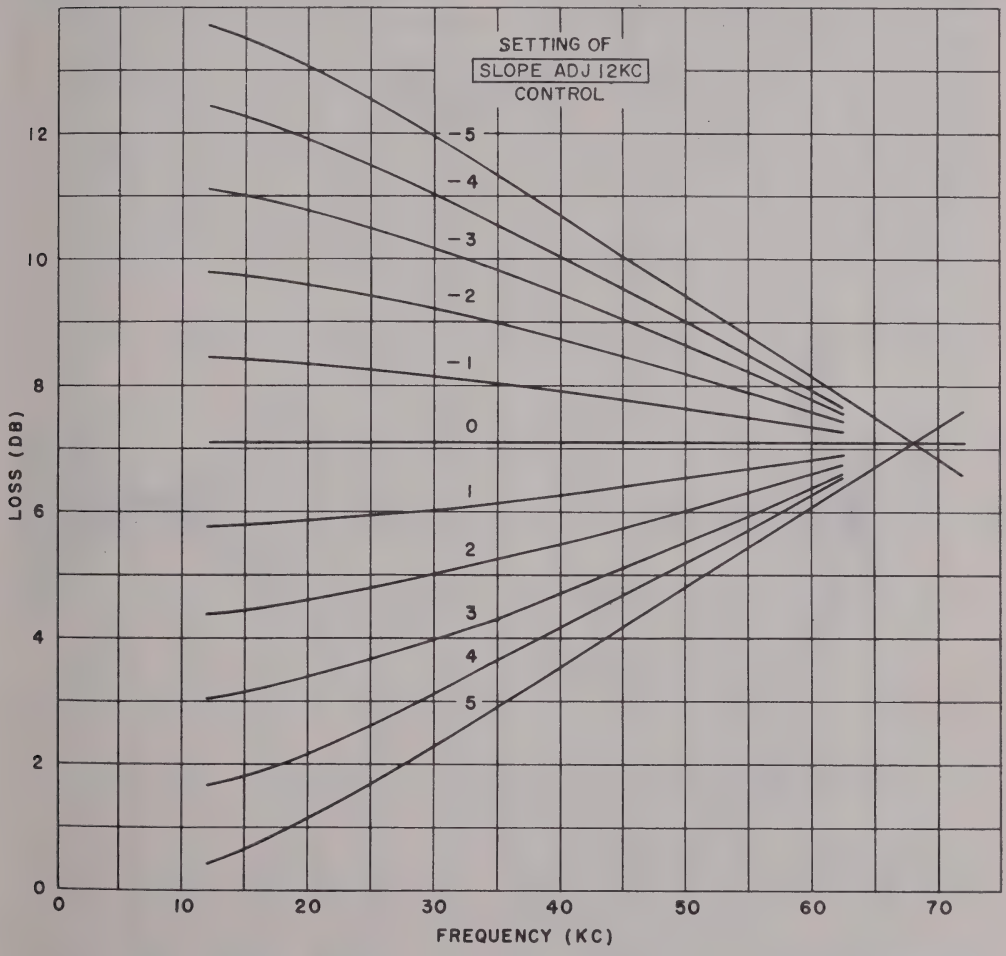


Figure 10. GROUP PANEL, slope network Z4, attenuation characteristics.

plied to cable building-out network Z1 through pins 14 and 16 on connector J4. This network is adjusted by TR CABLE REELS TO FIRST AN/TCC–11 control S6 to simulate transmission loss through 0 to 21 reels of cable in steps of 3 reels. Cable building-out network Z1 connects to pins F and S on GROUP PANEL connector J1.

12. Schematic Analysis, Receiving Circuit (fig. 7).

a. General. The 12- to 60-kc group input frequencies are demodulated in the receiving circuit with a 120-kc carrier signal supplied by the CARRIER SUPPLY PANEL. The lower sideband of the demodulated signal is selected by a band filter for application to the SUB-GROUP PANEL. A regulator circuit, controlled by the pilot frequency, regulates the power of the signals in the receiving circuit.

b. Equalizers. The signals from the JUNCTION PANEL are applied through a series of equalizer networks to receiving amplifier AR1. These networks and their specific functions are listed below in the order of their action.

(1) *Cable building-out network Z5.* Cable building-out network Z5 is varied by

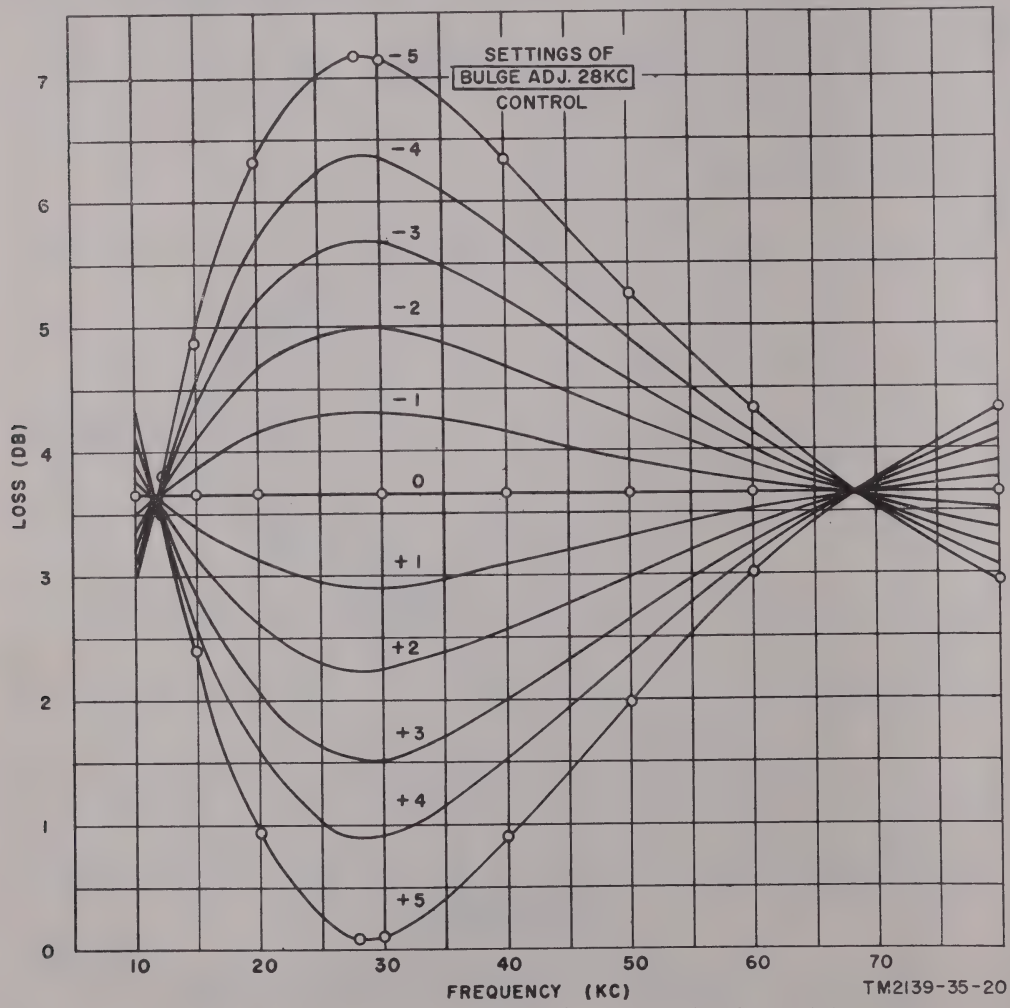


Figure 11. GROUP PANEL, bulge network Z3, attenuation characteristics.

means of REC CABLE REELS TO FIRST AN/TCC–11 controls S5 to simulate the transmission loss through 0 to 21 reels of cable in steps of 3 cable reels. The network is used to build out the cable section to the first Telephone Repeater AN/TCC–11 to a total of 23 reels.

(2) *Flat network.* The flat network is arranged as a bridged-T pad. The FLAT ADJ 68 KC control is a double variable resistor, adjustable to provide a flat loss to the received signals.

(3) *Slope network Z4.* Slope network Z4 compensates for the slope variation (68-kc loss minus 12-kc loss) of the line. Figure 10 shows attenuation characteristics of slope network Z4 for various settings of the SLOPE ADJ 12 KC control.

(4) *Bulge network Z3.* Bulge network Z3 compensates for the bulge variation (68-kc loss minus 28-kc loss after the slope has been reduced to 0 db) of the line. Figure 11 shows the attenuation characteristics of bulge network Z3 for the various settings of the BULGE ADJ 28 KC control.

(5) *Delay equalizer EQ3.* Delay equalizer EQ3 improves the delay distortion in the frequency band from 15 to 45 kc in the 12- to 60-kc special service circuit (fig. 7). The delay equalizer corrects for the delay distortion of the high-pass sections of high-pass, low-pass filter FL102 in the JUNCTION PANEL (fig. 17).

(6) *Basic equalizer EQ2.* Basic equalizer EQ2 corrects for variations in attenuation through 5¾ miles of spiral-four cable. Figure 12 shows the frequency attenuation characteristic of the spiral-four cable end of basic equalizer EQ2. The two curves are complementary and add up to uniform attenuation at all frequencies. When the temperature is other than a mean temperature of 45° F., the cable attenuation characteristic and basic equalizer EQ2 no longer correct the

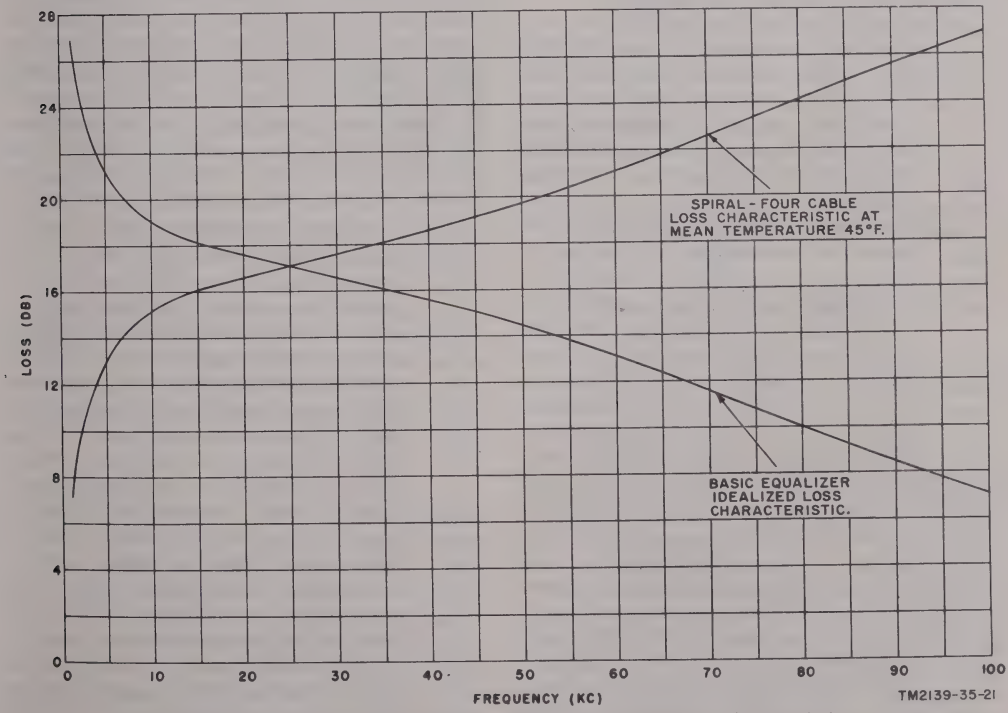


Figure 12. Spiral-four cable and equalizer EQ2, attenuation characteristics.

signal adequately. Correction at other temperatures is applied in the regulator circuit (par. 14).

c. Amplifier AR1 (fig. 9). Receiving amplifier AR1 is identical with transmitting amplifier AR3 (par. 11*e*). The impedance across terminals 1 and 4 of the input transformer is 720 ohms, which is the proper terminating impedance for basic equalizer EQ2. This series connection is made when receiving amplifier AR1 is plugged into connector J5. The input signals are applied to pins 0 and 5 on connector J5. Negative feedback of approximately 40 db is provided because no external network shunts feedback resistor R13. The nominal gain of receiver amplifier AR1 is 42 db. The output impedance is 600 ohms. REC AMP 1 OUT jack J14 and a pad composed of resistors R29 and R30 (fig. 7) are bridged across the 1–2 winding of receiving amplifier AR1 output transformer T2.

d. Deviation Equalizer and Regulator Networks (fig. 7). The output of receiving amplifier AR1 is applied through a deviation equalizer network to regulator network Z2.

(1) *Deviation equalizer.* The deviation equalizer is composed of resistors R45, and R49 through R51, and capacitor C14. The deviation equalizer network compensates for deviation from flat transmission of the transmitting and receiving circuits of Telephone Terminal AN/TCC–7.

(2) *Regulator network Z2.* Signals from the deviation equalizer are coupled to regulator network Z2 by transformer T3. Resistor R27 provides the correct impedance termination for the transformer. This network is controlled by thermistor RT1, which in turn is controlled by the regulator and alarm circuit Z6 (par. 14).

e. Receiving Amplifier AR2 (fig. 9). Receiving amplifier AR2 is identical with transmitting amplifier AR3 (par. 11*e*), except for external connections resulting in slight differences in the gain and feedback circuits. In addition to applying the output signal to filter FL1, amplifier AR2 also supplies the input signal to regulator and alarm circuit Z6 (par. 14) and synchronizing amplifier V1 (*f* below).

(1) The regulated input signal is applied between terminals 1 and 2 on connector P1. Externally connected resistor R26 and capacitor C12 (fig. 7) are connected to the cathode of amplifier V2 through pins 13 and 19 on connector J3 to improve the singing margin at low frequencies in amplifier V2.

(2) Negative feedback of approximately 30 db controls the gain of receiving amplifier AR2 when signals are applied to input transformer T1. The nominal gain of receiving amplifier AR2 is 50 db.

(3) The output impedance of the amplifier is 600 ohms. REC 62 KC jack J10 and protective resistor R20 are bridged across the output of the amplifier. REC AMP 2 OUT jack J11 and an attenuator composed of resistors R22 and R23 are bridged across the 1–2 winding of output transformer T2.

f. Carrier Synchronizing Circuit (fig. 7). The CARRIER SUPPLY PANEL may be synchronized to the frequency of the other terminal used in the carrier telephone system by operating the CARR SYNC switch on the CARRIER SUPPLY PANEL (fig. 20) to the REMOTE position. When the switch is operated, the 68-kc pilot signal, which is received from the spiral-four cable, is passed through the GROUP PANEL and JUNCTION PANEL to the CARRIER SUPPLY PANEL (par. 23*a*).

(1) *Synchronizing signal path.* A 68-kc pilot frequency and the group input frequencies (12 kc to 60 kc) are received from spiral-four cable connector J103 in the JUNCTION PANEL and passed through the GROUP PANEL receiving circuits. The 68-kc pilot signal is selected from the output of receiving amplifier AR2 by 68-kc band-pass filter FL2. Filter FL2 is bridged on the transmission path through resistor R21, which provides the proper impedance for the filter input. Resistor R42 provides a termination for the filter. The 68-kc pilot signal is amplified by tube V1 and applied through repeating coil T4 to terminals F and P on connector P2. These terminals connect through cable W2 to the JUNCTION PANEL.

Cable W103 conducts the 68-kc pilot signal from the JUNCTION PANEL to the SUPPLY PANEL where it is available for synchronizing the carrier signals generated in the CARRIER SUPPLY PANEL.

(2) *Synchronizing amplifier V1.* Resistor R41 provides cathode bias and degenerative feedback. The screen grid is connected to the cathode circuit through capacitor C13. Resistor R40 is the screen-dropping resistor. Repeating coil T4 is the output transformer of the amplifier. Plate voltage is applied through resistor R39 and bypass by capacitor C11.

g. Low-Pass Filter FL1 (fig. 7). The signals applied to low-pass filter FL1 include the 12- to 60-kc group input, 68-kc pilot, and 12- and 28-kc test frequencies. Low-pass filter FL1 rejects the pilot and test frequencies and selects the 12- to 60-kc group input frequencies. The output signals of filter FL1 are applied through contacts 10–9 and 13–12 of special service switch S2 to modem and amplifier AR4.

h. Modem and Amplifier AR4 (fig. 7). The 12- to 60-kc group input frequencies from low-pass filter FL1 are demodulated and amplified in modem and amplifier AR4. The output frequencies of the modem and amplifier become the 60- to 108-kc subgroup input frequencies.

(1) *Demodulator input pad* (fig. 8). The group input frequencies are applied through the 34-db demodulator input pad which attenuates the signal to the proper level for demodulation.

(2) *Demodulator circuit.* The attenuated group frequencies are applied to transformer T6 which couples the signals to lattice-type demodulator CR2. The resulting demodulated signals are the 60- to 108-kc subgroup input frequencies.

(3) *Demodulator output pad.* Transformer T5 couples the demodulated signals to the attenuator pad. The attenuator pad, composed of resistors R13 and R14, improves the impedance termination of filter FL1 and attenuates the demodulated signals 3.5 db.

(4) *Low-pass Filter FL1.* The 108-kc low-pass filter FL1 allows only subgroup input frequencies between 60 to 108 kc to pass to first amplifier V1 in modem and amplifier AR4. Capacitor C10 and inductor L1 provide correction for the loss-frequency characteristic introduced by transformer T2. The transformer couples subgroup input frequencies 60 to 108 kc to first amplifier V2.

(5) *First amplifier V2.* The input to first amplifier V2 is applied through sing-suppression resistor R19. Resistor R12 provides proper impedance termination for input transformer T2. Bias is obtained by resistors R10 and R11, and DEM GAIN control R7 (fig. 7). The DEM GAIN control is used to adjust the gain of the amplifier. Cathode bias resistor R10 (fig. 8) is bypassed by capacitor C7. Cathode bias resistors R11 and R7 are not bypassed and therefore introduce a small amount of degenerative feedback. Screen grid voltage is supplied through resistor R9. A small amount of negative feedback is introduced by returning screen bypass capacitor C6 directly to the cathode of tube V2. Negative feedback also is applied through capacitor C4 to cathode resistor R11 from the output of second amplifier V1. Plate voltage is supplied through resistor R8, bypassed by capacitor C5 and the 1–2 winding of interstage network Z1. The output of first amplifier V2 is applied through interstage network Z1 to second amplifier V1.

(6) *Second amplifier V1.* Interstage network Z1 couples the signals to the control grid through sing-suppressing resistor R18. Cathode bias is provided by resistor R6, bypassed by capacitor C3. Screen grid voltage is supplied through resistor R5, bypassed by capacitor C2. Resistors R2 through R4 form a voltage divider which determines the feedback voltage applied to first amplifier V2 through capacitor C4. Plate voltage is applied through resistors R7 and R4 and winding 5–6 of transformer T1. Capacitor C1 is the decoupling

capacitor. Capacitors C9 and C8 are feedback phase-shifting capacitors. The output of second amplifier V1 is applied to output transformer T1.

(7) *Output transformer T1.* Transformer T1 is connected in a hybrid arrangement. Resistor R1 is the balancing resistor for the circuit. The 60- to 108-kc output from second amplifier V1 is applied to pins H and R of connector P1 through pins 14 and 17 of connectors P1 and J2 and the contacts of 60–108 KC switch S1 (fig. 7). An alternate output is applied to the DEM OUT ALT binding posts through pins 15 and 18 of connectors P1 and J2. Resistor R1 is an impedance terminating resistor.

i. Special Service Switch S1, 60–108 KC (fig. 7).

(1) *REGULAR position.* Establishes continuity from the output of modem and amplifier AR4 to pins H and R of connector P1.

(2) *SPL SERV position.* When operated to this position, continuity is established from the output of modem and amplifier AR4, through contacts 10 and 11 and 13 and 14 of switch S1 to the SPL SERV 60–108 KC binding posts.

13. Block Diagram Analysis, Regulator and Alarm Circuit Z6 (fig. 13)

Regulator and alarm circuit Z6 regulates the group receiving gain of the GROUP PANEL according to the strength of the received 68-kc signal. The strength of the pilot frequency varies inversely as the loss (which varies directly as the temperature) of the spiral-four cable. Regulation of the output of receiving amplifier AR2 is held to ±1 db. When the output signal variation exceeds ±1 db, an alarm indicates the abnormal condition.

a. Input Circuit. The input circuit consists of band-pass filter FL1 and first amplifier V1.

(1) *Band-pass filter FL1.* The 68-kc pilot frequency is applied from receiving amplifier AR2 to band-pass filter FL1 which selects only the 68-kc pilot frequency from the received group input frequencies and applies it to regulator amplifier V1.

(2) *Amplifier V1.* From amplifier V1, the amplified signal is applied to voltage doubler rectifier V2 of the regulator section and alarm amplifier V4A of the alarm section.

b. Regulator Circuit. The output of rectifier V2 controls the operation of thermistor current supply tube V3. Tube V3 operates in conjunction with regulator network Z2 and thermistor RT1 (fig. 6) to control the gain of receiving amplifier AR2.

c. Alarm Circuits.

(1) *Alarm amplifier V4A.* If regulator network Z2 and thermistor RT1 fail to restore the normal signal outputs, an alarm sounds to indicate the condition. Heavily biased amplifier V4A permits only a small portion of its input signal to appear at the output circuit to operate the alarm circuits. The output of amplifier V4A is applied to alarm rectifier V4B.

(2) *Alarm rectifier V4B.* Tube V4B rectifies the 68-kc pilot frequency and develops negative and positive voltages at its plate and cathode circuits to be further applied to the high and low alarm circuits.

(3) *High alarm.* The negative voltage from the alarm rectifier is applied to high alarm dc amplifier V5A. Only a prolonged variation due to spiral-4 cable temperature changes in the 68-kc pilot frequency will be amplified and operate the high alarm circuit (par. 14*f*). Normally, tube V5A conducts sufficient current to keep relay K1 energized; however, should the pilot frequency to the input circuit exceed 1 db, the plate current of amplifier V5A would decrease sufficiently to deenergize the relay. When relay K1 deenergizes, HIGH ALARM lamp I 3 and buzzer I 1 (fig. 6) actuate to indicate the abnormal condition.

(4) *Low alarm.* The positive voltage from the alarm rectifier is applied to low alarm dc amplifier V5B. Only a prolonged variation in the 68-kc

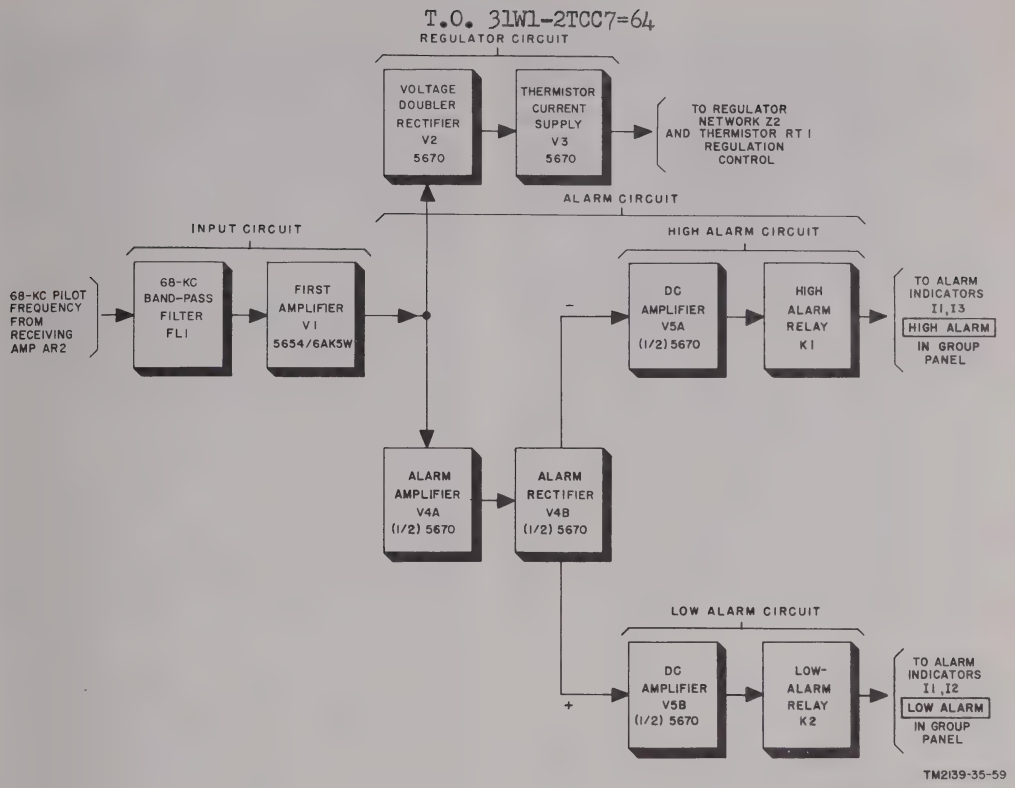


Figure 13. Regulator and Alarm Unit Z6, block diagram.

pilot frequency due to spiral-four cable temperature changes will be amplified and operate the low alarm circuit (par. 14*f*). Normally, tube V5B conducts sufficient current to keep low alarm relay K2 energized; however, should the pilot frequency applied to the input of the regulator and alarm circuit decrease below —1 db, the plate current of amplifier V5B would decrease sufficiently to deenergize the relay. When relay K2 deenergizes, LOW ALARM lamp I 2 lights and buzzer I 1 (fig. 6) sounds to indicate the abnormal condition.

14. Schematic Analysis, Regulator and Alarm Unit Z6

a. General.

(1) The regulator circuit (regulator and alarm Z6, on the GROUP PANEL) compensates for changes in the loss characteristics of the spiral-four cable at temperatures other than the mean temperature, 45° F. Basic equalizer EQ2 (par. 12*b*(6)) compensates for the cable loss characteristics at the mean temperature. Changes in the output of the 68-kc pilot frequency that accompanies the 12- to 60-kc signal frequencies along the spiral-four cable are used as a measure of the changes in the output of the signal frequencies. Variations in the output of the 68-kc pilot frequency control the regulator circuit which, in turn, controls the output of the signal frequencies passing through the receiving circuit. Figure 14 is a graph of the input to the regulator circuit versus the output of the circuit. The curve is essentially a straight line, because

the regulator circuit responds linearly to its input. The regulator circuit can maintain a ±.7-db flat gain error with ±5-db changes in the signal input. The ±5-db changes in the signal input can include changes in the signal input resulting from the most extreme combinations of ±20° F. ambient temperature change and ±30° F. spiral-four cable temperature change. The control is made by regulator network Z2 and thermistor RT1 shown on the block diagram in figure 6.

(2) If the 68-kc pilot signal received from the spiral-four line exceeds or falls below its normal output, the regulator circuit will operate to restore the normal output of the signals. If the range of the regulator circuit is not sufficient to restore the 68-kc pilot to within 1 db of its normal output, an alarm will sound.

b. Band-Pass Filter FL1 and First Amplifier V1. The input to regulator and alarm circuit Z6 is applied from receiver amplifier AR2 (12–68 KC AMPLIFIER) through the pad composed of resistors R22 through R24, and R31 in the GROUP PANEL (fig. 7). The signal is applied to terminals 0 and 3 of connector P1 on REGULATOR AND ALARM Z6 (fig. 15). From connector P1, the signal is applied through resistor R1, which is a part of the pad, to input transformer T1. Input transformer T1 steps up the input voltage and applies it to band-pass filter FL1. Filter FL1 Passes only 68 kc to the grid of regulator amplifier V1 through sing-suppression resistor R3. The 68-kc pilot signal voltage is applied to the grid of regulator amplifier V1. Resistor R2 is the grid leak and a terminating resistor for filter FL1. Some degenerative feedback is obtained through resistor-capacitor combination R5 and C2. A control grid voltage of 20 volts dc is developed by the voltage divider net-

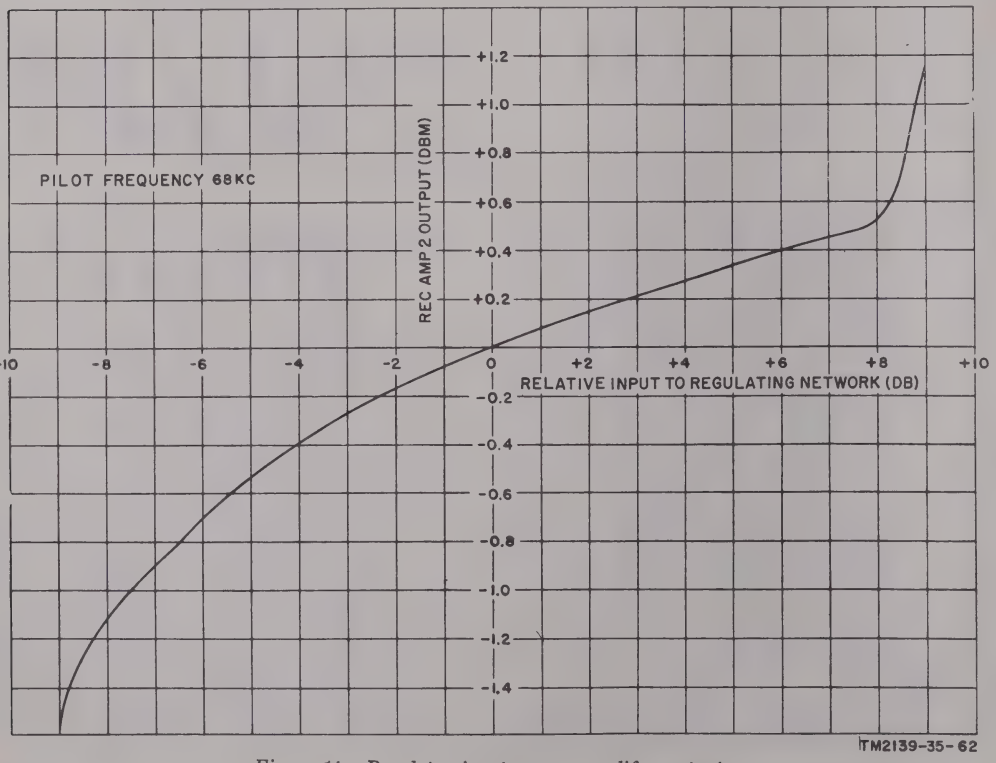


Figure 14. Regulator input versus amplifier output.

work composed of resistors R32 and R33. Capacitor C14 provides decoupling action of this voltage. This voltage partially cancels the high cathode voltage developed by cathode resistor R6. The plate voltage for tube V1 is fed through inductor L1. The screen and plate voltages are limited by resistor R7 and bypassed by capacitor C1. The output of the regulator amplifier is developed across resistor R4 and inductor L1.

c. Voltage Double Rectifier V2 (fig. 15). The 68-kc pilot frequency voltage is applied to the grid and plate of one-half of voltage double rectifier V2 through capacitor C3. The frequency voltage applied to the voltage doubler rectifier is rectified and doubled by the circuit arrangement. A negative dc voltage approximately equal to twice the peak signal voltage from tube V1 is developed across resistor R8 and capacitor C5. This negative voltage is opposed by an adjustable positive voltage applied to terminal 14 of connector P1 from AUTO REG OUTPUT potentiometer R44 (fig. 7) and resistor R43. The positive voltage is bypassed by capacitor C4. The combination of the negative output voltage and the adjustable positive opposing voltage produces an adjustable voltage on the paralleled grids of tube V3. Capacitor C6 and resistor R9 filter out rapid variations in the voltage applied to the grids of tube V3.

d. Thermistor Current Supply V3 (fig. 15). The rectified and doubled 68-kc pilot frequency is applied to the grids of dc amplifier V3 through resistors R10 and R11 which prevent spurious oscillations of the dc amplifier. The bias on tube V3 is adjusted by means of the adjustable positive opposing voltage, so that when the 68-kc frequency is at its normal voltage, approximately 6 ma of current flows from the paralleled plates of V3 through the parallel combination of current-limiting resistors R12 and R34 to pin 19 of connector P1. This current flows by way of an external connection (fig. 7) through transformer T3, regulator network Z2, thermistor RT1 in the GROUP PANEL (fig. 9), and then through input transformer T1 in amplifier AR2 and resistor R25 in the GROUP PANEL, to the 200-volt supply. Resistor R25 protects input transformer T1 in amplifier AR2 against excessive currents. Capacitor C4 acts as a filter. A check can be made at REG VOLTS jack J1 and J2 (fig. 15) to determine if the proper amount of current is flowing. Resistor R13 is the cathode bias resistor. Capacitor C7 provides filtering of the thermistor current. Regulator network Z2 (fig. 7) is in series with the received signal path in the GROUP PANEL. Changes in the loss of regulator network Z2 control the output of the received signals (par. 12*d*(2)). The loss of regulator network Z2 is controlled by the resistance of thermistor RT1. Thermistor RT1 is in series with tube V3 (fig. 15), and when the plate current changes in tube V3 the thermistor current changes. When the current flowing through the thermistor changes, the resistance of the thermistor changes. Figure 16 shows the loss of regulator network Z2 plotted against the frequency for different values of thermistor resistance.

(1) *Increase in pilot frequency level.* When the temperature of the spiral-four cable decreases, the loss of the cable decreases, increasing the output level of the 68-kc pilot frequency. As the output level of the 68-kc pilot frequency increases above its normal value, the negative voltage on the paralleled grids of tube V3 increases. When the grid voltage on tube V3 becomes more negative, the plate current decreases. This decreases the current through thermistor RT1. The resistance of the thermistor then increases. An increase in thermistor resistance increases the loss of the regulator network. Since the regulator network is in series with the received signal path in the GROUP PANEL (par. 12*d*(2)), the signal outputs are reduced to their normal values.

(2) *Decrease in pilot frequency level.* When the temperature of the spiral-four cable increases, the loss of the

Figure 15. Regulator and alarm unit Z6, schematic diagram.

(Contained in separate envelope)

cable increases and the output level of the 68-kc pilot frequency decreases. As the output of the 68-kc pilot frequency decreases below its normal value, the negative voltage on the paralled grids of tube V3 becomes less negative. As the current through tube V3 increases, the resistance of the thermistor in series with tube V3 tends to decrease; the loss of the regulator network decreases and the received signal levels increase to their normal values.

e. Alarm Amplifier V4A (fig. 15). The 68-kc pilot frequency is passed by capacitor C8 to the grid of alarm amplifier tube V4A. The cathode of tube V4A is positively biased (approximately 30 volts) by the voltage-divider circuit composed of resistors R17 through R19. ADJ HIGH resistor R18 determines the value of 68-kc input at which the alarm circuit will just indicate a high alarm. Since tube V4A is heavily biased, only a small portion of the input is permitted to produce an output voltage at the plate. A small amount of denegeration is provided by resistor R21 and capacitor C10.

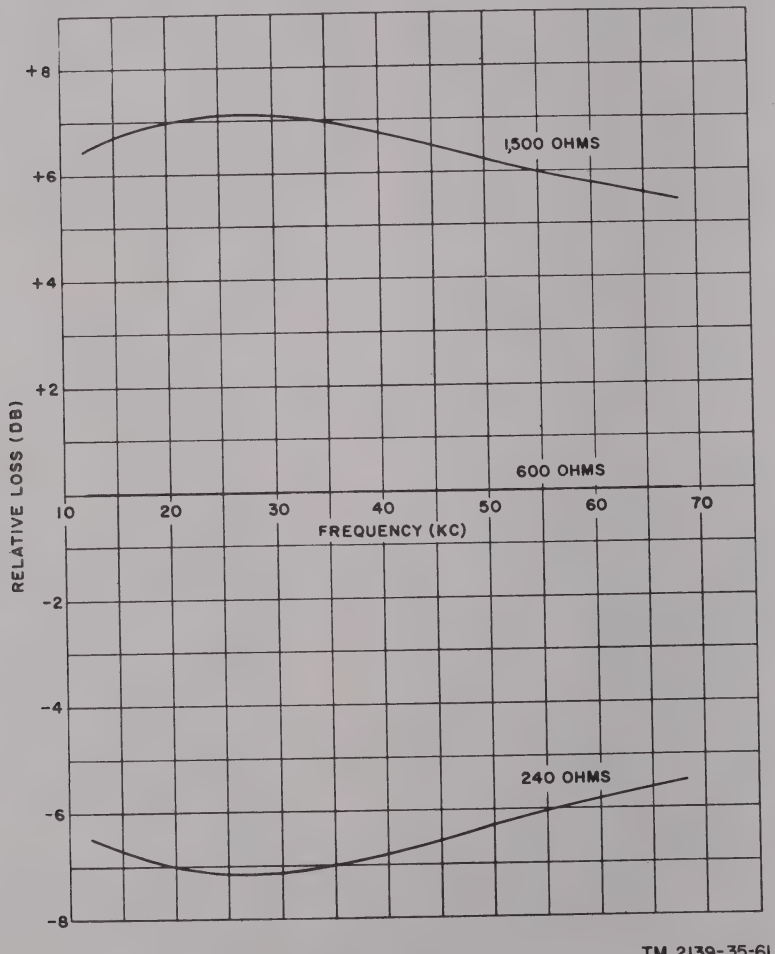


Figure 16. Regulator network Z2 attenuation versus thermistor RT1 resistance.

Resistor R15 is the dc return to the grid of tube V4A. Resistor R16 masks the shunting effect of the input capacity. Resistor R37 is the plate load resistor. Resistor R36 and capacitor C16 decouple the plate circuit. The output signal is applied through coupling capacitor C9 to the cathode of the alarm rectifier half of tube V4.

f. Alarm Rectifier V4B (fig. 15). The alarm rectifier rectifies the 68-kc pilot frequency and develops negative and positive voltages proportional to the level of the 68-kc pilot frequency applied. A positive voltage proportional to the output of V4A is developed across resistor R22 at the cathode of the rectifier. A negative voltage is developed across resistor R23, shunted by capacitor C11, at the plate of the rectifier.

(1) *Normal condition.* The positive voltage at the cathode of tube V4B is applied through the contacts of ALARM TEST switch S1 and resistor R27 to the grid of dc amplifier V5B. Resistor R27 and capacitor C13 provide a time delay of about 1 second to insure that only prolonged voltage variations in the 68-kc pilot frequency level (due to temperature changes) will affect the low alarm circuit. Resistor R38 prevents tube V5B from oscillating. The cathode of tube V5B is positively biased by means of the voltage divider composed of ADJ LOW potentiometer R28 and resistors R29 through R31, so that the grid to cathode bias is sufficient to keep the desired value of plate current flowing through the tube. The plate current is of sufficient magnitude to keep relay K2 energized under normal conditions. The ADJ LOW control is used to fix the value of 68-kc input at which the alarm circuit will just indicate a low alarm.

(2) *Operated condition.* When the level of the 68-kc pilot frequency decreases, the voltage at the load resistor combination, R22 and R35, in the cathode of tube V4B becomes less positive. When the cathode of tube V5B becomes less positive, the following actions occur:

(*a*) The grid of tube V5B becomes more negative and the plate current through the tube and series relay decreases.

(*b*) After the current through relay K2 decreases sufficiently to deenergize it, contacts 5 and 6, and 1 and 2 close to complete the circuit from terminal 1 to terminals 13 and 2 of connector P1. These contacts connect the ground side of the 6.3 voltage to the low alarm indicators (lamp I 2 and buzzer I 1) in the GROUP PANEL (fig. 7) for operation to indicate a low alarm condition.

(*c*) External ALARM CUTOFF switch S3, located on the front panel, is provided to permit the buzzer to be silenced. If the signal restores to normal, the bias on tube V5B becomes normal, plate current flows through the tube, and relay K2 operates again. When relay K2 is reenergized, it operates and causes the buzzer to sound again until ALARM CUTOFF switch S3 is restored to normal.

g. Alarm Rectifier V4B, High Alarm Condition (fig. 15).

(1) *Normal condition.* The negative voltage at the plate is applied through resistor R26 to the grid of tube V5A. Resistor R26 and capacitor C12 provide a time delay of about 1 second to insure that only prolonged voltage variations in the 68-kc pilot frequency will affect the alarm system. The combination of the negative voltage output from the plate of tube V4B and a slight positive bias derived from the voltage divider composed of resistors R25 and R24 produces a grid to cathode bias on tube V5A of sufficient magnitude to keep normal plate current flowing through the tube. The plate current is of sufficient magnitude to keep relay K1 operated under normal conditions.

(2) *Operated condition.* When the level of the 68-kc pilot frequency increases, the output of tube V4B increases and

the negative voltage across plate load resistor R23 increases. As a result, the plate becomes more negative and the grid of tube V5A becomes more negative. When the grid of tube V5A becomes more negative, the following actions occur:

(*a*) The plate current through the tube and relay K1 decreases.

(*b*) After the current through relay K1 decreases sufficiently to deenergize it, contacts 5 and 6 and 3 and 1 close to complete the circuit between terminal 1 of connector P1 and terminals 16 and 5 of the same connector to indicate a high alarm. These contacts connect the ground side of the 6.3-volt alarm voltage to HIGH ALARM lamp I 1 and buzzer I 5 in the GROUP PANEL (fig. 7).

(*c*) External ALARM CUTOFF switch S3, located on the front panel, is provided for silencing the buzzer. If the signal restores to normal, the bias on tube V5A becomes normal, plate current flows, and relay K1 operates again and causes buzzer I 1 to sound again until ALARM CUTOFF switch S3 is restored to normal.

h. Alarm Circuit Adjustments. Adjustments of the alarm are necessary to cause it to respond to the desired variations of the 68-kc pilot frequency. Three-position nonlocking switch S1 (ALARM TEST) (fig. 15) is provided to simulate a pilot frequency increase or decrease of approximately 1 db.

(1) *HIGH alarm.*

(*a*) When switch S1 is operated in the 1 HIGH position, resistor R20 shunts load resistor R22. The combination of resistors R20 and R22 provides an increase in the negative voltage across resistor R23 corresponding to an increase of 1 db in the 68-kc pilot frequency.

(*b*) In the same position, switch S1 connects the grid of tube V5B to the cathode so that the low alarm circuit is inoperative; the time constant of the high alarm circuit is lowered by the adding of capacitor C15 to the time delay combination of resistor R26 and capacitor C12. The time constant is lowered, so that the circuit will respond immediately to variations in adjustment ADJ HIGH resistor R18. The ADJ HIGH control then may be adjusted until a high alarm is just indicated.

Caution: **The alarms must never be adjusted without measuring the 68-kc pilot level at the output of AMPLIFIER-PILOT REGULATOR AM–707/TCC–7.** ***The HIGH alarm must be adjusted first.***

(2) *LOW alarm.* When switch S1 is operated to the 2 LOW position, a short circuit is removed from resistor R14, and the positive voltage applied to the grid of tube V5B is reduced by an amount corresponding to a decrease of 1 db in the 68-kc pilot frequency. The circuit then may be adjusted by variable resistor R28 (ADJ LOW) until a low alarm is just indicated.

Section IV. JUNCTION PANEL (PART OF AMPLIFIER-PILOT REGULATOR AM–707/TCC–7)

15. Block Diagram Analysis (fig. 17)

The JUNCTION PANEL is used primarily as an interconnecting unit for the components of Telephone Terminal AN/TCC–7. The JUNCTION PANEL is also used to connect the transmitting and receiving circuits of the telephone terminal to the spiral-four cable.

a. Transmitting Circuit.

(1) The group output frequencies from the GROUP PANEL are applied to the high-pass section of filter FL101. This filter passes only the 12- to 60-kc band of frequencies. The low-pass section of the filter selects the 300- to 1,700-cps frequency band from the ORDER WIRE PANEL.

(2) Signals from filter FL101 are applied across output transformer T101 to connector J103. The 600 VOLT

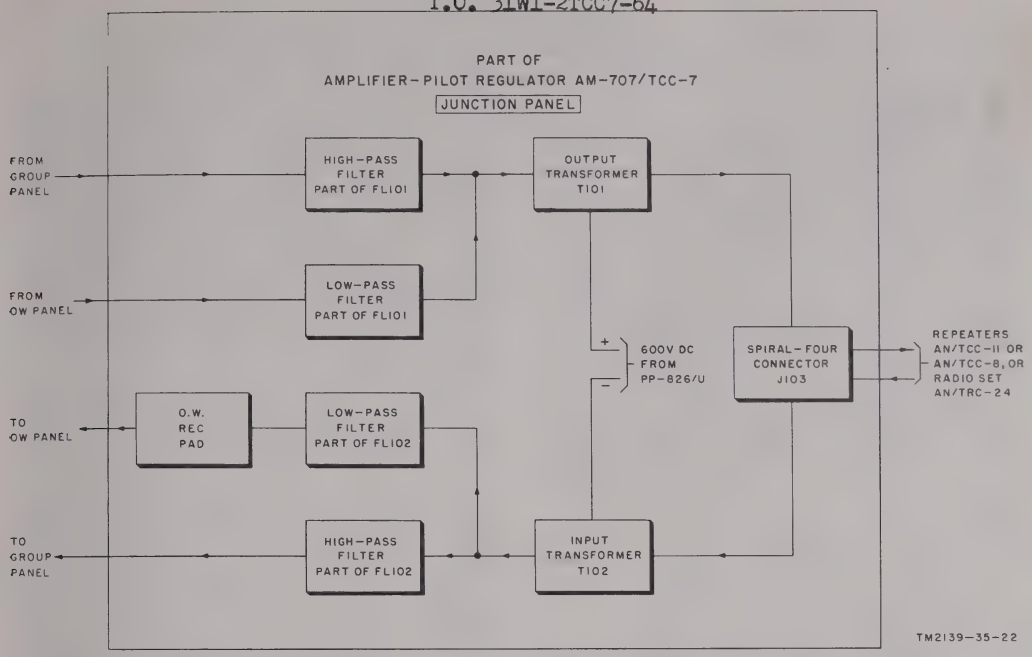


Figure 17. Junction Panel, (Part of Amplifier-Pilot Reguator AM-707/TCC-7), block diagram.

POWER SUPPLY introduces 600 volts dc to transformer T101 to be applied to connector J103 with the group output frequencies. This dc voltage is supplied as operating voltage for Telephone Repeaters AN/TCC-11 (unattended repeaters).

b. Receiving Circuit.

(1) The input signals are applied from connector J103 to transformer T102. The transformer couples the received signals to filter FL102.

(2) The high-pass section of filter FL102 selects the 12- to 60-kc group input, test, and pilot frequencies and applies them to the GROUP PANEL. The low-pass section of filter FL102 selects the order-wire frequencies for application to the ORDER WIRE PANEL through the order-wire receive pad. The pad provides the proper impedance termination for low-pass filter FL102 and offers a loss of approximately 2.5 db.

16. Schematic Analysis
(fig. 18)

a. Transmitting Circuit. The 12- to 60-kc frequency band and the test frequencies from the GROUP PANEL are applied from pins F and S on connector P105, through the high-pass section of filter FL101 and transformer T101 to the spiral-four cable. The 300- to 1,700-cps order-wire frequencies are applied from pins M and L of connector P101 through the low-pass section of FL101 and transformer T101 to the spiral-four cable.

b. Receiving Circuit. The 12- to 60-kc frequency band and test frequencies from the spiral-four cable are applied to the GROUP PANEL through transformer T102, the high-pass section of filter FL102, and pins C and P of connector P105. The 300- to 1,700-cps order wire frequencies are applied from the spiral-four cable to the ORDER WIRE PANEL through transformer T102, low-pass section of filter FL102, the order wire receive pad, (R102 through R104) and pins F and S of connector P101.

Figure 18. Junction Panel, (Part of Amplifier-Pilot Regulator AM-707/TCC-7), schematic diagram.

(Contained in separate envelope)

Section V. TELEPHONE CARRIER FREQUENCY SUPPLY TA–228/TCC–7

17. General

The modulator and demodulator circuits of Telephone Terminal AN/TCC–7 require several stable carrier-frequency signals for proper operation of the equipment. In addition, a pilot and two test frequencies are necessary for operation of the telephone terminal as a component part of the 12-channel telephone carrier system. These frequencies are furnished by Telephone Carrier Frequency Supply TA–228/TCC–7.

a. Carrier and Test Frequencies. The CARRIER SUPPLY PANEL supplies precise, stable, harmonically related frequencies for use in circuits indicated in (1) through (5) below.

(1) Carrier frequencies of 8, 12, 16, and 20 kc are supplied for the modulator and demodulator circuits of CHAN MODEM 1, 2, and 3.

(2) Carrier frequencies of 56, 72, and 88 kc are supplied for the modulator and demodulator circuits of the SUBGROUP PANEL.

(3) A 120 kc carrier frequency is supplied for the modulator and demodulator circuits of the GROUP PANEL.

(4) A 68-kc pilot frequency provides automatic signal level regulation in the receiving amplifier circuits and manual adjustment of the flat network of the remote AN/TCC–7 terminal. The 68-kc pilot frequency also is used for automatic signal level regulation in amplifier circuits of Telephone Repeaters AN/TCC–8, and AN/TCC–11, and for manual adjustment of flat networks, when this equipment is used as a component of the 12-channel telephone carrier system.

(5) Test frequencies of 12 and 28 kc are supplied, when required, for manual adjustment of slope and bulge networks of the remote AN/TCC–7 terminal. The 12- and 28-kc test frequencies are also used for manual adjustment of slope and bulge networks of Telephone Repeater AN/TCC–8 when this equipment is used in a system.

b. Synchronization of Carrier Frequencies. To avoid the possibility of frequency-shift distortion that occurs when the frequencies of carriers at one telephone terminal differ from those at the other, provisions are included in the CARRIER SUPPLY PANEL to use the 68-kc pilot frequency received from the distant terminal as a synchronizing frequency for local equipment.

18. Block Diagram Analysis, CARRIER SUPPLY PANEL (fig. 19)

a. Oscillator Circuit, 64-kc. The 64-kc oscillator circuit consists of an oscillator and a stabilizing network. In this text, the oscillator has been arbitrarily separated into a 64-kc oscillator stage V1A and a 64-kc feedback amplifier stage V1B.

(1) *Oscillator Stage, V1A, 64-kc.* Oscillator tube V1A can be considered the prime generator of the 64-kc signal. The frequency of this signal is controlled by a quartz crystal in frequency stabilizer network Z1. The 64-kc output of V1A is applied to the input of 64-kc feedback amplifier V1B.

(2) *Feedback amplifier V1B, 64-kc.* Feedback amplifier V1B amplifies the signal from the 64-kc oscillator. The amplifier inverts the signal polarity, so that when fed back (through frequency stabilizer network Z1) it is of proper phase to sustain oscillations in 64-kc oscillator stage V1A. The output is coupled to 64-kc amplifier V2.

(3) *Frequency stabilizer network Z1.* The frequency stabilizer network consists of a temperature-controlled quartz crystal. The quartz crystal permits only 64 kc to be fed back from 64-kc feedback amplifier V1B to 64-kc oscillator stage V1A. The 6.3 volts applied to the heater circuit in the network maintains the fre-

quency-controlling quartz crystal at a constant temperature.

b. Amplifier V2, 64-kc. Amplifier V2 isolates the 64-kc oscillator circuit from loading effects that would decrease the frequency stability of the 64-kc oscillator. The 64-kc amplifier is operative except when the synchronizing circuit (par. 12*f*) is in operation. The 64-kc amplifier then is cut off by negative dc voltage from rectifier V3. In normal operation, the 64-kc amplifier supplies power sufficient to drive the 64- to 4-kc frequency divider circuits.

c. Hybrid Network. The output of 64-kc amplifier V2 (or remote 64-kc amplifier V7) is applied to the resistor hybrid network to drive 64- to 16-kc divider V4. The hybrid network serves to isolate the output of 64-kc amplifier V2 from the output of remote 64-kc amplifier V7 to prevent unstable circuit operation.

d. Frequency Divider Circuits. The carrier frequencies, pilot frequency, and test frequencies supplied by the CARRIER SUPPLY PANEL are multiples of 4 kc. The 4-kc base frequency is obtained from 64 kc by frequency division in the frequency divider circuits. These circuits consist of a 64- to 16-kc frequency divider and a 16- to 4-kc frequency divider.

(1) *Frequency divider, 64- to 16-kc.* The 64-kc frequency from the resistor hybrid network is decreased to 16 kc by the 64- to 16-kc frequency divider. This circuit uses regenerative modulators CR1 and CR2, and first divider amplifier V4. The signal level is amplified by amplifier V4 to overcome losses introduced in the modulator and associated circuits. The 16-kc frequency is then applied to the 16- to 4-kc divider circuit.

(2) *Frequency divider, 16- to 4-kc.* The 16-kc frequency is decreased by the 16- to 4-kc frequency divider to a 4-kc base frequency. This circuit contains modulators CR3 and CR4 and second divider amplifier V5. This circuit functions similarly to the 64- to 16-kc frequency divider circuit. The 4-kc output is applied to 4-kc amplifier V6.

e. Amplifier V6, 4-kc. Amplifier V6 is used as an overdriven amplifier. The 4-kc signal from the 16- to 4-kc frequency divider is limited by amplifier V6 to provide a constant amplitude of output signal. The output of the 4-kc amplifier is applied to the harmonic generating circuits and synchronizing modulator CR5.

f. Harmonic Generating Circuits. The harmonic generating circuits distort the 4-kc base frequency and thereby produce harmonic frequency components. Separate outputs are provided for odd and even harmonics to simplify the frequency selectivity requirements of the band-pass filters.

(1) *Odd harmonic generator.* The odd harmonic generator consists of capacitor C32 and inductor L4. These circuit components distort the 4-kc frequency to obtain odd harmonic frequencies. The output of the odd harmonic generator is applied to the even harmonic generator circuit and the four odd harmonic band-pass filters.

(2) *Even harmonic producer.* The 4-kc base frequency and the odd harmonics from the odd harmonic generator are converted to even harmonics by varistors CR10 and CR11 connected as a full-wave rectifier. The output of the even harmonic producer is applied to the six even harmonic band-pass filters.

g. Odd Harmonic Filter and Amplifier Circuits.

(1) *Band-pass filters.* Band-pass filters, FL3, FL2, FL4, and FL5 select the third (12 kc), fifth (20 kc), seventh (28 kc) and seventeenth (68 kc) harmonic frequencies, respectively, from the output of the odd harmonic generator. The 20-kc signal selected by FL2 is applied to 20-kc amplifier V9. The 12-kc signal selected by filter FL3 is applied to 12-kc amplifier V10 and also to the 12-kc adjust pad. The 28-kc signal selected by filter FL4 is

Figure 19. Telephone Carrier Frequency Supply TA-228/TCC-7, block diagram.

(Contained in separate envelope)

applied to the 28-kc adjust pad. The 68-kc signal selected by filter FL5 is applied to the 68-kc adjust pad and to 68-kc alarm amplifier V8A (*j*(1) below).

(2) *Amplifiers, 12- and 20-kc.* Amplifiers V10 and V9 amplify the 12- and 20-kc signals, respectively, from the band-pass filters to the required level for use as carrier frequencies in modulation and demodulation. The outputs of the amplifiers are applied through the 12- and 20-kc isolation resistors, respectively, to CHAN MODEMS 1, 2, and 3.

(3) *Isolation resistors, 12- and 20-kc.* The isolation resistors prevent interaction between the three CHAN MODEMS.

(4) *Adjust pads, 12-, 28- and 68-kc.* These adjust pads provide means for adjusting the levels of the 68-kc pilot and the 12- and 28-kc test frequencies. The pads also provide isolation between each output of the 12-, 28-, and 68-kc band-pass filters to prevent interaction of the adjustments. The 68-kc pilot frequency is applied through the JUNCTION PANEL to transmitting amplifier AR3. The 12- and 28-kc test frequencies are applied to 12 & 28KC test switch S4.

(5) *Test Switch S4, 12 & 28KC.* Switch S4, when operated, permits the 12- and 28-kc test frequencies to be applied, with the 68-kc pilot frequency, through the JUNCTION PANEL to transmitting amplifier AR3.

h. Even Harmonic Filter and Amplifier Circuit. The even harmonic filter and amplifier circuit selects and amplifies the even harmonic frequencies for use in modulation and demodulation.

(1) *Band-pass filters.* Band-pass filters FL6 through FL11 select the second (8 kc), fourth (16 kc), fourteenth (56 kc), eighteenth (72 kc), twenty-second (88 kc), and thirtieth (120 kc) harmonic frequencies from the output of the even harmonic producer.

(2) *Amplifiers.* Amplifiers V11 through V16 amplify the signals to the required level for use as carrier frequencies in the modulator and demodulator circuits throughout the telephone terminal. The 8- and 16-kc frequencies are applied to their respective isolation resistors. The outputs from amplifiers V13 through V15 are applied to the SUBGROUP PANEL through the GROUP PANEL. The 120-kc output of amplifier V16 is applied to the GROUP PANEL and 120-kc alarm circuit V8B.

(3) *Isolation resistors, 8- and 16-kc.* The isolation resistors prevent interaction between the three CHAN MODEMS.

i. Synchronizing Circuits. The synchronizing circuits synchronize the carrier frequencies used at the local telephone terminal with those used at the remote telephone terminal. When the circuit is placed in operation by operating the CARR SYNC switch to the REMOTE position, the 4-kc base frequency is obtained indirectly from the 64-kc oscillator in the distant telephone terminal.

(1) *CARR SYNC switch S1.* In the REMOTE position, CARR SYNC switch S1 activates the synchronizing circuit by applying the 68-kc synchronizing signal (received pilot frequency from the GROUP PANEL) to synchronizing modulator CR5. In the LOCAL position or when failure of the 64-kc synchronizing signal of synchronizing circuit components occurs, rectifier V3 does not furnish cutoff voltage to amplifier V2. The amplifier then applies the local 64 kc to the frequency divider circuits.

(2) *Synchronizing modulator CR5.* In synchronizing modulator CR5, the 4-kc signal modulates the synchronizing signal, thus producing the upper and lower sideband frequencies.

(3) *Band-pass filter FL1, 64-kc.* Band-pass filter FL1 selects the lower sideband (64-kc) from the modulator output and applies it to remote 64-kc amplifier V7.

(4) *Remote 64-kc amplifier V7.* Amplifier V7 amplifies the lower sideband from filter FL1 and applies it through the

hybrid resistor network to the 64- to 4-kc frequency divided circuits and to rectifier V3.

(5) *Rectifier V3.* Rectifier V3 rectifies the 64-kc signal received from remote 64-kc amplifier V7 and applies a negative bias on 64-kc amplifier V2. The negative bias cuts off the amplifier, preventing the local 64-kc signal from being applied to the resistor hybrid network when the remote 64-kc signal is present.

(6) *Resistor hybrid network.* The resistor hybrid network isolates the outputs of 64-kc amplifier V2 and remote 64-kc amplifier V7 from each other.

j. Alarm Circuits, 68- and 120-kc. The alarm circuits give visual and audible indications of the absence of the 68-kc pilot or the 120-kc carrier frequencies.

(1) *Alarm amplifier V8A, 68-kc.* Alarm amplifier V8A lights 68KC indicator lamp I 1 and sounds transmission alarm buzzer I 1 when the 68-kc pilot frequency output fails.

(2) *Alarm amplifier V8B, 120-kc.* Alarm amplifier V8B lights 120KC indicator lamp I 2 and sounds transmission alarm buzzer I 1 when the 120-kc carrier frequency output fails.

19. Schematic Analysis, CARRIER SUPPLY PANEL
(fig. 20)

a. Oscillator Circuit, 64-kc. The 64-kc oscillator circuit supplies a stable 64-kc signal. The circuit is essentially a two-stage amplifier with feedback from the output to the input. The circuit consists of frequency stabilizer network Z1, 64-kc oscillator V1A, and 64-kc feedback amplifier V1B. Since the oscillator and the amplifier stages both provide signal gain, only a small amount of feedback is necessary to maintain oscillation.

(1) *Frequency stabilizer network Z1.* Frequency stabilizer network Z1 contains a heater unit and the frequency determining circuit for the oscillator. The frequency determining circuit is composed of an NT cut quartz crystal and its series capacitor, both of which, set the oscillator frequency at exactly 64 kc. The frequency stability is maintained by mounting the crystal in a hermetically sealed can surrounded by the heater unit. The crystal heater unit is in parallel with an ambient temperature-sensing disk thermistor and connected through an internal resistor and resistor R173 to a 6.3 volt source. The thermistor has a negative temperature-resistance characteristic. The crystal is maintained at a temperature of between 60° C. and 75° C. over an ambient temperature range of —40° C. to +65° C. This degree of temperature control is sufficient to maintain the required frequency stability. The crystal of frequency stabilizer network Z1 is connected as the frequency-determining element in the feedback circuit between 64-kc feedback amplifier V1B and 64-kc oscillator V1A. The series-resonant crystal offers very low resistance and no phase shift at a frequency of 64 kc. The crystal offers high impedance and phase shift to other frequencies. Therefore, only 64 kc is fed back to maintain oscillation.

(2) *Oscillator V1A, 64-kc.* The 64 kc from the crystal in the frequency stabilizer network is applied to the control grid of V1A through series resistor R172. Resistor R172 isolates the tube capacity from the crystal, so that the tube changes will not affect the frequency. Resistor R1 is the grid input resistor. When large input signals are applied, the control grid draws more current; this causes a greater negative voltage drop across resistor R1 and thereby increases the bias. The gain of the output signal is regulated by this action and, as a result the output amplitude, is nearly

Figure 20. Telephone Carrier Frequency Supply TA-228/TCC-7, schematic diagram.

(Contained in separate envelope)

constant. Cathode resistor R3 and bypass capacitor C1 develop cathode bias. Resistor R5 is the plate load resistor. Plate resistor R2 is used to minimize the effects of tube capacitance on the output frequency. The amplified 64 kc at the plate is coupled through resistor R2 and blocking capacitor C2 to the grid of 64-kc feedback amplifier V1B.

(3) *Feedback amplifier V1B, 64-kc.* The signal from 64-kc oscillator V1A is applied to the grid of 64-kc feedback amplifier V1B. Resistor R163 is the dc grid return. Cathode resistor R4 and bypass capacitor C48 furnish dc operating bias. The amplified 64-kc signal at the plate of tube V1B is coupled by blocking capacitor C3 to the LC tuned circuit (inductor L1 and capacitors C4, C49A, and C49B), which is resonant at 64 kc. Resistor R6 is the plate load. Voltage-divider resistors R7 and R8 are connected across the LC tuned circuit. The fraction of the 64-kc signal across resistor R8 is fed back through frequency-stabilizer network Z1 to 64-kc oscillator V1A. The voltage divider, consisting of capacitor C5 and resistors R9 and R10, couples a fraction of the 64-kc output to the grid of 64-kc amplifier V2. Because of this light loading provided by the grid of the 64-kc amplifier, the oscillator frequency stability will be unaffected by load variations.

b. Amplifier V2, 64-kc. The output of the 64-kc oscillator circuit is amplified in 64-kc amplifier V2 when no negative voltage is applied to the suppressor grid from rectifier V3 (par. 23*e*). Resistor R10 is the dc grid return. Unbypassed cathode resistor R11 provides cathode bias and also degeneration. Impedance matching transformer T1 couples the 64-kc output from amplifier V2 to the 64- to 4-kc frequency divider circuits through the hybrid resistor network. Capacitor C7 tunes the primary of transformer T1 to 64 kc. Capacitor C6 is the screen bypass capacitor. Resistor R12 is the screen voltage dropping resistor. Capacitor C8 is the suppressor grid bypass capacitor. An attenuator pad composed of resistors R13 through R15 provides the proper level of test voltage at 64KC LOCAL test jack J1.

c. Resistor Hybrid Network. The resistor hybrid permits either 64-kc amplifier V2 or remote 64-kc amplifier V7 to drive modulator CR1. This arrangement is possible, because the resistor hybrid network isolates the two amplifiers from each other. The network forms a balanced bridge which consists of resistors R20 through R23 in addition to the load. This network attenuates the applied signal by 6 db.

d. Frequency Divider Circuits, 64- to 4-kc.

(1) *General.* The 64-kc signal from amplifier V2 and remote amplifier V7 is divided by the 64- to 4-kc frequency divider circuits to obtain a 4-kc base frequency. For frequency division, regenerative modulators are used in a double-balanced arrangement. The arrangement is regenerative in that the output frequency of the modulator is modulated by the input to obtain the same output frequency. The desired difference frequencies are selected by LC circuits. Four modulators are used to divide the frequency from 64 to 4 kc. The regenerative action may be considered as starting on the 32-kc component of the noise, and building up by amplification until the output frequency is obtained. This output maintains itself by regeneration.

(2) *Frequency divider, 64- to 16-kc.* The 64-kc signal from the resistor hybrid network is applied through bridging resistors R24 through R27 to modulator CR1. A 32-kc signal from the feedback loop is fed to terminal 1 and 4 of the modulator. Since the modulator is balanced, neither of these signals appears in the output; but the sums and differences appear at terminals 5 and 2; that is, 96 kc and 32 kc. The 32 kc is the same signal as that in the feedback loop but is obtained as the difference between the two inputs. Transformer T2 couples the signals through sing-suppression re-

sistor R170 to the grid of first divider amplifier V4. The amplifier overcomes losses in the circuit. Resistor R28 supplies cathode bias for the amplifier. In the plate of amplifier V4, the primary of transformer T3 is tuned by capacitor C10 and selects 32 kc from the output. One secondary of the transformer supplies 32-kc regenerative feedback through resistor R29 to modulator CR1 as explained above. The other secondary supplies 32 kc to modulator CR2 through bridging resistors R30 through R33. Modulator CR2 mixes the 32-kc signal with a regenerative 16-kc signal to obtain 16 and 48 kc. This output is combined with the output of modulator CR1. The combined outputs are applied through transformer T2 and antising resistor R170 to first divider amplifier V4. The primaries of transformers T4 and T3 are in series. Transformer T4 is tuned by capacitor C11 and selects the 16-kc signal. Winding 1–2 of transformer T4 applies the 16-kc regenerative signal to modulator CR2 through R34. Winding 3–4 applies the 16-kc signal to modulator CR3. Resistors R35 through R37 comprise an attenuator pad for providing the proper test voltage at DIV 1 test jack J2.

(3) *Frequency divider, 16- to 4-kc.* The 16- to 4-kc frequency divider is similar to the 64- to 16-kc frequency divider. The 16-kc signal from the secondary of transformer T4 is applied through bridging resistors R39 through R42 to modulator CR3. An 8-kc signal from the feedback loop is applied to terminals 1 and 4 of the modulator. The 16- and 8-kc signals are mixed in the modulator and the sum and difference frequencies (8 and 24 kc) appear at output terminals 5 and 2. Transformer T5 couples the signals through antising resistor R171 to the grid of second divider amplifier V5. The amplifier reestablishes the proper signal level. Resistor R43 develops cathode bias for the amplifier. Transformer T6, tuned by capacitor C12, selects the 8-kc output. Winding 3–4 applies the 8-kc regenerative feedback used in modulator CR3. Winding 1–2 applies 8 kc to modulator CR4 through bridging resistors R45 through R48. Modulator CR4 mixes the 8-kc signals with a regenerative 4-kc signal to obtain 4 kc and 12 kc. This output is applied with the output of modulator CR3 through transformer T5 and antising resistor R171, and is amplified in second divider amplifier V5. The primaries of transformers T7 and T6 are in series. Transformer T7 is tuned by capacitor C13 and selects the 4-kc signal. One secondary supplies a 4-kc regenerative signal to modulator CR4 through resistor R44. The other secondary supplies 4 kc to amplifier V6. Resistors R49 through R51 comprise an attenuator pad for providing the proper test voltage at DIV 2 test jack J3.

e. Amplifier V6, 4-kc. Amplifier V6 is an overdriven amplifier that gives a steady ¾-watt output despite variations that may occur in the input level. The peak positive voltage is limited at each grid by grid current limiting resistors R52 and R53. The signal negative peaks are limited, because the grids are driven beyond cutoff. The high impedance plate load of transformer T9 reduces variations in output caused by any change of characteristics in the relatively lower impedance of tube V6. The two sections of tube V6 are operated as a push-pull amplifier.

(1) The 4 kc from the 16- to 4-kc frequency divider circuit at the secondary of transformer T7 is coupled by capacitor C14 to the primary of transformer T8. Capacitor C14 partially tunes the windings of transformers T7 and T8 to 4 kc. Transformer T8 steps up the 4-kc signal voltage. Capacitor C15 tunes the secondary of the transformer to 4 kc. Cathode resistor R54 and bypass capacitor C16 develop dc bias for the stage.

(2) Transformer T9 matches the amplifier plate output impedance to that of

the harmonic generating circuit. Capacitor C17 tunes the transformer primary to 4 kc. A fraction of the 4-kc output across transformer T9 is applied through resistor R57 to synchronizing modulator CR5 in the synchronizing circuit. Resistors R55 and R56 provide the proper test voltage at 4 KC output test jack J4.

20. Harmonic Generating Circuits
(figs. 20 and 21)

The carrier, pilot, and test frequencies required are all multiples (harmonics) of the 4-kc base frequency. In the odd harmonic generator, nonlinear coil L4 and capacitor C32 peak the 4-kc sine wave to generate odd harmonics. The even harmonic generator, consisting of full-wave rectifier CR10 and CR11 produces even harmonics from the odd harmonic input. The separate odd and even harmonic outputs simplify the filter requirements because any frequency to be rejected is at least 8 kc from the desired frequency.

a. Odd Harmonic Generator (fig. 20).

(1) *Circuit arrangement.* Inductor L3 and capacitor C29 form a series-resonant circuit which acts as a selective filter for the 4-kc input signal. Inductor L4 and capacitor C32 comprise the odd harmonic generator. Capacitors C30 and C31 are used during manufacture to tune the circuit for 4 kc. These capacitors require no further attention unless the associated parts are replaced. The load consists of the following components: resistor R74, filters FL2 through FL5, and the even harmonic generator (CR10 and CR11).

(2) *Circuit operation* (fig. 21). When transformer T9 applies the 4-kc sine wave to nonlinear inductor L4, the impedance of the inductor presented to the signal varies according to the rate of change of current. On the initial rise of current (A, fig. 21), the impedance presented to the signal between points X and Y is high; therefore, the larger amount of voltage is applied to the load, thus charging capacitor C32. Positive current increases in the load circuit due to the charging of capacitor C32. When inductor L4 is saturated, it presents a low impedance to the incoming signal and capacitor C32. Capacitor C32 then discharges through the load circuit and L4, the larger amount of discharge current flowing through the inductor. The discharge of the capacitor produces sharply peaked negative surges of current in the load circuit. During the negative half-cycle of the applied signal, the operation of the circuit is the same as that of the positive half-cycle except that the polarities are opposite. The output developed in the load circuit by the odd harmonic generator consists of alternately positive and negative peaks. This wave form is very rich in odd harmonics of 4 kc.

b. Even Harmonic Generator (fig. 20).

(1) The input pulses to the even har-

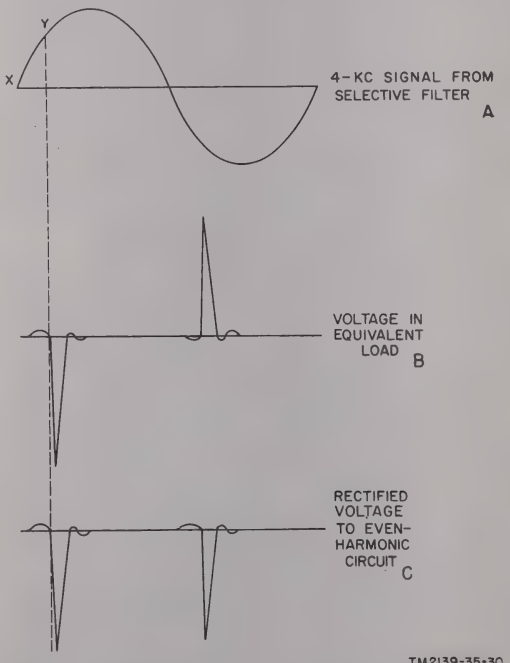


Figure 21. Voltage curves, harmonic generating circuits (part of Telephone Carrier Frequency Supply TA-228/TCC-7).

monic generator from the odd harmonic generator consist of the 4-kc fundamental and odd harmonic frequencies. The even harmonic generator consists of two full-wave copper-oxide bridge rectifiers CR10 and CR11. To reduce losses, the two rectifiers are connected in parallel. The output of the full-wave rectifier is shown in C, figure 21.

(2) The output contains dc and the even harmonics of the input frequencies. The input frequencies are balanced out in the bridge circuit. Any odd harmonics remaining in the output that are caused by unbalance in the bridge rectifiers are at least 25 db below the desired level of the even harmonics. The output is applied to impedance matching transformer T18 (fig. 20). This transformer also isolates the dc and the ungrounded input from the grounded band-pass filters of the load. These filters, FL6 through FL11, are connected in parallel.

21. Odd Harmonic Filters and Amplifier Circuits
(fig. 20)

The output of the odd harmonic generator is also applied to the odd harmonic filter and amplifier circuit. The circuit selects and amplifies 12- and 20-kc carrier frequencies; selects and provides for adjusting 68-kc pilot frequency; and selects and provides for adjusting and switching the 12- and 28-kc test frequencies. The circuit consists of the carrier supply filters for 12 kc, 20 kc, 28 kc, and 68 kc; amplifiers for 12 kc and 20 kc; isolation resistors for 12 kc and 20 kc; adjust pads for 12 kc, 20 kc, and 68 kc; and 12 & 28KC switch S4.

a. Band-Pass Filters. Band-pass filters FL2 through FL5 select 12-, 20-, 28-, and 68-kc signals from the output of the odd harmonic generator. The signal selected by 20-kc band-pass filter FL2 is applied to amplifier V9. The signal selected by 12-kc band-pass filter FL3 is supplied to amplifier V10 and also to the 12-kc adjust pad. The signal selected by 28-kc band-pass filter FL4 is supplied to the 28-kc adjust pad. The signal selected by 68-kc band-pass filter FL5 is supplied to the 68-kc adjust pad and also to 68-kc alarm amplifier V8A. The input impedance of each band-pass filter is 135 ohms. The 20-kc band-pass filter (FL2), which feeds an amplifier grid directly, has an output impedance of 40,000 ohms. The other three band-pass filters have output impedances of 135 ohms.

b. Amplifiers 12- and 20-kc. Amplifiers V10 and V9 amplify the 12- and 20-kc signals from their respective band-pass filters. The amplifiers use negative feedback developed by unbypassed cathode resistors. The amplifiers raise the signals to the required level for use as carriers in modulation and demodulation. The 12- and 20-kc amplifiers are electrically identical except for their input circuits. Amplifier V9, 20-kc, has its input directly coupled to the control grid since band-pass filter FL2 has a high impedance output. The two circuits are discussed simultaneously and parentheses are used in the text to indicate the 20-kc amplifier.

(1) The output of 12-kc band-pass filter FL3 is applied to the 12-kc adjust pad and amplifier V10. The output of 20-kc band-pass filter FL2 is applied to amplifier V9. Resistor R83 (R75) terminates the filter in the proper impedance. Transformer T16 steps up and couples the signal to the control grid of amplifier V10. The primaries are in parallel to provide greater voltage step-up. Capacitor C35 tunes the transformer secondary to 12 kc. Sing-suppression resistor R84 (R76) reduces any tendency of the amplifier to oscillate. The value of resistor R86 (R78) is predetermined at the time of manufacture; it controls the amount of degeneration in the circuit. Inductor L6 (L5) provides an effective short for dc across resistor R86 (R78). Only resistor R85 (R77) is effective in providing cathode bias for the tube. At the signal frequency, inductor L6 (L5) has a much higher impedance than resistor R86 (R78); therefore, at the signal frequency the inductor may be neglected.

(2) The amplified signal at the plate of 12-kc (20-kc) amplifier V10 (V9) is coupled by step-down transformer T17 (T15) to the 12-kc (20-kc) isolation resistors R145 through R150 (R139 through R144). Resistors R88 through R90 (R80 through R82) comprise an attenuator pad to provide the proper test voltage at 12 KC (20 KC) test jack J8 (J7). Resistor R87 (R79) is the screen-dropping resistor and capacitor C36 (C34) is the screen bypass capacitor.

c. Isolation Resistors, 12- and 20-kc. The outputs of the 12- and 20-kc amplifiers are used as carriers in the channels of CHAN MODEM 1, 2, and 3 (par. 3). Since each CHAN MODEM uses the same carriers, the outputs of the amplifiers are distributed through isolation resistors. These resistors provide isolation and reduce interaction between the CHAN MODEMS. The 12-kc carrier signal is supplied to CHAN MODEM 1 through resistors R145 and R146, to CHAN MODEM 2 through resistors R147 and R148, and to CHAN MODEM 3 through resistors R149 and R150 through pins D and N on connectors P1, P2, and P3 respectively. Similarly the 20-kc carrier signal is applied to CHAN MODEMS 1, 2, and 3 through their respective isolation resistors and pins F and R on connectors P1, P2, and P3 respectively.

d. Adjust Pads 12-, 28-, and 68-kc. These adjust pads provide means for adjusting the levels of the 68-kc pilot and the 12- and 28-kc test frequencies. The pads also provide isolation (attenuation) between the 12-, 28-, and 68-kc adjustments to prevent interaction of the adjustment.

(1) The 12-, 28-, and 68-kc signal level may be adjusted by variable resistors R92, R95, and R99, respectively, for proper output at the transmitting amplifier output. Resistor R91 is a series element in the 12-kc pad.

(2) Resistor R93 terminates 28-kc carrier supply filter FL4 in the proper impedance. Resistor R94 is a series element in the 28-kc pad. Resistor R96 terminates the 28-kc and the 12-kc pads, so that the two signals now are combined.

(3) Resistor R97 terminates 68-kc carrier supply filter FL5 in the proper impedance. Resistor R169 terminates the 68-kc pad.

(4) Series resistors R164 and R101 and terminating resistors R100 and R102 form another pad element to combine the 68-kc pilot with the 12- and 28-kc test signals, provided that 12 & 28KC switch S4 is in the ON position.

(5) The 68-kc pilot is applied through the JUNCTION PANEL to transmitting amplifier AR3 (GROUP PANEL) (par. 11*e*). The 12- and 28-kc test frequencies are applied to 12 & 28KC test switch S4.

e. Switch S4, 12- & 28 KC.

(1) When the 12 & 28KC switch is operated to the ON position, the 12- and 28-kc test frequencies are applied through contacts 4–5 and 8–9, resistors R100 through R102, and combined with the 68-kc pilot frequency. The signals are further applied to pins H and J of connector J16. The signal path is completed through the junction panel to transmitting amplifier AR3 (GROUP PANEL). When switch S4 is in the OFF position, contacts 5–6 and 7–8 are grounded to prevent the test frequencies from being applied through the switch capacitance to the output circuit.

(2) To indicate that the test frequencies are applied on the line, lamp I 3 is energized when contacts 1–2 of the switch are made.

22. Even Harmonic Filters and Amplifier Circuits
(fig. 20)

The even harmonic filter and amplifier circuit selects and amplifies carriers for use in modulation and demodulation. The circuits are similar to the odd harmonic filters and amplifier circuits, but they are treated separately for convenience. The circuit consists of six band-pass filters and six amplifiers.

a. Band-Pass Filters. Band-pass filters FL6, FL7, FL8, FL9, FL10, and FL11 select 8, 16, 56, 72, 88, and 120 kc, respectively, from the even harmonic output from matching

transformer T18. Each filter has an input impedance of 135 ohms and an output impedance of 40,000 ohms. The signals selected are applied to their respective amplifiers.

b. Amplifiers. The amplifiers amplify the respective signals selected by the band-pass filters. The amplifiers raise the signals to the required level for use as carriers in modulation and demodulation. The six amplifiers are similar. The 8-kc amplifier (V11) is representative and is discussed below.

(1) Resistor R103 terminates 8-kc filter FL6 in the proper impedance. Antising resistor R104 reduces any tendency of the amplifier to oscillate. The value of resistor R106 is predetermined at the time of manufacture; it controls the amount of degeneration in the circuit. Inductor L7 provides an effective short for dc across resistor R106. Resistor R105 effectively provides cathode bias for the tube. At the signal frequency, inductor L7 has a much higher impedance than resistor R106; therefore the inductance is negligible.

(2) The amplified signal at the plate of the 8-kc amplifier is coupled by transformer T19 to 8-kc isolation resistors R151 through R156. Resistors R108 through R110 comprise an attenuator pad that provides the proper test voltage at 8 KC jack J9. Resistor R107 is the screen grid dropping resistor and capacitor C37 serves as the screen bypass.

(3) The other amplifier circuits are similar except in the following cases: test jack circuits for jacks J11 through J14 contain no attenuating resistors; band-pass filter FL10, for 88-kc has no terminating resistor because loading the filter introduces additional attenuation to the harmonic frequencies. The outputs of transformers T21 and T24 are applied directly to TO GROUP PANEL connector J15. The output of 120-kc amplifier V16 is also applied to the 120-kc alarm circuit (par. 24*b*).

c. Isolation Resistors, 8- and 16-kc. The outputs of the 8- and 16-kc amplifiers are used as carriers in the three CHAN MODEMS. Since the same carrier frequencies are distributed to each CHAN MODEM, the outputs of the amplifiers are applied through isolation resistors to reduce interaction between the CHAN MODEMS. The 8-kc carrier signal is applied to the CHAN MODEM 1, 2, and 3 through the isolation resistors and pins C and M of TO JUNCTION PANEL connectors P1, P2, and P3, respectively.

23. Synchronizing Circuits
(fig. 20)

The synchronizing circuit provides for synchronization of the carrier frequencies with those used at the distant telephone terminal. When the synchronizing circuit is placed in operation by operating the CARR SYNC switch to the REMOTE position, the 4-kc base frequency is obtained indirectly from the 64-kc oscillator in the distant telephone terminal; the local 64-kc oscillator output is not used. Should the synchronizing operation fail, the output of the local 64-kc oscillator is automatically switched in and used as described in paragraph 18*b*. The synchronizing circuit consists of CARR SYNC switch S1, synchronizing modulator CR5, 64-kc band-pass filter FL1, remote 64-kc amplifier V7, and rectifier V3. In addition, the frequency divider circuits (par. 19*d*) and the 4-kc amplifier (par. 19*e*) are necessary to the operation of the synchronizing circuit. These circuits supply 4 kc to synchronizing modulator CR5 to complete the regenerative path.

a. CARR SYNC Switch S1. CARR SYNC switch S1 selects the type of operation for Telephone Terminal AN/TCC–7. The switch has two positions: LOCAL and REMOTE.

(1) *LOCAL position.* When switch S1 is in the LOCAL position, the 4-kc base frequency is generated in the local CARRIER SUPPLY PANEL. Oscillator V1 supplies the 64-kc frequency to the frequency divider circuits.

(2) *REMOTE position.* When the switch is operated to the REMOTE position the synchronizing circuit is activated by the 68-kc pilot frequency received from the distant telephone terminal. The 68-kc pilot frequency is applied

from the GROUP PANEL to the CARRIER SUPPLY PANEL through pins P and F on TO GROUP PANEL connector J15.

b. Sync Modulator CR5. Resistor R57 and transformer T10 couple 4-kc from 4-kc amplifier V6 to synchronizing modulator CR5. The modulator combines the 68-kc synchronizing frequency with the output of 4-kc amplifier V6. The output contains the sum and difference frequencies of 72 kc and 64 kc, respectfully. Transformer T11 matches the modulator output to 64-kc band-pass filter FL1. Transformers T10 and T11 also balance the 68-kc synchronizing input to the modulator.

c. Band-Pass Filter FL1, 64-kc. Band-pass filter FL1 selects 64 kc from the synchronizing modulator CR5 output and passes it to remote 64-kc amplifier V7. Resistor R58 provides the proper impedance load for the filter.

d. Remote 64-kc Amplifier V7. Amplifier V7 amplifies the 64-kc signal from the band-pass filter to the proper level to drive the 64- to 4-kc frequency divider circuits. The 64-kc signal also is applied through capacitor C9 to rectifier V3.

(1) Input transformer T12 matches the low impedance output of the filter to the high input impedance of remote 64-kc amplifier V7. Capacitor C19 tunes the transformer secondary to 64 kc.

(2) Resistor R59 and capacitor C20 provide cathode bias for the amplifier.

(3) A portion of the 64-kc signal at the plate of the tube is coupled to rectifier V3. Transformer T13 matches the output of the amplifier to the resistor hybrid network. Capacitor C21 tunes the transformer T13 primary to 64 kc.

(4) Resistors R60 through R62 constitute the isolation and attenuation pad for 64 KC REMOTE test jack J5.

e. Rectifier V3. Rectifier V3 rectifies the 64-kc signal received from remote 64-kc amplifier V7 and applies a negative dc output to the suppressor grid of 64-kc amplifier V2 (par. 19*b*). The negative dc voltage cuts off 64-kc amplifier V2, preventing the 64-kc oscillator circuit output from reaching the resistor hybrid network (par. 19*c*).

(1) Capacitor C9 couples the 64-kc signal at the plate of remote 64-kc amplifier V7 to rectifier V3. Capacitor C9 is also the charging capacitor for the voltage doubling action. The two sections of rectifier V3 are connected as diodes in a voltage doubler circuit. The dc load on the rectifier is composed of resistors R17 and R18. The negative dc voltage at the junction of resistors R17 and R18 is supplied to the suppressor grid of 64-kc amplifier V2. Capacitor C8 filters the rectifier output.

(2) When the synchronizing circuit is not in operation, and rectifier V3 is not providing the negative cutoff voltage, voltage divider resistors R19 and R16 provide (through resistor R17) a small positive voltage to the suppressor grid of 64-kc amplifier V2.

f. Resistor Hybrid Network. The resistor hybrid network (R20 through R23) isolates the 64-kc amplifier V2 and the remote 64-kc amplifier V7 outputs from each other. Thus, 64-kc amplifier V2 is prevented from cutting itself off by feeding 64 kc to rectifier V3.

24. Alarm Circuits, 68- and 120-kc (fig. 20)

Visual and audible alarms are provided at the output circuits of the 68-kc pilot and 120-kc carrier frequencies. A failure or substantial drop in output level will cause the corresponding alarm to operate. Since the alarm relays are maintained in the operated condition, failure of heater or plate voltage to the tube will release the relay and close the circuit to the lamps and to the transmission alarm buzzer.

a. Alarm Amplifier V8A, 68-kc. Alarm amplifier V8A lights 68KC indicator lamp I 1 and sounds transmission alarm buzzer I 1 (fig. 7) when the 68-kc pilot output fails.

(1) The 68-kc pilot frequency at filter FL5 is supplied through resistor R98 to transformer T14. The output of 68-kc filter FL5 is stepped up by transformer T14 and applied to 68-kc alarm amplifier V8A. The secondary of transformer T14 is tuned to 68 kc by capacitor C23. Capacitor C26 pro-

vides a low impedance path to ground for the 68-kc signal.

(2) The inductance of alarm relay K1 is the plate impedance. The amplified 68-kc signal is coupled by capacitor C24 to the voltage doubler rectifier, CR6 and CR7. Capacitor C24 is the charging capacitor for the voltage doubling action. The filter and load for the rectifier is resistor R64 and capacitor C25. Resistor R65 decouples the 68-kc signal input at transformer T14 from the rectifier to prevent oscillation in the amplifier tube. The positive dc voltage at the junction of resistors R64 and R65 is applied in series with the 68-kc signal supplied by transformer T14 to the control grid of alarm amplifier V8A.

(3) Voltage divider resistors R66 through R68 supply positive voltage to the cathode of 68-kc alarm amplifier V8A. If the 68-kc pilot frequency decreases in amplitude, less positive voltage is supplied to the V8A control grid, and the dc plate current decreases. When the signal decreases 6 db or more, 68-kc alarm relay K1 closes one set of contacts to connect 68KC indicator I 1 to ground. Another set of contacts supplies a ground through 68KC ALARM CUTOFF switch S2, to transmission alarm buzzer I 1 in the GROUP PANEL (fig. 7).

(4) The operator may silence the buzzer by operating 68KC ALARM CUTOFF switch S2. If, during an alarm condition, the cutoff switch is operated to silence the buzzer, the relay will operate and sound the buzzer again when conditions return to normal. To silence the buzzer, switch S2 must be operated to its original position.

b. Alarm Amplifier V8B, 120-kc. Alarm amplifier V8B lights 120KC indicator lamp I 2 and sounds transmission alarm buzzer I 1 (fig. 7) when the 120-kc carrier output fails. The corresponding parts perform the same functions as those in the 68-kc alarm amplifier. The 120-kc carrier is coupled from the plate of 120-kc amplifier V16 at a high level, so that the signal is supplied to rectifiers CR8 and CR9 without further amplification. Therefore, fewer circuit components are required in the 120-kc alarm amplifier V8B. Resistor R73 provides attenuation to supply the rectifiers with the proper signal amplitude. The positive dc rectified output is applied directly to the control grid of tube V8B. Loss of the 120-kc carrier signal will cause 120KC indicator lamp I 2 to light and transmission alarm buzzer I 1 (fig. 7) to sound. The function of 120KC ALARM CUTOFF switch S3 is identical with that described for 68KC ALARM CUTOFF switch S2 (*a*(4) above).

Section VI. ORDER WIRE RECEIVER-TRANSMITTER RT–280/TCC–7 (PART OF RECEIVER-TRANSMITTER TEST SET GROUP OA–443/TCC–7)

25. General

Order Wire Receiver-Transmitter RT–280/TCC–7 provides facilities for transmitting and receiving signals in a vf band of 300 to 1,700 cps over the order wire circuit to the distant telephone terminal, attended repeaters, and unattended repeaters. Ringer-oscillator Y101 provides a means for transmitting ringing signals to the distant terminal and attended repeaters, and for receiving ringing signals from the distant terminal, attended repeaters, and unattended repeaters.

26. Order Wire Voice Transmission Circuits, Block Diagram Analysis (fig. 22)

a. Transmitting Circuit.

(1) ORDER WIRE switch S104 arranges the circuit, so that voice signals from the transmitter of handset HS101 are applied through transformer T101 and SEND OW switch S102 (nonoperated position), to line transformer T103.

(2) SEND OW switch S102 (operated

position) permits the 1-kc test signal from the TEST PANEL (par. 38*d*) to be applied over the order wire transmitting circuit for alinement and transmission measurements.

(3) Line transformer T103 is used to couple a balanced line to an unbalanced line. The voice and ringing signals are combined at the output of the transmitting pad.

(4) The combined voice and ringing signals are applied to equalizing network EQ101. This network precompensates for the shape of the loss-frequency characteristic of the succeeding spiral-four cable and circuit components.

(5) From the cable equalizing network, the signal is amplified by transmitting amplifier AR101, and applied to auxiliary low-pass filter FL101. The level of the amplified output signal may be adjusted by means of TR GAIN control R114.

(6) Auxiliary low-pass filter FL100 rejects undesirable intermodulation products developed by transmitting amplifier AR101. The output signal is then applied to the JUNCTION PANEL (par. 16).

b. Receiving Circuit.

(1) The received signal from the JUNCTION PANEL is applied through receiving gain control R124 to receiving amplifier AR102. The signal is amplified and applied to the attenuator pad.

(2) The attenuator pad reduces the level of the signal to the proper amplitude for application to the telephone receiver.

(3) Line transformer T105 is used to couple a balanced line to an unbalanced line. Transformer T102 couples the signal through ORDER WIRE switch S104 (TALK position) to the receiver of handset HS101.

c. Auxiliary Order Wire Connections.

(1) Hybrid coil T104 is connected to the receiving and transmitting circuits of the order wire, making it possible to talk over the order wire circuit from an external two-wire telephone set. Signaling from the extension point requires vf ringing equipment such as Telegraph-Telephone Signal Converter TA–182/U (TM 11–2137).

(2) CHANNEL TALK switch S101 (LINE position) permits communication to the distant terminal over the vf channels of CHAN MODEM 1, 2, or 3 from order wire handset HS101. When the switch is operated to the TEST BD position, connection is made between handset HS101 and the switchboard side of the vf channels.

d. Ringer-Oscillator Y101 (fig. 22).

(1) *Transmitting.* When ORDER WIRE switch S104 is operated to the RING position, ringer-oscillator Y101 is arranged to function as a 1,600-cps oscillator. The output of ringer-oscillator Y101 is applied through the RING contacts of ORDER WIRE switch S104 to the order wire transmitting circuit.

(2) *Receiving.* When ORDER WIRE switch S104 is operated to the TALK position, ringer-oscillator Y101 is arranged to amplify and rectify the received 1,600-cps ringing signals. Audible and visual indications are provided.

27. Schematic Analysis, Transmitting Circuit

(figs. 23 and 24)

a. Handset HS101 (fig. 23). When the press-to-talk switch is operated on handset HS101, the telephone transmitter is connected in series with the primary of transformer T101, current limiting resistor R101, and a 10-volt supply. The —10 volts is applied from the JUNCTION PANEL through terminals A and T of connector J101. The voice signal is induced into the secondary of transformer T101.

b. ORDER WIRE Switch S104 (fig. 23).

Figure 22. Order Wire Receiver-Transmitter RT–280/TCC–7, (part of Receiver-Transmitter Test Set Group OA–443/TCC–7), block diagram.

(Contained in separate envelope)

When ORDER WIRE switch S104 is operated to the TALK position, the voice signal from the secondary of transformer T101 is applied through contacts 12–13 and 11–14 of ORDER WIRE switch S104 and the contacts of SEND CW switch S102 to the primary of transformer T103. Transformer T103 matches the balanced line to the unbalanced line.

c. Transmitting Pad (fig. 23). The voice signal induced in the secondary of transformer T103 is applied to the transmitting pad (R109 through R111). The pad reduces the level of the voice signal to that of the 1,600-cps ringing signal injected at the pad output, so that all transmitted signals will be at relatively the same level. The output of the transmitting pad is applied through the RING contacts of ORDER WIRE switch S104 to equalizer EQ101. CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch S103 controls the loss-frequency characteristics of equalizer EQ101.

d. CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 Switch S103 (fig. 23).

(1) Switch S103, in conjunction with equalizer EQ101 provides a means for compensating for the loss-frequency characteristic of the spiral-four cable, the repeating coils, and the filters in the order wire circuit. The nine available steps make it possible to approximately preequalize the order wire circuit to the next attended repeater for 0 to 160 cable reels.

(2) Variations in temperature will cause a considerable change in the loss-frequency characteristic of the spiral-four cable. Adjustment of switch S103 can partially overcome the effects of these temperature variations on the order wire circuit.

(3) When the AN/TCC–7 terminal is used in conjunction with a radio set, switch S103 is operated to the RADIO position. In the RADIO position, resistor R138 is connected in place of equalizer EQ101, producing a flat loss, and resistor R113 is connected across terminals F and S on connector J101 (par. 28*a*(2)). No frequency compensation by equalizer EQ101 is required.

(4) For transmitting through 0 to 11 reels of cable, no frequency compensation is required. With switch S103 in the 0–11 position, resistor R138 remains connected and resistor R113 is disconnected from terminals F and S on connector J101. For 12 to 160 reels of cable, equalization is required. Switch S103 provides the proper circuit configuration of resistors R127 through R143 and equalizer EQ101, so that the loss-frequency characteristic of the network precompensates for the spiral-four cable loss-frequency characteristics. The output of equalizer EQ101 is applied to transmitting amplifier AR101.

e. Transmitting Amplifier AR101 (fig. 24).

(1) *Circuit arrangement.* Operating and signal voltages are applied to the amplifier circuit through connector P1. Transformer T1 is the input transformer, and resistors R1 and R4 provide the correct termination for it. Resistor R12 builds out the amplifier input impedance to the required 600 ohms. Resistors R10 and R11 limit the screen and plate voltages, respectively. Capacitors C1 and C2 provide signal decoupling at the 200-volt dc input. Common cathode resistor R7 provides cathode bias for amplifiers V1 and V2.

(2) *Circuit operation.* The vf signal is coupled through transformer T1 and sing-suppression resistor R5 to the control grid of amplifier V1, and through sing-suppression resistor R9 to the control grid of amplifier V2. The amplifiers are arranged for push-pull operation. The output of amplifier AR101 is applied across output transformer T2 to pins 17 and 19 of connector P1. Feedback is obtained from the 4–5 winding of transformer T2 and applied across resistors R8

Figure 23. Order Wire Receiver-Transmitter RT–280/TCC–7, (part of Receiver-Transmitter Test Set Group OA–443/TCC–7), schematic diagram.

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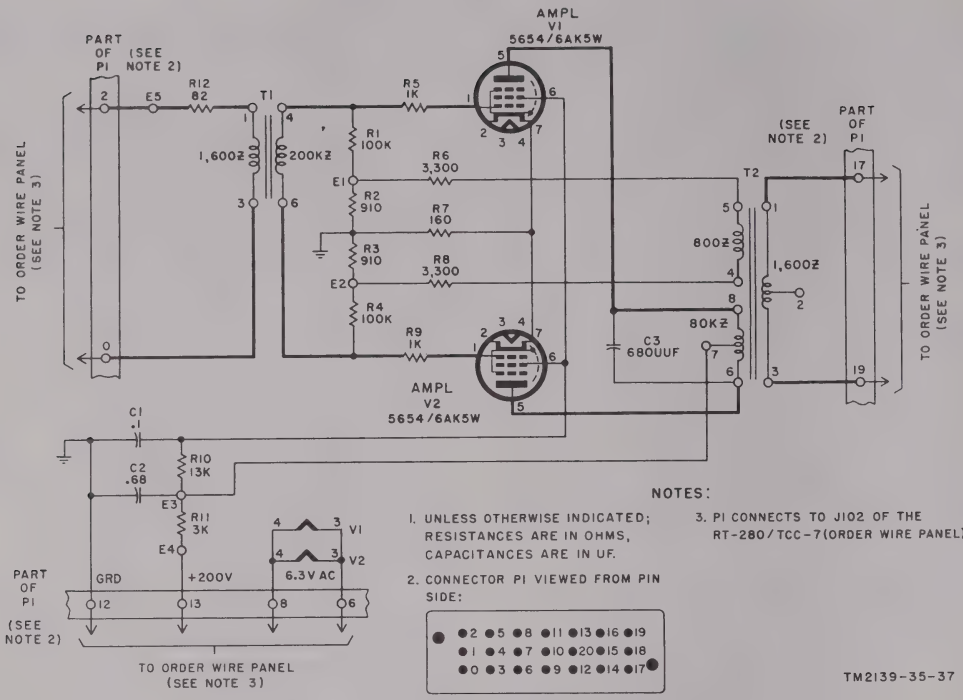


Figure 24. Transmitting Amplifier AR101 (part of Order Wire Receiver-Transmitter RT-280/TCC-7 panel), schematic diagram.

and R3 for the control grid of amplifier V2. Resistors R6 and R2 develop the feedback voltage for the control grid circuit of amplifier V1. Capacitor C3 provides a singing margin for the amplifier.

f. TR GAIN Control Network (fig. 23).

(1) The amplified voice output signal of transmitting amplifier AR101 is applied from pins 17 and 19 of connector P1 through corresponding pins of connector J102 to the transmitting gain control circuit. This circuit consists of a bridged-T pad that uses resistors R115, R116, and TR GAIN control R114. The TR GAIN control provides a means for adjusting the level of the signal to be transmitted over the spiral-four cable.

(2) When the order wire circuit is initially adjusted, the transmitting gain control is used to establish the level of the transmitted signal. The level of the 1-kc test signal is adjusted in accordance with the OW TR AMP OUT table on the front panel of the ORDER WIRE PANEL.

g. Auxiliary Low-Pass Filter FL101 (fig. 23). The signal is then applied through auxiliary low-pass filter FL101 which suppresses undesirable modulation products above 12 kc generated by the transmitting amplifier. The output of FL101 is connected to terminals L and M of connector J101. The signal passes through connector P101 and cable W101 to the low-pass section of low-pass, high-pass filter FL101 (on the JUNCTION PANEL), which separates the order wire voice frequencies from the carrier frequencies.

28. Receiving Circuit, Schematic Analysis
(figs. 23 and 25)

a. REC GAIN Control Network (fig. 23).

(1) Signals from the JUNCTION PANEL are applied from terminals F and S

of connector J101 to the REC GAIN control network (resistors R125, R126, R124A, and R124B, all of which form a bridged-T network). REC GAIN control R124 provides a means of adjusting the input level of the signal to receiving amplifier AR102.

(2) The RADIO position of CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch S103 connects resistor R113 across terminals F and S of connector J101. This additional loss permits proper adjustment of the signal level received from a radio set.

b. Receiving Amplifier AR102 (fig. 25). The operating and signal voltages are applied to the amplifier circuit through connector P1. This circuit is a two-stage voltage amplifier with negative feedback.

(1) *Amplifier V1.* Transformer T1 is the input transformer for the amplifier circuit. Capacitor C1 tunes the secondary of the transformer to 1,000 cps. Resistor R1 provides the proper impedance termination for the transformer. Resistor R2 provides cathode bias and degeneration for the stage. Resistor R4 is the screen-dropping resistor and capacitor C2 is the screen bypass. Input signals are applied through transformer T1 to the control grid of tube V1. The amplified signal is developed across plate load resistor R6.

(2) *Amplifier V2.* Capacitor C3 and resistor R7 form the resistance-capacitance coupling network between amplifiers V1 and V2. Resistor R9 develops cathode bias and degeneration for the amplifier circuit. Resistor R8 limits the plate voltage for the amplifier. Resistors R8, R10, and R11 form a voltage divider network to provide the proper screen grid voltage. Capacitor C3 couples the output

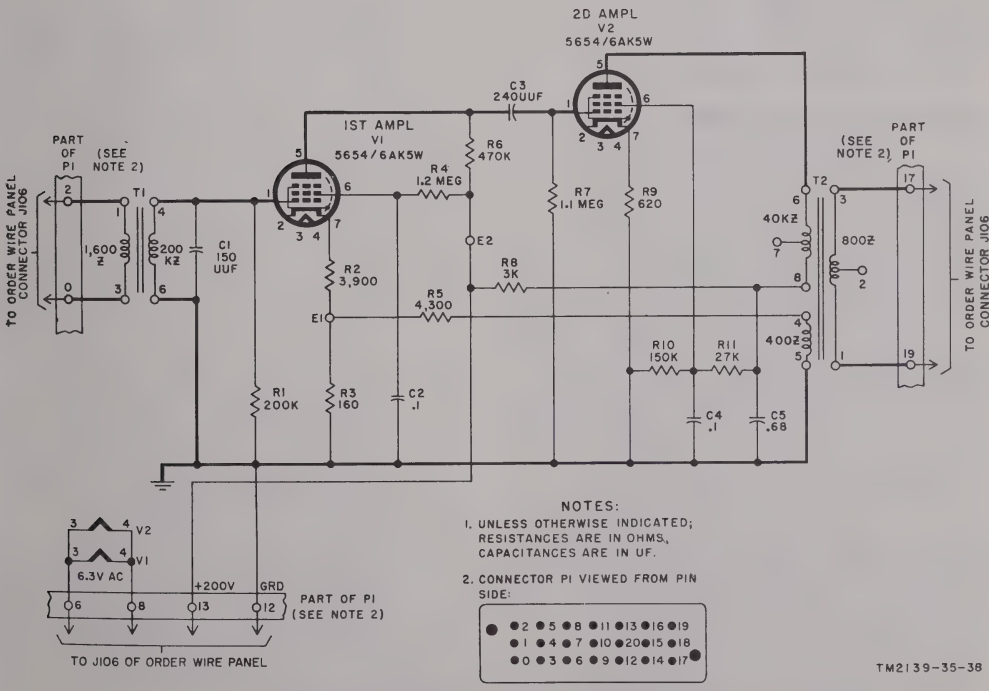


Figure 25. Receiving amplifier AR102, (part of Order Wire Receiver-Transmitter RT-280/TCC-7), schematic diagram.

of amplifier V1 to the control grid of amplifier V2. The amplified signal is applied to output transformer T2. Negative feedback, in addition to that provided by unbypassed resistors R2 and R9, is provided for receiving amplifier AR102 by the 4–5 winding of output transformer T2. The feedback path is through resistors R5 and R3 to the cathode of amplifier V1.

c. REC AMP OUT Jack (fig. 23). This jack (J105) and resistors R122 and R123, bridged across the output of the amplifier, provide a test point for measuring the output of the amplifier.

d. Receiving Pad (fig. 23). The amplified voice signal is applied to the receive pad (composed of resistors R119 through R121) which reduces the signal level applied to the telephone receiver. The signal is then applied through line balancing transformer T105 and contacts 15–16 and 17–18 of ORDER WIRE switch S104 (TALK position). From the order wire switch, the received signal path is completed through impedance matching transformer T102 to the receiver of handset HS101.

29. Order Wire Auxiliary Connections

a. Two-Wire Telephone Extension (fig. 23). Transformer T104 is connected in a hybrid arrangement and interconnects the transmitting and receiving circuits of the order wire circuit to the 2W EXT binding posts. A telephone set connected to the 2W EXT binding posts can be used to talk over the order wire circuit from a remote point. For a detailed description of connections to the CHAN MODEMS refer to paragraph 6*b*. Capacitors C101 through C104, and resistor R117 are connected to transformer T104 to provide correct hybrid balance.

b. CHANNEL TALK Switch S101 (figs. 23 and 26). CHANNEL TALK switch S101, in conjunction with the TALK-MON switches of the CHAN MODEMS, permits the use of handset HS101 for talking over any one of the 12 message channels. Subparagraphs (1) through (4) below cover circuit conditions when arranging order wire handset HS101 for talking over CHAN 1 of CHAN MODEM 1. The switching operation for talking over any of the message channels is identical with that of CHAN 1.

(1) CHANNEL TALK switch S101 (ORDER WIRE PANEL) is connected to terminals C, P, D, and R of connector J101. These pins are connected through connector P101 to the JUNCTION PANEL, and through connector P104 to connector J9 on the SUBGROUP PANEL. In the SUBGROUP PANEL, pins C and P and D and R of connector J9 are connected to pins M and C and L and B respectively of parallel connectors P1, P2, and P3.

(2) When handset HS101 is to be used to communicate over the channel, CHANNEL TALK switch S101 is operated to LINE and TALK-MON switch S101 (CHAN MODEM) is operated to TALK. Thus, handset HS101 is connected through the contacts of the TALK-MON switch to the transmitting and receiving circuits of the CHAN MODEM.

(3) When CHANNEL TALK switch S101 is operated to TEST BD, and TALK-MON switch S101 is operated to TALK, the transmitter of handset HS101 is connected through the contacts of the TALK-MON switch to the output of the channel demodulator. This connection provides a transmitting path from the handset to the receiving circuit of the switchboard. At the same time, the receiver of handset HS101 is connected to the input of the channel modulator. This connection permits handset HS101 to receive signals from the transmitting circuit of the switchboard.

(4) When the TALK-MON switch is operated to MON, and the CHANNEL TALK switch operated to LINE, handset HS101 is connected through the contacts of TALK-MON switch

Figure 26. Order Wire Receiver-Transmitter RT–280/TCC–7, handset connected to CHAN MODEM, functional schematic diagram.

(Contained in separate envelope)

S101 and resistors R102 and R103 to the transmitting circuit of the channel. The handset is connected to the channel receiving circuit through resistors R104 and R105. The resistance of resistors R102 through R105 permits bridging the handset across the channel transmitting and receiving circuits with only relatively small loss to channel transmission.

c. SEND OW Switch S102 (fig. 23). When SEND OW switch S102 is operated to ON, a 1-kc test frequency is transmitted over the order wire circuit for testing and alinement. The 1-kc test signal from the TEST PANEL is applied to the transmitting circuit of the ORDER WIRE PANEL through pins K and W of connector J101 and resistors R107 and R108. Resistors R107 and R108 build out the output impedance of the 1-kc oscillator to a nominal 600 ohms to match the input impedance of transformer T103.

30. Ringer-Oscillator Circuit

When ORDER WIRE switch S104 (fig. 23) is in the nonoperated or TALK position, ringer-oscillator Y101 is arranged to receive an incoming 1,600-cps ringing signal from a terminal, an attended repeater, or an unattended repeater. In the RING position, the circuit is arranged as a 1,600-cps oscillator to signal a distant terminal or attended repeater. When functioning as a ringer, the circuit amplifies and rectifies the 1,600-cps and provides an audible and visual signal. When functioning as an oscillator, the circuit produces the 1,600-cps ringing signal.

a. Ringer Circuit.

(1) *Input amplifier.* An incoming signal from the primary of transformer T105 (fig. 23) is applied through resistor R118 and the normal contacts of ORDER WIRE switch S104 to terminal 1 of connector P1 (fig. 27). Resistor R118 limits the input to the amplifier to the proper operating level. The 1,600-cps input signal is stepped up by transformer T1 and is applied through coupling capacitor C12 and grid current limiting resistor R2 to the grid of amplifier-oscillator tube V1A. Capacitor C12 reduces the response of the amplifier to frequencies below 300 cycles. Resistor R1 (used only when the circuit functions as an oscillator) is shortened by contacts 4–5 of ORDER WIRE switch S104 (fig. 23) when the switch is in the unoperated position. Resistor R3 (fig. 27) terminates input transformer T1. Resistor R5 serves as a cathode bias resistor for tube V1A.

(2) *Signal response circuit, 1,600-cps.* The 1,600-cps signal response circuit consists primarily of transformer T3 and 1,600-cps detector tube V2B. The 5–3 winding of transformer T3 is shunt-tuned to 1,600-cps by adjustable capacitor C5 and fixed capacitors C6 through C9 (as required). The 1,600-cps output of this tuned circuit is taken across terminals 3 and 4 of transformer T3 and applied to the cathode of tube V2B and through capacitor C11 to the plate of tube V2B. On the negative half-cycle of the input signal, tube V2B conducts, charging capacitor C11. During the positive half-cycle of the input signal, while V2B is not conducting, resistor R15 tends to maintain the voltage developed across capacitor C11. The negative voltage developed across capacitor C11 is applied to the control grid of tube V1B through resistor R8 and across capacitor C1 to ground. The time constant of this resistance-capacitance circuit is of such magnitude that it takes approximately .2 second for a sufficiently negative voltage to build up on the grid of tube V1B to reduce the plate current of tube V1B and release relay K1. This delay prevents momentary response of the ringer from speech signals in the vicinity of 1,600-cps.

(3) *Relay control circuit.* Relay control tube V1B controls the operating current through relay K1. Normally, the control grid is slightly positive with respect to the cathode, and sufficient plate current flows to energize relay K1. When a ringing sig-

nal is received, the negative voltage from the junction of capacitor C11 and resistor R15 reduces the plate current of tube V1B, releasing relay K1. Contacts 4–5 break and contacts 5–6 make, discharging time-delay capacitor C1. The relay will reoperate immediately when the ringing signal is removed. Make contacts 1–2 connect buzzer I1 across 6.3 volts through terminals 12 and 15 of connector P1. The CALL lamp (fig. 23), which is connected in parallel with the buzzer through terminals 7 and 17 of connector P1, lights.

(4) *Guard channel circuit.* The guard channel circuit consists primarily of transformer T2 and guard channel detector tube V2A. The secondary winding of transformer T2 is shunted by a 1,600-cps series-resonant circuit consisting of capacitors C3 and C4 and inductor L1. Therefore, only those frequencies outside a narrow band centered about 1,600 cps are passed by this circuit. Shunt capacitor C13 imposes an upper limit on the resonant circuit of about 2,500 cps. The output developed across the secondary of transformer T2 is rectified by guard channel detector V2A. During the conduction period of the tube V2A, capacitor C10 charges across resistors R14 and R17. This rectified positive voltage is taken from the junction of voltage dividers R14 and R17 and applied through resistor R8 to the control grid of tube V1B. This voltage is in series with the negative voltage developed across capacitor C11 by the 1,600-cps signal ((2) above). Speech signals containing a 1,600-cps component may develop an appreciable negative voltage across capacitor C11 that could cause false operation of the ringer. However, the guard channel circuit develops a positive voltage across capacitor C10 from speech frequencies other than 1,600 cps. The resultant voltage applied to the grid of relay control tube V1B would be near zero. Capacitors C12 and C13 limit the band of frequencies to which the guard circuit may respond.

(5) *Clipper circuit.* Varistors CR3 and CR4 limit the amplitude of negative peaks of 1,600-cps signals. This prevents unusually high level speech signals (containing 1,600 cps) from overdriving the guard circuit and causing false operation of the ringer. A —10 volts, obtained from terminal 13 of connector P1, develops a bias voltage of approximately —9 volts at the junction of voltage divider resistors R12 and R13. Thus, when a negative input voltage at the cathode of tube V2B exceeds the bias voltage, the varistors conduct, reducing the voltage at the cathode of tube V2B to approximately that of the bias voltage.

b. Oscillator Circuit (figs. 23 and 27). When ORDER WIRE switch S104 (fig. 23) is operated to the RING position, the ringer-oscillator circuit is arranged as an oscillator.

(1) A feedback path is provided for the 1,600-cps signal from terminal 4 of transformer T3 (fig. 27) to the grid circuit of tube V1A through pin 6 of connector P1 and contacts 1–2 of ORDER WIRE switch S104 (fig. 23), pin 2 of connector P1, voltage divider resistor R1 (fig. 27), pin 5 of connector P1 contacts 3–4 of switch S104 (fig. 23), and pin 8 of connector P1 to current limiting resistor R2 and grid resistor R3. The amplitude of the 1,600-cps oscillations is limited by the bias developed by varistors CR3 and CR4. Capacitor C12 is shorted by contacts 3–4 of ORDER WIRE switch S104 through pins 5 and 8 of connector P1 (fig. 23).

Oscillator-amplifier V1A amplifies the signal causing buzzer I 1 to sound and CALL lamp I 101 to light.

(2) Transformer T1 (fig. 27) serves as an output transformer for oscillator-amplifier V1A by coupling the 1,600-cps signal to the order wire transmitting circuit through contacts 8–9 of ORDER WIRE switch S104 (fig. 23).

Figure 27. Ringer-oscillator Y101, (part of Order Wire Receiver-Transmitter RT–280/TCC–7), schematic diagram.

(Contained in separate envelope)

Section VII. TELEPHONE TEST SET TS–760/TCC–7 (PART OF RECEIVER-TRANSMITTER TEST SET GROUP OA–443/TCC–7)

31. General

The TEST PANEL contains circuits for making selective and nonselective transmission measurements at various points in the transmission circuits of Telephone Terminal AN/TCC–7. The sensitivity and selectivity of the measuring circuits are controlled by the operation of two rotary switches. To make measurements, a measure cord terminated in a measure plug is provided. The measure plug is inserted into various test jacks located on the front panel or chassis of the AN/TCC–7 terminal components. These measurements are made without disturbing the operation of the system. The result of these measurements is indicated on a meter calibrated in decibels. In addition, circuits are provided to measure the voltage of the power supplies. Two oscillators generate test signals that are used for—calibration of the selective measuring circuits, telephone system line-up, system modulation tests, and localizing trouble to unattended repeaters.

32. Block Diagram Analysis of TEST PANEL (fig. 28)

a. Input Circuit. The input circuit consists of flexible measure cord W1 and measure plug P1, input transformer T2, and ATTENUATOR switch S2.

(1) The measure cord and plug are used to connect the measuring circuit to the various test jacks in the telephone terminal. Input transformer T2 presents a high input impedance for minimum bridging loss at each measuring point. The input transformer also permits balanced—or unbalanced-to-ground circuit measurements. From the input transformer, signals are applied to the attenuator.

(2) The attenuator, controlled by ATTENUATOR switch S2, is used to adjust the level of the signals being tested. A maximum of 35-db attenuation may be introduced into the circuit in 5-db steps.

b. Nonselective Control Circuit. The nonselective control circuit consists of MEASURE NON-SELECTIVE switch S4, frequency discriminating filters FL4 and FL5, and attenuators. By operating switch S4, the test signals may be applied to either the selective control circuit, filter FL4 or FL5, the attenuators, or directly to the amplifier-detector circuit (*e* below).

c. Selective Control Circuit.

(1) For selective measurements, a highly selective superheterodyne type of receiver is used. The selective control circuit consists of attenuator and GAIN control R71, MEASURE SELECTIVE switch S3, attenuators, and 62-kc band-pass filter FL1. Attenuator and GAIN control R71 is used to adjust the input level to the circuit during calibration of the circuit. Selective measurements are necessary when one frequency among many

Figure 28. Telephone Test Set TS–760/TCC–7, (part of Receiver-Transmitter Test Set Group OA–443/TCC–7), block diagram.

(Contained in separate envelope)

must be chosen for test, and in an operating system where speech and stray frequency disturbances interfere with precise measurements. When MEASURE NON-SELECTIVE switch S4 is in the OFF position, all signals are applied to the selective control circuit.

(2) When MEASURE SELECTIVE switch S3 is operated to the GRP PANEL 62KC or CHECK GAIN positions, band-pass filter FL1 and the attenuators are connected in the circuit, respectively, to prearrange the sensitivity and selectivity of the modulator-amplifier circuit.

(3) When switch S3 is operated to either the 12KC, 28KC, 67KC, 83KC, or 99KC position, the test signals are applied directly to the modulator-amplifier circuit.

d. Modulator-Amplifier Circuit. The modulator-amplifier circuit consists of a modulator circuit (transformer T3, varistor CR1 and the transformer contained in 194-kc crystal FL2), carrier oscillator V2, 194-kc crystal filter FL2, amplifier AR1, 194-kc band-pass filter FL3, and the output attenuator.

(1) The incoming signal from the selective control circuit is applied to the modulator where it modulates the carrier oscillator frequency. The carrier oscillator frequency is maintained at 194 kc *above* the incoming signal frequency by MEASURE SELECTIVE switch S3. Upper and lower sideband frequencies are produced in the modulator circuit. The output of modulator is applied to crystal filter FL2.

(2) Crystal filter FL2 is tuned to the lower sideband (194 kc) of the modulator output. The filter has a narrow band-pass characteristic which makes the modulator-amplifier circuit highly selective. The output of filter FL2 is then applied to IF amplifier AR1.

(3) Intermediate frequency (IF) amplifier AR1 has characteristics similar to flat amplifier AR2 except that the gain of the IF amplifier is higher. The input signal is amplified and applied to band-pass filter FL3.

(4) Band-pass filter FL3 permits the 194kc IF to pass and suppresses all others. The signal is then applied through the output attenuator to the amplifier-detector circuit (*e* below).

e. Amplifier-Detector Circuit. The amplifier-detector circuit consists of flat amplifier AR2, meter rectifier V3, and test indicating meter M1.

(1) The input to flat amplifier AR2 is controlled by the nonselective control circuit, so that numerous level measurements of preselected test points may be made. The amplifier is stable and has a wide frequency response in order to accept all signals undergoing test. The test signal is amplified and applied to meter rectifier V3.

(2) Meter rectifier V3 rectifies the signals from flat amplifier AR2 and applies the rectified voltages to meter M1.

(3) Meter M1 is a dc microammeter calibrated in db. The input to the meter is selected by MEASURE switch S1. In the TRANSMISSION position, the meter is connected to the output of the meter rectifier. When switch S1 is in the 200 VOLTS and 600 VOLTS position, the meter is connected to the 200-volt and 600-volt power supplies, respectively.

f. Test Oscillators. High-frequency (hf) oscillator V4 and 1-kc oscillator V1 supply signals that are used for system lineup, system modulation tests, and for locating trouble throughout the system.

(1) The hf oscillator generates frequencies of 65, 68, 83, 91, and 99 KC. The 65- and 68-kc test frequencies are controlled by SEND switch S5. The 81-, 91-, and 99-kc test frequencies are controlled by FAULT TEST switch S6. These test frequencies are used for testing, calibration purposes, and for system checks of unattended repeater troubles.

(2) The 1-kc oscillator generates a 1-kc test tone for each channel of CHAN

MODEM 1, 2, and 3 for the ORDER WIRE PANEL.

33. Input Circuit, TEST PANEL, Schematic Analysis
(fig. 29)

a. From measure plug P1, test signals are applied to terminals 4 and 1 of input transformer T2. Input transformer T2 is approximately a 2 to 1 ratio transformer with an effective input impedance of 52,000 ohms. A bridging loss of .3 db or less occurs in the circuit undergoing test because of the high impedance of transformer T2. From terminals 6 and 5 of transformer T2, signals are applied to the attenuator circuit.

b. The attenuator circuit is controlled by ATTENUATOR switch S2, which is a three-section, nonlocking, push-button switch.

(1) *5DB position.* When the 5DB push button is pressed, the input signal passes through a 5-db attenuating pad composed of resistors R25 through R27 before being applied to the nonselective control circuit.

(2) *10DB position.* When the 10DB push button is pressed, the input signal is applied through 10-db attenuating pad composed of resistors R28 through R30 before being applied to the nonselective control circuit.

(3) *20DB position.* When the 20DB push button is pressed, the input signal is applied through 20-db attenuating pad composed of resistors R31 through R33 before being applied to the nonselective control circuit.

34. Nonselective Control Circuit
(fig. 29)

a. Section 1 of MEASURE NON-SELECTIVE switch S4 receives signals from the input circuit on contact 12. In positions corresponding to contacts 1 and 11, the input signal is directed to section 2 of MEASURE SELECTIVE switch S3. In positions corresponding to contacts 2 through 10, the input signal is connected to section 2 of MEASURE NON-SELECTIVE switch S4 either directly, through attenuators, or through frequency discriminating filters.

b. Section 2 of MEASURE NON-SELECTIVE switch S4 controls the input to the amplifier-detector circuit. The signal from contact 12 is applied to the input of the amplifier-detector in all 11 positions (par. 37).

c. Section 3 of MEASURE NON-SELECTIVE switch S4 controls the output of the modulator-amplifier. In the position corresponding to contact 1, the output signals of the modulator-amplifier are applied to section 2 of MEASURE NON-SELECTIVE switch S4 through an attenuating pad composed of resistors R43 and R39 and potentiometer R44. Potentiometer R44 is a factor-adjusted gain control. In the position corresponding to contact 11 of section 3, the output signals of the modulator-amplifier are applied directly to section 2 of MEASURE NON-SELECTIVE switch S4. In positions corresponding to contacts 2 through 10 of section 3, the output of the modulator-amplifier is shorted to ground.

35. Selective Control Circuit
(fig. 29)

An adjustable T pad (resistors R69 through R72) is connected at the input of the selective control circuit to adjust the input level to the circuit. Attenuator and GAIN control R71 is adjusted as required during the initial calibration of the selective control circuit. The function of each section of MEASURE SELECTIVE switch S3 is given in *a* through *c* below.

a. Section 1 of MEASURE SELECTIVE switch S3 connects the various capacitors to the tank circuit of the carrier oscillator. Contact 12 connects the capacitors to the plate of the carrier oscillator (one side of tank circuit) when the switch is operated to contacts 2 through 11. Contact 1 is not connected.

b. Section 2 of MEASURE SELECTIVE switch S3 receives signals from the input circuit on contact 12. Contacts 2 through 11 apply the input signal to section 3 of switch S3 either directly, through attenuators, or through a frequency discriminating filter. Contact 1 is not connected.

Figure 29. Telephone Test Set TS-760/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), schematic diagram.

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c. Section 3 of MEASURE SELECTIVE switch S3 controls the input to the modulator-amplifier circuit (par. 36). Contact 1 applies the signal to the input of the modulator-amplifier from contacts 2 through 10, and 12. The rotating pole is divided into two sections. This is necessary to reduce the capacity between the pole and the other contacts, when the switch is operated to contact 12. To insure correct measurements in this position, it is essential that no signals bypass 62-kc filter FL1 to the input of the modulator-amplifier circuit.

36. Modulator-Amplifier Circuit

a. Carrier Oscillator (fig. 29). The feedback circuit for carrier oscillator tube V2 is composed of the 3–4 winding of transformer T4, coupling capacitor C13, and grid resistor R16. Feedback voltage of the proper phase and magnitude is developed across the 3–4 winding of transformer T4 and applied to the control grid of oscillator tube V2. A portion of the oscillator tank circuit consists of the 5–6 winding of transformer T4, and capacitors C7 through C12. The remaining portion of the tank circuit consists of the capacitors connected into the circuit by section 3 of MEASURE SELECTIVE switch S3. Plate and screen grid operating voltages are supplied through resistor R21. Capacitor C20 bypasses the screen grid to ground. COARSE TUNE capacitor C9 and FINE TUNE capacitor C8 tune the oscillator for maximum response. A carrier voltage of approximately .75 volt root mean square (rms) is developed across the 1–2 winding of transformer T4 and applied to the modulator circuit.

b. Modulator Circuit (fig. 29).

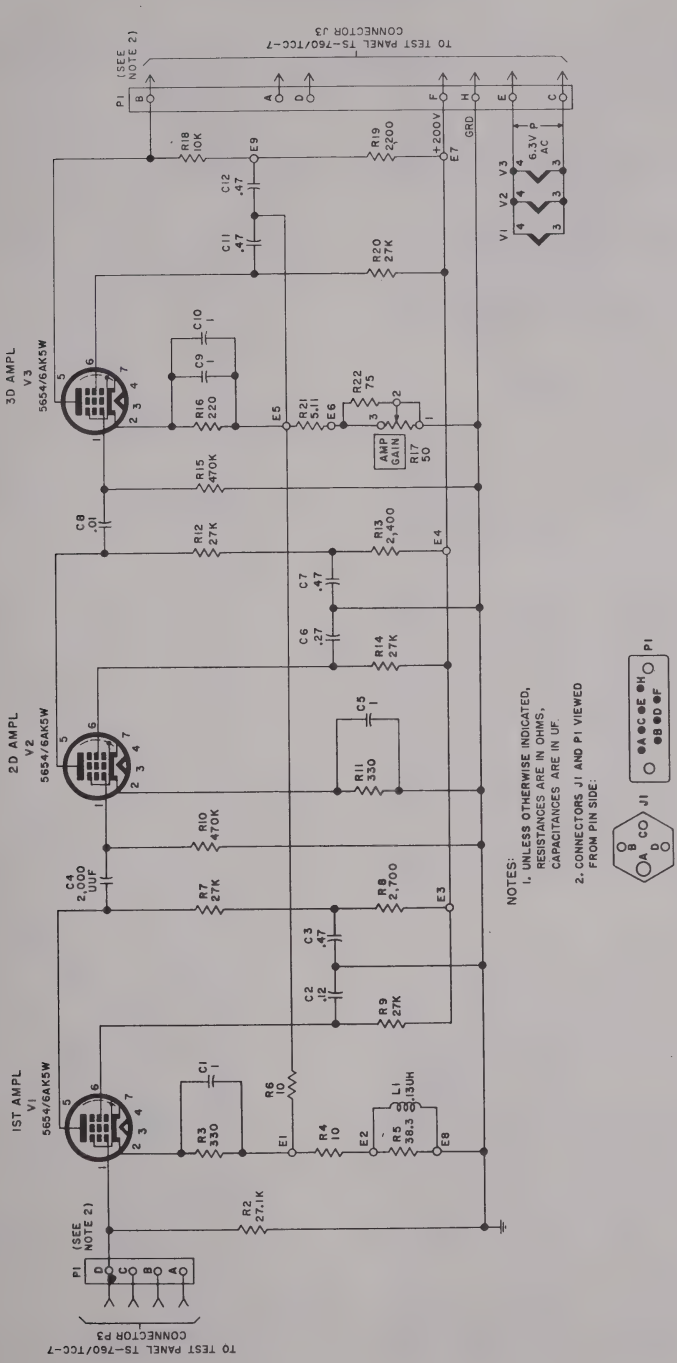
(1) The modulator circuit consists of varistor CR1, connected as a lattice type circuit, input transformer T3, and 194-kc crystal filter FL2. The carrier frequency from oscillator tube V2 is connected through resistors R82 and R83 to terminal 2 of input transformer T3 and terminal 3 of the output transformer (in filter FL2). The oscillator supplies a frequency 194 kc greater than the input frequency that is to be selected. The modulation products in the modulator output include a 194-kc component that has a voltage proportional to the input voltage of the frequency under measurement. The modulator output is connected to the 1–4 terminals of the transformer incorporated in 194-kc crystal filter FL2.

(2) Crystal filter FL2 selects the 194-kc ±25-cps modulation product from the modulator circuit and offers a loss of approximately 40 db at ±500 cycles away from the band pass. This extreme selectivity is necessary, so that the desired frequencies of the system may be selected and measured in the presence of speech on adjacent channels. The output of crystal filter FL2 is applied to IF amplifier AR1 through pin D of connector P3.

c. IF Amplifier AR1 (fig. 30).

(1) Intermediate frequency (IF) amplifier AR1 is essentially the same in circuit and equipment features as flat amplifier AR2 (par. 37*a*). However, they are not interchangeable electrically and cannot be substituted mechanically. In IF amplifier AR1, the phase correcting resistance (R1 of flat amplifier AR2) in series with the grid of first amplifier tube V1 is not used. In addition, less feedback is used. These differences result in slightly more gain in IF amplifier AR1. AMP GAIN control R17 is used to supplement the range of adjustment provided by basic GAIN control R71 (fig. 29). The corresponding control in flat amplifier AR2 does not have a chassis marking, and is factory sealed.

(2) From IF amplifier AR1, signals are applied to terminals 1–2 of 194-kc band-pass filter FL3 (fig. 29). The signals are applied to the band-pass filter through coupling capacitor C14 and an attenuating pad composed of resistors R17 and R77. The 194-kc band-pass filter selects a narrow frequency band centered at 194 kc to increase the selectivity of crystal filter FL2. A peak of discrimination is provided at about 256 kc to further



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Figure 80. IF amplifier AR1 (part of Telephone Test Set TS-760/TCC-7), schematic diagram.

suppress carrier leak from the modulator when maximum sensitivity is required for modulation measurements at 62 kc.

(3) The output of 194-kc band-pass filter FL3 is applied to MEASURE NON-SELECTIVE switch S4 through an attenuating pad composed of resistors R18 through R20. This pad isolates the band-pass filter from circuit capacitance changes caused by the operation of MEASURE NON-SELECTIVE switch S4.

37. Amplifier-Detector Circuit
(figs. 29 and 31)

The amplifier-detector circuit consists of flat amplifier AR2, a meter rectifier, and test indicating meter M1. The input to flat amplifier AR2 is applied from the outputs of the measure nonselective (par. 34) and measure selective (par. 35) control circuits.

a. Flat Amplifier AR2 (fig. 31). Flat amplifier AR2 is a three-stage, wide-band amplifier with negative feedback. To improve the IF characteristics of the flat amplifier, the value of the cathode, screen, and plate filter components are different for each stage of amplification. To improve the hf response, stray capacitance is reduced by placing circuit components away from ground. The frequency response of flat amplifier AR2 is essentially linear from 1,000 to 200,000 cps. The amount of negative feedback in the amplifier circuit is approximately 40 db.

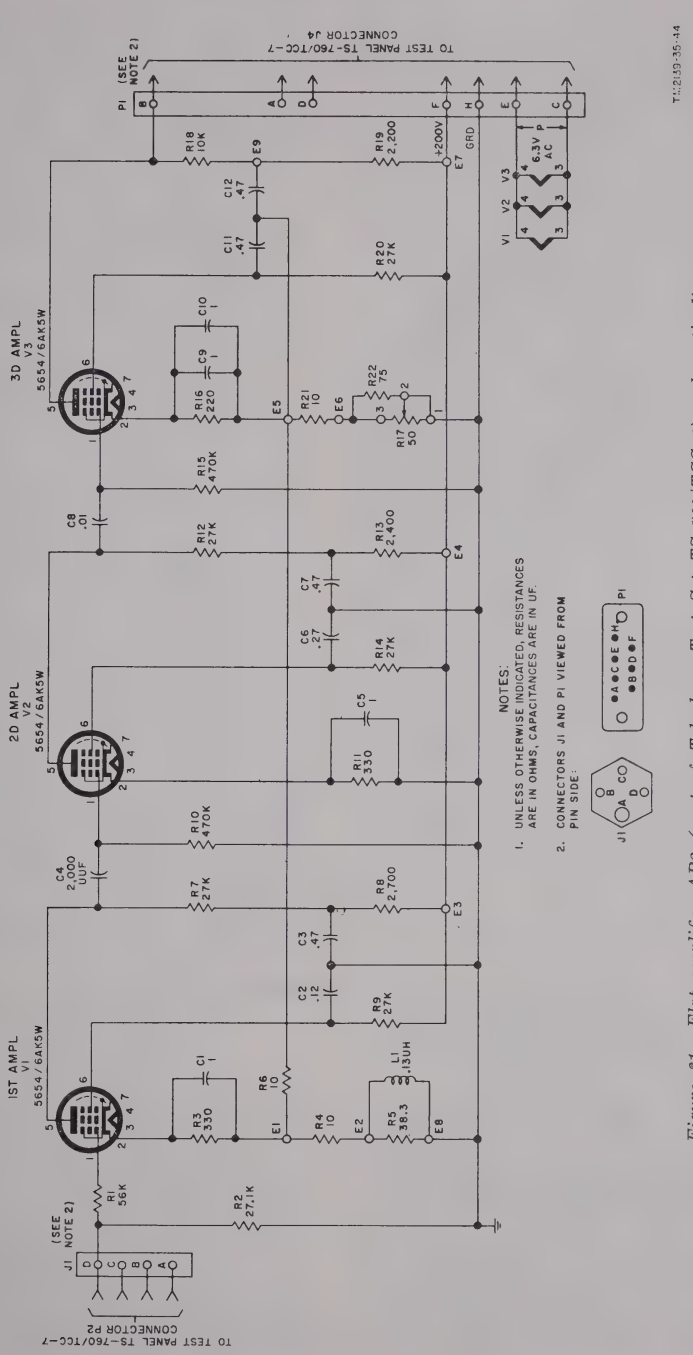
(1) *First amplifier V1.* The input to flat amplifier AR2 is applied through terminal D of connector P2 to first amplifier V1. Resistor R1 provides isolation from the different impedances presented to the amplifier input in the various positions of MEASURE NON-SELECTIVE switch S4 (fig. 29); thus, adequate phase margins at high frequencies are insured. Resistor R2 (fig. 31) provides a grid return path. Cathode bias is provided by resistor R3. Capacitor C1 is a cathode filter connected in parallel with resistor R3. Resistors R4 and R6 are unbypassed, providing degenerative feedback for all frequencies. Resistor R5 lowers the Q of inductor L1 and damps any oscillations that may occur. Inductor L1 improves the hf response and phase margins, making a large amount of negative feedback possible. Resistor R9 drops the voltage to the screen grid and capacitor C2 bypasses variations in the screen grid voltage to ground. Resistor R8 and capacitor C3 provide plate decoupling. The output of first amplifier V1 is developed across plate load resistor R7 and applied through coupling capacitor C4 to the input of second amplifier V2.

(2) *Second amplifier V2.* Resistor R10 provides a grid return path. Cathode bias is provided by resistor R11, and bypassed by capacitor C5. Resistor R14 drops the voltage to the screen grid and capacitor C6 bypasses the screen grid voltage variations to ground. Resistor R13 and capacitor C7 provide plate decoupling. The output of second amplifier V2 is developed across plate load resistor R12 and applied to the input of third amplifier V3 through coupling capacitor C8.

(3) *Third amplifier V3.* Resistor R15 provides a grid return path. Capacitors C9 and C10 bypass cathode bias resistor R16. Degenerative feedback is provided by unbypassed resistor R21. Resistor R22 is a current limiting resistor for potentiometer R17. Potentiometer R17, sealed at the time of manufacture, is used for circuit gain adjustment. Resistor R20 and capacitor C11 are the screen dropping resistor and bypass capacitor, respectively. Resistor R19 and capacitor C12 provide plate decoupling. The output of the amplifier is developed across plate load resistor R18 and is applied through pin B of connector P1 and coupling capacitor C18 (fig. 29) to the input of rectifier tube V3.

b. Meter Rectifier V3 and MEASURE switch S1 (fig. 29).

(1) The input signals from flat amplifier AR2 are applied through coupling



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Figure 31. Flat amplifier AR2 (part of Telephone Test Set TS-760/TCC-7), schematic diagram.

capacitor C18 to rectifier tube V3. Tube V3 is a duotriode connected as a duodiode. Resistor R22 balances the dc resistance of the meter. The meter and resistor R22 are bypassed by capacitors C17 and C16, respectively. Resistors R22 and R23 form a voltage divider circuit. The voltage developed across resistor R22 provides a reverse bias current that effectively opposes the zero-signal diode current. The rectified output from tube V3 is applied to test indicating meter M1 through the contacts of MEASURE switch S1.

(2) When MEASURE switch S1 is operated to 200 VOLTS or 600 VOLTS, the output voltage of 200 volt and 600 volt Power Supplies PP–827/U and PP–826(*)/U, respectively are measured through voltage-dropping resistors R12 and R11. These resistors are connected in series with the positive side of the meter through section 2 of switch S1. The negative side of meter M1 is grounded through contact 2 (200 VOLTS position) or 4 (600 VOLTS position) of section 1 of switch S1. When MEASURE switch S1 is operated to TRANSMISSION, the input polarities to meter M1 are reversed because the negative output of rectifier V3B is used.

38. Test Panel Oscillator Circuits (fig. 29)

The hf and the 1-kc oscillators supply frequencies that are used for calibration of the selective measuring circuits, system modulation tests, and locating system troubles.

a. Hf Oscillator.

(1) The hf oscillator uses pentode tube V4 as its amplifier. The feed-back circuit is composed of the 6–7 winding of transformer T5, coupling capacitor C25, and grid resistor R56. A portion of the oscillator tank circuit consists of the 1–3 winding of transformer T5 and capacitors C23 and C24, which are common to the frequencies generated by the oscillator. The remaining portion of the tank circuit consists of capacitors C49 through C59 which are connected in the oscillator tank circuit through the contacts of SEND switch S5 (*b* below) or FAULT TEST switch S6 (*c* below). Plate and screen grid voltages are supplied through voltage dropping resistor R57. Capacitor C22 bypasses the screen grid to ground. Feed-back voltage for the circuit is developed across the 6–7 winding of transformer T5.

(2) When any one of push buttons REP1, REP2, or REP3 of FAULT TEST switch S6 is not pressed, the output of the oscillator is applied to section 1, terminal 6 of SEND switch S5 through an attenuating pad composed of resistors R52 through R55. Hf potentiometer R55 provides for adjusting the output level of high-frequency oscillator V4.

(3) When any one of push buttons REP1, REP2, or REP3 of FAULT TEST switch S6 is pressed, the attenuating pad is changed by disconnecting resistor R53 from the circuit and inserting potentiometer R38 and resistor R79 in its place. Potentiometer R38 is factory adjusted and sealed.

b. SEND Switch S5. SEND switch S5 controls the distribution of signals generated by hf oscillator V4 and also the selection of the 65- or 68-kc frequency signal.

(1) When SEND switch S5 is operated to the 65KC TR OR FAULT TEST position, SEND lamp I 1 lights and the output of high-frequency oscillator V4 is applied to pins K and R of connector J2, through an attenuating pad composed of resistors R48 through R51. 65KC TR OR FAULT TEST resistor R48 provides for adjusting the output level of the 65-kc test frequency.

(2) When SEND switch S5 is operated to the CHECK GAIN CHECK HF position, the 68-kc output of high-frequency oscillator V4 is applied to CHECK HF test jack J6 through an attenuating pad composed of resistors

R45 through R47, and R80. The 68-kc output is also applied to pin R of TO TS-712/TCC-11 TEST SET connector J5, from the junction of divider resistors R46 and R80. Resistor R24 provides proper impedance termination when adjusting Telephone Test Set TS-712/TCC-11.

(3) When switch S5 is operated to 65KC REC position, SEND lamp I 1 lights and the output of the high oscillator is applied to pins D and R of connector J2 through an attenuating pad composed of resistor R81 and 65KC REC potentiometer R37.

(4) The tank circuit of high-frequency oscillator V4 is connected to section 2, contact 12 of SEND switch S5. When SEND switch S5 is operated to 65KC TR OR FAULT TEST or 65KC REC, capacitors C58 and C59 are connected across the tank circuit to lower the basic oscillator frequency from 68 to 65 kc.

c. FAULT TEST Switch S6. FAULT TEST switch S6 controls the output of the 91-, 83-, and 99-kc fault test frequencies through the operation of push buttons REP 1, REP 2, and REP 3. When any one of the push buttons is pressed, capacitors C49 through C51 are disconnected from the oscillator tank circuit, and output signal level of the oscillator is changed by substituting potentiometer R38 and resistor R79 for resistor R53.

(1) When the REP 1 pushbutton is pressed, capacitors C53 and C52 are connected across the oscillator tank circuit and an oscillator frequency of 99kc is produced.

(2) When the REP 2 pushbutton is pressed, capacitors C55 and C54 are connected across the oscillator tank circuit and an oscillator frequency of 91 kc is produced.

(3) When the REP 3 pushbutton is pressed, capacitors C57 and C56 are connected across the oscillator tank circuit and an oscillator frequency of 83 kc is produced.

d. Oscillator, 1-kc. The output from tube V1 is developed across the 6–7 winding of transformer T1. Feedback of the proper phase and magnitude is developed across the 4–5 winding of the transformer and through coupling capacitor C1 and grid resistor R1. The tank circuit consists of capacitors C2 and C3 and winding 1–3 of transformer T1. Resistor R74 is a grid limiting resistor. Resistor R2 develops cathode bias. Plate voltage is supplied through dropping resistor R3. Capacitors C4 and C5 are plate decoupling and screen grid bypass capacitors, respectively. Control of the output level of 1-kc oscillator V1 is provided by potentiometer R5. Resistors R7 and R75 shunt the output winding of the transformer to prevent load variations from affecting the operation of the 1-kc oscillator. Resistors R8 through R10 terminate CHECK 1KC test jack J1. The output of the 1-kc oscillator is applied to the ORDER WIRE PANEL and the CHAN MODEMS through pins C and P, and S and F of connector J2, respectively.

Section VIII. POWER SUPPLY PP-827/U

39. Block Diagram Analysis
(fig. 32)

a. Input Power Circuit. Either 115 or 230 volts, 49 to 65 cps, is applied to the 200 VOLT POWER SUPPLY. The two TO 600V POWER SUPPLY outlets, J2 and J3, are connected across the input. The primary voltage is applied to AC POWER switch S1, which is operated to energize or deenergize the circuits of the 200 VOLT POWER SUPPLY.

(1) *AC POWER switch S1.* When AC POWER switch S1 is in the ON position, the input voltage is applied through 115/230 V 6 AMP fuses F1 and F2 to 115V–230V change-over switch S3. Power is supplied directly to the transformers from the switch.

(2) *Change-over switch S3, 115V–230V.* When switch S3 is in the 115V position, power is applied through fuse F3 to 115V CONVENIENCE OUTLETS J4 and J5. When switch S3 is in the 230V position, these outlets are not energized. Power is supplied through 230V 3 AMP fuse F4 to the transformers.

b. Filament Supply and Blower Circuit.

(1) *Filament supply.* The filament voltages required for the electron tubes of components of Telephone Terminal AN/TCC–7 are provided by the output of four secondaries of filament supply transformer T3.

(2) *Blower circuit.* The blower circuit operates on 115 volts ac, which is supplied from the input power circuit. Power is applied to blower motor B1 through thermostat switch S2. Thermostat switch S2 is controlled by ambient temperature variations within the 200 VOLT POWER SUPPLY PANEL.

c. Low-Voltage Rectifier Circuit.

(1) The low-voltage rectifier circuit is energized by voltage from one secondary of transformer T1. The output of this secondary is applied to bridge-type full-wave rectifier CR1. The negative 10-volt dc output of the rectifier is filtered by inductor L2 and capacitor C9 and applied through the JUNCTION PANEL to the transmitting and limiting circuits in the ORDER WIRE PANEL.

(2) Two other secondaries of low-voltage rectifier transformer T1 supply power to the filaments of high-voltage rectifiers V1 through V3, to the filaments of series-regulator tubes V4 through V7, and to regulator control amplifier V8.

(3) AC POWER pilot lamp I 1, lights when power is applied through AC POWER switch S1.

d. High-Voltage Rectifier Circuit. Power is applied to the primary of transformer T2 from the input power circuit. Transformer T2 is a step-up transformer which delivers high voltage to high-voltage rectifiers V1 through V3. The rectifiers convert the ac to pulsating dc. The dc output of the rectifiers is applied through the high-voltage filter consisting of inductor L1 and capacitors C1 and C2 to the voltage regulator circuit.

e. Voltage Regulator Circuit. The voltage regulator circuit consists of series-regulator tubes V4 through V7, reference voltage regulator tube V9, and regulator control amplifier V8. These circuits function together to maintain the output of the 200 VOLT POWER SUPPLY at a constant 200 volts.

40. Schematic Analysis, Power Supply PP–827/U

(fig. 33)

a. Input Circuit. Voltage of 115 volts or 230 volts 49 to 65 cps, is supplied to the 200 VOLT POWER SUPPLY through connector P2 and cable W1. The input circuit contains TO 600V POWER SUPPLY outlets J2 and J3, AC POWER switch S1, 115V–230V switch S3, and 115V CONVENIENCE OUTLETS J4 and J5.

(1) *AC POWER switch S1.* AC POWER switch S1 controls the input to power transformers T1 through T3 and to blower motor B1.

(2) *115V–230V switch S3.*

(*a*) *115V position.* When 115V–230V switch S3 is operated to the 115V position, 115 volts ac is applied to parallel-connected primary windings 1–2 and 3–4 of power transformers T1 through T3. The 115-volt ac input is also applied through thermostat switch S2 to blower motor B1. In this position, 115 volts ac is available at 115V CONVENIENCE OUTLETS J4 and J5. This circuit is protected by CONV OUT 6 AMP fuse F3. When 115V–230V switch S3 is operated to the 230V position, the convenience outlets are disconnected.

(*b*) *230V position.* When 115V–230V switch S3 is operated to the 230V position, ac power is applied to series-connected windings 1–2 and 3–4 of power transformers T1 through T3. In this position, 230V 3 AMP fuse F4 is connected into the line to provide additional protection against overload.

Figure 32. Power Supply PP–827/U, block diagram.

Figure 33. Power Supply P–827/U, schematic diagram.

(Contained in separate envelope)

b. Filament Supply and Blower Circuit.

(1) *Filament supply.* Filament voltage of 5.1 volts ac for rectifiers V1 through V3 is obtained from terminals 9 and 10 of transformer T1. Filament voltage of 6.4 volts ac for series-regulator tubes V4 through V7 and for regulator control amplifier V8 is obtained from terminals 5 and 6 of transformer T1. This winding also supplies the voltage for AC POWER indicating lamp I 1. Tube filament voltage of 6.55 volts for the components of Telephone Terminal AN/TCC–7 is obtained from four secondary windings of power transformer T3. Voltage drops in the interconnecting cables reduce the voltage to 6.3 volts at the tubes.

(2) *Blower circuit.* To prevent an excessive temperature rise inside the 200 VOLT POWER SUPPLY, blower motor B1 furnishes forced ventilation whenever the temperature inside the unit exceeds approximately 80° F. The motor is connected to the input power circuit through connectors P1 and J1, and power is applied through thermostat switch S2. Switch S2 remains open until the ambient temperature of the power supply rises to approximately 80° F. At this temperature, the switch closes and the blower motor is energized. When the ambient temperature falls to approximately 65° F., switch S2 opens and the ac power is removed from the motor. Capacitor C8 provides the phase shift which is necessary for operating the motor.

c. Low-Voltage Rectifier Circuit.

(1) The secondary winding between terminals 7 and 8 of transformer T1 supplies 14.5 volts to low-voltage rectifier CR1. The positive dc output appears at terminal 3 of the rectifier; the negative dc output appears at terminal 1. The choke input filter, consisting of inductor L2 and capacitor C9, filters the rectified output. The 10-volt output of the low-voltage rectifier circuit is connected through terminals ED and EH on terminal board TB1 to pins D and H, respectively, of connector P3.

(2) The positive 10 volts dc at pin H of connector P3 is grounded to the chassis of the JUNCTION PANEL which, in turn, is connected through pin R on connector P3 to the chassis ground of the 200 VOLT POWER SUPPLY. The negative 10 volts dc at pin D is applied through the JUNCTION PANEL to the ORDER WIRE PANEL.

d. High-Voltage Rectifier Circuit.

(1) The plates of high-voltage rectifier tubes V1 through V3 are connected to the secondary winding of high-voltage transformer T2 in a conventional full-wave rectifier circuit. The three rectifiers are paralleled to handle the required heavy current load.

(2) The rectifier output is filtered by a choke input filter consisting of inductor L1 and series capacitors C1 and C2. Capacitors C1 and C2 are series-connected, so that their voltage ratings are not exceeded.

(3) Resistors R1 and R2 are connected across capacitors C1 and C2, respectively, to divide the dc voltage evenly between the two capacitors. Because of differences in capacitor leakage resistance, these resistors prevent a difference in voltage from appearing across each capacitor. In addition, resistors R1 and R2 provide a slow discharge path across the capacitors when the power supply is turned off.

e. Voltage Regulator Circuit.

(1) *Series-regulator tubes V4 through V7.* The positive dc output voltage from the filter circuit (*d*(2) above) is applied to plate pins 2 and 5 of parallel-connected series regulator tubes V4 through V7. Resistors R5 through R12, connected to the control grids of the series-regulator tubes, are antising resistors. Resistors R13 through R20 at the cathodes of the series-regulator tubes keep the load current balanced among the triode sections of the four tubes by varying the bias on the tri-

ode section which tends to draw more current. Resistor R3 is connected in parallel with the four parallel series-regulator tubes to shunt some of the heavy load current around the series-regulator tubes.

(2) *Regulator control amplifier V8.* Regulator control amplifier V8 is a twin triode which provides two stages of amplification for the changes in the output voltage of the power supply. Output voltage changes appear as bias voltage changes on amplifier V8A.

(*a*) *Regulator control amplifier V8A.* The center tap of 200V ADJ potentiometer R28 is connected to the control grid of V8A to provide grid excitation for the operation of the first stage of amplification. Potentiometer R28 is part of the voltage divider circuit, consisting of resistors R24 and R23, connected across the 200-volt output. Capacitor C3 maintains the control grid voltage relatively constant in relation to the negative side of the voltage output circuit, and thus makes the input circuit to regulator control amplifier V8A more sensitive to rapid changes in output voltage. The input signal to amplifier V8A is developed across cathode resistor R27, which is also part of a voltage divider circuit, including resistors R25 and R26. Resistor R22 is the plate load resistor for amplifier V8A. Resistor R21 and capacitor C4 eliminate any tendency of the amplifier to oscillate.

(*b*) *Regulator control amplifier V8B.* The amplified output at the plate of amplifier V8A is coupled directly to the control grid of amplifier V8B. Resistor R4 is the plate load resistor for tube V8B. The cathode is held at a constant voltage, with relation to the varying input voltage on the control grid, by the connection to the constant voltage across R26. The voltage across R26 is held constant by the action of voltage regulator tube V9. Capacitor C5 is connected between the cathode and plate supply circuit of amplifier V8B to prevent oscillation at low frequencies. The amplified voltage variations at the plate of amplifier V8B are applied to the control grids of the series-regulator (*e*(1) above) tubes.

(3) *Reference voltage regulator tube V9.* Voltage regulator tube V9 provides a constant voltage drop (108 volts) across resistors R25 and R26. All the rapid variations in the output voltage appear across resistor R27. Because resistor R27 is also the cathode resistor of regulator control amplifier V8A, the variations across it serve as the signal input to that stage. Capacitor C6 aids in keeping the voltage drop across V9 constant, especially when rapidly changing voltages are applied to the tube.

f. Output circuit. Capacitor C7 is a filter capacitor across the 200-volt output of the power supply which lowers the output ripple voltage and provides a low impedance shunt for high frequencies that may appear across the output. The output of the 200 VOLT POWER SUPPLY is connected through terminals EA and EK of terminal board TB1 to pins A and K, respectively, of connector P3.

g. Regulation under Varying Load Voltages.

(1) *General.* A tendency for the output voltage to vary results in change in voltage and current across the voltage divider circuit composed of resistors R25 through R27. Reference voltage regulator tube V9 provides a constant voltage drop of 108 volts across resistors R25 and R26. A voltage is developed across resistor R27 proportional to the change in the output voltage. Resistor R27 is connected to the cathode of regulator control amplifier V8B; the control grid is connected to terminal 2 of 200V ADJ potentiometer R28. The voltage developed across the 1–2 resistance of potentiometer R28 and resistor R24 is held constant to rapid output voltage variations by capacitor C3. The variation in voltage across resistor R27 changes the

bias of regulator control amplifier V8A.

(2) *Increase in output voltage.* When the output of the power supply momentarily increases, the voltage change developed across resistor R27 increases the bias of regulator control amplifier V8A. The increase bias on amplifier V8A causes an increase in plate voltage. The rise in plate voltage is impressed on the control grid of V8B, decreasing its bias. Cathode voltage on amplifier V8B is held constant, with relation to the signal input, by the constant voltage drop across resistor R25. The decrease in bias on the control grid of V8B causes a decrease in plate voltage at pin 6. This decrease in voltage is applied through grid resistors R5 through R12, increasing the grid bias (and dc plate resistance) on series-regulator tubes V4 through V7. The increased dc plate resistance of the series-regulator tubes causes a greater dc voltage drop across the tubes. The increased voltage drop across the series-regulator tubes counteracts the tendency for the output voltage to rise.

(3) *Decrease in output voltage.* A decrease in the output voltage has exactly the opposite effect to that described in (2) above.

Section IX. POWER SUPPLY PP–826A/U

41. General

Power Supply PP–826A/U furnishes a regulated current of .1 ampere dc at a nominal 600 volts to the spiral-four line, to supply operating voltages for Telephone Repeaters AN/TCC–11. Dummy-load resistors are used to compensate for a load decrease when less than three repeaters are used. Protective features include lamp- and buzzer-alarm indicators, and cutoff circuits. The cutoff circuits automatically remove input power from the high-voltage transformers when abnormal operating conditions are encountered.

42. Block Diagram Analysis
(fig. 34)

a. Input Power Circuit. Primary power of 115 or 230 volts is applied through the input power circuit (consisting of AC POWER switch S1, line fuses F1 and F2, and 115V–230V changeover switch S2) to low-voltage transformer T1 on low-voltage rectifier and alarm unit Z2. The output of low-voltage rectifier and alarm unit Z2 provides continuous audible and visual alarms, if any abnormal operating conditions occur. Power cutoff relay K1 is energized through the contacts of RESTORE switch S5, establishing continuity between the input power circuit and high-voltage rectifier transformer T1 and reference voltage rectifier transformer T2. Fuses F3 and F4 are connected into the circuit when 115V–230V changeover switch S2 is operated to 230V.

b. High-Voltage Rectifier Circuit. The high-voltage rectifier circuit consists of a conventional full-wave rectifier circuit (transformer T1, rectifiers V1 and V2), and a high-voltage capacitive input filter (capacitors C1 and C2 and inductor L1). The high-voltage rectifier circuit supplies filtered dc voltage to the current regulator circuit.

c. Current Regulator Circuit. The current regulator circuit controls the current output of the high-voltage rectifier circuit. The circuit consists of parallel regulator tubes V3 and V4, regulator control amplifier V5, and load resistor R6.

d. Reference Voltage Rectifier Circuit. Reference voltage rectifier transformer T2 provides filament voltages for the electron tubes on the 600 VOLT POWER SUPPLY, and input voltage to reference voltage rectifier V6. The dc output of the rectifier filter circuit (capacitors C1 and C2 and inductor L1) is applied to regulator reference voltage tubes V2 through V4. The regulator reference voltage tubes provide standard operating voltages for regulator control amplifier V5 and current regulator tubes V3 and V4.

e. Output Circuit. The output circuit consists of REPEATER switch S6 and load resistors R16 and R17 (not shown). This circuit

functions to maintain a constant load on the power supply whether one, two, three or no Telephone Repeaters AN/TCC–11 are installed on the spiral-four line. In addition, one switch position inserts a dummy load across the power supply output for purposes of test and adjustment.

f. Low-Voltage Rectifier and Alarm Unit Z2. This circuit contains visual and audible alarm circuits that operate to protect equipment and to indicate circuit failures. The low-voltage rectifier and alarm circuit consists of power-cutoff relay K1, which removes ac power from the high-voltage rectifier when the dc output voltage increases during operation, low- and high-voltage alarm circuit, a relay control circuit, and two low-voltage rectifiers which provide power to energize the various relays.

43. Input Power Circuit
(fig. 35)

a. Either 115- or 230-volt primary power for Power Supply PP–826A/U is obtained through connector P1 and cable W1. AC POWER switch S1 applies the 115- or 230-volt input to the power supply. Fuses F1 and F2 protect the primary input power circuit. Switch S2 is the 115- to 230-volt changeover switch. Whenever the temperature within the unit reaches 80° F., thermostat switch S3 closes and operates blower motor B1.

(1) With 115V–230V switch S2 in the 115V position, the 1–2 and 3–4 windings of transformers T1 and T2 on the main chassis and transformer T1 on low-voltage rectifier and alarm unit Z2 (subchassis) are connected in parallel. Blower motor B1 is then connected across the 115-volt line.

(2) With 115V–230V switch S2 in the 230V position, the 1–2 and 3–4 windings in each transformer are connected in series, and blower motor B1 is connected across the 115-volt windings of the transformers. Fuses F3 and F4 protect transformers T1 and T2 on the main chassis and transformer T1 on the subchassis, respectively.

b. When AC POWER switch S1 is operated to ON, voltage is applied to the primary windings of transformer T1 on low-voltage rectifier and alarm unit Z2. Under normal operating conditions, transformer T1 supplies power to rectifier CR2 which energizes the relay circuits to actuate power-cutoff relay K1. When relay K1 operates, power is applied to the primary windings of transformers T1 and T2 and the blower motor circuit on the main chassis.

44. High-Voltage Rectifier Circuit
(fig. 35)

a. The high-voltage rectifier is a conventional full-wave rectifier and filter system consisting of power transformer T1, rectifiers V1 and V2, filter capacitors C1 and C2, and inductor L1. The secondary winding of transformer T1 supplies 1,980 volts ac to rectifiers V1 and V2. Filament voltage for rectifiers V1 and V2 is supplied from the 10 and 11 windings of power transformer T2.

b. The dc voltage output from rectifiers V1 and V2 is filtered by capacitors C1 and C2 and inductor L1. Resistors R6, R7, R10, and R11 on the main chassis, and resistors R10 and R11 and LOW-VOLT ALARM potentiometer R13 on the subchassis form a bleeder path for filter capacitors C1 and C2. From the filter circuit, the output is applied to the plates of current regulator tubes V3 and V4.

45. Reference Voltage Rectifier Circuit
(fig. 35)

a. The reference voltage rectifier circuit consists of transformer T2 and rectifier tube V6 located in the main chassis, and capacitor input filter consisting of capacitors C1 and C2, and inductor L1, voltage regulator tubes V2 through V4, and voltage divider network R4, R5, and R14 located in low-voltage rectifier and alarm unit Z2 (subchassis). Transformer T2 steps up the primary voltage (115 or 230 volts ac) to 770 volts ac in the 5–7 secondary winding. This voltage is applied to full-wave rectifier tube V6. The rectified output of fu l-wave rectifier tube V6 is filtered by filter capacitors C1 and C2 and inductor L1. The

Figure 34. Power Supply PP–826A/U, block diagram.
Figure 35. Power Supply PP–826A/U, schematic diagram.

(Contained in separate envelope)

ripple from the output of the filter is further reduced by the action of current regulator tubes V3 and V4 (main chassis) and resistors R1 and R2, located on the subchassis. Terminal 6 on transformer T2 serves as a common negative point for the rectifier circuit.

b. A constant potential of 300 volts dc is maintained across series current regulator tubes V3 and V4. The permissible 15 percent input voltage variation, the normal dc load of current regulator and control amplifier tubes (main chassis) have no effect on the magnitude of the 300 volts dc. Additional filtering action is provided by resistor R9 and capacitors C4 and C5. These capacitors require approximately 8 seconds to charge up to the full value of the 150 volts developed across voltage regulator tube V4 (located in the subchassis). This 150-volt delayed voltage is applied to the plate of control amplifier tube V5 through plate-load resistor R5, and through resistors R1 and R2 to the screen grids of current regulator tubes V3 and V4, all located in the main chassis.

c. To develop a stable reference voltage for close regulation, the voltage across current regulator tube V3 is further stabilized by current-limiting resistor R3 and voltage regulator tube V2 located in the subchassis. The voltage divider network, consisting of resistors R4 and R5 and potentiometer R14 on the subchassis, is connected to the control grid of control amplifier tube V5 on the main chassis for regulating action (par. 47).

46. Current Regulator Circuit
(fig. 35)

The high voltage from the rectifier and filter circuit (par. 44) is applied to the current regulator circuit which regulates this output at 100 milliamperes. The current regulator circuit consists of regulator tubes V3 and V4, control amplifier tube V5, and load resistor R6, all located in the main chassis.

a. From the negative side of the current regulator circuit (terminal B of TB1), the current flows through pin B of connector P3 to the external load. From the external load, the current path is completed through A of connector P3 and TB1, resistors R12 through R15, CURRENT meter M1, and resistor R6 to the cathodes of regulator tubes V3 and V4. REPEATER switch S6 (par. 48) controls the selection of load resistors R13 through R15 to obtain a fixed load according to the number of unattended repeaters being used. Resistors R10 and R11 provide a voltage divider circuit for the current regulator tubes. The current path for the high-voltage rectifier current regulator circuit is completed from the plates of regulator tubes V3 and V4 to terminal B of TB1 through inductor L1, rectifiers V1 and V2, and terminal 6 of transformer T1.

b. About two seconds after the input power is applied, approximately 80 milliamperes are delivered to the load. The current path is through current-limiting resistor R7, bypassing current regulator tubes V3 and V4 which have not yet reached their operating point. Time delay network resistor R9 and capacitors C4 and C5 introduce a delay of approximately 8 seconds before the full 150 volts from the reference voltage circuit is applied to the screen grids of regulator tubes V3 and V4 and the plate of control amplifier V5. When the delay time has elapsed, the current to the load reaches the full operating value of 100 milliamperes. This delay is necessary to prevent an excessively high voltage from being applied to the tube circuits in the unattended telephone repeaters before their warmup time is reached. This excessive voltage would materially shorten the lives of these tubes and might cause arcing across the lightning arresters used in the system.

47. Regulating Action
(fig. 35)

For automatic regulation, the voltage drop across load resistor R6, which carries the total load current, is compared with a voltage developed in the reference voltage circuit. This voltage is derived from the voltage drop across voltage regulator tube V2 and a parallel voltage-divider circuit consisting of resistors R4 and R5 and LOAD CURRENT potentiometer R14 located in the subchassis.

a. The positive side of load resistor R6 is connected to voltage-regulator tube V2 and the screen grid of control amplifier V5. The net bias between the cathode and grid of control amplifier V5 is the difference between the voltage drop across load resistor R6 and the independent reference voltage on the grid of

control amplifier V5. The reference voltage is developed across voltage regulator tube V2 and the voltage-divider network. Resistors R1 through R4, connected to the screen and grid circuits of current regulator tubes V3 and V4, are used to prevent oscillation. A 600V ADJ variable resistor, R12, is used to compensate for the variations in voltage drop in the spiral-four cable used between repeaters. This condition is caused by variations in the dc resistance of the cable due to temperature changes. Capacitor C3, across the output, is used to provide additional filtering. Resistors R10 and R11 provide a voltage-divider network, whereby the voltage developed across resistor R11 is used as a reference when measuring the output voltage on the meter of the TEST PANEL.

b. An increase in the voltage drop across load resistor R6 will decrease the difference between the cathode and the grid of control amplifier V5, reducing the bias on this tube. This difference between the voltage drop across R6 and the reference voltage from voltage regulator tube V2 is amplified in control amplifier V5 and appears as an increase in plate current. The current rise increases the voltage drop across plate-load resistor R5.

c. Since the plate of amplifier V5 is also connected to the control grids of current regulator tubes V3 and V4, an increase in the voltage drop across R5 will make the bias on regulator tubes V3 and V4 more negative, increasing their dc plate resistance until the load current through resistor R6 is reduced to the proper value of 100 milliamperes.

d. A decrease in the voltage drop across R6 (caused by a decrease in load current) increases the bias on amplifier V5. This results in a decrease in the voltage drop across plate load resistor R5 which, in turn, makes the bias on regulator tubes V3 and V4 less negative. Tubes V3 and V4 conduct just enough to increase the current through resistor R6 to its proper value of 100 milliamperes. The combined output current from regulator tubes V3 and V4 and the current through resistor R7 is measured by CURRENT meter M1 and is adjusted by LOAD CURRENT potentiometer R14 in the voltage reference circuit.

48. REPEATER Switch S6
(fig. 35)

REPEATER switch S6 is provided to insert dummy load resistors R13 through R15 to maintain a constant load on the 600 VOLT POWER SUPPLY when less than three unattended repeaters are used in the power loop. The switch has five positions—0, 1, 2, 3, and TEST.

a. Position 0. REPEATER switch S6 is operated to 0 when no unattended repeaters are used in the power loop. Resistors R13 through R15 simulate the resistance that would be offered by three unattended repeaters and cable. In this position, conditioning current is applied to the cable to lower the contact resistance of the spiral-four cable connectors.

b. Position 1. When only one repeater is used in the power loop, switch S6 is operated to position 1. In this position, resistors R13 and R14 simulate the resistance that would be offered by two unattended repeaters and cable.

c. Position 2. When two repeaters are used in the power loop, switch S6 is operated to position 2. In this position, resistor R13 simulates the resistance that would be offered by one unattended repeater and cable.

d. Position 3. When three repeaters are used in the power loop, switch S6 is operated to position 3. In this position, resistors R13 through R15 are shorted out. 600V ADJ resistor R12 remains in series with the load to provide a means of adjusting the output voltage of the power supply.

e. Position TEST. In this position, resistors R13 through R15 are connected as described in *a* above, except that the output of the power supply is shorted out by contacts 2 and 8 of section 2 of REPEATER switch S6. This position is used when performing initial tests on the unit.

49. Low-Voltage Rectifier and Alarm Unit Z2, General

Low-voltage rectifier and alarm unit Z2 is a subassembly mounted on the main chassis of Power Supply PP–826A/U, and is interconnected with the main chassis by connectors J11 and P11. The major functions of the subassembly are as follows:

a. Senses the resistance of the power loop

(dc resistance of the spiral-four cable, the unattended repeaters, and resistors R12 and R13 through R15 (depending on the position of REPEATER switch S6)) immediately after the power supply is energized (par. 51).

b. Applies input power to the high-voltage rectifier circuit, if the line resistance is correct or, if the line resistance is not correct, will not apply input power to the high-voltage rectifier circuit. Visible and audible alarms indicate incorrect power loop resistance.

c. Disables the sensing and starting circuits if the output of the high-voltage rectifier is not applied to the line within 1 second after the input power is applied to the high-voltage rectifier circuit. This prevents placing high-voltage dc on the line, if line resistance is not correct.

d. Provides visual and audible alarms, if the dc output voltage of the 600-VOLT POWER SUPPLY *decreases* during operation.

e. Removes input power from the high-voltage rectifier circuit, if the dc output voltage *increases* during operation.

f. Provides a means of checking the resistance of the power loop with RESTORE switch S5 and CURRENT meter M1.

50. Starting, Initial Circuit Conditions (fig. 35)

Immediately after AC POWER switch is operated to ON, the following conditions exist:

a. A regulated voltage of +108 volts dc (produced by rectifier CR2 and voltage regulator V1) is applied through terminal 22 of connectors P11 and J11, the contacts of RESTORE switch S5, terminal 24 of connectors J11 and P11, and contacts 3–10 of relay K5, to terminal 8 of relay K6. Terminal 7 of relay K6 is connected to ground through three parallel current paths. One current path is from ground through terminal B of connector P3, the power loop, terminal A of connector P3, the circuit elements between terminal A of connector P3 and terminal 29 of connectors J11 and P11, contacts 6–11 of relay K2, contacts 10–3 of relay K7, to the winding of relay K6. A second current path is from ground through resistors R11, R13, and R10, (on subchassis), through contacts 6–11 of relay K2, contacts 10–3 of relay K7, to the winding of relay K6. A third current path is from ground through closed contacts 8–12 of relay K7, resistor R27, to the winding of relay K6.

b. A dc voltage is produced by a low-voltage power supply that consists of rectifier CR1 and its associated circuit elements. Terminal 21 of relay K7 is connected to +24 volts dc from rectifier CR1. Terminal 22 of relay K7 is connected, *before the operation of relay K6*, through parallel resistors R29 and R30, contacts 3–1 of relay K6, resistor R32, the winding of relay K10, contacts 8-12 of relay K5, terminals 25 of connectors P11 and J11, the contacts of RESTORE switch S5, and terminals 26 of connectors J11 and P11 to the —24-volt dc output of rectifier CR1. Because of the resistance of the winding of relay K10 and resistor R32, relay K7 will not operate.

c. The +24-volt dc output of rectifier CR1 is applied to terminal 7 of relay K1. Terminal 8 of relay K1 is connected through resistors R26 and R32, the winding of relay K10, contacts 8–12 of relay K5, terminals 25 of connectors P11 and J11, the contacts of RESTORE switch S5, and terminals 26 of connectors J11 and P11 to the —24-volt dc side of rectifier CR1. Because of the resistance of the winding of relay K10 and resistor R32, relay K1 will not operate.

d. As described in *b* and *c* above, the winding of relay K10 is in the path from the —24-volt dc side of rectifier CR1 to terminal 8 of relay K1 and terminal 22 of relay K7. However, capacitor C7, which is connected across the winding of relay K10 and is not charged initially, acts as a shunt immediately after the AC POWER switch is operated to ON. Therefore, the initial current flow through the winding of relay K10 is not large enough to energize the relay. Relay K10 remains unoperated throughout normal operation unless the power supply fails to start or, after having started, is turned off by a high-voltage output condition (par. 53*b*).

e. The operating path of relay K5 is open and remains so throughout normal operation unless the power supply fails to start or, after having started, is turned off by a high-voltage output condition.

f. Seven volts ac is developed across winding 11–12 of transformer T1 on the subchassis. One terminal of each of the three alarm lamps (I 1, I 2, and I 3) and ac buzzer I 4 is con-

nected to terminal 11 of the 7-volt winding. However, before the operation of relay K2, K5, or K7, the 7 volts ac is not connected to any of the lamps or the buzzer. Therefore, the lamps are not lighted and the buzzer is silent.

51. Line Resistance Sensing Circuit, General
(fig. 36)

a. Power Supply PP–826A/U has been designed to operate into a nearly constant load equal to the resistance of a power loop that incorporates a maximum of three unattended repeaters. If fewer than three unattended repeaters are used, additional resistance is inserted into the power loop by the operation of REPEATER switch S6 (par. 48) to make the total loop resistance approximately equal to that of a system with three unattended repeaters. The resistance of each unattended repeater is between 1,100 and 1,800 ohms. Therefore, together with the dc resistance of the spiral-four cable sections, the total resistance of a power loop containing three unattended repeaters, should be approximately 5,000 ohms.

b. If the power loop resistance is between 3,500 ohms and 6,500 ohms, input power is applied to the high-voltage rectifier. The sensing and starting functions are accomplished as follows: Relay K6 operates when the line resistance is 6,500 ohms or less. The operation of relay K6 causes relay K7 to operate. After relay K7 has operated, relay K6 will release if the line resistance is more than 3,500 ohms. Relay K1 operates when relay K6 releases, applying ac input power to the high-voltage rectifier.

52. Relay Starting Action

a. Operation of Relay K6 (fig. 36).

(1) The current that flows through the winding of relay K6 will be enough to operate relay K6 if the resistance of the line load does not exceed 6,500 ohms (par 51*b*).

Note. Relay K6 is hermetically sealed. It cannot be adjusted. Generally, relay K6 will not operate if the loop resistance is more than 6,500 ohms. However, because of manufacturing variations, some of these relays will operate between 6,500 and 16,000 ohms.

(2) The operation of relay K6 closes contacts 4–5 and contacts 2–3 (fig. 37), operating relay K7.

b. Operation of Relay K7 (fig. 37).

(1) When relay K6 is energized, its 2–3 contacts close, providing a lower resistance path to operate relay K7. This path is from terminal 22 of relay K7 through parallel resistors R29 and R30, contacts 3–2 of relay K6, contacts 11–6 of relay K5, terminals 25 of connectors J11 and P11, the contacts of RESTORE switch S5 and terminals 26 of connectors J11 and P11 to the —24-volt dc side of rectifier CR1. Contacts 2–9 of relay K7 provide holding action for the relay.

(2) When relay K7 is energized, its 3–10 contacts (fig. 35) open and relay K6 deenergizes, if the power loop is not less than 3,500 ohms (*c* below).

c. Deenergizing Relay K6 (fig. 36).

(1) Before the operation of relay K7, contacts 4–5 of relay K6 are closed, and variable resistor R16 is shorted by closed contacts 3–10 of relay K7.

(2) After relay K7 operates, its 3–10 contacts open. The energizing path for relay K6 is now through resistor R16.

(3) Resistor R16 is adjusted, so that the current through the winding of relay K6 will decrease to the point where relay K6 will deenergize, if the resistance of the power loop is greater than 3,500 ohms.

(4) If relay K6 deenergizes, relay K1 is operated (fig. 35) and 115 volts ac is applied to power transformers T1 and T2 on the main chassis (*d* and *e* below).

(5) When relay K6 deenergizes, its 4–5 contacts open (fig. 36). Since contacts 3–10 of operated relay K7 are also open, the winding of relay K6 will therefore be isolated from the

Figure 36. Power Supply PP–826A/U, sensing circuits, schematic diagram.

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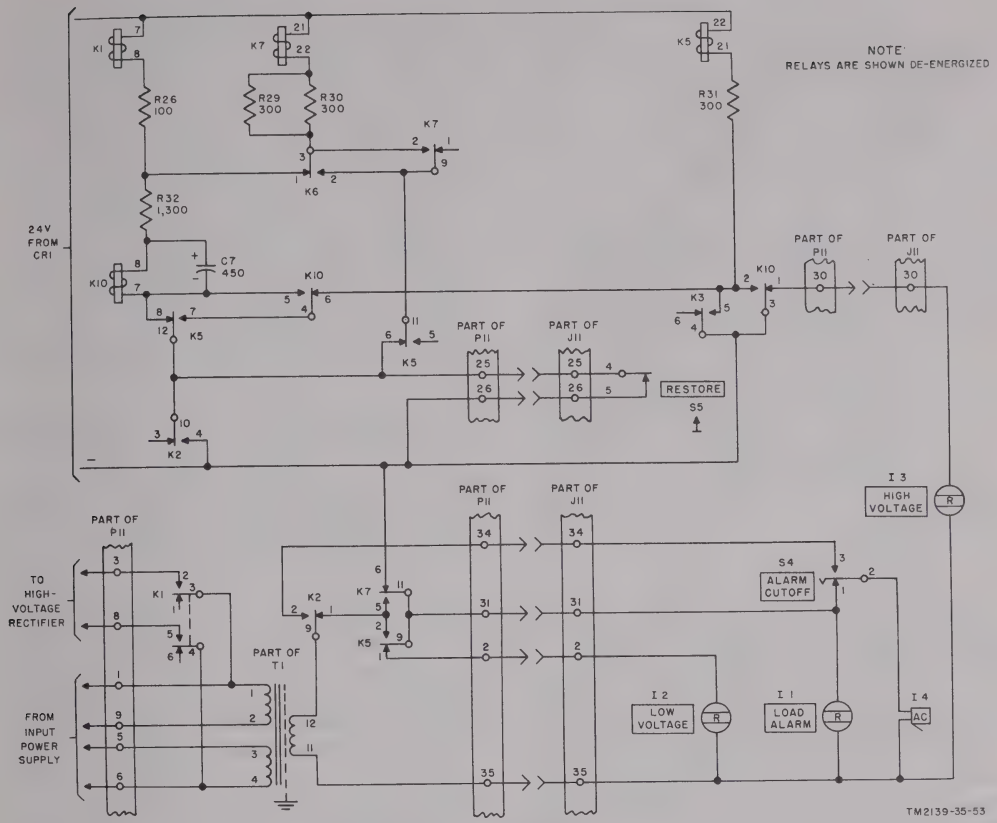


Figure 37. Power Supply PP-826A/U, starting and alarm indicating circuits, schematic diagram.

600 volts dc that will appear at terminal 29 of connector P11 after input power has been applied to the high-voltage rectifier circuit.

d. Operation of Relay K1 (fig. 37).

(1) When relay K6 operates (*c* above), its contacts 1–3 open without affecting the resistance of the energizing path of relay K1.

(2) When relay K7 operates (*b* above), its 2–9 contacts close. However, this will not affect the resistance of the energizing path of relay K1 unless K6 has deenergized (*c* above).

(3) With relay K7 operated and relay K6 deenergized, the —24-volt dc side of rectifier CR1 is connected to terminal 8 of relay K1 through a lower resistance path, operating relay K1. This lower resistance path is from terminal 8 of relay K1, through resistor R26, contacts 1–3 of released relay K6, contacts 2–9 of operated relay K7, contacts 11–6 of unoperated relay K5, terminals 25 of connectors P11 and J11, the contacts of RESTORE switch S5, and terminals 26 of connectors J11 and P11 to the —24-volt dc side of rectifier CR1.

e. Applying Power to High-Voltage Rectifier Circuit (fig. 37). The high-voltage rectifier circuit receives 115 volts ac through terminals 1 and 6 of connector P11, contacts 4–5 and 3–2 of operated relay K1, and terminals 3 and 8 of connector P11.

f. Visual and Audible Indications (fig. 37).

(1) After relay K7 operates (*b* above), its contacts 5–11 close, energizing LOAD ALARM and LOW VOLTAGE lamps I 1 and I 2, respectively, and buzzer I 4 sounds. The buzzer can be silenced by operating ALARM CUTOFF switch S4.

(2) Relay K2 operates approximately 20 seconds after the high-voltage rectifier circuit has been activated. Contacts 1–9 of relay K2 open, deenergizing LOAD ALARM and LOW VOLTAGE lamps I 1 and I 2, respectively. If the ALARM CUTOFF switch is in its operated position, the buzzer will sound. Operating the switch to its normal position will silence the buzzer.

53. Sensing and Failure To Operate, General

(figs. 36 and 37)

If the power loop resistance is too high (6,500 ohms) or too low (3,000 ohms), the power supply will not start. In either case, failure to start causes relay K10 to operate and after a delay of approximately 1 second, relay K5 will also operate. The operation of relay K5 disables the sensing and starting circuits. If an intermittent open or short in the power loop initially prevents the power supply from starting, it will not be able to start automatically until the intermittent condition is cleared. The power supply can be made to sense the line conditions again by operating RESTORE switch S5 or by resetting AC POWER switch S1 (fig. 35). A detailed description of sensing and starting functions is given in paragraphs 54 through 56.

54. Failure To Operate, Resistance Above 6,500 Ohms

a. If the resistance of the power loop is too high, relay K6 (fig. 36) will not operate (par. 52*a*). Although relays K1, K7, and K10 (fig. 37) are connected across the output of rectifier CR1, the current through the relay windings is insufficient to cause the operation of relays K7 and K1.

b. Capacitor C7 prevents current from flowing through the winding of relay K10 immediately after AC POWER switch S1 is set to ON (par. 50*d*). The capacitor also prevents the current through the winding of relay K10 from reaching the value required to operate the relay for approximately 1 second after the AC POWER switch is operated to ON. This prevents disabling the sensing and starting circuits before the power has been able to start into the correct power loop resistance.

c. When relay K7 operates and relay K6 deenergizes, relay K10 is prevented from operating by a short circuit connected across its winding. The short circuit is traced from the junction of resistors R26 and R32 through contacts 1–3 of deenergized relay K6, contacts 2–9 of operated relay K7, contacts 11–6 of unoperated relay K5, and contacts 12–8 of relay K5, to terminal 7 of the winding of relay K10. Therefore, relay K10 operates approximately 1 second after AC POWER switch S1 is operated to ON, *only* if the power supply has *not* been activated during this period.

d. Following the 1-second time delay (*b* above), relay K10 energizes, operating relay K5. The energizing path for relay K5 is from the —24-volt dc side of rectifier CR1 through contacts 3–2 of relay K10, current-limiting resistor R31, and the winding of relay K5 to the +24-volt dc side of rectifier CR1. Contacts 4–5 of relay K10 close immediately without affecting the operation of any other relay.

e. The operation of relay K5 causes the following actions:

(1) Contacts 3–10 of relay K5 open (fig. 36), removing the +108 volts from terminal 8 of relay K6. This disables the sensing functions because relay K6 cannot operate regardless of the power loop resistance.

(2) Contacts 4–10 or relay K5 close, providing a discharge path for capacitor C6. If the sensing function is initiated again by operating RESTORE switch S5 (par. 53), capacitor C6 will recharge and prevent the power supply from starting into an open line.

(3) Contacts 6–11 of relay K5 open the locking path for relay K7 (fig. 37).

(4) When contacts 8–12 of relay K5 open, capacitor C7 discharges through the

winding of relay K10. The capacitor discharge current will be enough to keep relay K10 operated until contact 12 of relay K5 moves from contact 8 to contact 7. The winding of relay K10 remains connected to the —24-volt dc side of rectifier CR1 through contacts 7–12 of relay K5.

(5) When relay K5 operates, contacts 2–9 close and LOAD ALARM lamp I 1 is energized by the ac voltage developed across winding 11–12 of transformer T1 on the subchassis. If ALARM CUTOFF switch S4 is in the unoperated position, the ac buzzer will sound.

55. Failure To Operate, Resistance Below 3,500 Ohms

a. If the resistance of the power loop is less than 3,500 ohms, enough current from the +108-volt supply (CR2 and associated circuit elements) will operate relay K6 (fig. 36). Relay K7 will then operate and lock itself (fig. 37). The energizing path of relay K6 is through potentiometer R16 (fig. 36). This potentiometer is adjusted, so that K6 releases *only* if the power loop resistance is *greater than 3,500 ohms.* Relay K6 remains operated.

b. Under the condition stated in *a* above, current flows through relay K1, but it is not enough to operate the relay (fig. 37). This current path is from the —24-volt dc side of rectifier CR1 through terminals 26 of connectors P11 and J11, contacts of the RESTORE switch, terminals 25 of connectors J11 and P11, contacts 12–8 of relay K5, the winding of relay K10, resistors R32 and R26, and the winding of relay K1, to the +24-volt dc side of rectifier CR1.

c. When the 600 VOLT POWER SUPPLY fails to operate because of a high resistance power loop, relay K10 energizes after a time delay of approximately 1 second (par. 54*b*). As a result of relay K10 energizing, relay K5 energizes; when relay K5 energizes, the same actions as those described in paragraph 54*e* occur except that LOAD ALARM and LOW VOLTAGE lamps I 1 and I 2, respectively, will light and buzzer I 4 will sound before relay K5 operates.

d. When relay K5 operates, its contacts 1–9 open and LOW VOLTAGE lamp I 2 is extinguished.

e. Contacts 6–11 of relay K5 open, deenergizing relay K7. Contacts 5–11 of relay K7 open; however, LOAD ALARM lamp I 1 will not be extinguished. The lamp remains connected to terminal 12 of transformer T1 through contacts 2–9 of relay K5 and contacts 1–9 of relay K2.

56. Resensing After Failure To Operate (fig. 37)

After the 600 VOLT POWER SUPPLY has failed to operate, it can be made to resense either by operating and releasing nonlocking RESTORE switch S5 or resetting AC POWER switch S1. The power supply will then operate if the power loop resistance is correct.

a. The operation of RESTORE switch S5 opens the path from the —24-volt dc side of rectifier CR1 to the winding of relay K10. When relay K10 deenergizes, contacts 2–3 of relay K10 open and relay K5 deenergizes.

b. To initiate resensing action, RESTORE switch S5 must be held in the operated position long enough for relay K10 to deenergize. Relay K10 does not deenergize immediately, because the discharge current of capacitor C7 holds the relay energized for approximately 2 seconds.

c. By relay K10 and relay K5 energizing, LOAD ALARM lamp I 1 and ac buzzer I 4 energize (if ALARM CUTOFF switch S4 is unoperated). The LOAD ALARM lamp provides an indication of the release of relay K10. To be sure that relays K10 and K5 deenergize, RESTORE switch S5 is held operated until the LOAD ALARM lamp extinguishes.

57. Control Amplifier, General

The control amplifier circuit includes amplifier V6, voltage regulator V5, low-voltage relay K2, and high-voltage relay K3 (fig. 38). This circuit responds to variations of the 600-volt dc output and actuates alarms when this voltage is either too low or too high. Approximately 20 seconds after the high-voltage rectifier circuit has been energized, the plate current of amplifier V6 will respond to the 600-volt dc output voltage of the power supply. If this voltage is normal (*a* below), low-voltage relay K2 is operated and high-voltage relay K3

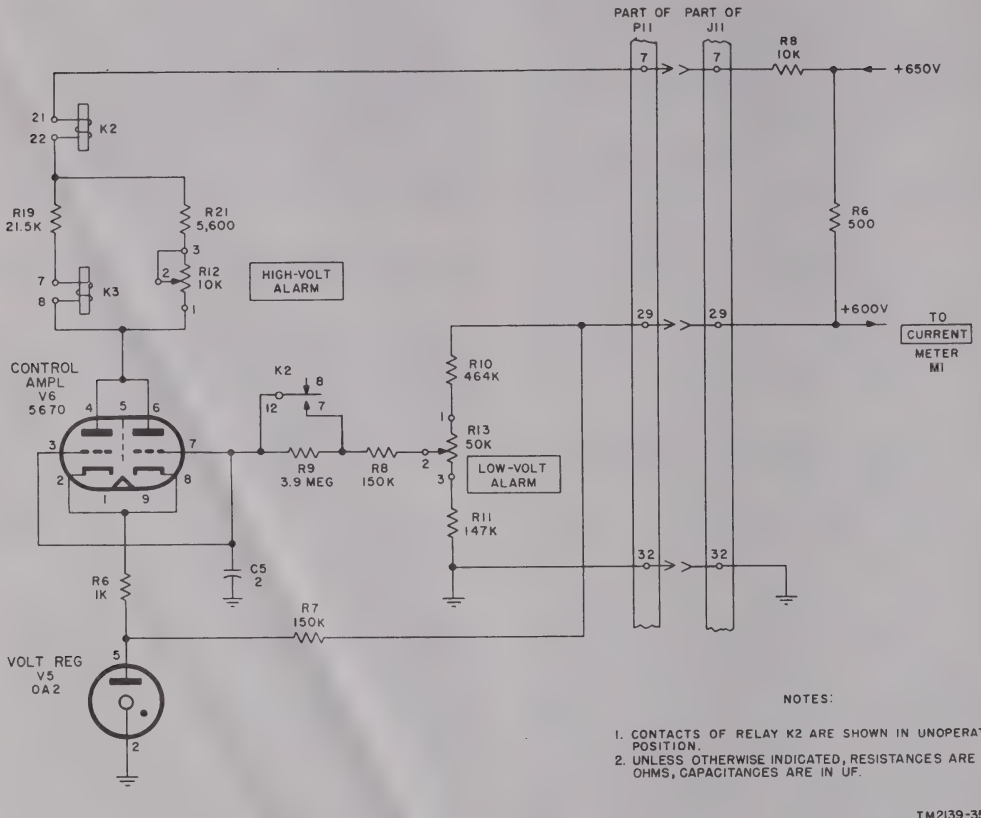


Figure 38. Power Supply PP-826A/U, control amplifier circuit, schematic diagram.

is unoperated. If the output voltage is too low (*b* below) (power loop resistance less than that of a normal system), relay K2 releases. If the output voltage is too high (*c* below) (power loop resistance greater than that of a normal system), relay K3 operates.

a. Normal Output Voltage Condition (fig. 38). Amplifier V6 functions as a single-stage dc amplifier with two paralleled sections. A voltage of 650v dc from the high-voltage regulator circuit is applied through resistor R8 to the plate circuit of control amplifier V6. The cathode of amplifier V6 is maintained at a fixed potential by voltage regulator tube V5. The 600-volt dc output voltage of the power supply is applied across resistors R10, R13, and R11, and across voltage-dropping resistor R7 and voltage regulator tube V5 (on the subchassis).

(1) Immediately after the high-voltage rectifier circuit is energized, the potential at terminal 2 of LOW-VOLT ALARM potentiometer R13 is applied through resistors R8 and R9 to the grids of amplifier V6. Initially, uncharged capacitor C5 acts as a low impedance path to ground for the grids of tube V6. The plate current of amplifier V6 will not be enough to make relay K2 or K3 operate. The impedance of capacitor C5 increases as it charges through resistor R8 and R9, increasing the voltage applied to the grids of amplifier V6. The values of resistors R8 and R9 and capacitor C5 are chosen, so that the full voltage present at terminal 2 of LOW-VOLT ALARM potentiometer R13 is applied

to the grids after a time delay of approximately 20 seconds. The plate current of amplifier V6 is then enough to operate relay K2.

(2) The 20-second delay in applying the voltage to the grids of tube V6 ((2) above) is necessary, because the output voltage of the power supply is higher than 600 volts dc until the filaments of the tubes in the unattended repeaters have reached operating temperature. An excessively high voltage initially applied to the grids of amplifier tube V6 would immediately energize relay K3, interrupting the dc output of the power supply. However, because of the 20-second time delay, the initial high-voltage output does not affect the potential at the grids of amplifier tube V6. During the 20-second time delay, the dc output voltage of the power supply returns to its normal value of 600 volts, applying the correct voltage to the grids of amplifier tube V6.

b. Energizing of Relay K2 (fig. 37). The energizing of relay K2 causes the following changes in circuit condition:

(1) LOAD ALARM and LOW VOLTAGE lamps I 1 and I 2 extinguish.

(2) Contacts 4–10 of operated relay K2 close, bypassing the contacts of RESTORE switch S5. Therefore, the operation of this switch cannot break the energizing paths of relays K7 and K1.

(3) Contacts 7–12 short out resistor R9 (fig. 38). The time constant of the RC network in the grid circuit of amplifier tube V6 is shortened to enable the plate current of the tube to change very quickly in response to variations of the output voltage of the power supply.

(4) Contacts 6–11 of operated relay K2 open (fig. 36), removing the +600 volts dc that appears at terminal 29 of connector P11 from the +108-volt circuit (rectifier CR2 associated circuit elements).

58. Low-Voltage Relay Circuit

a. General (fig. 38). If the resistance of the power loop decreases, the output voltage of the 600 VOLT POWER SUPPLY will decrease, and its output current will increase. The decrease in output voltage results in a decrease of the voltage applied to the grids of amplifier tube V6. This action decreases the plate current of the tube, causing relay K2 to release. LOW-VOLT ALARM control R13 is adjusted during initial adjustments of the power supply to make relay K2 release when the output voltage of the power supply decreases to 530 volts dc.

b. Deenergizing of Relay K2. When relay K2 deenergizes, the dc output of the power supply is not interrupted, and relays K1 and K7 remain energized (fig. 37). The deenergizing of relay K2 causes the following changes in circuit condition:

(1) Contacts 4–10 of relay K2 open. The energizing path for relays K1 and K7 is through the contacts of RESTORE switch S5. The RESTORE switch may be operated to determine the resistance of the power loop (par. 61).

(2) Contacts 6–11 of relay K2 close (fig. 36), enabling the measurement of power loop resistance (par. 61).

(3) Contacts 1–9 of relay K2 close, energizing LOAD ALARM lamp I 1 and buzzer I 4 through contacts 5–11 of operated relay K7 (fig. 37). The buzzer can be silenced by operating ALARM CUTOFF switch S4.

59. High-Voltage Relay Circuit

a. Operation (fig. 38).

(1) The voltage output of the 600 VOLT POWER SUPPLY will increase, if the resistance of the power loop increases. The increase in output voltage results in an increase of the voltage applied to the grids of amplifier tube V6. This increases the plate current of the tube, energizing relay K2.

(2) HIGH-VOLT ALARM control R12 and resistors R19 and R21 control the portion of the plate current that flows

through relay K3. The control is adjusted during initial adjustment of the power supply to operate relay K3 when the output voltage of the power supply increases to 670 volts dc.

(3) When relay K3 energizes, its 4–5 contacts close to complete the energizing path for relay K5 (fig. 37).

b. Energizing of Relay K5 (fig. 37). The energizing path for relay K5 is from the —24-volt dc side of rectifier CR1, through contacts 4–5 of relay K3, current-limiting resistor R31, and the winding of relay K5, to the +24-volt dc side of rectifier CR1. The energizing of relay K5 causes the following changes in circuit conditions:

(1) Contacts 7–12 of relay K5 close, locking relay K5 through contacts 4–6 of unoperated relay K10.

(2) Contacts 6–11 of relay K5 open, breaking the energizing path of relay K7 (par. 52*b*). The release of the 2–9 contacts of relay K7 causes relay K1 to deenergize, removing the ac input voltage from the high-voltage rectifier circuit. The interruption of the 600-volt dc output causes relays K2 and K3 to deenergize (fig. 38).

(3) Contacts 4–10 of relay K5 close, disabling the sensing circuit and discharging capacitor C6 (fig. 36).

(4) LOAD ALARM lamp I 1 and buzzer I 4 energize through closed contacts 2–9 of relay K5 (fig. 37). The buzzer can be silenced by operating ALARM CUTOFF switch S4.

(5) HIGH VOLTAGE lamp I 3 is also energized when contacts 2–9 of relay K5 close. The energizing path for HIGH VOLTAGE lamp I 3 is from terminal 12 of transformer T1, contacts 9–1 of unoperated relay K2, contacts 2–9 of operated relay K5, contacts 11–6 of unoperated relay K7, contacts 3–1 of unoperated relay K10, terminal 30 of connectors P11 and J11 to HIGH VOLTAGE alarm lamp I 3. The circuit is completed from the lamp to terminal 11 of transformer T1.

c. Resensing After High-Voltage Condition.

(1) An excessively high-voltage output interrupts the 600-volt dc output of the power supply and disables its sensing circuit (par. 59). When this condition occurs, the LOAD ALARM and HIGH VOLTAGE alarm lamps light and the buzzer sounds.

(2) When the power supply fails to operate, sensing can be initiated by momentarily operating the RESTORE switch or resetting AC POWER switch S1.

60. Protection Against Operating into Open Power Loop

a. The distributed capacitance of an open spiral-four line, the unattended repeaters, and the capacitance of capacitors C1 and C2 on the main chassis (fig. 35) initially permit enough current to flow through relay K6 to operate the relay. Since this capacitance is not initially charged, it presents a short circuit to the +108-volt dc from rectifier CR2 (fig. 36) immediately after the AC POWER switch has been operated to ON. This would cause the power supply to start into an open line.

b. The 600 VOLT POWER SUPPLY is prevented from operating into an open power loop by capacitor C6 and resistor R28 (fig. 36). Capacitor C6 acts as a short, preventing current from the +108-volt dc supply from rectifier CR2 from flowing through the winding of relay K6. As capacitor C6 charges, the reactance of the capacitor increases, and current begins to flow through the winding of relay K6. Since the increase of current through the relay is gradual, relay K6 does not operate.

c. When relay K7 operates, which occurs as part of the starting sequence, its contacts 7–12 close (fig. 36) and a low-resistance discharge path for capacitor C6 is provided through current-limiting resistor R28. It is necessary to discharge capacitor C6 quickly after the power supply has started, so that the capacitor may again momentarily short out relay K6 should the operation of the power supply be interrupted and started again after a short interval.

61. Determining Power Loop Resistance (figs. 36 and 37)

a. CURRENT meter M1 and RESTORE switch S5 provide the means of measuring the resistance of the power loop. The power loop resistance should be determined whenever anyone of the following conditions occurs:

(1) The 600 VOLT POWER SUPPLY fails to operate. This condition is indicated by the energizing of LOAD ALARM lamp I 1 and ac buzzer I 4.
(2) Approximately 20 seconds after the power supply has been energized, the LOW VOLTAGE and LOAD ALARM lamps do not extinguish.
(3) After the power supply has been operating normally, the LOW VOLTAGE and LOAD ALARM lamps light.
(4) The output of the 600 VOLT POWER SUPPLY is interrupted during operation, as indicated by the lighting of HIGH VOLTAGE lamp I 3.

b. Under the conditions given in *a*(1) and (4) above, relay K5 is operated and its open contacts 3–10 remove the 108 volts dc from the sensing circuit (fig. 36). When RESTORE switch S5 is operated, relay K5 deenergizes and 108-volts dc is applied to the sensing circuits through closed contacts 3–10 of relay K5. The current path is through the power loop resistance, internal resistors R15 through R12 (depending upon the position of REPEATER switch S6), CURRENT meter M1, contacts 6–11 of relay K2, contacts 10–3 of relay K7, the winding of relay K6, contacts 10–3 of relay K5, and current-limiting resistor R33 (which is not shorted by operating the RESTORE switch), to the +108-volt dc from rectifier CR2. The current reading on the meter can be converted to the resistance of the power loop by the following formula: where (R) equals the resistance of the power loop and (I) equals the indication on CURRENT meter M1.

$$\text{R (ohms)} = \left(\frac{108\ \text{(volts)} \times 1{,}000}{\text{I(ma)}}\right) - 2{,}000$$

c. Under the conditions given in subparagraph *a*(2) and (3) above, an indication is also produced on CURRENT meter M1 when RESTORE switch S5 is operated. This meter indication can be converted to the resistance of the power loop by the formula given in *b* above when the RESTORE switch is operated. In addition, the operating path of relay K7 is opened by operating the RESTORE switch (fig. 37). Relay K5 is not operated under the conditions given in *a*(2) and (3) above; therefore, the operation of the RESTORE switch has no effect on relay K5.

Section X. POWER SUPPLY PP–826/U

62. General

a. Power Supply PP–826/U provides a regulated current of .1-ampere dc at a nominal 600 volts, and can be used interchangeably with Power Supply PP–826A/U. It supplies power for one, two, or three Telephone Repeaters AN/TCC–11 (unattended repeaters). Dummy load resistors in the 600 VOLT POWER SUPPLY are used to compensate for a decrease in power loop resistance when less than three unattended repeaters are used.

b. Protective features include lamp and buzzer alarm indicators, and cutoff circuits which remove input power from the high-voltage transformers when abnormal operating conditions are encountered. Power Supply PP–826/U consists of a main chassis and a plug-in assembly contained in the same transmit case.

c. The circuits that are identical in both the PP–826/U and the PP–826A/U power supplies are referenced in (1) through (7) below:

(1) Block diagram (par. 42).
(2) Input power circuit (par. 43).
(3) High-voltage rectifier circuit (par. 44).
(4) Reference voltage rectifier circuit (par. 45).
(5) Current regulator circuit (par. 46).
(6) Regulating action (par. 47).
(7) REPEATER switch S6 (par. 48).

63. Low-Voltage Rectifier and Alarm Unit Z1, General (fig. 34)

Note. Some low-voltage rectifier and alarm units Z1 are different from others. In this manual, some units have been arbitrarily designated *original units*, and others *revised units*. For specific differences between the *original* and *revised* units, refer to the equipment differences chart (par. 2). Paragraphs 63 through 74 apply to both *original* and *revised* low-voltage rectifier and alarm units Z1 unless otherwise specified.

a. Low-voltage rectifier and alarm unit Z1 consists of the following subcircuits and relays:

(1) *Low-voltage rectifier circuit.* The low-voltage rectifier circuit consists

of power transformer T1 and rectifiers CR1 and CR2. Rectifier CR1 supplies 24 volts dc for the operation of all relays except K2, K3, and K6. Rectifier CR2 in conjunction with voltage-regulator tube V1, supplies 108-volts dc for the initial starting action of resistance check and starting relay K6.

(2) *Initial starting circuit.* The initial starting circuit energizes relays K6, K7, K8, K9, and K1 in sequence. When relay K1 energizes, ac input power is applied to the high-voltage rectifier circuit (main chassis). A detailed description of this starting action appears in paragraph 65.

(3) *Relay-control circuit.* The relay-control circuit is a conventional control-amplifier circuit used to energize the low- and high-voltage alarm circuits during abnormally high- or low-voltage output conditions. A detailed description of the relay-control circuit is given in paragraph 66.

(4) *Low-voltage relay and alarm circuit.* The low-voltage relay and alarm circuit removes ac input power from the high-voltage rectifier circuit when the high-voltage output falls to 535 volts or lower, and provides visual and audible alarm indications. A detailed description of the low-voltage relay and alarm circuit is given in paragraph 67.

(5) *High-voltage relay and alarm circuit.* The high-voltage relay and alarm circuit removes ac input power from the high-voltage rectifier circuit when the high-voltage output rises to 670 volts or higher, and provides visual and audible alarm indications. A detailed description of the high-voltage relay and alarm circuit is given in paragraph 70.

(6) *Low line-voltage protective circuit.* The low line-voltage protective circuit removes ac input power from the high-voltage rectifier circuit when input voltage falls to 93 volts during 115-volt operation, or 186 volts during 230-volt operation, and provides visual and audible alarm indications. A detailed description of the low line-voltage protective circuit is given in paragraph 72.

(7) *Restore circuit.* The restore circuit reapplies ac input power to the high-voltage rectifier circuit when the abnormally high or low-voltage output conditions have been corrected. A detailed description of the restore circuit is given in paragraph 73.

b. A list of all relays on low-voltage rectifier and alarm unit Z1 and their functions is given in the following chart:

Relay	Name	Function
K1	Power-cutoff relay	Completes the ac input circuit to transformers T1 and T2 on the main chassis.
K2	Low-voltage control relay	Actuates low-voltage alarm relay during low-voltage trouble conditions.
K3	High-voltage control relay	Actuates high-voltage alarm relay during high-voltage trouble conditions.
K4	Low-voltage alarm relay	Releases power-cutoff relay K1 during low-voltage trouble conditions.
K5	High-voltage alarm relay	Releases power-cutoff relay K1 during high-voltage trouble conditions.
K6	Resistance check and starting relay	Actuates power-cutoff relay K1 when line load conditions are normal. Under abnormal conditions, K6 will not actuate K1.
K7	Starting-power relay	Actuates relay K8 during the starting cycle. During normal operating conditions, relay K7 releases, buzzer I4 is silenced, and LOAD ALARM lamp I1 is extinguished.
K8	Operating-power relay	Actuates relay K9 during the starting cycle.
K9	Power-holding relay	Holds relay K1 operated during normal operating and line-voltage conditions. Deenergizes relay K1 during low line-voltage conditions.

64. Starting-Relay Circuit, General

(figs. 39 and 41 (original units) or figs. 40 and 42 (revised units))

a. Relay K6 functions as a starting relay to actuate relays K7, K8, K9, and K1 in turn. The operation of relay K1 applies ac input power to transformers T1 and T2 in the high-voltage rectifier circuit.

b. The energizing path for starting relay K6 consists of two parallel paths to contacts 6 and 11 of deenergized relay K5.

(1) One path from the —108-volt dc side of rectifier CR2 is through the voltage-divider network consisting of resistors R11, R13, and R10 to contacts 6 and 11 of relay K5.

(2) The other path is from the —108-volt dc side of rectifier C2 through terminal 32 of connectors P11 and J11, the external power loop (including resistors R13 through R15 (main chassis), depending on the position of REPEATER switch S6, variable resistor R12, and milliameter M1), terminal 29 of connectors J11 and P11, to contacts 6 and 11 of relay K5.

c. Resistance-Check Circuit. Both of these paths are in series with the winding of starting relay K6. Thus, the combined resistance in the two paths controls the current flow through starting relay K6. Relay K6 will operate when the resistance of the second path (*b*(2) above) is between 0 and 100,000 ohms. If the second path is open, or higher than 100,000 ohms, starting relay K6 will not operate.

65. Relay Starting Action

(figs. 39 and 41 (original units) or figs. 40 and 42 (revised units))

When AC POWER switch S1 is operated to the ON position, voltage is applied through transformer T1 on the subchassis to rectifiers CR1 and CR2, the filaments of V6, LOAD ALARM lamp I 1, and buzzer I 4. LOAD ALARM lamp I 1 will light and buzzer I 4 will sound.

a. Operation of Starting Relay K6. Under normal starting conditions (0 to 100,000 ohms in the load) the 108-volt dc regulated output from voltage regulator V1 will energize starting relay K6. When relay K6 energizes, its 2 and 3 contacts apply the —24-volt dc output of rectifier CR1 through current-limiting resistor R23 to the winding of starting-power relay K7. From the winding of K7 the current returns to the +24-volt dc.

b. Operation of Starting-Power Relay K7. The current from rectifier CR1 energizes relay K7. When the relay energizes, the following actions occur:

(1) Contacts 3 and 10 break, connecting potentiometer R16 and resistor R17 in series with the winding of starting relay K6. Potentiometer R16 is adjusted during manufacture to permit relay K6 to deenergize when the load is approximately 4,800 ohms. When the load is less than 4,800 ohms, relay K6 will not deenergize. Under normal operating conditions, relay K6 deenergizes.

(2) Contacts 9 and 2 of relay K7 close; the relay is held operated by current flow through contacts 3 and 10 of deenergized relay K2.

(3) Contacts 4 and 10 or relay K7 close, connecting resistor R22 in parallel with that part of the voltage-divider network composed of resistor R10 and potentiometer R13 which connects to the grids of amplifier tube V6. This parallel combination reduces the bias, so that the high-voltage output of tube V6 will be 445 volts.

(4) Contacts 5 and 11 close, and the operating path for LOAD ALARM lamp I 1 and buzzer I 4 in the alarm cir-

Figure 39. Power Supply PP–826/U, schematic diagram (original units).

Figure 40. Power Supply PP–826/U, schematic diagram (revised units).

Figure 41. Power Supply PP–826/U, starting action, schematic diagram (original units).

Figure 42. Power Supply PP–826/U, starting action, schematic diagram (revised units).

(Contained in separate envelope)

cuit is transferred from contacts 6 and 11.

(5) Contacts 7 and 12 of relay K7 close; the 24-volt dc output from rectifier CR1 energizes relay K8. This circuit is from the —24-volt dc terminal of rectifier CR1, through contacts 3 and 1 of deenergized relay K6, contacts 12 and 7 of energized relay K7, RESTORE switch S5 (located on the main chassis), the winding of relay K8, and resistor R15 to the +24-volt dc.

c. Operation of Operating-Power Relay K8. When relay K8 is energized (*b*(5) above), the following actions occur:

(1) Contacts 3 and 10 open to prevent the output from the high-voltage rectifier circuit from appearing across starting relay K6, voltage-regulator tube V1, and rectifier CR2.

(2) Contacts 7 and 12 close to form part of the operating path of low-voltage alarm relay K4.

(3) Contacts 5 and 11 (original units only, fig. 41) close to transfer the operating path for LOAD ALARM lamp I 1 and buzzer I 4 in the alarm circuit from contacts 6 and 11.

(4) Contacts 5 and 11 (revised units only, fig. 42) close to supply 24-volt dc power from rectifier CR1 to energize power-holding relay K9. This circuit is from the —24-volt dc terminal of rectifier CR1 through contacts 3 and 1 of released relay K6, contacts 11 and 5 of operated relays K7 and K8, and the winding of relay K9 to the +24-volt dc.

(5) Contacts 2 and 9 (original units only, fig. 41) close to supply the 24-volt dc output from rectifier CR1 to energize power-holding relay K9. This circuit is from the —24-volt dc terminal of rectifier CR1, through contacts 3 and 1 of released relay K6, and contacts 12 and 7 of energized relay K7, to RESTORE switch S5. From switch S5, through contacts 9 and 2 of energized relay K8, contacts 11 and 6 of released relay K2, and the winding of relay K9 to the +24-volt dc.

(6) Contacts 2 and 9 (revised units only, fig. 42) close to connect a short across potentiometer R20 and form part of the operating path for relay K8, established after the release of relay K7. Terminal 1 of potentiometer R20 is connected through contacts 2 and 9 of relay K8, RESTORE switch S5, contacts 7 and 12 of operated relay K7, and contacts 1 and 3 of released relay K6 to the —24-volt dc. Terminal 3 of potentiometer R20 is connected to the same potential as terminal 1 through contacts 5 and 11 of relays K8 and K7, and contacts 1 and 3 of released relay K6, thereby shorting potentiometer R20.

d. Operation of Power-Holding Relay K9. When relay K9 is energized, the following operations occur:

(1) Contacts 2 and 3 (original units only, fig. 41) close to lock up relays K8 and K9 through contacts 3 and 10 of released relays K4 and K5. This circuit is from the —24-volt dc terminal of rectifier CR1 through contacts 3 and 10 of released relays K4 and K5, contacts 3 and 2 of energized relay K9, contacts 11 and 6 of deenergized relay K2 and the winding of relay K9 to the +24-volt dc.

(2) Contacts 2 and 3 (revised units only, fig. 42) close to set up the path for energizing relays K8 and K9 when relay K7 releases. Relay K8 then will be operated by current flowing from the —24-volt dc terminal of rectifier CR1 through contacts 3 and 10 of released relays K4 and K5, contacts 3 and 2 of operated relay K9, contacts 2 and 9 of relay K8, and the winding of relay K8 to the +24-volt dc.

(3) Contacts 4 and 5 close to supply 24-volt dc power from rectifier CR1 to the winding of power-cutoff relay K1. Relay K1 is thus energized.

e. Operation of Power-Cutoff Relay K1. When relay K1 is energized, contacts 2 and 3 on one side of the ac input power line and contacts 4 and 5 on the other side of the ac input powerline close; this action causes primary

input power to be applied to the windings of high-voltage rectifier transformers T1 and T2 on the main chassis. Power is also applied to blower motor B1 if thermostatic switch S3 is closed.

f. Compensating Resistor, Function. Resistor R17 is a special resistor used to compensate for small changes in the release current of starting relay K6 due to changes in ambient temperature. In some 600 VOLT POWER SUPPLY units, resistor R23 is in series with the winding of relay K7 to prevent overheating of the relay if relay K6 does not release. In other 600 VOLT POWER SUPPLY units, a different type of relay has been substituted for relay K7. The latter type relay prevents possible chattering of relays K6 and K7. When the latter type relay is used, resistor R23 is replaced by a strap.

66. Relay-Control Circuit

(figs. 39 and 43 (original units) or figs. 40 and 44 (revised units))

a. General. The relay-control circuit operates the low- and high-voltage alarm and cutoff relays during abnormal low- or high-voltage operations. This circuit is a conventional control amplifier circuit in which variations in the high-voltage or load circuit are compared with a reference voltage developed by a voltage-regulator and voltage-divider network. The difference is applied to the grid of control-amplifier tube V6, and the amplified difference is used to operate the protective relays. In addition, a time-delay network is incorporated to prevent high-voltage cutoff and alarm indications during starting, when the output voltage is above high-voltage cutoff value.

b. Control-Amplifier Circuit. The relay-control circuit consists of control-amplifier tube V6, voltage-regulator tube V5, and a voltage-divider network consisting of resistors R10 and R11, and potentiometer R13. The filament supply for control-amplifier tube V6 is obtained from a 6.4-volt stepdown winding on power transformer T1. Resistor R6, between the plate of voltage-regulator tube V5 and the cathodes of control-amplifier tube V6, stabilizes the operating conditions of amplifier tube V6 during variations in filament voltage. Plate voltage for amplifier tube V6 is obtained from the cathodes of current regulator tubes V3 and V4 on the main chassis.

(1) A constant potential of 150 volts dc is maintained across voltage-regulator tube V5 in conjunction with current-limiting resistor R7. This current potential is independent of variations in the high-voltage output and is impressed on the cathodes of control-amplifier tube V6. The two sections of this tube are connected in parallel.

(2) The voltage-divider network, consisting of resistors R10 and R11 and LOW-VOLT ALARM potentiometer R13, is connected to both the output of the high-voltage rectifier circuit and the grids of control-amplifier tube V6. Thus, any variations in the high-voltage output circuit will cause the bias to vary on amplifier tube V6. The variations in the high-voltage output circuit are amplified by control amplifier tube V6 and are used to operate low- and high-voltage cutoff and alarm relays K2 and K3 respectively. A detailed description of the operation of the low- and the high-voltage relay and alarm circuits is given in paragraphs 67 through 73.

c. Time-Delay Circuit. A time-delay circuit, consisting of resistors R8 and R9 capacitor C5, prevents the high-voltage surge from operating the high-voltage cutoff and alarm circuit when the tube filaments of the unattended repeaters are warming up. Resistors R8 and R9 are connected to the grid of amplifier tube V6. Capacitor C5 is connected from the grid of amplifier V6 to the negative side of the high-voltage rectifier output.

(1) When the output voltage rises across voltage-regulator tube V5, a potential of 150 volts dc is applied to the cathodes of control-amplifier tube V6. The time-delay network maintains the grids of control-amplifier tube V6 at —150-volt dc potential in respect to the cathodes. This voltage cuts off the tube.

(2) At the end of 20 seconds, capacitor C5 is charged fully and the abnormal bias is removed from the tube, caus-

ing it to conduct. This delay is sufficient to allow the initial voltage in the high-voltage rectifier circuit to subside while the tube filaments of the unattended repeaters are warming up. The 20-second time delay prevents this voltage peak from causing excessive current flow in control-amplifier tube V6, which would otherwise operate high-voltage cutoff and alarm relays K2 and K3.

67. Low-Voltage Relay and Alarm Circuit

(figs. 39 and 43 (original units) or figs. 40 and 44 (revised units))

a. General. The low-voltage relay and alarm circuit removes primary power from the high-voltage rectifier circuit when the high-voltage output falls to 535 volts dc. In addition, the alarm lamp and a buzzer operate to alert the operator in case of trouble. The low-voltage relay and alarm circuit consists of the relay-control circuit (par. 66), low-voltage relay K2, low-voltage alarm relay K4, LOW VOLTAGE indicator lamp I 2, ALARM CUTOFF switch S4, buzzer I 4, and RESTORE switch S5.

b. Energizing Circuit. From the plates of control-amplifier tube V6, the path of the low-voltage relay energizing circuit is through the series parallel combination of variable resistor R12 and resistor R21, the winding of high-voltage relay K3, and resistor R19, to the winding of low-voltage relay K2. From relay K2, the path is completed through resistor R8 on the main chassis to the cathodes of current regulator tubes V3 and V4.

c. Initial Action, Time Delay. When power-cutoff relay K1 applies power to the primaries of high-voltage transformers T1 and T2 on the main chassis, high voltage is developed in the high-voltage rectifier output circuit. This voltage is applied to the cathodes of control-amplifier tube V6 through voltage-regulator tube V5 in conjunction with current-limiting resistor R7. The application of this initial output voltage from the voltage-divider network, R10, R13, and R11, to the grids of amplifier tube V6 is delayed for approximately 20 seconds by the time-delay network, R8, R9, and C5 (par. 66*c*). At the end of 20 seconds, capacitor C5 is charged fully and control-amplifier tube V6 will conduct. Under normal operating conditions, V6 will conduct enough current to energize low-voltage relay K2, but not enough to energize high-voltage relay K3. A detailed description of the operation of relay K2 is given in paragraph 68.

68. Low-Voltage Relay Operation

(figs. 39 and 43 (original units) or figs. 40 and 44 (revised units))

When energized, low-voltage relay K2 performs the following functions:

a. Release of Relay K7. Contacts 3 and 10 of relay K2 open, breaking the operating path of relay K7, and deenergizing it. When deenergized, relay K7 performs the following operations.

(1) When contacts 4 and 10 of relay K7 open, resistor R22 is removed from the grid circuit of control-amplifier tube V6. Initially, resistor R22 is connected in parallel with part of the voltage-divider formed by resistors R10 and R11 and LOW-VOLT ALARM potentiometer R13, in the grid circuit of control-amplifier tube V6. This allows the tube to conduct enough current to energize relay K2 when the high-voltage rectifier output has reached a value of 445 volts dc. Without resistor R22 in the grid circuit, the bias on control-amplifier tube V6 is made more negative, and current flow is decreased enough, so that relay K2 will deenergize when the high-voltage rectifier output has dropped to 530 volts dc, or less. This provides overlapping protection during low-voltage trouble conditions. For example, if the high-voltage output falls to 460 volts dc (4,600-ohm power loop resistance), relay K2 will deenergize. When RESTORE switch S5 is operated, starting relay K6 should not deenergize. Relay K6 will not deenergize below 4,800-ohm

Figure 43. Power Supply PP-826/U, relays in normal operating condition, schematic diagram (original units).

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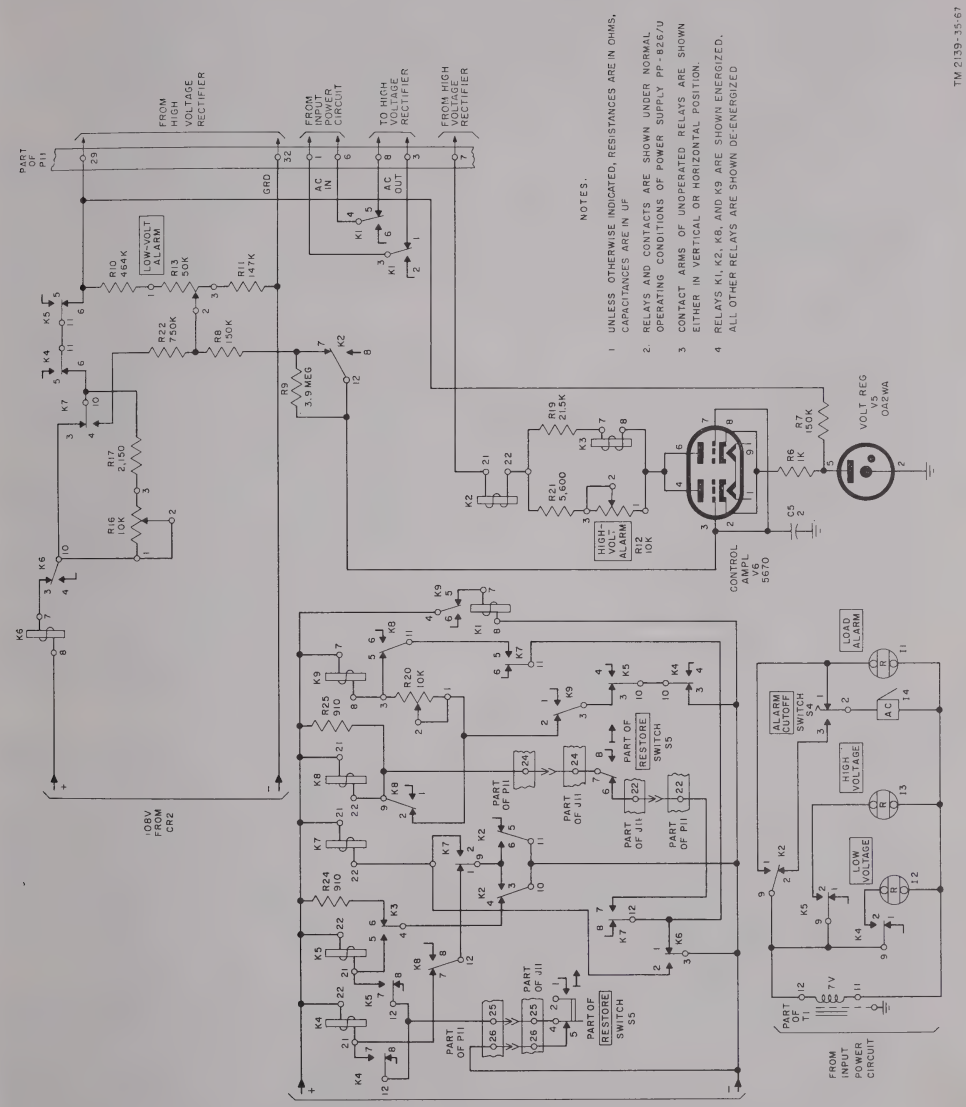


Figure 44. Power Supply PP-826/U, relays in normal operating condition, schematic diagram (revised units).

power loop resistance. If relay K6 does deenergize because of changes in ambient temperature not compensated by temperature-compensating resistor R17, resistor R22 will be reinserted in grid circuit and relay K2 will operate at 460 volts. When resistor R22 is removed from the grid circuit of control-amplifier tube V6, relay K2 will deenergize.

(2) Contacts 8 and 12 close to form part of the energizing path for low-voltage alarm relay K4.

(3) Contacts 3 and 10 close to place a short across resistors R16 and R17, in series with the winding of relay K6, and restore this circuit to starting condition.

(4) Contacts 5 and 11 (original units only, fig. 43) open to extinguish LOAD ALARM lamp I 1 and silence buzzer I 4, if ALARM CUTOFF switch S4 is not in the cutoff position. If the ALARM CUTOFF switch is in the cutoff position, buzzer I 4 will operate; the operating path is completed through contacts 5 and 11 of energized relay K8 and contacts 6 and 11 of released relay K7. This alarm is provided to prevent the operator from leaving switch S4 in the cutoff position during normal operation.

(5) Contacts 5 and 11 (revised units only, fig. 44) open to insert previously shorted variable resistor R20 (par. 65*c*(6)) into the operating path of relay K9. Potentiometer R20 is adjusted during manufacture or following repair of low-voltage rectifier and alarm Z1 to release relay K9 when the ac input voltage drops below 93 volts during 115-volt operation, or below 186 volts during 230-volt operation.

b. Operating Circuit, Original Units Only (fig. 43). Contacts 5 and 11 of relay K2 close to place resistor R24 in parallel with the energizing circuits of relays K8, K9, and K1 to replace the resistance formerly supplied by relay K7. Without resistor R24, relay K1 would overheat.

(1) Contacts 1 and 9 of relay K2 open to prevent the output of rectifier CR1 from being applied to the winding of low-voltage alarm relay K4 during normal operating conditions.

(2) Contacts 2 and 9 of relay K2 close to form part of the energizing path for high-voltage alarm relay K5.

(3) Contacts 6 and 11 of relay K2 open to place potentiometer R20 in series with the winding of power-holding relay K9. Potentiometer R20 is adjusted during manufacture to permit relay K9 to be deenergized when the ac input voltage drops below 93 volts during 115-volt operation or below 186 volts during 230-volt operation. When relay K9 deenergizes, relay K1 deenergizes and as a result, the primary power to the high-voltage circuit is removed.

(4) Contacts 7 and 12 of relay K2 close to short out resistor R9 in the time-delay network on the grids of control-amplifier tube V6. This reduces the 20-second time factor associated with control-amplifier tube V6 for starting to a 1-second time factor for alarm indications produced by variations in the high-voltage output circuit.

c. Opening Circuit, Revised Units Only (fig. 44). Contacts 4 and 10 of relay K2 close to place resistor R24 in parallel with the energizing circuits of relays K8, K9, and K1, and to replace the resistance formerly supplied by the winding of relay K7. Without resistor R24, relay K1 may overheat. Closed contacts 4 and 10 of relay K2 also form part of the operating path for high-voltage alarm relay K5.

(1) Contacts 1 and 9 of relay K2 open to extinguish LOAD ALARM lamp I 1 and to silence buzzer I 4 if ALARM CUTOFF switch S4 is not in the cutoff position. If ALARM CUTOFF switch S4 is in the cutoff position, buzzer I 4 is energized through contacts 2 and 9 of relay K2 and through the contacts of ALARM CUTOFF switch S4. This alarm is provided to prevent the operator from leaving

switch S4 in the cutoff position during normal operation.

(2) Contacts 7 and 12 of relay K2 close to short out resistor R9 in the time-delay network on the grids of control-amplifier tube V6. This reduces the 20-second time factor associated with control-amplifier tube V6 for starting to a 1-second time factor for alarm indications produced by variations in the high-voltage output circuit.

(3) Paralleled contacts 11 and 6 and 10 and 3 of relay K2 open to prevent application of dc voltage from rectifier CR1 to low-voltage alarm relay K4.

69. Low-Voltage Alarm Operation

a. Deenergizing of Relay K2, Original Units Only (figs. 39 and 43). LOW-VOLT ALARM potentiometer R13 is adjusted so that relay K2 deenergizes at 530 volts. When the output in the high-voltage rectifier circuit drops to 530 volts or less, low-voltage relay K2 will deenergize. When relay K2 deenergizes, the following operations occur:

(1) Contacts 6 and 11 close to short out potentiometer R20 in series with the winding of power-holding relay K9.

(2) Contacts 3 and 10 close to prepare the lockup path of relay K7. Relay K7 does not operate, because contacts 2 and 9 of the relay are open.

(3) Contacts 7 and 12 open to remove the short from resistor R9 in the time-delay network in the grid circuit of control-amplifier tube V6.

(4) Contacts 1 and 9 close, supplying voltage from rectifier CR1 to energize low-voltage alarm relay K4. The energizing path of this circuit is traced from the negative terminal of rectifier CR1 through contacts 1 and 3 of deenergized relay K6, contacts 12 and 8 of deenergized relay K7, contacts 7 and 12 of energized relay K8, and contacts 9 and 1 of deenergized relay K2. From contact 1 of relay K2, the path is completed through the winding of relay K4, resistor R15 to the positive side of rectifier CR1.

b. Deenergizing of Relay K2, Revised Units Only (figs. 40 and 44). LOW-VOLT ALARM potentiometer R13 is adjusted so that relay K2 deenergizes at 530 volts. When the output in the high-voltage rectifier circuit drops to 530 volts or less, low-voltage relay K2 will deenergize. When relay K2 deenergizes, the following operations occur:

(1) Parallel-connected contacts 3 and 10 and 6 and 11 close to operate low-voltage alarm relay K4. This circuit is from the negative side of rectifier CR1 through parallel-connected contacts 3 and 10 and 6 and 11 of operated relay K2, contacts 1 and 9 of released relay K7, contacts 12 and 7 of operated relay K8, and through the winding of relay K4 to +24 volts dc.

(2) Contacts 4 and 10 open to disconnect resistor R24 from the negative side of CR1. Resistor R24 is no longer required to prevent overheating of relay K1 (par. 71*c*) because relay K1 is disconnected from the 24-volt dc source after relay K2 releases.

(3) Contacts 7 and 12 open to remove the short from resistor R9 in the time delay network on the grids of control amplifier tube V6.

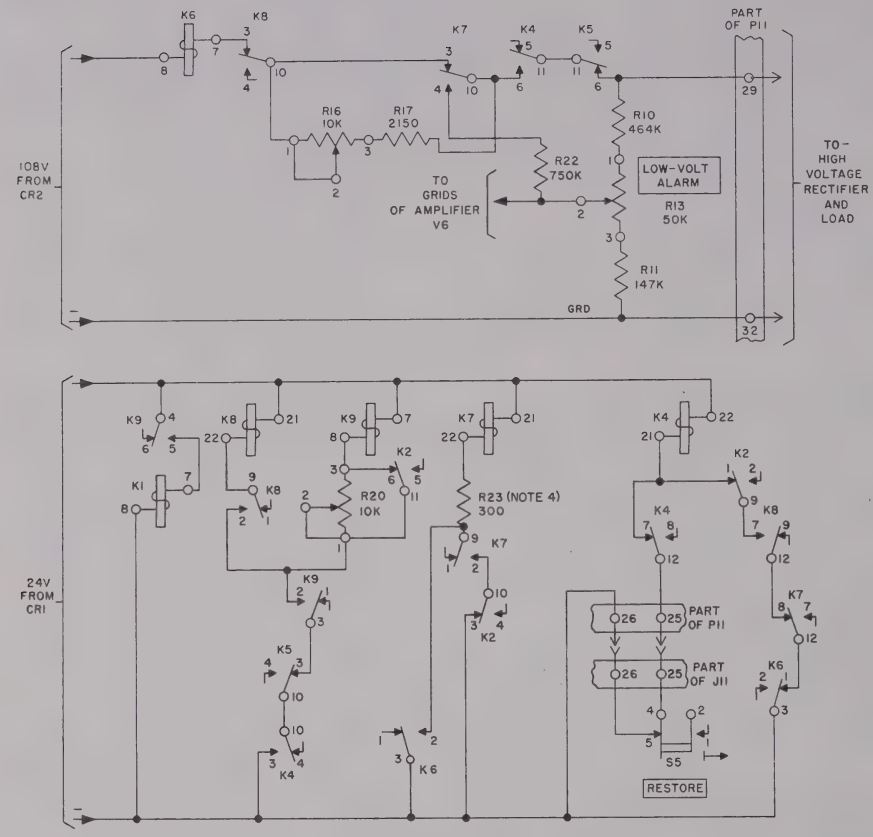
(4) Contacts 1 and 9 close to operate buzzer I 4 and LOAD ALARM lamp I 1. The buzzer may be silenced by operating ALARM CUTOFF switch S4.

c. Energizing of Low-Voltage Alarm Relay K4 (figs. 39 and 45 (original units) and figs. 40 and 46 (revised units)). When relay K4 is energized, the following operations occur:

(1) Contacts 2 and 9 close to light LOW VOLTAGE indicator lamp I 2.

(2) Contacts 7 and 12 close to lock the relay. The locking path of relay K4 is from the negative terminal of rectifier CR1 through RESTORE switch S5, contacts 12 and 7 of energized relay K4, and the winding of relay K4, to the +24 volts dc. Relay K4 will remain energized until RESTORE switch S5 is operated.

(3) Contacts 6 and 11 open to break the operating path of relay K6. This



NOTES:

1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS.
2. CIRCUITS ARE SHOWN IN LOW-VOLTAGE CONDITION OF POWER SUPPLY PP-826/U.
3. RELAYS ARE SHOWN EITHER ENERGIZED OR DE-ENERGIZED AS INDICATED IN TABLE BELOW:

RELAY	ENERGIZED	DE-ENERGIZED
K1		X
K2		X
K3		X
K4	X	
K5		X
K6		X
K7		X
K8		X
K9		X

4. ON SOME 600-VOLT POWER SUPPLY UNITS R23 IS REPLACED BY A STRAP.

TM2139-35-58

Figure 45. Power Supply PP-826/U, low-voltage relay and alarm circuits in low-voltage condition, schematic diagram (original units).

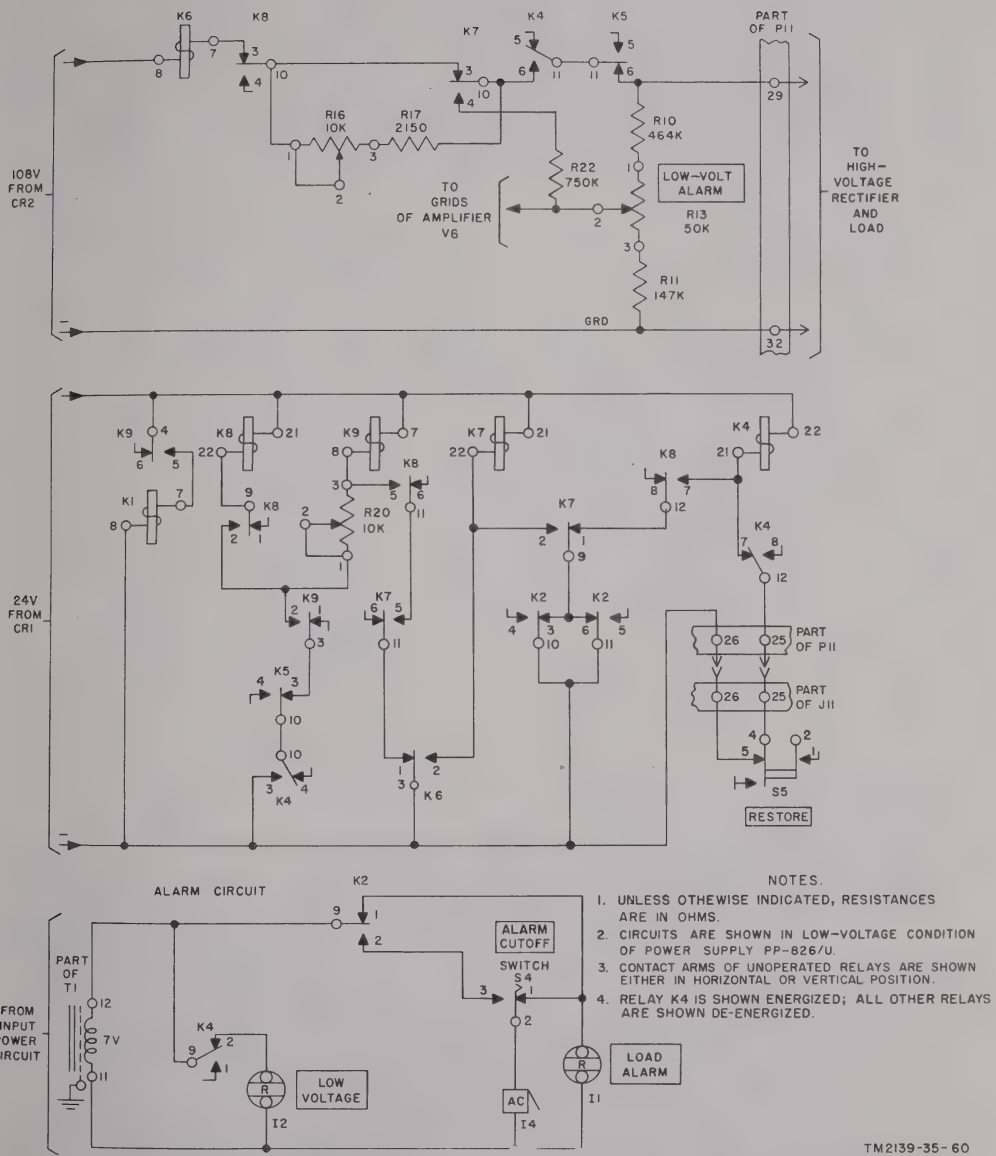
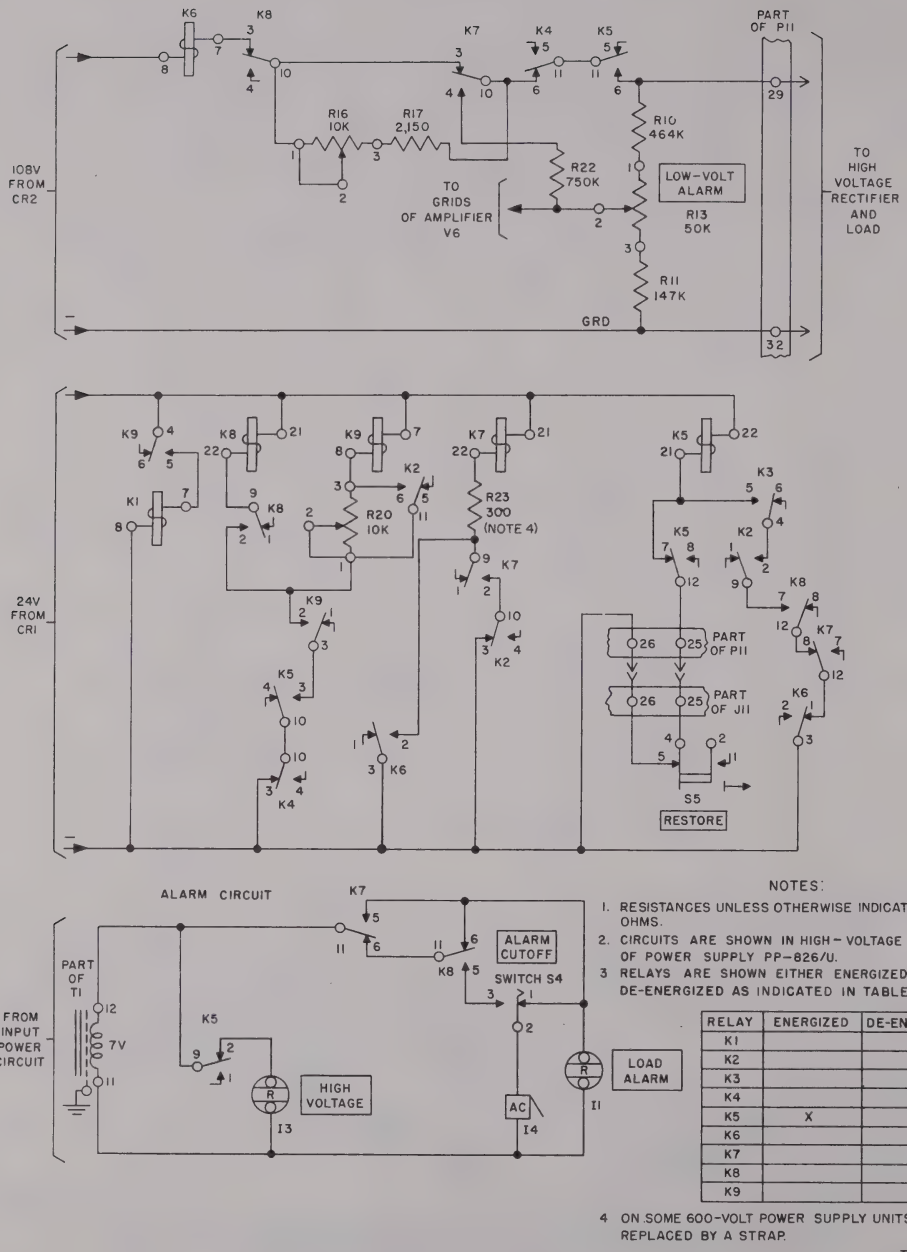


Figure 46. Power Supply PP-826/U, low-voltage relay and alarm circuits in low-voltage condition, schematic diagram (revised units).



NOTES:

1. RESISTANCES UNLESS OTHERWISE INDICATED, ARE IN OHMS.
2. CIRCUITS ARE SHOWN IN HIGH-VOLTAGE CONDITION OF POWER SUPPLY PP-826/U.
3. RELAYS ARE SHOWN EITHER ENERGIZED OR DE-ENERGIZED AS INDICATED IN TABLE BELOW:

RELAY	ENERGIZED	DE-ENERGIZED
K1		X
K2		X
K3		X
K4		X
K5	X	
K6		X
K7		X
K8		X
K9		X

4. ON SOME 600-VOLT POWER SUPPLY UNITS, R23 IS REPLACED BY A STRAP.

TM2139-35-57

Figure 47. Power Supply PP-826/U, high-voltage relays and alarm circuits in high-voltage condition, schematic diagram (original units).

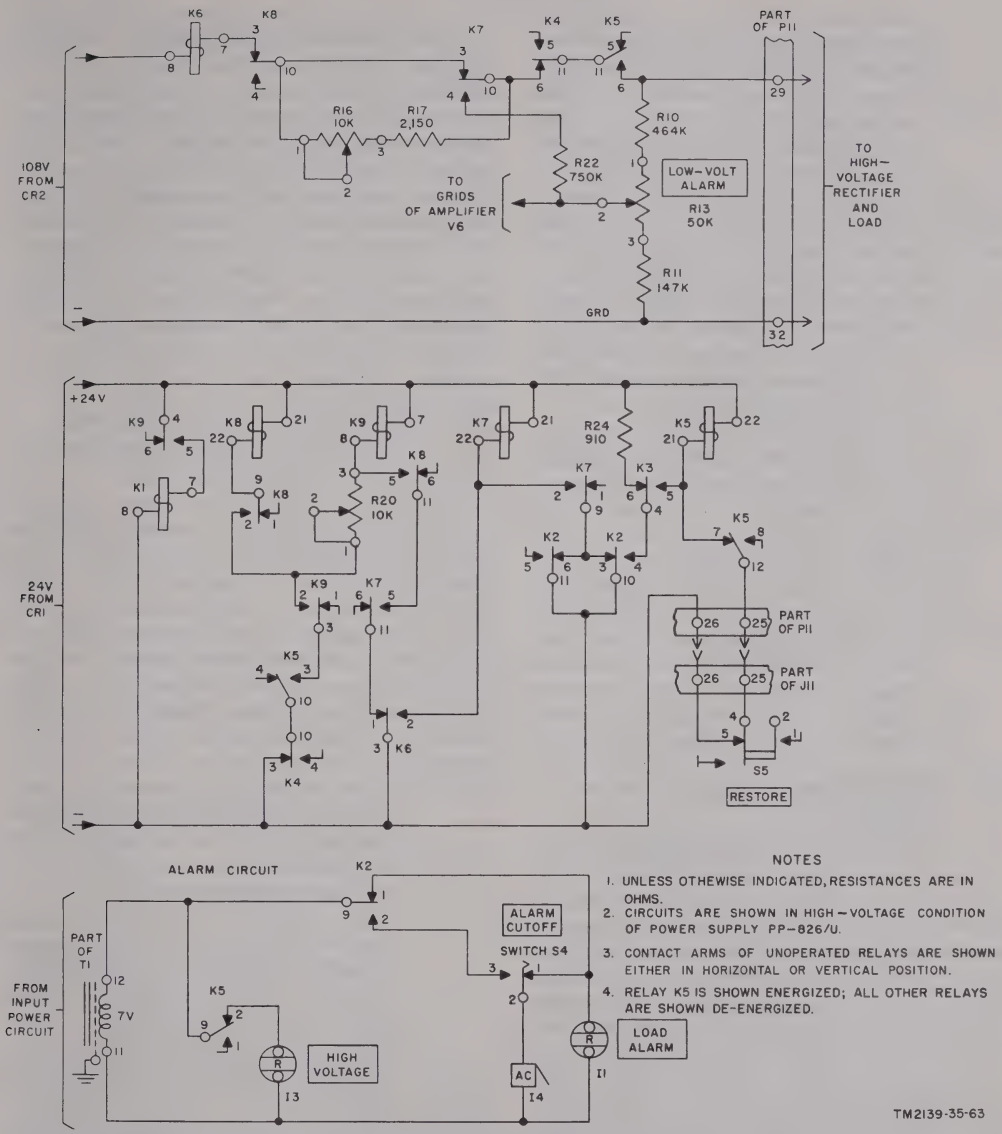


Figure 48. Power Supply PP-826/U, high-voltage relays and alarm circuits in high-voltage condition, schematic diagram (revised units).

prevents the reenergizing of relay K6 and further relay operations.

(4) Contacts 3 and 10 open the locking path of power-holding relay K9; relay K9 deenergizes. When relay K9 deenergizes, contacts 4 and 5 open to break the energizing path of power-cutoff relay K1. When relay K1 deenergizes contacts 2, 3, 4, and 5 open. This removes the ac input power from the primaries of high-voltage transformers T1 and T2, and cuts off the

high-voltage rectifier output. Contacts 2 and 3 of relay K9 open the locking path of relay K8; relay K8 deenergizes. Resistor R25, connected across the winding of relay K8, delays the deenergizing for a short time to insure the lockup of relay K4.

d. Deenergizing of Relay K8 (figs. 39 and 45 (original units) and figs. 40 and 46 (revised units)). When relay K8 deenergizes, the following operations occur:

(1) Contacts 6 and 11 close (original units only) to operate buzzer I 4 and LOAD ALARM lamp I 1. The buzzer may be silenced by operating ALARM CUTOFF switch S4.

(2) Contacts 7 and 12 open to break the initial energizing path of relay K4, but not before relay K4 is locked up by its own contacts 7 and 12 (*c* above).

(3) Contacts 2 and 9 open to break further the operating path of relay K8.

(4) Contacts 3 and 10 close to prepare the energizing path for starting relay K6. Relay K6 does not operate because this energizing path is broken by opened contacts 6 and 11 in energized low-voltage alarm relay K4.

70. High-Voltage Relay and Alarm Circuit

(figs. 39 and 43 (original units) or figs. 40 and 44 (revised units))

a. General. The high-voltage relay and alarm circuit removes primary power from the high-voltage rectifier circuit when the high-voltage output exceeds 670 volts. In addition, the buzzer and an alarm lamp operate to alert the operator in case of trouble. The high-voltage relay and alarm circuit consists of the relay-control circuit (par. 66), high-voltage relay K3, high-voltage alarm relay K5, HIGH-VOLTAGE indicator lamp I 3, ALARM CUTOFF switch S4, buzzer I 4, and RESTORE switch S5.

b. Energizing Circuit. From the plates of control-amplifier tube V6, the path of the high-voltage relay energizing circuit is through the series parallel circuit consisting of potentiometer R12 and resistor R21, the winding of relay K3 and resistor R19, and the winding of relay K2. From relay K2, the path is completed through resistor R8 (main chassis) to current regulator tubes V3 and V4. Resistor R19 has a negative temperature coefficient which compensates for the positive temperature coefficient of relay K3. This stabilizes the deenergizing point of relay K3 during changes in ambient temperature. Potentiometer R12 is adjusted, so that relay K3 will operate when the voltage in the high-voltage output reaches 670 volts. If variable resistor R12 is shorted accidentally or has been adjusted to a very low resistance, resistor R21 insures the operation of relay K3 when the high-voltage output reaches 800 volts.

71. High-Voltage Alarm Operation

(figs. 39 and 43 (original units) or figs. 40 and 44 (revised units))

During normal operation, control-amplifier tube V6 conducts enough current to operate low-voltage relay K2, but not high-voltage relay K3. When the output voltage of the high-voltage rectifier circuit rises to 670 volts, the voltage applied to the control grids of tube V6 increases proportionately to cause the tube to conduct enough current to energize relay K3.

a. Energizing of High-Voltage Relay K3. When relay K3 is energized, the following operations occur:

(1) Contacts 3 and 1 of relay K3 (original units only, fig. 43) open to remove resistor R24 from its parallel connection with the operating circuits of relays K8, K9, and K1.

(2) Contacts 4 and 6 of relay K3 (revised units only, fig. 44) open to remove resistor R24 from its parallel connection with the operating circuits of relays K8, K9, and K1.

(3) Contacts 4 and 5 of relay K3 close, and high-voltage alarm relay K5 is energized.

b. Energizing of High-Voltage Alarm Relay K5, Original Units Only (fig. 43). The energizing path of high-voltage alarm relay K5 is from the negative terminal of rectifier CR1 through contacts 3 and 1 of deenergized relay K6, contacts 12 and 8 of deenergized relay K7, contacts 12 and 7 of energized relay K8, contacts 9 and 2 of energized relay K2, contacts 4 and 5 of energized relay K3, and

through the winding of relay K5 to the +24 volts dc. Relay K5 operates (*d* below).

c. Energizing of High-Voltage Alarm Relay K5, Revised Units Only (fig. 44). The energizing path of high-voltage alarm relay K5 is from the negative terminal of rectifier CR1 through contacts 10 and 4 of energized relay K2, contacts 4 and 5 of energized relay K3, and the winding of relay K5 to the +24 volts dc. Relay K5 operates (*d* below).

d. Functions of High-Voltage Alarm Relay K5.

(1) Contacts 9 and 2 close to energize HIGH-VOLTAGE indicater lamp I 3.

(2) Contacts 7 and 12 close to lock the relay. The locking circuit is from the negative terminal of rectifier CR1 through RESTORE switch S5, contacts 12 and 7 of energized relay K5, and the winding of relay K5 to the +24 volts dc. Relay K5 will remain energized until RESTORE switch S5 is operated to break the locking circuit.

(3) Contacts 6 and 11 of K5 open to break the operating path of relay K6. This prevents the reenergizing of relay K6 and further relay operations. In addition, contacts 6 and 11 open to prevent high voltage from appearing across relay K6 and rectifier CR2 when relay K8 deenergizes.

(4) Contacts 3 and 10 of relay K5 open to break the locking path of relay K9 and cutoff the high-voltage rectifier (par. 69*b*(4)).

72. Low Line-Voltage Protective Circuit

(figs. 39 and 43 (original units) or figs. 40 and 44 revised units))

The low line-voltage protective circuit removes power from the high-voltage rectifier circuit when the ac input voltage to the power supply falls below 93 volts on 115-volt operation, or 186 volts on 230-volt operation.

a. Functions of Potentiometer R20. Potentiometer R20, in series with the winding of power-holding relay K9, is adjusted during manufacture to permit relay K9 to deenergize when the ac input voltage falls to 93 volts on 115-volt operation or 186 volts on 230-volt operation. When relay K9 deenergizes, its 4 and 5 contacts open the energizing path of relay K1. When relay K1 deenergizes, its 4 and 5, and 2 and 3 contacts open to remove the ac input power from the primaries of high-voltage transformers T1 and T2.

b. Deenergizing of Relay K8. The locking path of relay K8 is from the negative terminal of rectifier CR1 through contacts 3 and 10 of deenergized relays K4 and K5, through contacts 3 and 2 of energized relay K9, contacts 2 and 9 of energized relay K8 and the winding of relay K8, to the +24 volts dc. When K9 deenergizes, contacts 2 and 3 open to break the locking path of relay K8.

c. Deenergizing of Relay K2. When relay K1 deenergizes and removes the ac input to the high-voltage transformers, the output voltage of the high-voltage circuit falls to zero. Filter capacitors C1 and C2 in the high-voltage circuit discharge enough current through the relay-control circuit and relay K2 to delay the deenergizing of K2 until relay K8 has deenergized. This prevents low-voltage alarm relay K4 from operating and locking. Relay K4 will not operate when relay K8 is deenergized, because the energizing path is through contacts 7 and 12 of energized relay K8. Since contacts 7 and 12 are open on deenergized relay K8, relay K4 will not operate.

d. Recycling Action. Because relay K2 is delayed in deenergizing, relay K4 is prevented from lockingup and the recycling of the starting action is allowed. Rectifier CR2 still has a sufficiently high output at 93-volt-ac input power to energize starting relay K6. Relay K6 will energize to cause relays K7, K8, K9, and K1 to energize as described in paragraph 64. After relay 7 energizes, relay K6 deenergizes since the starting action has been initiated. Relay K2 will then operate and insert variable resistor R20 in series with the winding of power-holding relay K9. Thus relay K9 will deenergize if the ac input voltage remains below 93 volts, and the circuit will recycle. Thus it is possible for the low-voltage input protection circuit to recycle continuously when the input power is between 93 and 92 volts ac. When the input voltage returns to 97.5 volts or higher, the circuit will operate normally. If the ac input voltage drops below 92 volts, rectifier CR2 will not provide enough

power to energize starting relay K6, and this starting and restoring action to the high-voltage rectifier circuit will not occur.

73. Restore Circuit

(fig. 39 (original units) or fig. 40 (revised units))

RESTORE switch S5 is provided to open the locking path of the low- and high-voltage alarm relays. These relays deenergize to extinguish the indicator lamps, silence the buzzer, restore power from rectifiers CR1 and CR2 to energize relays K6, K7, K8, K9, and K1, and restore ac input power to the primaries of high-voltage transformers T1 and T2.

74. Test Jacks

(fig. 39 (original units) or fig. 40 (revised units))

Jacks J1 and J3 through J5 (located on the main chassis) are test jacks provided for measuring the voltages in the main chassis of the 600 VOLT POWER SUPPLY. Jacks J1 through J10 (located on the subchassis) are test jacks provided for measuring voltages on low-voltage rectifier and alarm unit Z1.

CHAPTER 3
OPERATIONAL TESTS AND TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING INFORMATION

Warning: **When troubleshooting or making repairs in this equipment, be extremely careful. Voltages as high as 1,000 volts are present internally. Use insulated test probes when making the required voltage measurements. Always disconnect the power cord from the equipment and short the suspected part to chassis ground before touching it.**

75. General Instructions

a. Troubleshooting at field and depot maintenance level includes all the techniques required to isolate a defective part. The field and depot maintenance procedures are not complete in themselves but supplement the procedures described in organizational maintenance. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks performed at an organizational level, must be completed by further localizing and isolating techniques.

b. Troubleshooting may be performed while the equipment is operating as part of a system or, if necessary, after the equipment (or parts of it) have been removed from service. When trouble occurs, certain observations and measurements can be made which will help in determining whether the local equipment is at fault or if the trouble exists elsewhere in the system. Usually, when troubleshooting is performed while the equipment is operating as part of a system, it is done at the organizational level (TM 11–2139–20). Troubleshooting at the field level is usually done with the component removed from the equipment with which it is normally associated. Paragraph 76 describes the systematic procedures to be followed which will enable the repairman to isolate the cause of the trouble and correct the fault.

76. Troubleshooting Procedures

a. General. The first step in servicing a defective equipment is to *sectionalize* the fault. Sectionalization means tracing the fault to the major component or circuit responsible for abnormal operation. The second step is to *localize* the fault. Localization means tracing the fault to the defective subchassis or stage. Refer to TM 11–2139–10 for sectionalization procedures and to TM 11–2139–20 for localization procedures. The third step, *isolation*, means tracing the fault to the defective part. Some faults, such as burned-out resistors, arching, or shorted transformers, can often be isolated by sight, smell, or hearing. The majority of faults, however, must be localized by checking voltages and resistances. Use resistor and capacitor color codes (figs. 137 and 136) to find the value of the components. Use tube socket voltage and resistance diagrams (TM 11–2139–20) to determine normal readings, and compare them with the readings taken. In all 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 connection to the units of the set.

b. Procedure.

(1) If the trouble symptom, as reported by organizational maintenance personnel, is in terms of improper continuity or tube-socket voltage and resistance measurements, arrange the defective panel or pluck-out assembly in an operational test setup. Refer to the appropriate test setup schematic, wiring, and parts location diagrams and perform *additional* voltage

and resistance measurements to isolate the defective part.

(2) If the trouble symptom has *not* been localized to a suspected stage or circuit by organizational maintenance personnel, connect the defective panel or pluck-out assembly in an operational test setup and proceed to make tube-socket voltage, resistance, and continuity checks to localize the trouble. Refer to TM 11–2139–20 for tube socket voltage and resistance values. After localizing the trouble, perform *additional* voltage and resistance measurements to isolate the defective part. Refer to the appropriate test setup schematic, wiring, and parts location diagrams in this manual.

(3) If the trouble has not been isolated after performing the troubleshooting procedures in (1) or (2) above, perform an *operational test* on the defective panel or subassembly. The operational tests, in conjunction with their respective troubleshooting and signal substitution charts, should aid in further localizing and isolating the defective part.

77. Test Equipment, Tools, and Special Equipment Required

The chart in *a* below lists the test equipment required for troubleshooting Telephone Terminal AN/TCC–7. Tools and special equipment are listed in *b* below.

a. Test Equipment.

Item	Technical manual	Common name
Attenuator TS–402/U	TM 11–2044	Attenuator.
Audio Level Meter ME–71A/FCC or equal	TM 11–2151	Audio level meter.
Electron Tube Test Set TV–7/U or equal	TM 11–5083	Tube test set.
Frequency Meter AN/USM–26	TM 11–5057	Frequency meter.
Multimeter AN/URM–105 or equal		Multimeter.
Multirange Instrument Shunt MX–1471/U		Shunt.
Signal Generator SG–71/FCC or equal	TM 11–5088	Signal generator.
Voltmeter, Meter ME–30A/U or equal	TM 11–5132	Voltmeter.
Electronic Multimeter TS–505 or equal	TM 11–5511	Electronic multimeter

b. Tools and Special Equipment.

Tools and special equipment	Technical manual	Common name
Telephone Carrier System Test Facilities Kit MK–155/TCC	TB SIG 328	Test facilities kit.
Tool Equipment TE–123.		
Tube Socket Adapter Kit MX–1258/U		Tube socket adapter
Power Supply PP–827/U or equal	TM 11–2139–35	200-VOLT POWER SUPPLY.
Variable Transformer TF–171/USM		Variable transformer.

78. Telephone Carrier System Test Facilities Kit MK–155/TCC

The test facilities kit contains test cable assemblies, impedance matching transformers and pads, assorted resistors and capacitors, and test leads. The components contained in the test facilities kit are used when performing operational troubleshooting and final-testing procedures on the panels and subassemblies. A complete description and detailed listing of the contents of the test facilities kit is covered in TB SIG 328.

79. Calibration of Audio Level Meter ME–71A/FCC

(fig. 49)

To calibrate the audio level meter with sufficient accuracy to perform the operational tests, follow the procedures given below before

using the meter. Refer to TM 11–2151 for operating instructions of the audio level meter.

Note. For all tests described in this manual using the audio level meter, the selector switch on the front panel of the meter must be operated to the VM–UNBAL 600 Ω BRG position. All connections to the audio level meter must be made to the unbalanced binding posts adjacent to the selector switch.

a. Connections. Connect the audio level meter to a circuit arranged as shown in figure 49. Be sure that all components have the proper values and are properly connected.

b. Calibration Test. Record the results of the following test on charts explained in *c* below, so that proper correction procedure (*d* below) can be applied to the audio level meter indications.

(1) Calibrate the audio level meter against its internal standard as described in TM 11–2151.

(2) Set Attenuator TS–402/U to provide 0-db attenuation.

(3) Adjust the output frequency of the signal generator to frequencies of 20 kc, 28 kc, 37 kc, 50 kc, 68 kc, and 100 kc for each of the nine tests listed in the chart in (8) below.

(4) Adjust the output level of the signal generator to provide the voltmeter indication given in the *voltmeter indication* column.

(5) Set Attenuator TS–402/U as listed in the *attenuator setting* column.

(6) Set the ATTENUATOR DB switch on the audio level meter to the position indicated in the *audio level meter ATTENUATOR DB switch* column.

(7) Insert the test plug assembly into the test jack assembly.

(8) Set the frequency dial of the audio level meter to the same frequency as the signal generator. Adjust the frequency dial to obtain a maximum meter indication on the audio level meter. The indication should be approximately 0 db. Record the indication on the chart (*c* below).

Test No.	Voltmeter indication (ac volts)	Attenuator setting (db)	Audio level meter ATTENUATOR DB switch
1	7.75	0	+20
2	2.45	0	+10
3	.775	0	0
4	.775	10	−10
5	.775	20	−20
6	.775	30	−30
7	.775	40	−40
8	.775	50	−50
9	.775	60	−60

c. Preparation of Calibration Charts. The calibration charts are used to record the response curves for each frequency and attenuator setting of the audio level meter being used. Prepare a calibration chart for each of the audio level meter ATTENUATOR DB switch settings *except* +30 and +40. Plot the audio level meter readings (*b*(8) above) against their respective frequencies for the setting of the ATTENUATOR DB switch setting. Figure 49 illustrates *sample* charts.

d. Test Measurement Correction Procedure. Use the following procedure to correct the indications given by the audio level meter:

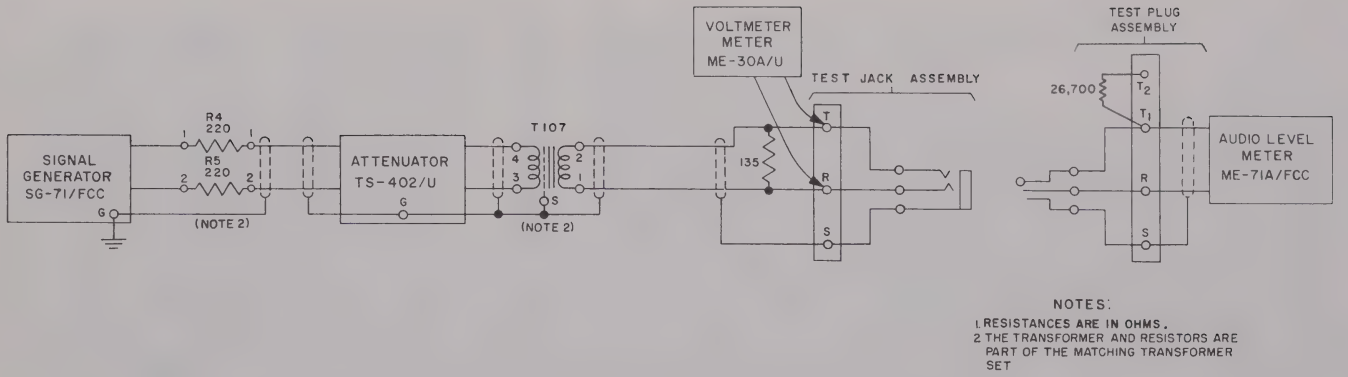
(1) Determine the ATTENUATOR DB switch setting used to obtain the indication.

(2) Select the calibration chart corresponding to the ATTENUATOR DB switch setting.

(3) Determine the amount of deviation for the frequency that was measured and whether it is above the 0-db line (positive) or below the 0-db line (negative).

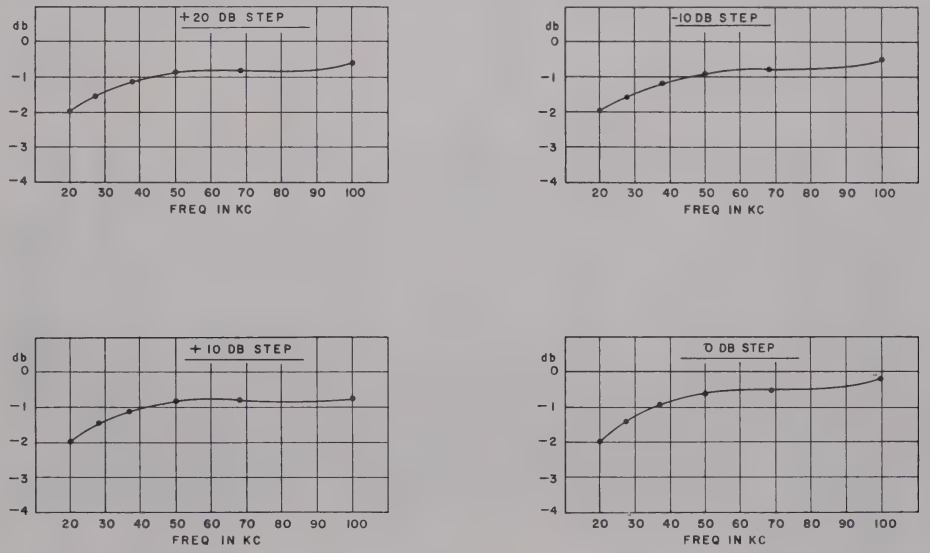
(4) If the response curve is above the 0-db line, subtract the deviation from the actual reading to obtain the corrected value.

(5) If the response curve is below the 0-db line, add the deviation to the actual reading to obtain the corrected value.



NOTES:
1. RESISTANCES ARE IN OHMS.
2. THE TRANSFORMER AND RESISTORS ARE PART OF THE MATCHING TRANSFORMER SET

SAMPLE CALIBRATION CHARTS FOR AUDIO LEVEL METER ME-71A/FCC



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Figure 49. Calibration setup and sample calibration charts for Audio Level Meter ME-71A/FCC.

Section II. TELEPHONE MODEM TA–219/U

80. CHAN MODEM, Troubleshooting Data

Fig. No.	Par. No.	Description
3		Telephone Modem TA–291/U, main chassis, schematic diagram.
2		Channel assembly, schematic diagram.
10, TM 11–2139–20.		CHAN 1, 2, 3, and 4, tube socket voltage and resistance chart.
52		CHAN MODEM top view, assemblies removed, location of parts.
53		Channel assembly, bottom view, location of parts.
54		Channel assembly, left side view, location of parts.
55		Channel assembly, top view, location of parts.
138		Telephone Modem TA–219/U, wiring diagram.
139		CHAN 1, wiring diagram.
140		CHAN 2, wiring diagram.
141		CHAN 3, wiring diagram.
142		CHAN 4, wiring diagram.
	88	CHAN MODEM, dc resistance of transformers.
	89	Channel Assemblies, thermistor resistance.

81. Channel Assemblies, Test Frequencies

Each channel assembly requires a different test frequency. The charts given in *a* and *b* below list the test frequencies and output levels for performing the operational tests given in paragraphs 82 and 83.

a. Carrier Test Frequencies.

Channel assembly under test	Signal generator output	
	Frequency (kc)	Output level (volt)
1	8	.82
2	12	.82
3	16	.82
4	20	.82

b. Receive Circuit Test Frequencies.

Channel assembly under test	Signal generator output	
	Frequency (kc)	Output level (volt)
1	7	.31
2	11	.31
3	15	.31
4	19	.31

82. Channel Assembly, Transmitting Circuit Test

(fig. 50)

Perform the tests given in *a* through *d* below *in sequence* for each channel assembly.

a. Initial Procedures.

(1) Connect the test cable assemblies, 600-ohm resistors, power supply, and channel assembly being tested as shown in figure 50.

(2) Connect signal generator No. 1 to terminals 0 and 3 of the modem and amplifier test cable assembly; adjust the output frequency and the output level for the channel assembly being tested (par. 81*a*).

b. Two- and Four-wire Tests.

(1) Connect signal generator No. 2 to the 2W–4WT binding posts; adjust the output frequency to 1 kc and the output level to .49 volt.

(2) Operate the 4W–2W switch to the 4W position.

(3) Connect a voltmeter across terminals 16 and 19 of the test cable assembly terminal board. The voltmeter should indicate .014 ±.002 volt.

(4) Readjust the output level of signal generator No. 2 to .78 volt.

(5) Operate the 4W–2W switch to the 2W position.

(6) The voltmeter should indicate .014 ±.002 volt.

c. Order-Wire Circuit Tests.

(1) Connect signal generator No. 2 to terminals 9 and 12 of the modem and amplifier test cable assembly.

(2) Operate the TALK-MON switch to the TALK position.

(3) The voltmeter should indicate .014 volt ±.002 volt.

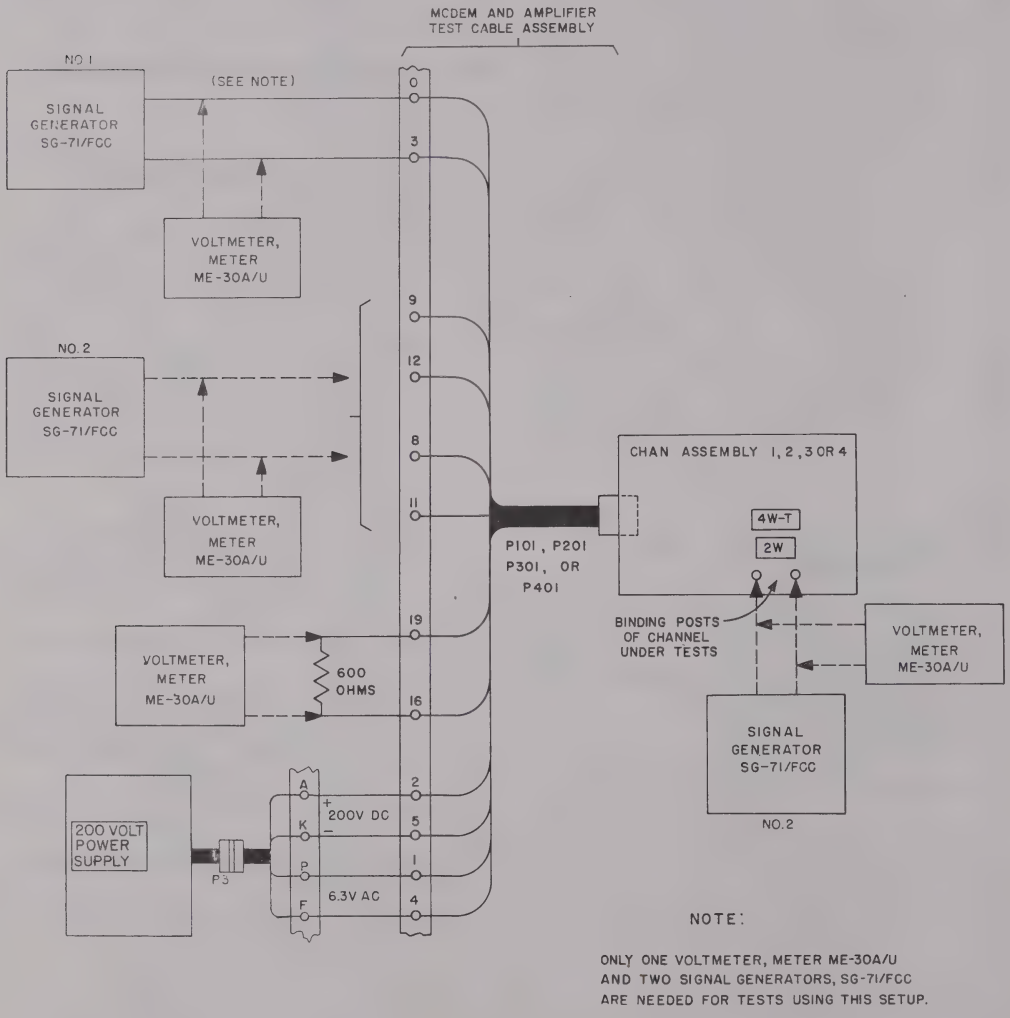
(4) Readjust the output level of signal generator No. 2 to 1.75 volts. Operate and hold the TALK-MON switch to the MON position.

(5) The voltmeter should indicate .0022 volt ±.0005 volt.

d. Test Signal Circuit Test.

(1) Operate the SEND-MEAS switch to the SEND position.

(2) Connect signal generator No. 2



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Figure 50. Channel assembly, operational test setup, transmitting circuit.

across terminals 8 and 11 of the modem and amplifier test cable assembly and readjust the output level to .73 volt.

(3) The voltmeter should indicate .014 ±.002 volt.

83. Channel Assembly, Receiving Circuit Test
(fig. 51)

Perform the tests given in *a* through *d* below in sequence for each channel assembly.

a. Initial Procedures.

(1) Connect the test cable assemblies, 600-ohm resistor, power supply, and channel assembly being tested as shown in figure 51.

(2) Connect signal generator No. 1 to terminals 0 and 3 of the modem and amplifier test cable assembly; adjust the output frequency and the output level for the channel assembly being tested (par. 81*a*).

b. Two- and Four-Wire Tests.

(1) Connect signal generator No. 2 to terminals 14 and 17 of the modem and amplifier test cable assembly; adjust the output frequency and the output level for the channel assembly being tested (par. 81*b*).

(2) Operate the 4W–2W switch to the 4W position.

(3) Connect the voltmeter across the 4WR binding posts. The voltmeter should indicate 2.45 ±.8 volts.

(4) Operate the 4W–2W switch to the 2W position.

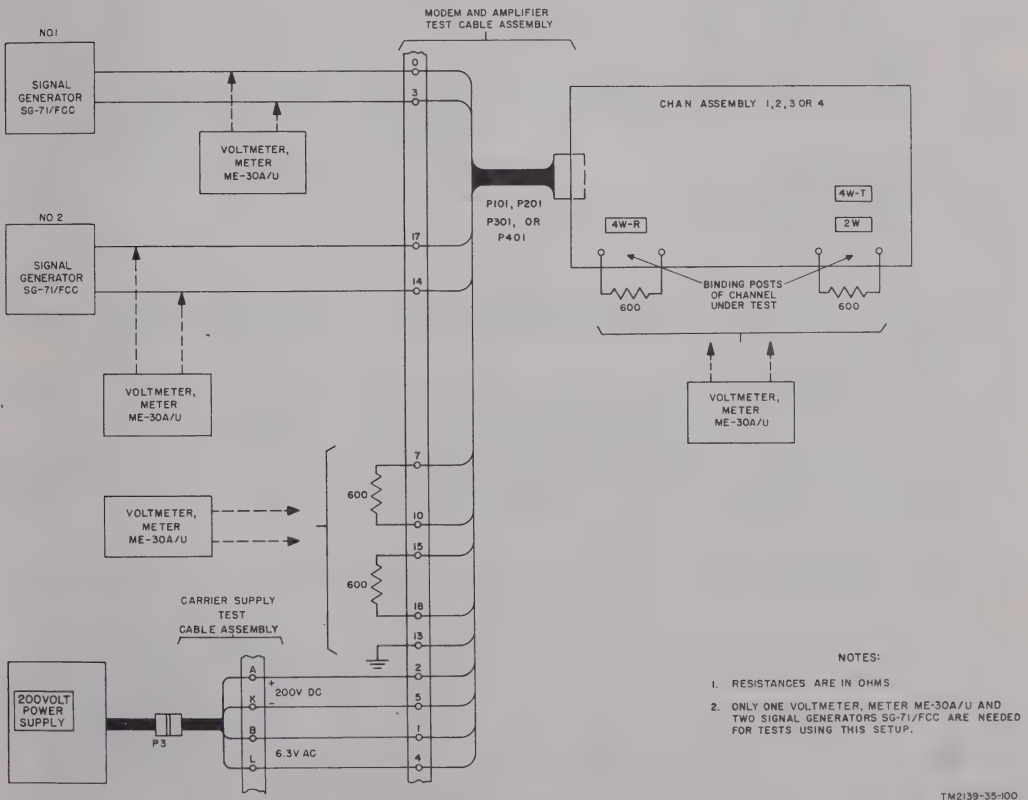


Figure 51. Channel assembly, operational test setup, receiving circuit.

(5) The voltmeter should indicate 1.55 ±.5 volts.

c. Order-Wire Circuit Tests.

(1) Operate the GAIN control on the channel assembly to the extreme clockwise position.

(2) Connect the voltmeter across terminals 7 and 10 of the modem and amplifier test cable assembly.

(3) Operate the TALK-MON switch to the TALK position.

(4) The voltmeter should indicate 2.45 ±.8 volts.

(5) Operate and hold the TALK-MON switch to the MON position.

(6) The voltmeter indication should be 2.45 ±.8 volts.

d. Test Signal Circuit Test.

(1) Operate the SEND-MEAS switch to the SEND position.

(2) Connect the voltmeter across terminals 15 and 18 of the modem and amplifier test cable assembly.

(3) The voltmeter indication should be 2.45 ±.8 volts.

84. Continuity Test

The continuity tests are for circuits in the CHAN MODEM not covered in the operational tests (pars. 82 and 83). All power must be removed from the CHAN MODEM during this test. Use the multimeter to check the continuity of the CHAN MODEM (fig. 3). The CHAN MODEM should indicate zero resistance for each check except the following:

Connector J5 terminals	Connector J1, J2, J3, and J4 terminals	Multimeter indication (ohms)
E	17	532
P	17	823

85. Channel Assemblies, Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in individual channel assemblies. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). When the trouble has been localized to a stage or circuit, a tube check and a voltage and resistance measurement of this stage or circuit ordinarily should be sufficient to isolate the defective part. Normal tube socket voltage and resistance measurements appear in TM 11–2139–20, figure 10.

Symptom	Probable trouble	Corrective measures
1. No transmission through a channel in transmitting and receiving directions.	Failure of carrier distribution circuit.	Check carrier distribution circuits for open and short circuits (fig. 3).
2. Transmission through two-wire input of channel under test out of limits.	Failure of transmission circuits between 2W–4WT binding posts and terminals 16 and 19 of P101, P201, P301, or P401.	Use signal substitution procedure (par. 86, tests No. 1 through 5) to localize the trouble.
3. Transmission through four-wire input of channel under test out of limits.	Failure of transmission circuits between 2W–4WT binding posts and terminals 16 and 19 of P101, P201, P301, or P401.	Use signal substitution procedure (par. 86, test 1 through 5) to localize trouble.
4. Transmission through order-wire talking and monitoring circuit in transmitting direction out of limits.	Failure of transmission circuits between terminals 9 and 12 and terminals 16 and 19 of P101, P201, P301, or P401.	*a.* Perform operational test (par. 82*c*). *b.* If normal output is obtained in correction *a* above, check contacts of TALK-MON lever switch (S101, S201, S301, or S401). *c.* Check order-wire talking circuit connections between TALK-MON lever switch and terminals 9 and 12 of P101, P201, P301, or P401 for open and short circuits (fig. 2).

Symptom	Probable trouble	Corrective measures
5. Transmission through order-wire monitoring circuit out of limits.	Failure of TALK-MON lever switch contacts or connections.	*a.* Perform operational test (par. 82*c*). *b.* If normal output is obtained in correction *a* above, check contacts of TALK-MON lever switch and wiring and resistances associated with it (fig. 2).
6. Transmission through test signal circuit in transmitting direction out of limits.	Failure of SEND-MEAS lever switch contacts or of its connections to terminals 8 and 11 of connector P101, P201, P301, or P401.	*a.* Perform operational test (par. 82*d*). *b.* If normal output is obtained in correction *a* above, check contacts of SEND-MEAS lever switch. *c.* Check test signal circuit connections between the SEND-MEAS lever switch and terminals 8 and 11 of connector P101, P201, P301, or P401 for open and short circuits (fig. 2).
7. Transmission through two-wire output of channel under test in receiving direction out of limits.	Failure of transmission circuits between terminals 14 and 17 of connector P101, P201, P301, or P401 and 2W–4WT binding posts.	*a.* Check tube socket voltages and resistances at XV101, XV201, XV301, or XV401 (fig. 10, TM 11–2139–20). Localize and remove fault. *b.* Use signal substitution procedures to localize the trouble (par. 86, tests No. 1 through 5).
8. Transmission through four-wire output in receiving direction out of limits.	Failure of transmission circuits between terminals 14 and 17 of connector P101, P201, P301, or P401 and 4WR binding posts.	*a.* Perform operational test (par. 83*b*). *b.* If normal output is obtained in corrections *a* above, check the contacts and wiring of the 4W–2W lever switch. Replace the switch if it is defective. *c.* Check the connections between the 4W–2W lever switch and the 4WR binding posts for open or short circuits and correct the fault.
9. Transmission through order-wire talking and monitoring circuit in receiving direction out of limits.	Failure of transmission circuits between terminals 14 and 17 and terminals 7 and 10 of connector P101, P201, P301, or P401.	*a.* Perform operational test (par. 83*c*). *b.* If normal output is obtained in corrections *a* above, check contacts of the TALK-MON lever switch and wiring and resistance associated with it.
10. Transmission through test signal circuit in receiving direction out of limits.	Failure of SEND-MEAS lever switch contacts of its connections to terminals 15 and 18 of connector P101, P201, P301, or P401.	*a.* Perform operational test (par. 83*d*). *b.* If normal output is obtained in correction *a* above, check contacts of SEND-MEAS lever switch. *c.* Check test signal circuit connections between SEND-MEAS lever switch and terminals 18 and 18 of connector P101, P201, P301, or P401 (fig. 2).

86. Channel Assemblies, Transmitting Direction, Signal Substitution Charts

The signal substitution chart supplements the troubleshooting procedures (par. 85). This chart will help to determine the defective stage or circuit. Resistance and voltage measurements will isolate the defective part within the stage or circuit. Connect the channel assembly under test according to the procedures outlined in paragraphs 81 and 82. The signal substitution procedures at each step assume that all previous steps have been completed satisfactorily. Small variations from the spe-

cified voltmeter readings do not necessarily indicate trouble. However, any marked variations from normal readings indicate the presence of trouble and may imply the nature of the trouble.

Note. Throughout the chart, reference symbols are for CHAN 1. Components of CHAN 2, CHAN 3 and CHAN 4 are the same except that the reference designations are in a different hundred block as indicated below.

Channel No.	*Hundred block*
2	201 to 299
3	301 to 399
4	401 to 499

Test No.	Voltmeter probe connections		Meter indication (ac volt)	Corrective measures
	Positive	Negative		
1	Standoff E107	Standoff E108	0.5	Check circuit between 2W–4WT binding posts and standoffs E107 and E108 for opens and shorts (fig. 2). Operate the 4W–2W lever switch to 4W position. Check voltage across standoffs E107 and E108 and if normal voltage of .8 volt is obtained, it indicates trouble in transformer T101, capacitor C101, C102, C103, or C104, or resistor R101. Check these components.
2	Terminal 3 of FL101	Ground	.17	Check circuit between standoffs E107, E108, and filter FL101 for open and shorts. Check resistors R106 through R109. Check capacitors C105 and C106. Check transformer T102. Check filter FL101.
3	Terminal 3 of FL102	Ground	.10	Check circuit between filters FL101 and FL102 for opens and shorts. Perform test No. 5. Check thermistors RT103, RT104, RT107, and RT108. Check resistors R114 through R116, and R142 through R145. Check transformers T103 and T104. Check resistors R110 through R113. Check varistor CR101.
4	Terminal 19 of modem and amplifier test cable assembly.	Terminal 16 of modem and amplifier test cable assembly.	.014	Check circuit between filter FL102 and connector P101. Check filter FL102.
5	Terminal 2 of T104	Terminal 2 of T103	.4	Check circuit between terminals 0 and 3 of connector P101 and transformers T103 through T106 for opens and shorts. Check resistors R126 through R129. Check thermistors RT101 and RT102.

87. Channel Assemblies, Receiving Direction, Signal Substitution Chart

The receiving direction signal substitution chart is similar to the signal substitution chart for the transmitting direction (par. 86). Perform the initial procedures described in paragraph 82.

Note. Throughout the chart, reference symbols are for CHAN 1. Components of CHAN 2, CHAN 3, and CHAN 4 are the same except that they are in a different hundred block (par. 86).

Test No.	Voltmeter probe connections		Meter indication (ac volt)	Corrective measures
	Positive	Negative		
1	Terminal 3 of FL103	Ground	.14	Check circuit between terminals 14 and 17 of connector P101 and terminals 1 and 2 of filter FL103 for opens and shorts (fig. 2). Check filter FL103.
2	Terminal 6 of T106	Ground	.04	Check circuit between FL103 and T106 for opens and shorts. Check thermistors RT105, RT106, RT109, and RT110. Check resistors R119, R120, R121, R146, and R147.
3	Terminal 6 of T105	Ground	.02	Check circuit between T106 and T105 for opens and shorts. Perform test No. 4. Check resistors R122 through R125. Check transformers T104 and T105. Check varistor CR102.
4	Terminal 3 of T105	Terminal 3 of T106	.4	Check circuit between terminals 0 and 3 of connector P101 and transformer T103 through T106 for opens and shorts. Check resistors R126 through R129. Check thermistors RT101 and RT102.
5	Terminal 3 of FL104	Ground	.02	Check circuit connections between T105 and FL104. Check filter FL104.
6	Terminal 3 of T107	Ground	.02	Check circuit between filter FL104 and transformer T107 for opens and shorts. Check resistors R140, R141, and R138A and R138B.
7	Terminal 1 of T108	Terminal 2 of T108	2	Check tube socket XV101 voltages (TM 11-2139-20, fig. 10). Check resistors and capacitors associated with the tube socket terminals that have abnormal dc voltages. Check tube socket XV101 resistances (TM 11-2139-20, fig. 10). Check resistors and capacitors associated with tube socket terminals that have abnormal resistance indications. Check resistors R130, R131, R134, and R137. Check capacitors C107 through C111. Check transformers R107 and T108.
8	Binding post E101	Binding post E102	1.25	Check circuit between 2W-4WT binding posts and T108 for opens and shorts. Perform test No. 9. If normal voltage is obtained, it indicates trouble in transformer T101, capacitors C101, C102, C103, C104, or resistor R101. Check these components.
9	Binding post E103	Binding post E104	2	Check circuit between 4WR binding posts and transformer T108 for opens and shorts.

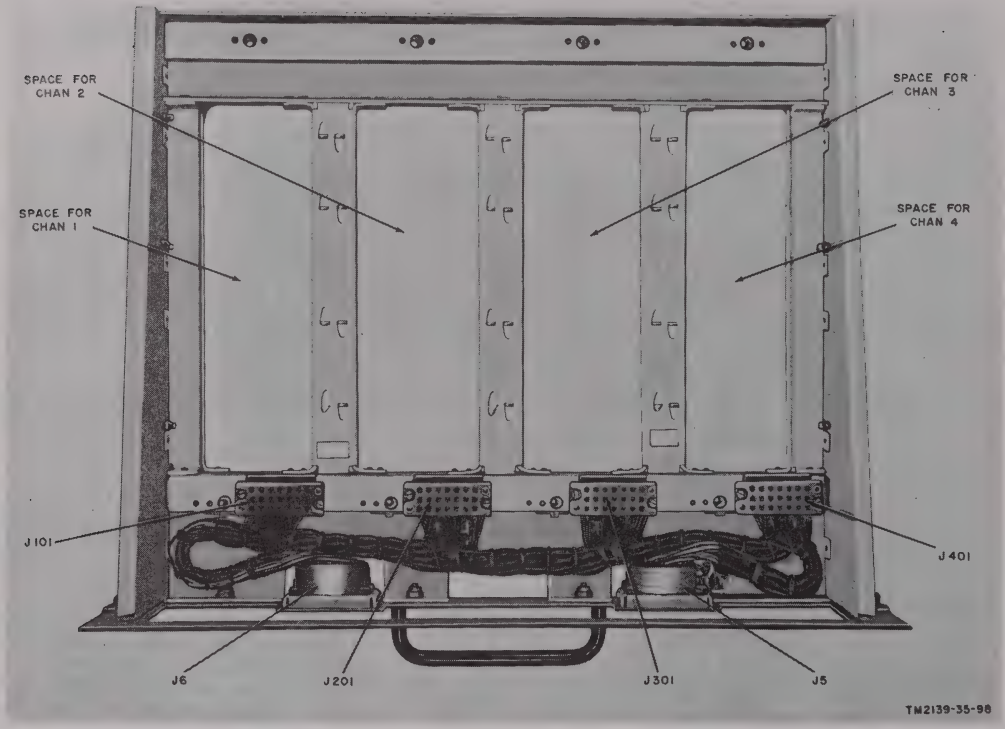


Figure 52. Telephone Modem TA-219/U, main chassis, channel assemblies removed, top view.

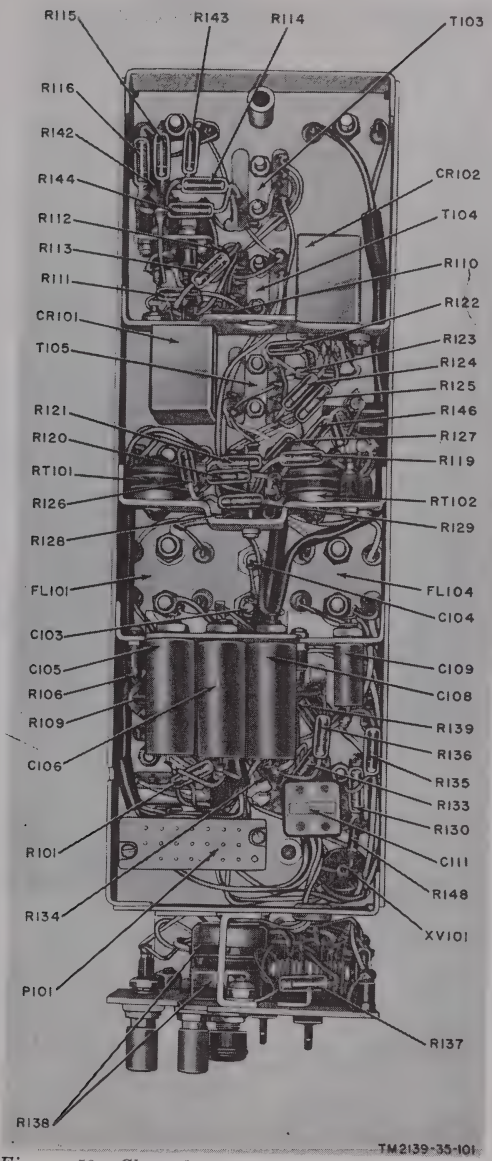


Figure 53. Channel assembly (part of Telephone Modem TA-219/U), bottom view, location of parts.

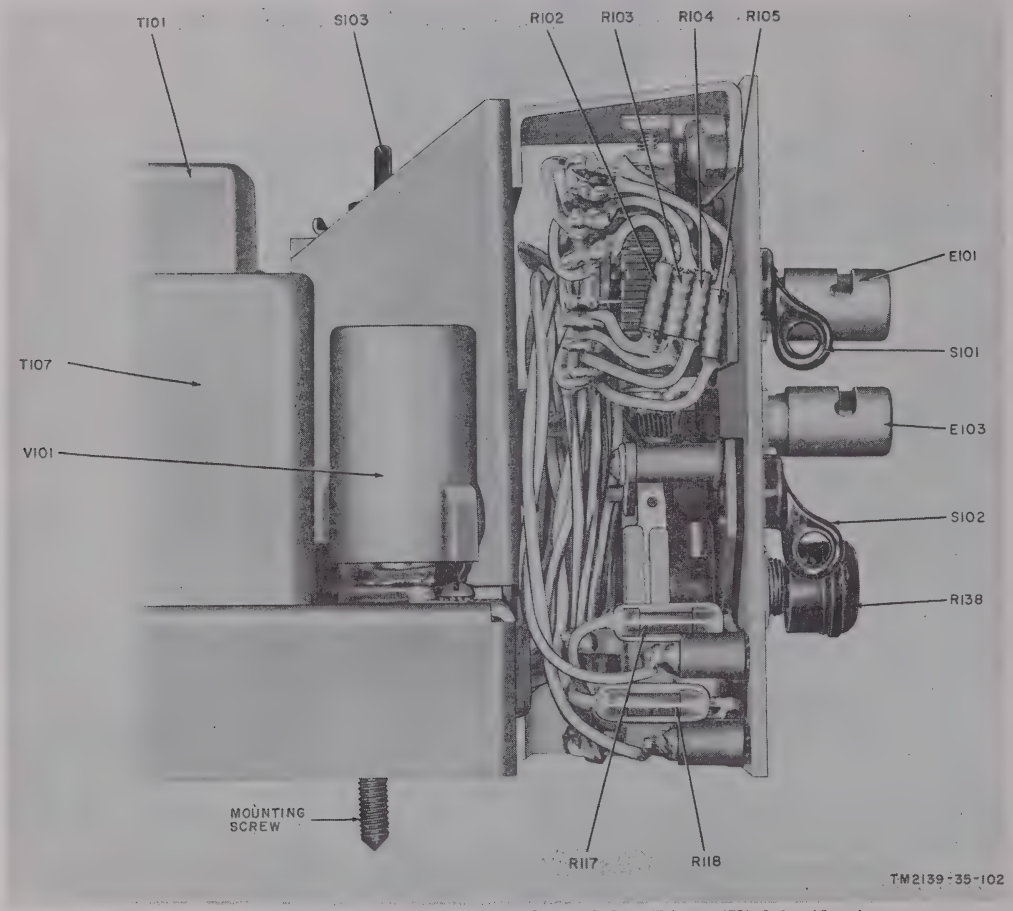


Figure 54. Channel assembly (part of Telephone Modem TA-219/U) left side view, location of panel-mounted parts.

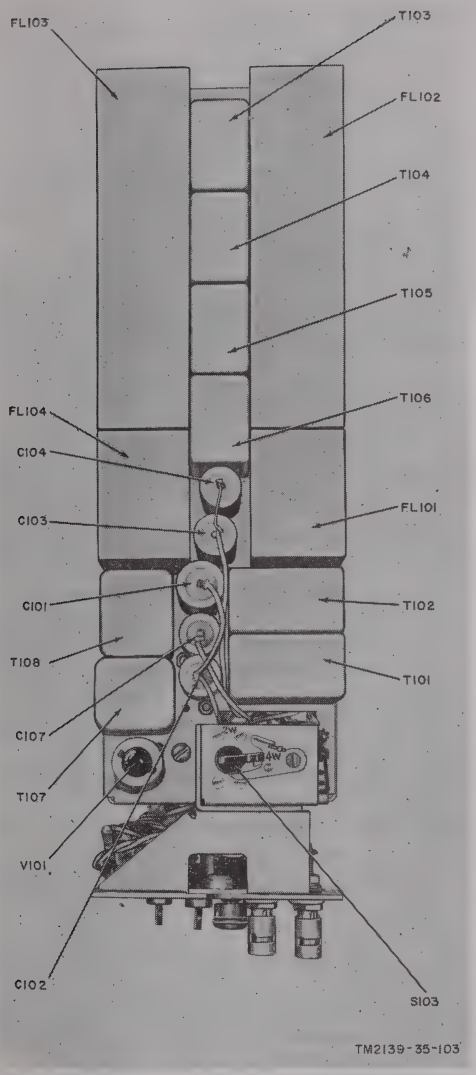


Figure 55. Channel assembly (part of Telephone Modem TA-219/U), top view, location of parts.

88. CHAN MODEM, Dc Resistance of Transformers

Transformers	Terminals	Resistance (ohms)
T101, T201, T301, and T401.	1–2	24
	2–3	27
	1–3	51
	4–5	24
	5–6	27
	4–6	51
	7–8	27
	9–10	27
T102, T202, T302, and T402.	1–2	57
	3–4	34
	5–6	34
T103 through 106, T203 through T206, T303 through T306, and T403 through T406.	1–2	13
	3–4	13
	5–6	48 (115 for T103 through T106 only)
T107, T207, T307, and T407.	1–3	20
	4–6	7,500
T108, T208, T308, and T408.	1–2	100
	3–4	83
	5–6	1,720

89. Channel Assemblies, Thermistor Resistance

Test the thermistors with an ohmmeter. Because the resistance of the thermistor varies with temperature, check the thermistor at a room temperature between 70° and 80° F.

Thermistor	Approx. resistance (ohms)
RT101 and RT102	31.5
RT201 and RT202	31.5
RT301 and RT302	31.5
RT401 and RT402	31.5
RT103 through RT110	1,000
RT203 through RT206	1,000
RT303 through RT306	1,000
RT403 through RT406	1,000

Section III. TELEPHONE MODEM TA-227/U

90. Troubleshooting Data

Fig. No.	Par. No.	Description
5		Schematic diagram.
12, TM 11-2139-20.		Tube socket voltage and resistance chart.
58, 59		Bottom view, location of parts.
60		Top view, location of parts.
143		Wiring diagram.
	96	Dc resistance of transformers and coils.

91. Transmitting Circuit, Test (fig. 56)

a. Initial Procedures.

(1) Calibrate the audio level meter (par. 79).

(2) Connect the transmission, carrier supply and power test cable assemblies, two 135-ohm resistors, 200 VOLT POWER SUPPLY, and the SUBGROUP PANEL as shown in figure 56.

(3) Connect signal generator No. 2, resistors R1 through R3, attenuator, and transformer T108 as shown in figure 56. Connect the subgroup test cable assembly as specified in the following procedure.

(4) Adjust the TR AMP GAIN control on the SUBGROUP PANEL to the extreme clockwise position.

b. Subgroup Channel Test.

(1) Connect signal generator No. 1 to terminals C and L of the transmission test cable assembly (fig. 56); adjust the output frequency to 56 kc at an output level of —2.5 db.

(2) Connect the subgroup test cable assembly connector into CHAN MODEM 1 connector P3; set the attenuator for a 35-db loss. Adjust the output frequency of signal generator No. 2 to 20 kc and an output level of —35 db measured across terminals A and K of the subgroup test cable assembly.

(3) Connect the audio level meter to terminals T_1 and R of the test plug assembly (fig. 56); insert the plug of the test plug assembly into the MOD IN 1 jack on the SUBGROUP PANEL. The audio level meter should indicate —39 ±2 db.

(4) Insert the plug of the test plug assembly into the 60–108 KC OUT jack; the audio level meter should indicate —48 ±1.5 db.

(5) Disconnect the audio level meter from the test plug assembly and connect it across the terminals indicated in (*a*) through (*d*) below. The audio level meter should indicate —48 ±1.5 db when connected to each of the test points.

(*a*) Terminals A and L on the power test cable assembly.

(*b*) Terminals K and W on the power test cable assembly.

(*c*) Binding posts 60–108KC OUT on the SUBGROUP PANEL.

(*d*) Binding posts 60–108KC OUT-ALT on the SUBGROUP PANEL.

(6) Test subgroup channels 2 and 3; use the procedures given in (1) through (4) above. The frequencies, connections, and output levels remain the same unless otherwise specified in the chart below.

Subgroup channel	Subgroup test cable connection	Signal generator No. 1			Test plug assembly connection (jack)
		Connection	Frequency (kc)	Level (db)	
2	CHAN MODEM 2 P2	A and J	72	—2.5	MOD IN 2
3	CHAN MODEM 3 P1	D and E	88	—2.5	MOD IN 3

Figure 56. SUBGROUP PANEL, operational and final test setup, transmitting direction.

(Contained in separate envelope)

c. Special Service Test.

(1) Operate the SPECIAL SERVICE switch on each subgroup channel to the SPL SERV position.

(2) Connect signal generator No. 2, resistors R1 through R3, attenuator, and transformer T108 as shown in figure 56, to the SPECIAL SERVICE IN binding posts on the channel being tested; set the attenuator for 0-db loss. Adjust the frequency of signal generator No. 2 to 20 kc and the output level to 0 db measured at the SPECIAL SERVICE IN binding posts.

(3) Connect and adjust signal generator No. 1 as specified in the following chart.

Subgroup channel	Signal generator No. 1		
	Transmission test cable assembly connection	Frequency (kc)	Level (db)
1	C and L	56	−2.5
2	A and J	72	−2.5
3	D and E	88	−2.5

(4) Connect the audio level meter across terminals A and L of the power test cable assembly. The meter should indicate −48 ±1.5 db on each subgroup channel at frequencies of 76, 92, and 108 kc for channels 1, 2, and 3 respectively.

92. Receiving Circuit, Tests
(fig. 57)

a. Initial Procedure.

(1) Calibrate the audio level meter (par. 79).

(2) Connect the transmission, carrier supply, and power test cable assemblies, and SUBGROUP PANEL as shown in figure 57.

(3) Connect a 600-ohm resistor across each SPECIAL SERVICE OUT binding post.

(4) Connect signal generator No. 2, resistors R1 through R3, attenuator, and transformer T107 as shown in figure 57.

(5) Adjust the DEM 1 GAIN, DEM 2 GAIN, and DEM 3 GAIN controls to their extreme clockwise positions.

(6) Connect signal generator No. 2 and associated components ((3) above) to terminals H and R of the transmission test cable assembly. Set the attenuator for a 10-db loss.

b. Subgroup Channel 1 Test.

(1) Connect the subgroup test cable assembly and 600-ohm resistor to CHAN MODEM 1 connector P3.

(2) Connect signal generator No. 1 to terminals C and L of the transmission test cable assembly (fig. 57); adjust the output frequency to 56 kc at an output level of −2.5 db.

(3) Adjust the output frequency of signal generator No. 2 to 76 kc at an output level of 11.5 db as measured across terminals H and R of the transmission test cable assembly.

(4) Operate the SPECIAL SERVICE 1 switch to SPL SERV.

(5) Arrange the audio level meter to measure a frequency at 20 kc. Connect the audio level meter to the SPECIAL SERVICE 1 OUT binding posts. The audio level meter should indicate a level of 7.5 ±2 db at 20 kc.

(6) Operate the SPECIAL SERVICE 1 switch to CHAN MODEM.

(7) Connect the audio level meter to terminals P and E of the subgroup test cable assembly. The audio level meter should indicate a level of 7.5 ±2 db at 20 kc.

(8) Connect the audio level meter to terminals T, and R of the test plug assembly (fig. 57).

(9) Insert the plug of the test plug assembly into the DEM OUT 1 jack. The audio level meter should indicate 7.5 ±2 db.

c. Subgroup Channel 2 Test.

(1) Perform the initial procedures given in *a* above.

(2) Connect the subgroup test cable assembly and 600-ohm resistor to CHAN MODEM 2 connector P2.

(3) Connect signal generator No. 1 to terminals A and J of the transmission

test cable assembly (fig. 57); adjust the output frequency to 72 kc at an output level of —2.5 db.

(4) Adjust the output frequency of signal generator No. 2 to 92 kc at an output level of 11.5 db as measured across terminals H and R of the transmission test cable assembly.

(5) Operate the SPECIAL SERVICE 2 switch to SPL SERV.

(6) Arrange the audio level meter to measure a frequency of 20 kc. Connect the audio level meter to the SPECIAL SERVICE 2 OUT binding posts. The audio level meter should indicate a level of 6.5 ±2 db at 20 kc.

(7) Operate the SPECIAL SERVICE 2 switch to CHAN MODEM.

(8) Connect the audio level meter to terminals P and E of the subgroup test cable assembly. The audio level meter should indicate a level of 6.5 ±2 db at 20 kc.

(9) Connect the audio level meter to terminals T_1 and R of the test plug assembly (fig. 57).

(10) Insert the plug of the test plug assembly into the DEM OUT 2 jack. The audio level meter should indicate 6.5 ±2 db at 20 kc.

d. Subgroup Channel 3 Test.

(1) Perform the initial procedures given in *a* above.

(2) Connect the subgroup test cable assembly and 600-ohm resistor to CHAN MODEM 3 connector P1.

(3) Connect signal generator No. 1 to terminals D and E of the transmission test cable assembly (fig. 57); adjust the output frequency to 88 kc at an output level of —2.5 db.

(4) Adjust the output frequency of signal generator No. 2 to 108 kc at an output level of 11.5 db as measured across terminals H and R of the transmission test cable assembly.

(5) Operate the SPECIAL SERVICE 3 switch to SPL SERV.

(6) Arrange the audio level meter to measure a frequency of 20 kc. Connect the audio level meter to the SPECIAL SERVICE 3 OUT binding posts. The audio level meter should indicate a level of 5.5 ±2 db at 20 kc.

(7) Operate the SPECIAL SERVICE 3 switch to CHAN MODEM.

(8) Connect the audio level meter to terminals P and E of the subgroup test cable assembly. The audio level meter should indicate a level of 5.5 ±2 db at 20 kc.

(9) Connect the audio level meter to terminals T_1 and R of the test plug assembly (fig. 57).

(10) Insert the plug of the test plug assembly into the DEM OUT 3 jack. The audio level meter should indicate 5.5 ±2 db at 20 kc.

93. Miscellaneous Continuity Tests (fig. 57)

The following continuity tests are for the circuits of the SUBGROUP PANEL not tested in previous operational tests (pars. 91 and 92). All power must be removed when performing these tests.

a. Connect the power test cable assembly to connector J9 on the SUBGROUP PANEL.

b. Connect the subgroup test cable assembly to connector P1, P2, or P3 on the SUBGROUP PANEL as shown in the chart (*d* below).

c. Use the multimeter to check continuity of the transmission circuits listed in the chart. Make the continuity checks between each subgroup test cable assembly terminal listed in the chart and the power test cable assembly terminal in the same horizontal row. The meter should indicate zero resistance for each check.

d. Use the multimeter to check for short circuits between the terminals listed in row *a* and those listed in row *b* for each path tested in the chart below. The multimeter should indicate infinite resistance between the terminals listed in row *a* and those listed in row *b*.

Figure 57. SUBGROUP PANEL, operational and final test setup, receiving direction.

(Contained in separate envelope)

Circuit under test		Subgroup test cable assembly connected to			Power test cable assembly terminals
		P1 terminals	P2 terminals	P3 terminals	
Send path between J9 and P1, P2, or P3	*a*	D	D	D	F
	b	N	N	N	S
Measure path between J9 and P1, P2, or P3	*a*	F	F	F	U
	b	R	R	R	H
Modulator talk path between J9 and P1, P2, or P3	*a*	C	C	C	P
	b	M	M	M	C
Demodulator talk path between J9 and P1, P2, or P3	*a*	B	B	B	R
	b	L	L	L	D

94. Subgroup Panel Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the SUBGROUP PANEL. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). Normal tube socket voltage and resistance measurements appear in TM 11–2139–20.

Symptom	Probable trouble	Corrective measures
1. No transmission through subgroups 1, 2, and 3 in transmitting and receiving directions.	*a.* Failure of +200-volt dc distribution circuits.	*a.* Check for presence of 200 volts dc from standoffs E12, E27, E42, and E50 to ground. If not present, refer to overall schematic diagram and locate open or short circuits.
	b. Failure of 6.3-volt ac distribution circuits.	*b.* Check for presence of 6.3 volts ac across terminals 3 and 4 of all tube sockets, with terminal 3 ground. If not present, check the 6.3-volt ac distributing circuits and locate open or short circuits.
2. No transmission through subgroup 1 in transmitting and receiving directions.	Failure of 56-kc carrier distribution circuit.	*a.* Check performance as given in operational tests (pars. 91 and 92). *b.* If normal output is obtained in correction *a*, check the 56-kc carrier distribution circuit between terminals L and C of J10 and T11, T12, T14, and T15, and locate open or short circuits.
3. No transmission through subgroup 2 in transmitting and receiving directions.	Failure of 72-kc carrier distribution circuit.	*a.* Check performance as given in operational tests (pars. 91 and 92). *b.* If normal output is obtained in correction *a*, check the 72-kc carrier distribution circuit between terminals A and J of J10 and T6, T7, T9, and T10, and locate open or short circuits.
4. No transmission through subgroup 3 in transmitting and receiving directions.	Failure of 88-kc carrier distribution circuit.	*a.* Check performance as given in operational tests (pars. 91 and 92). *b.* If normal output is obtained in correction *a*, check the 88-kc carrier distribution circuit between terminals D and E of J10 and T1, T2, T4, and T5, and locate open or short circuits.

Symptom	Probable trouble	Corrective measures
5. Transmission measurements through the message transmission path of subgroup 1 in the transmitting direction, out of limits.	Failure of transmission circuits between terminals A and K of P3, and A and L of J9.	*a.* Check performance as given in operational tests (par. 91*b*). *b.* If normal output is obtained in correction *a*, use signal substitution procedures given in paragraph 95*a*, tests No. 1 through 6, to locate the trouble.
6. Transmission measurements through the special service transmission path of subgroup 1 in the transmitting direction, out of limits.	Failure of SPECIAL SERVICE 1 switch and associated circuits.	*a.* Check performance as given in operational tests (par. 91*c*). *b.* If normal output is obtained in correction *a*, check the contacts of the SPECIAL SERVICE 1 switch and the wiring and resistances between it and the SPECIAL SERVICE 1 IN binding posts.
7. Transmission measurements through the message transmission path of subgroup 2 in the transmitting direction, out of limits.	Failure of transmission circuits between terminals A and K of P2, between terminals A and L of J9 and terminals K and W of J9, between the transmission path and the 60–108 KC OUT or 60–108 KC OUT ALT binding posts, or between the transmission path and the 60–108 KC OUT test jack.	*a.* Check performance as given in operational tests (par. 91). If normal indication is obtained, proceed to correction *d* below. *b.* If normal output is not obtained in correction *a*, check tube socket XV7 voltages (TM 11–2139–20, fig. 12). *c.* If normal indications are obtained in correction *b*, use signal substitution procedures (par. 95*b*, tests No. 7 through 13) to localize the trouble. *d.* If normal output is obtained in correction *a*, use signal substitution procedures (par. 95*b*, tests No. 1 through 6) to localize the trouble.
8. Transmission measurements through the special service transmission path of subgroup 2 in the transmitting direction, out of limits.	Failure of SPECIAL SERVICE 2 switch and associated circuits.	*a.* Check performance as given in the operational tests (par. 91*c*). *b.* If normal output is obtained in correction *a*, check the contacts of the SPECIAL SERVICE 2 switch and the wiring and resistances between it and the SPECIAL SERVICE 2 IN binding posts.
9. Transmission measurements through the message transmission path of subgroup 3 in the transmitting direction, out of limits.	Failure of transmission circuits between terminals A and K of P1 and A and L of J9.	*a.* Check performance as given in the operational tests (par. 91*b*). *b.* If normal output is obtained in correction *a*, use signal substitution procedures (par. 95*c*, tests No. 1 through 6) to locate the trouble.
10. Transmission measurements through the special service transmission path of subgroup 3 in the transmitting direction, out of limits.	Failure of SPECIAL SERVICE 3 switch and associated circuits.	*a.* Check performance as given in the operational tests (par. 91*c*). *b.* If normal output is obtained in correction *a*, check the contacts of the SPECIAL SERVICE 3 switch and the wiring and resistances between it and the SPECIAL SERVICE 3 IN binding posts.
11. Transmission measurements through the transmission path of subgroup 1 in the receiving direction, out of limits.	Failure of transmission circuits between terminals H and R of J10 and P and E of P3, between J10 and DEM OUT 1 jack, or between J10 and SPECIAL SERVICE 1 OUT binding posts.	*a.* Check performance as given in the operational tests (par. 92*b*). *b.* If normal output is obtained in correction *a*, check tube socket XV5 and XV6 voltages (TM 11–2139–20, fig. 12).

Symptom	Probable trouble	Corrective measures
		c. If normal indications are obtained in correction *b*, use signal substitution procedures (par. 95*d*, tests No. 4 through 13) to localize the trouble.
12. Transmission measurements through the transmission path of subgroup 2 in the receiving direction, out of limits.	Failure of transmission circuits between terminals H and R of J10 and P and E of P2, between J10 and DEM OUT 2 jack, or between J10 and SPECIAL SERVICE 2 OUT binding posts.	*a.* Check performance as given in the operational tests (par. 92*b*). *b.* If normal output is not obtained in correction *a*, use signal substitution procedures (par. 95*e*, tests No. 1 through 3) to localize the trouble. *c.* If normal output is obtained in correction *a*, check tube socket XV3 and XV4 voltages (TM 11-2139-20, fig. 12). *d.* If normal indications are obtained in correction *c*, use signal substitution procedures (par. 95*e*, tests No. 4 through 13) to localize the trouble.
13. Transmission measurements through the transmission path of subgroup 3 in the receiving direction out of limits.	Failure of transmission circuits between terminals H and R of J10 and P and E of P1, between J10 and DEM OUT 3 jack, or between J10 and SPECIAL SERVICE 3 OUT binding posts.	*a.* Check performance as given in the operational tests (par. 92*b*). *b.* If normal output is obtained in correction *a*, check tube socket XV1 and XV2 voltages (TM 11-2139-20, fig. 12). *c.* If normal indications are obtained in correction *b*, use signal substitution procedures (par. 95*f*, tests No. 4 through 13) to localize the trouble.
14. No transmission through test signal send path from P1, P2, or P3 to J9.	Failure of transmission circuit between P1, P2, or P3 and J9.	Check for open or short circuits (par. 93).
15. No transmission through test signal measure path from P1, P2, or P3 to J9.	Failure of transmission circuit between P1, P2, or P3 and J9.	Check for open or short circuits (par. 93).
16. No transmission through modulator talk path from P1, P2, or P3 to J9.	Failure of transmission circuit between P1, P2, or P3 and J9.	Check for open or short circuits (par. 93).
17. No transmission through demodulator talk path from P1, P2, or P3 to J9.	Failure of transmission circuit between P1, P2, or P3 and J9.	Check for open or short circuits (par. 93).

95. Signal Substitution Charts

The signal substitution charts (*a* through *f* below) are used to supplement the trouble-shooting procedures (par. 94). These charts will help isolate the defective stage or circuit. Voltage and resistance measurements taken at the defective stage or circuit will ordinarily isolate the defective part. The signal substitution charts are outlined for each subgroup channel transmitting and receiving circuit. The signal substitution procedures at each step are based on the assumption that all previous steps have been completed satisfactorily.

a. Signal Substitution Chart for Subgroup 1, Transmitting Direction.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	MOD IN 1 jack (tip)	MOD IN 1 jack (ring)	20	−39	*a.* Check circuit from terminals A and K of P3 to T11 and J5. *b.* Check resistors R69 through R71.
2	Terminal 4 of T11	Ground	20	−39	*a.* Check circuit from SPECIAL SERVICE 1 IN binding posts to T11. *b.* Check resistors R72 through R75.
3	Terminal 1 of T12	Ground	76	−53.5	*a.* Perform test No. 4. *b.* Check transformers T11 and T12. *c.* Check varistor CR5.
4	Terminal 2 of T11	Terminal 4 of T12	56	−2.5	Check circuit from terminals L and C of J10 to T11, T12, T14, and T15.
5	Terminal 3 of FL8	Ground	76	−61.5	*a.* Check circuit from T12 to FL8. *b.* Check resistors R76 through R85.
6	Terminal 1 of T16	Ground	76	−65	*a.* Check circuit from FL8 to T16. *b.* Check filter FL8.
7	Terminal 1 of tube socket XV7.	Ground	76	−64.5	Perform test No. 7 (*b* below).
8	Terminal 6 of T17	Ground	76	−25	Perform test No. 8 (*b* below).
9	60–108 KC OUT jack (tip).	60–108 KC OUT jack (ring).	76	−48	Perform test No. 9 (*b* below).
10	Terminal A of J9	Terminal L of J9	76	−48	Perform test No. 10 (*b* below).

b. Signal Substitution Chart for Subgroup 2, Transmitting Direction.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	MOD IN 2 jack (tip)	MOD IN 2 jack (ring)	20	−39	*a.* Check circuit from terminals A and K of P2 to T6 and J3. *b.* Check resistors R35 through R37.
2	Terminal 4 of T6	Ground	20	−39	*a.* Check circuit from SPECIAL SERVICE 2 IN binding posts to T6. *b.* Check resistors R38 through R41.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
3	Terminal 1 of T7	Ground	92	−53.5	*a.* Perform test No. 4. *b.* Check transformers T6 and T7. *c.* Check varistor CR3.
4	Terminal 2 of T6	Terminal 4 of T7	72	−2.5	Check circuit from terminals A and J of J10 to T6, T7, T9, and T10.
5	Terminal 3 of FL6	Ground	92	−59.5	*a.* Check circuit from T7 to FL6. *b.* Check resistors R42 through R51.
6	Terminal 4 of T16	Ground	92	−65	*a.* Check circuit from FL6 to T16. *b.* Check filter FL6.
7	Terminal 1 of tube socket XV7.	Ground	92	−64.5	*a.* Check circuit from T16 to tube socket XV7 and to ground. *b.* Check resistors R103 through R107, and R127. *c.* Check capacitors C34, C35, and C42. *d.* Check transformer T16.
8	Terminal 6 of T17	Ground	92	−25	*a.* Check tube socket XV7 voltages (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV7 resistances (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal resistance indications. *c.* Check resistors R109 through R112. *d.* Check capacitors C36, C37, C39, and C40.
9	60–108 KC OUT jack (tip).	60–108 KC OUT jack (ring).	92	−48	*a.* Check circuit from T17 to J7. *b.* Check resistor R115. *c.* Check transformer T17.
10	60–108 KC OUT binding post (E52).	60–108 KC OUT binding post (E53).	92	−48	Check circuit from T17 to 60–108 KC OUT binding posts.
11	60–108 KC OUT ALT binding posts (E54).	60–108 KC OUT ALT binding posts (E55).	92	−48	Check circuit from T17 to 60–108 KC OUT ALT binding posts.
12	Terminal K of J9	Terminal W of J9	92	−48	Check circuit from T17 to J9.
13	Terminal A of J9	Terminal L of J9	92	−48	Check circuit from T17 to J9.

c. Signal Substitution Chart for Subgroup 3, Transmitting Direction.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	MOD IN 3 jack (tip)	MOD IN 3 jack (ring)	20	−39	*a.* Check circuit from terminals A and K of P1 to J1 and T1. *b.* Check resistors R1 through R3.
2	Terminal 4 of T1	Ground	20	−39	*a.* Check circuit from SPECIAL SERVICE 3 IN binding posts to T1. *b.* Check resistors R4 through R7.
3	Terminal 1 of T2	Ground	108	−53	*a.* Perform test No. 4. *b.* Check transformers T1 and T2. *c.* Check varistor CR1.
4	Terminal 2 of T1	Terminal 4 of T2	88	−2.5	Check circuits from terminals D and E of J10 to T1, T2, T4, and T5.
5	Terminal 3 of FL4	Ground	108	−58.5	*a.* Check circuit from T2 to FL4. *b.* Check resistors R8 through R17.
6	Terminal 1 of T16	Ground	108	−64.5	*a.* Check circuit from FL4 to T16. *b.* Check filter FL4.
7	Terminal 1 of tube socket XV7.	Ground	108	−64.5	Perform corrective measures for test No. 7 (*b* above).
8	Terminal 6 of T17	Ground	108	−25	Perform corrective measures for test No. 8 (*b* above).
9	60–108 KC OUT jack (tip).	60–108 KC OUT jack (ring).	108	−48	Perform corrective measures for test No. 9 (*b* above).
10	Terminal A of J9	Terminal L of J9	108	−48	Perform corrective measures for test No. 10 (*b* above).

d. Signal Substitution Chart for Subgroup 1, Receiving Direction.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	60–108 KC IN jack (tip).	60–108 KC IN jack (ring).	76	−11.5	Check circuit from terminals H and R of J10 to J8 and to 60–108 KC IN binding posts.
2	Terminal 4 of T18	Terminal 5 of T18	76	−28	*a.* Check circuit from terminals H and R of J10 to T18. *b.* Check resistors R117 through R120. *c.* Check capacitor C41.
3	Terminal 1 of FL9	Ground	76	−30	*a.* Check circuit from T18 to FL9. *b.* Check resistors R116. *c.* Check transformer T18.
4	Terminal 3 of FL9	Ground	76	−34	Check filter FL9.
5	Terminal 1 of T15	Ground	76	−39	*a.* Check circuit from FL9 to T15. *b.* Check resistors R100 through R102.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
6	Terminal 4 of T14	Ground	20	−27	*a.* Perform test No. 7. *b.* Check transformers T14 and T15. *c.* Check varistor CR6.
7	Terminal 2 of T14	Terminal 4 of T15	56	−2.5	Check circuit from terminals L and C of J10 to T11, T12, T14, and T15.
8	Terminal 1 of FL3	Ground	20	−27.5	Check circuit from T14 to FL3.
9	Terminal 1 of tube socket XV5.	Ground	20	−11.5	*a.* Check tube socket XV6 voltages (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV6 resistances (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal resistance indications. *c.* Perform corrective measures for test No. 10.
10	Terminal 5 of T13	Ground	20	+19.5	*a.* Check tube socket XV5 voltages (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV5 resistances (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals, which have abnormal resistance indications. *c.* Check resistors R126, R125, R88, and R86. *d.* Check capacitors C23 through C33.
11	Terminal 1 of T13	Ground	20	+7.5	*a.* Check for proper termination of transformer T13. *b.* Check transformer T13.
12	DEM OUT 1 jack (tip)	DEM OUT 1 jack (ring)	20	+7.5	Check circuit from T13 to J6.
13	Terminal E of P3	Terminal P of P3	20	+7.5	Check circuit from T13 to terminals P and E of P3.

e. Signal Substitution Chart for Subgroup 2, Receiving Direction.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	60–108 KC IN jack (tip)	60–108 KC IN jack (ring)	92	−11.5	Check circuit from terminals H and R of J10 to J8 and to 60–108 KC IN binding posts.
2	Terminal 4 of T18	Terminal 5 of T18	92	−28	*a.* Check circuit from terminals H and R of J10 to T18. *b.* Check resistors R117 through R120. *c.* Check capacitor C41.
3	Terminal 1 of L7	Ground	92	−30	*a.* Check circuit from T18 to FL7. *b.* Check resistor R116. *c.* Check transformer T18.
4	Terminal 3 of FL7	Ground	92	−35	Check filter FL7.
5	Terminal 1 of T10	Ground	92	−40	*a.* Check circuit from FL7 to T10. *b.* Check resistors R66 through R68.
6	Terminal 4 of T9	Ground	20	−28.5	*a.* Perform test No. 7. *b.* Check transformers T9 and T10. *c.* Check varistor CR4.
7	Terminal 2 of T9	Terminal 4 of T10	72	−2.5	Check circuit from terminals A and J of J10 to T6, T7, T9, and T10.
8	Terminal 1 of FL2	Ground	20	−28.5	Check circuit from T9 to FL2.
9	Terminal 1 of tube socket XV3.	Ground	20	−12.5	*a.* Check tube socket XV4 voltages (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV4 resistances (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal resistance indications. *c.* Perform corrective measures for test No. 10.
10	Terminal 5 of T8	Ground	20	+18.5	*a.* Check tube socket XV3 voltages (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV3 resistances (TM 11–2139–20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal resistance indications.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
					c. Check resistors R124, R123, R54, and R52. *d.* Check capacitors C12 through C22.
11	Terminal 1 of T8	Ground	20	+6.5	*a.* Check for proper termination of transformer T8. *b.* Check transformer T8.
12	DEM OUT 2 jack (tip)	DEM OUT 2 jack (ring)	20	+6.5	Check circuit T8 to J4.
13	Terminal E of P2	Terminal P of P2	20	+6.5	Check circuit from T8 to terminals P and E of P2.

f. Signal Substitution Chart for Subgroup 3, Receiving Direction.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	60–108 KC IN jack (tip)	60–108 KC IN jack (ring)	108	−11.5	Check circuits from terminals H and R of J10 to J8 and to 60–108 KC IN binding posts.
2	Terminal 4 of T18	Terminal 5 of T18	108	−29	*a.* Check circuit from terminals H and R of J10 to T18. *b.* Check resistors R117 through R120. *c.* Check capacitor C41.
3	Terminal 1 of FL5	Ground	108	−30	*a.* Check circuit from T18 to FL5. *b.* Check resistor R116. *c.* Check transformer T18.
4	Terminal 3 of FL5	Ground	108	−36	Check Filter FL5.
5	Terminal 1 of T5	Ground	108	−42	*a.* Check circuit from FL5 to T5. *b.* Check resistors R32 through R34.
6	Terminal 4 of T4	Ground	20	−29	*a.* Perform test No. 7. *b.* Check transformers T4 and T5. *c.* Check varistor CR2.
7	Terminal 2 of T4	Terminal 5 of T7	88	−2.5	Check circuit from terminals D and E of J10 to T1, T2, T4, and T5.
8	Terminal 1 of FL1	Ground	20	−29	Check circuit from T4 to FL1.
9	Terminal 1 of tube socket XV1.	Ground	20	−14	*a.* Check tube socket XV2 voltages (TM 11-2139-20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV2 resistances (TM 11-2139-20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal resistance indications.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
					c. Perform corrective measures of test No. 10.
10	Terminal 5 of T3	Ground	20	+17.5	*a.* Check tube socket XV1 voltages (TM 11-2139-20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal dc voltages. *b.* Check tube socket XV1 resistances (TM 11-2139-20, fig. 12). Check resistors and capacitors associated with tube socket terminals which have abnormal resistance indications. *c.* Check resistors R121, R122, R18, and R20. *d.* Check capacitors C1 through C11.
11	Terminal 1 of T3	Ground	20	+5.5	*a.* Check for proper termination of transformer T3. *b.* Check transformer T3.
12	DEM OUT 3 jack (tip)	DEM OUT 3 jack (ring)	20	+5.5	Check circuit from T3 to J2.
13	Terminal E of P1	Terminal P of P1	20	+5.5	Check circuit from T3 to terminals P and E of P1.

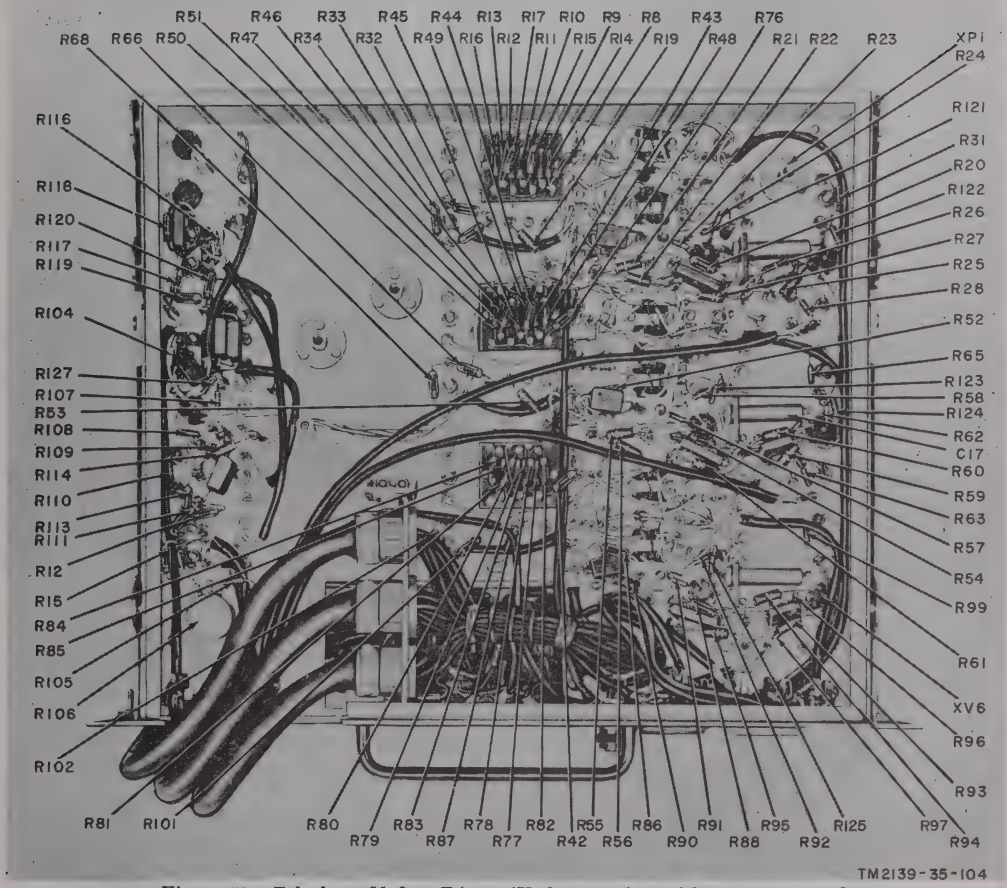


Figure 58. Telephone Modem TA-227/U, bottom view with covers removed, showing resistors.

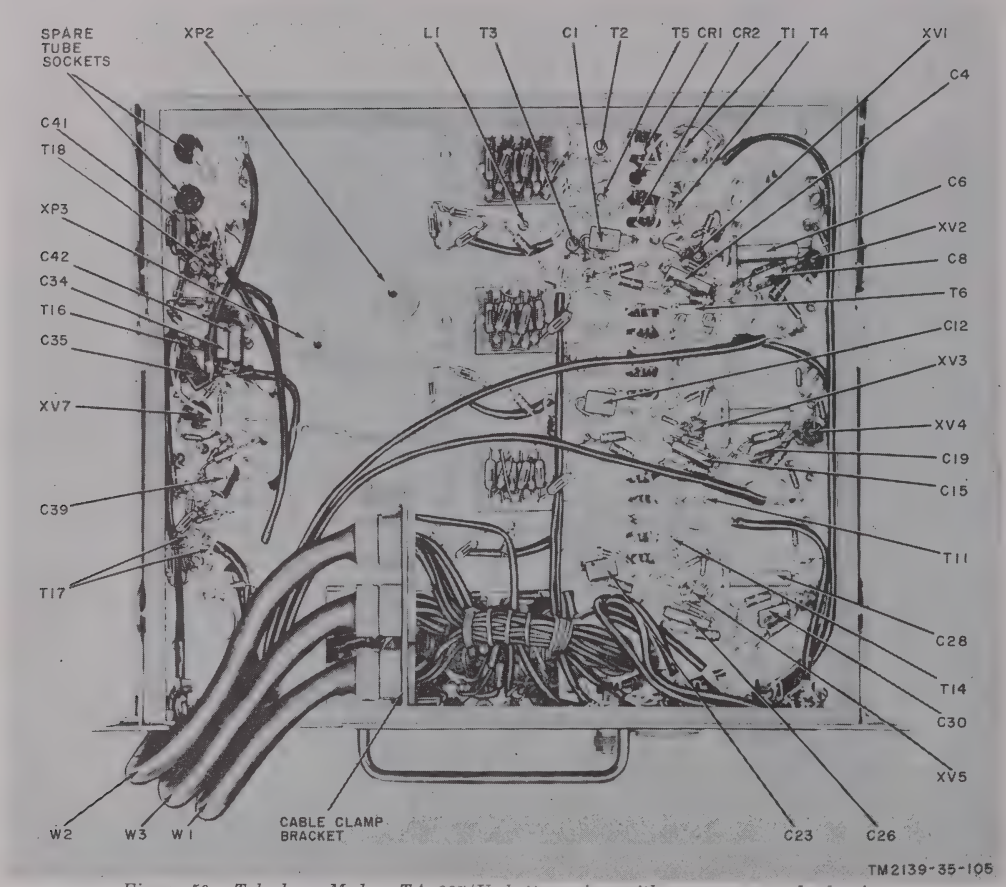


Figure 59. Telephone Modem TA-227/U, bottom view with covers removed, showing capacitors and transformers.

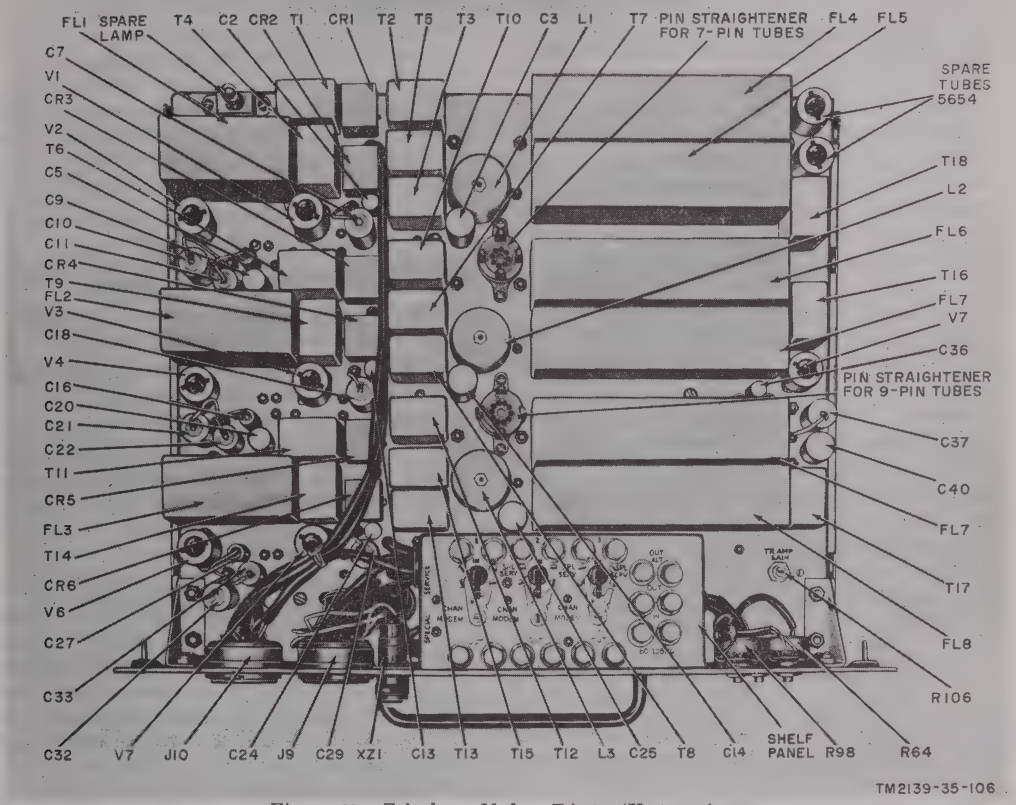


Figure 60. Telephone Modem TA-227/U, top view.

96. Dc Resistance of Transformers and Coils

Transformer or Coil	Terminals	Resistance (ohms)
T1, T6, and T11	1–3	1.7
	4–5	.622
T2, T7, and T12	1–2	1.16
	3–5	2.85
T3, T8, and T13	1–2	39.6
	3–4	17.6
	4–5	7.4
	3–5	25
T4, T9, and T14	1–3	3.32
	4–5	1.72
T5, T10, and T15	1–2	1.16
	3–5	2.85
T16 and T17	1–2	2.47
	3–4	2.47
	5–6	140
T18	1–3	1.7
	4–5	.622
L1, L2, L3		295

Section IV. GROUP PANEL (PART OF AMPLIFIER-PILOT REGULATOR AM–707/TCC–7)

97. GROUP PANEL, Troubleshooting Data

Fig. No.	Par. No.	Description
		GROUP PANEL, schematic diagram.
9		12–68 kc amplifier, schematic diagram.
15		Regulator and alarm unit Z6, schematic diagram.
8		Modem and amplifier unit AR4, schematic diagram.
TM 11–2139–20, fig. 13.		GROUP PANEL, tube socket voltage and resistance chart.
TM 11–2139–20, fig. 14.		12–68 kc amplifier, tube socket voltage and resistance chart.
TM 11–2139–20, fig. 15.		Regulator and alarm unit Z6, tube socket voltage and resistance chart.
TM 11–2139–20, fig. 16.		Modem and amplifier unit AR4, tube socket voltage and resistance chart.
74		GROUP PANEL, B+ distribution diagram.
62		GROUP PANEL, assemblies removed, top panel raised, top view.
63		GROUP PANEL, cover removed, bottom view.
65		12–68 kc amplifier, top view.
66		12–68 kc amplifier, bottom view.
68		Regulator and alarm unit Z6, top view.
69		Regulator and alarm unit Z6, bottom view.
70		Regulator and alarm unit Z6, side view.
72		Modem and amplifier unit AR4, top view.
73		Modem and amplifier unit AR4, bottom view.
144		GROUP PANEL, wiring diagram.
145		12–68 kc amplifier, wiring diagram.
146		Regulator and alarm unit Z6, wiring diagram.
147		Modem and amplifier unit AR4, wiring diagram.
	111*a*	GROUP PANEL, main chassis, dc resistance of transformers, coils, and thermistor.
	111*b*	12–68 kc amplifier, dc resistance of transformers and coil.
	111*c*	Regulator and alarm unit Z6, dc resistance of transformer and coil.
	111*d*	Modem and amplifier unit AR4, dc resistance of transformers and coil.

98. Transmitting Circuit Tests (fig. 61)

a. Initial Procedures.

(1) Calibrate the audio level meter (par. 79).

(2) Connect the power, subgroup, and carrier supply test cable assemblies, 10-ohm resistor, 135-ohm resistor, 600-ohm resistor, 200 VOLT POWER SUPPLY, and GROUP PANEL as shown in figure 61.

(3) Connect signal generator No. 1 across terminals H and R of the subgroup test cable assembly; adjust signal generator No. 1 for an output frequency of 120 kc at an output level of —2.5 db as measured across terminals H and R with the audio level meter.

(4) Connect signal generator No. 2, resistors R1 through R3, attenuator, and transformer T107 together as shown in figure 61.

(5) Connect a 135-ohm across DEM OUT binding posts E9 and E10 and E13 and E14.

(6) Connect the audio level meter across the 600-ohm resistor connected to terminals F and S of the power test cable assembly. Arrange the meter to measure a frequency of 37 kc at a level of +.5 db.

b. Message Transmitting Circuit Test. Perform the initial procedures given in *a* above before performing steps (1) through (4) below.

(1) Operate the 12–60KC and 60–108KC switches to REGULAR and operate the TR CABLE REELS TO FIRST

AN/TCC–11 switch to the extreme clockwise position.

(2) Connect signal generator No. 2 and the associated components (*a*(4) above) across terminals A and L of the power test cable assembly. Set the attenuator for a 30-db loss and adjust the output frequency of the signal generator to 83 kc at an output level of —48.5 db measured across terminals A and L.

(3) The audio level meter (*a*(6) above) should indicate +.5 ±1.5 db.

(4) Operate the TR CABLE REELS TO FIRST AN/TCC–11 switch through one position at a time to the extreme counterclockwise position; the audio level meter indication should decrease about 3 db for each position of the switch.

c. 60–108KC Special Service Transmitting Test.

(1) Operate the 60–108KC and the 12–60KC switches to SPL SERV and REGULAR, respectively. The SPL SERV lamp should light.

(2) Connect signal generator No. 2 with associated components (*a*(4) above) across the SPECIAL SERVICE 60–108KC IN binding posts. Adjust the output frequency of the signal generator to 83 kc at an output level of —6.5 db measured across the binding posts; adjust the attenuator for a 0-db loss.

(3) The audio level meter connected across terminals F and S of the power test cable indicate +.5 db ±2 db.

d. 12–60KC Special Service Transmitting Test.

(1) Operate the 12–60 KC switch to the SPL SERV position. The SPL SERV lamp should light.

(2) Connect signal generator No. 2 with associated components (*a*(4) above) across the SPECIAL SERVICE 12–60KC IN binding posts and readjust the output frequency of the signal generator to 37 kc at an output level of —6.5 db measured across the binding posts. The audio level meter (*a*(6) above) should indicate +.5 db ±1.5 db.

e. Pilot Transmission Circuit Test.

(1) Connect signal generator No. 2 with associated components (*a*(4) above) across terminals K and W of the power test cable assembly; set the attenuator for a 30-db loss and readjust the signal generator for an output frequency of 68 kc at an output level of —42 db measured across terminals K and W with the audio level meter.

(2) Connect the audio level meter across terminals T_1 and R of the test plug assembly; arrange the audio level meter to measure a frequency of 68 kc at a level of —38.5 db.

(3) Insert the plug of the test plug assembly into the TR AMP OUT jack; the audio level meter should indicate —38.5 ±1 db.

(4) Reinsert the plug of the test plug assembly into the TR 62 KC jack; the audio level meter should indicate —1 ±1 db.

99. Receiving Circuit Tests
(fig. 61)

a. Initial Procedures.

(1) Calibrate the audio level meter (par. 79).

(2) Connect the power and subgroup test cable assemblies, 10-, 135-, and 600-ohm resistors, 200 VOLT POWER SUPPLY, and GROUP PANEL as shown in figure 61.

(3) Connect signal generator No. 1 across terminals H and R of the subgroup test cable assembly; adjust signal generator No. 1 for a frequency of 120 kc at a level of —2.5 db.

(4) Connect signal generator No. 2 resistors R1 through R3, attenuator, and transformer T107 as shown in figure 61.

(5) Connect a 135-ohm resistor across DEM OUT binding posts E9 and E10 and E13 and E14 on the GROUP PANEL.

(6) Set the BULGE ADJ 28 KC and

SLOPE ADJ 12 KC controls to position 0 and the TR and REC CABLE REELS TO FIRST AN/TCC-11 to position 23 for all tests unless otherwise specified.

b. Pilot and Message Receiving Circuit Test. Perform the initial procedures given in *a* above.

(1) Connect signal generator No. 2 and the associated components across terminals C and P of the power test cable assembly; set the attenuator for a 10-db loss and adjust the signal generator for a frequency of 68 kc at an output level of −23 db measured across terminals C and P.

(2) Connect the audio level meter across binding posts T_1 and R on the test plug assembly and arrange the audio level meter to measure a frequency of 68 kc at the levels indicated in the chart in (3) below.

(3) The following chart lists the test jack into which the plug of the test plug assembly must be inserted for each test, the GROUP PANEL control adjustments necessary, and the meter indication which should be obtained on the audio level meter.

Test plug assembly connection	Test and adjustment procedure	Audio level meter indication
1. REC IN	Set FLAT ADJ 68 KC control on position 3	−28.5±3 db
2. REC AMP 1 OUT	*a.* Set FLAT ADJ 68 KC control at maximum	−28.5±3 db
	b. Set FLAT ADJ 68 KC control at minimum	−54.5±3 db
	c. Adjust FLAT ADJ 68 KC control for a reading of.	−38.5 db
3. REC AMP 2 OUT	*a.* Operate REGULATOR switch to MAN.	
	b. Set MAN REG control at maximum	−25.5±4 db
	c. Set MAN REG control at minimum	−45±4 db
	d. Adjust MAN REG control for a reading of	−38.5 db
4. REC AMP 2 OUT	*a.* Operate REGULATOR switch to AUTO.	
	b. Set AUTO REG control at maximum	−33±3 db
	c. Set AUTO REG control at minimum	−47±3 db
	d. Adjust the AUTO REG control for a reading of. (After adjustment, do not disturb the control until all tests are completed.)	−38.5 db

(4) To test the automatic regulation of the pilot receiving circuit, perform the tests listed in the chart below. The chart lists the jack into which the test plug of the test plug assembly must be inserted for each test, the group panel control adjustments necessary, and the meter indication which should be obtained on the audio level meter.

Test plug assembly connection	Test and adjustment procedure	Audio level meter indication
1. REC AMP 1 OUT	Adjust FLAT ADJ 68 KC control for a reading of	−44.5 db
2. REC AMP 2 OUT	Controls as set in test 4*d* of the chart in *b*(3) above	Should stabilize between −39 and −38.5 db.
3. REC AMP 1 OUT	Adjust FLAT ADJ 68 KC control for a reading of	−32.5 db.
4. REC AMP 2 OUT	Controls as set in test 4*d* of the chart in *b*(3) above	Should stabilize between −39 and −38.5 db.
5. REC 62 KC	Controls as set in tests 2 and 4 of the chart in *b*(3) above.	+3.5±2 db.

c. Pilot Transmission Alarm Circuit Test.

(1) Connect signal generator No. 2 and the associated components (*a*(4) above) across terminals C and P of the power test cable assembly; set the attenuator for a 10-db loss and adjust the output frequency of the signal generator to 68 kc at a level of −23 db measured across terminals C and P.

(2) Adjust the MAN REG control to the position given in test 3*d* of the chart in *b*(3) above.

(3) Connect the multimeter to the REG VOLTS jacks on regulator and alarm unit Z6.

(4) Operate the ALARM TEST switch to the 1 HIGH position and adjust the ADJ HIGH control to the position at which the HIGH alarm lamp lights and the alarm buzzer sounds. The multimeter should indicate 3.5 ±1 volt dc.

(5) Operate the ALARM TEST switch to the 2 LOW position and adjust the ADJ LOW control to the position at which the LOW alarm lamp lights and the alarm buzzer sounds. The multimeter should indicate 3.5 ±1 volt dc.

d. Synchronizing Signal Receiving Circuit Test. Perform the initial procedures given in *a* above.

(1) Connect signal generator No. 2 and the associated components *a*(4) above across terminals C and P of the power test cable assembly with terminal P ground. Set the attenuator for a 10-db loss and adjust the output frequency of the signal generator to 68 kc at a level of —23 db measured across terminals C and P.

(2) Arrange the audio level meter to measure 68 kc at a level of 0 db. Connect the audio level meter to terminals P and F of the subgroup test cable assembly.

(3) Adjust signal generator No. 2 and the audio level meter to obtain a maximum indication on the audio level meter; the maximum indication should be 0 ±3 db.

e. 28 Kc Test Signal. Perform the initial procedure given in *a* above.

(1) Connect signal generator No. 2 and the associated components (*a*(4) above) to terminals C and P of the power test cable assembly. Set the attenuator for a 20-db loss and adjust the output frequency of the signal generator to 28 kc at an output level of —30 db measured across terminals C and P.

(2) Connect the audio level meter across terminals T_1 and R of the test plug assembly. Arrange the audio level meter to measure 28 kc at a —38.5-db level.

(3) Insert the plug of the test plug assembly into the REC AMP 2 OUT jack. The audio level meter should indicate —38.5 ±2 db.

(4) Adjust the SLOPE ADJ 12 KC control to the extreme counterclockwise position (—5). Turn the control one step at a time, to the extreme clockwise position (+5); the indication on the audio level meter should increase 1 db for each step of the SLOPE ADJ 12 KC control. Return the SLOPE ADJ 12 KC control to the 0 position.

(5) Operate the BULGE ADJ 28 KC control to the extreme counterclockwise position (—5). Turn the control, one step at a time, to the extreme clockwise position (+5); the indication on the audio level meter should increase .75 db for each step of the BULGE ADJ 28 KC control. Return the BULGE ADJ 28 KC control to the 0 position.

(6) Adjust the REC CABLE REELS TO FIRST AN/TCC–11 switch to the extreme counterclockwise position (2). Turn the switch, one step at a time, to the extreme clockwise position (23). The audio level meter indication should increase 3 db for each step of the switch.

f. 65 Kc Test Signal Receiving Circuit Test.

(1) Connect signal generator No. 2 and the associated components (*a*(4) above) to terminals D and R of the power test cable assembly. Set the attenuator for 0-db loss and adjust the output frequency of the signal generator to 65 kc at a level of —10.5 db.

(2) Connect the audio level meter across terminals T_1 and R of the test plug assembly; arrange the audio level meter to measure 65 kc at a level of —38.5 db.

(3) Insert the plug of the test plug assembly into the REC AMP 1 OUT

jack. The audio level meter should indicate —38.5 ±1.5 db.

g. Message Circuit Receiving Test.

(1) Connect signal generator No. 2 and the associated components (*a*(4) above) to terminals C and P of the power test cable assembly.

(2) Set the attenuator for 10-db loss and adjust the signal generator for an output frequency of 68 kc at a level of —23 db.

(3) Connect the audio level meter to terminals T_1 and R of the test cable assembly (with terminal R to ground).

(4) Insert the plug of the test plug assembly into the REC AMP 1 OUT jack. Adjust FLAT ADJ 68 KC control for a reading of —38.5 db on the audio level meter.

(5) Insert the plug of the test plug assembly into the REC AMP 2 OUT jack. Operate the REGULATOR switch to MAN and adjust the MAN REG control for an audio level meter indication of —38.5 db.

(6) Operate the REGULATOR switch to AUTO and adjust the AUTO REG control for an audio level meter indication of —38.5 db.

(7) Adjust the DEM GAIN control to the extreme clockwise position.

(8) Operate the 60–108KC and 12–60KC switches to REGULAR.

(9) Readjust the output frequency of signal generator No. 2 to 37 kc.

(10) Arrange the audio level meter to measure a frequency of 83 kc at a level of —35 db. Connect the audio level meter to terminals H and R of the subgroup test cable assembly. The meter should indicate —35 ±2 db.

(11) Insert the plug of the test plug assembly into the DEM OUT jack; the audio level meter should indicate —35 ±2 db.

(12) Reconnect the audio level meter to the SPECIAL SERVICE 60–108KC OUT binding posts; and operate the 60–108KC switch to the SPL SERV. The audio level meter should indicate —35 db ±2 db.

(13) Readjust the audio level meter to measure 37 kc. Connect the meter to the SPECIAL SERVICE 12–60KC OUT binding posts. Operate the 12–60KC switch to SPL SERV. The audio level meter should indicate —9 ±1 db.

100. Miscellaneous Continuity Tests

a. Initial Procedures. Connect one subgroup test cable assembly to connector P1 and another subgroup test cable assembly to connector P2 on the GROUP PANEL.

b. Cable Continuity and Short Circuit Tests. Use the multimeter to check the transmission circuits listed in the chart in *c* below. Make continuity tests between the subgroup test cable assembly terminals in the same horizontal row. The multimeter should indicate 0 ohms resistance for each check. Make short circuit checks between the terminals listed in row *a* and those listed in row *b* for each path in the chart. The multimeter should indicate infinite resistance for each check.

c. Cable Assembly Continuity Chart.

Circuit under test		Subgroup test cable assembly connected to	
		P1	P2
56 KC path between connectors P1 and P2	*a*	C	C
	b	L	L
72 kc path between connectors P1 and P2	*a*	J	J
	b	A	A
88 kc path between connectors P1 and P2	*a*	E	E
	b	D	D

101. GROUP PANEL Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the GROUP PANEL. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11-2139-20). Once the trouble has been localized to a stage or circuit, a tube

Figure 61. GROUP PANEL, operational test setup.

(Contained in separate envelope)

check and voltage and resistance measurements of this stage or circuit will usually be sufficient to isolate the defective part. Normal tube socket voltage and resistance measurements are provided in TM 11–2139–20, figures 13 through 16.

Symptom	Probable trouble	Corrective measures
1. No transmission through GROUP PANEL IN BOTH transmitting and receiving directions.	*a.* Failure of 200-volt dc distribution circuits.	*a.* Check for presence of 200 volts dc between standoff E52 and ground. If not present, refer to B+ distribution diagram (fig. 74) and locate open and short circuits.
	b. Failure of 6.3-volt ac distribution circuits.	*b.* Check for presence of 6.3 volts ac across standoffs E54 and E55 and across terminals 7 and 8 of connector J2 (fig. 7). If not present, check the 6.3-volt ac distribution circuits and locate open and short circuits.
	c. Failure of 120-kc carrier distribution circuits.	*c.* Use signal substitution procedures (par. 102*a*, test No. 3) to localize the trouble.
2. Transmission through normal transmitting circuit from terminals A and L to terminals F and S of connector J1, out of limits.	Failure of a component between terminals A and L, and F and S of connector J1.	*a.* Replace 12–68 kc amplifier AR3. *b.* If normal output is not obtained in correction *a*, use signal substitution procedures (par. 102*a*, tests No. 1 through 12) to localize trouble.
3. Transmission through 60–108 kc special service transmitting circuits from SPECIAL SERVICE 60–108 kc IN binding posts to terminals F and S of connector J1, out of limits.	Failure of a component between SPECIAL SERVICE 60–108 kc IN binding posts and connector J2 of modem and amplifier AR4.	*a.* Check performance (par. 98*c*). *b.* If normal output is obtained in correction *a*, use signal substitution procedures (par. 102*a*, tests No. 13 and 14) to localize trouble.
4. Transmission through 12–60 kc special service transmitting circuit from SPECIAL SERVICE 12–60KC IN binding posts to terminals F and S of connector J1 out of limits.	Failure of a component between SPECIAL SERVICE 12–60KC IN binding posts and terminals 3 and 4 of filter FL3.	*a.* Check performance (par. 98*d*). *b.* If normal output is obtained in correction *a*, use signal substitution procedures (par. 102*a*, tests No. 15 and 16) to localize trouble.
5. 68 kc pilot transmission from terminals K and W of connector J1, through 12–68 kc amplifier AR3, to the TR AMP OUT jack, or the TR 62 KC jack, out of limits.	Failure of a component between terminals K and W of connector J1 and output of 12–68 kc amplifier AR3.	Use signal substitution procedures (par. 102*a*, test No. 17) to locate trouble.
6. Transmission through receiving circuit from terminals C and P of connector J1 to terminals H and R of connector P1, out of limits.	Failure of a component between C and P of connector J1 and terminals H and R of connector P1.	*a.* Check performance (par. 99*b*). *b.* If normal output is obtained in correction *a*, use signal substitution procedures (par. 102*b*, test No. 18) to localize trouble.
7. Pilot transmission out of limits at REC IN jack.	Failure of cable building-out network Z5 and associated circuits.	Check performance of REC CABLE REELS TO FIRST AN/TCC–11 switch as outlined in paragraph 99*b*.
8. Pilot transmission out of limits at REC AMP 1 OUT jack.	Failure of a component between cable building-out network Z1 and output of 12–68 kc amplifier AR1.	*a.* Check performance (par. 99*b*). *b.* Replace 12–68 kc amplifier AR1. *c.* If normal output is not obtained in corrections *a* and *b*, use signal substitution procedures (par. 102*b*, tests No. 1 through 11) to localize trouble.

Symptom	Probable trouble	Corrective measures
9. Pilot transmission out of limits at REC AMP 2 OUT jack, REGULATOR switch in MAN position.	Failure of a component between output of 12–68 kc amplifier AR1 and output of 12–68 kc amplifier AR2.	*a.* Check performance (par. 99*b*). *b.* Replace 12–68 kc amplifier AR2. *c.* If normal output is not obtained in corrections *a* and *b*, use signal substitution procedures (par. 102*b*, tests No. 1 through 11) to localize trouble.
10. Test signal transmission out of limits at REC AMP 2 OUT jack.	Failure of a component between terminals C and P of connector J1 and output of 12–68 kc amplifier AR2.	Use signal substitution procedures (par. 102*b*, tests No. 32 through 40) to localize trouble.
11. Pilot transmission output too low at REC AMP 2 OUT jack (par. 99*b*, test No. 4). Normal reading at REC AMP 1 OUT jack. LOW alarm indication on GROUP PANEL. Connect the multimeter to REG VOLTS jacks on regulator and alarm Z6. Arrange the multimeter to read dc volts. The multimeter reads 6 volts dc or higher (normal reading is 3.5 volts dc).	Failure of a component between output of 12–68 kc amplifier AR1 and 12–68 kc amplifier AR2.	*a.* Operate REGULATOR switch to MAN position and check performance (par. 99). If out of limits, proceed as in symptom 9. *b.* If normal output is obtained in correction *a*, check capacitors C1 through C4 for short circuits. Check the wiring to thermistor RT1; check thermistor for open circuit between terminals 1 and 2.
12. Pilot transmission output too low at REC AMP 2 OUT jack (par. 99*b*, test No. 4). Normal reading at REC AMP 1 OUT jack. LOW alarm indication on GROUP PANEL. Connect the multimeter to REG VOLTS jacks on regulator and alarm Z6. Arrange the multimeter to measure dc volts. The multimeter reads less than 1 volt dc (normal reading is 3.5 volts dc).	Failure of a component in automatic regulation loop.	*a.* Operate REGULATOR switch to MAN position and check performance (par. 99). If out of limits, proceed as in symptom 9. *b.* If normal output reading is obtained in correction *a*, replace regulator and alarm Z6. *c.* If procedure in correction *b* does not clear trouble, check for presence of +200 volts dc between terminal 19 of connector J6 and ground. Operate the AUTO REG OUTPUT control to the extreme clockwise position and check for +140 volts dc between terminal 14 of connector J6 and ground. If not present, refer to B+ distribution diagram (fig. 74) and locate open and short circuits.
13. Pilot transmission output too high at REC AMP 2 OUT jack (par. 99*b*, test No. 4). Normal reading at REC AMP 1 OUT jack. LOW alarm indication on GROUP PANEL. Connect the multimeter to terminal 14 of connector P1 on regulator and alarm Z6 and to chassis ground. Arrange the multimeter to measure 70 volts dc. Adjust AUTO REG OUTPUT control for a reading of 70 volts on the multimeter. Connect the multimeter to the REG VOLTS jacks on the regulator and alarm Z6.	*a.* Failure of regulator and alarm unit Z6 or 16–28 kc amplifier AR2. *b.* Failure of connections between connectors J3 and J6.	*a.* Replace regulator and alarm unit Z6 and 12–68 kc amplifier AR2, one at a time. *b.* If procedures in correction *a* do not clear trouble, use signal substitution procedures (par. 102*b*, test No 19) to locate trouble.

Symptom	Probable trouble	Corrective measures
Arrange the multimeter to measure dc volts. The multimeter reads 10 volts dc or higher (normal reading is 3.5 volts dc).		
14. Pilot transmission output too high at REC AMP 2 OUT jack (par. 99*b*, test No. 4). Normal reading at REC AMP 1 OUT jack. HIGH alarm indication on GROUP PANEL. Connect the multimeter to REG VOLTS jacks on regulator and alarm Z6. Arrange the multimeter to measure dc volts. The multimeter reads less than 1 volt dc (normal reading is 3.5 volts dc).	Failure of component in automatic regulation loop.	*a.* Operate REGULATOR switch to MAN position and check performance (par. 99). If out of limits, proceed as in symptom 9. *b.* If normal output reading is obtained in correction *a*, check thermistor RT1 for short circuit between terminals 1 and 2.
15. Pilot transmission output too high at REC AMP 2 OUT jack (par. 99*b*, test No. 4). Normal reading at REC AMP 1 OUT jack. HIGH alarm indication on GROUP PANEL. Connect the multimeter to REG VOLTS jacks on regulator and alarm Z6. Arrange the multimeter to measure dc volts. The multimeter reads 6 volts dc or higher (normal reading is 3.5 volts dc).	*a.* Failure of regulator and alarm Z6	*a.* Operate REGULATOR switch to MAN position and check performance (par. 99) of operational test. If normal, replace regulator and alarm Z6.
	b. Failure of AUTO REG OUTPUT control and associated circuits.	*b.* If procedure in correction *a* does not clear trouble, check voltage between terminal 14 of connector J6 and ground. Adjust the AUTO REG OUTPUT control to its extreme counterclockwise position. The voltage at the REG VOLTS jacks (as checked with the multimeter) on the regulator and alarm Z6 should be less than 1 volt dc. Check AUTO REG OUTPUT variable resistor and associated circuits for opens and shorts.
16. Pilot transmission output out of limits at REC 62 KC jack. HIGH alarm indication on GROUP PANEL that cannot be removed by adjustment. REGULATOR switch in MAN or AUTO position. Normal reading at REC AMP 2 OUT jack.	Open circuit at output of 12–68 kc amplifier AR2.	Use signal substitution procedures (par. 102*b*, test No. 20) to locate trouble.

Symptom	Probable trouble	Corrective measures
17. Pilot transmission output out of limits at REC 62 KC jack. HIGH alarm indication on GROUP PANEL that cannot be removed by adjustment. REGULATOR switch in MAN or AUTO position. Normal reading at REC AMP 2 OUT jack.	Short circuit at output of 12–68 kc amplifier AR2.	Use signal substitution procedures (par. 102*b*, test No. 20) to locate trouble.
18. Incorrect alarm indications for corresponding output reading of REC AMP 2 OUT jack; or permanent HIGH or LOW alarm; no visual and/or audible HIGH or LOW alarm indication on GROUP PANEL.	*a.* Failure of regulator and alarm unit Z6. *b.* Failure of alarm voltage distribution paths.	*a.* Replace regulator and alarm unit Z6. *b.* If procedure in correction *a* does not clear trouble, check for open and short circuits in alarm voltage distribution paths.
19. Synchronizing signal at terminals P and F of connector P2 out of limits.	Failure of a component between 12–68 kc amplifier AR2 output and terminals P and F of connector P2.	*a.* Check performance (par. 99). *b.* If normal output is obtained (par. 99), replace tube V1. *c.* If procedure in correction *b* does not clear trouble, use signal substitution (par. 102*b*, tests No. 41 through 44) to localize trouble.
20. Transmission through 60–108 kc special service receiving circuits, from terminals C and P of connector J1 to SPECIAL SERVICE 60–108KC OUT binding posts, out of limits.	Failure of special service switch and associated circuits.	Check performance (par. 99*e*) of operational tests; if normal, check for shorts and open circuit between terminals 14 and 17 of connector J2 and SPECIAL SERVICE 60–108KC OUT binding posts.
21. Transmission through 12–60 kc special service receiving circuit, from terminals C and P of connector J1 to SPECIAL SERVICE 12–60KC OUT binding posts, out of limits.	Failure of special service switch, transformer T2, or associated circuits.	*a.* Check performance (par. 99*b* and *e*). *b.* If normal output is obtained in correction *a*, use signal substitution procedures (par. 102*b*, test No. 31) to localize trouble.
22. 65 kc modulation test signal through REC AMP 1 from terminals D and R of connector J1 to REC AMP 1 OUT jack, out of limits.	Failure of a component between terminals D and R of connector J1 and output of 12–68 kc amplifier AR1.	*a.* Check circuits from terminal D of connector J1 to terminals 0 or 3 of connector J3. Check circuits from terminal R of connector J1 to ground. *b.* Check resistors R32 and R33.

102. GROUP PANEL Signal Substitution Chart

Separate GROUP PANEL signal substitution charts are provided for the transmitting direction (*a* below) and the receiving direction (*b* below). Use the signal substitution charts to supplement the troubleshooting procedures outlined in paragraph 101. These charts will help determine the defective stage or circuit. Voltage and resistance measurements taken at the defective stage or circuit will ordinarily isolate the defective part. The signal substitution procedures at any step assumes that all previous steps have been satisfactorily completed. Use the same equipment arrangements in the signal substitution tests as were used in the operational tests.

a. Signal Substitution Chart, Transmitting Direction.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
1	98*b*	Terminal 4 of P1 on modem and amplifier AR4.	Terminal 5 of P1 on modem and amplifier AR4.	83	−48.5	Check circuit from terminals A and L of J1 to terminals 4 and 5 of J2.
2	98*b*	Terminal 2 of P1 on modem and amplifier AR4.	Terminal 1 of P1 on modem and amplifier AR4.	37	−46.5	*a.* Perform test No. 3. *b.* If normal indication is obtained in step *a*, check modem and amplifier AR4.
3	98*a*	Terminal 11 of P1 on modem and amplifier AR4.	Terminal 1 of P1 on modem and amplifier AR4.	120	−2.5	Check circuit from terminals H and R of P2 to terminals 10 and 11 of J2.
4	98*b*	Terminal 1 of FL3	Ground	37	−50	*a.* Check circuit from terminals 1 and 2 of J2 to FL3. *b.* Check resistors R11 through R13.
5	98*b*	Terminal 3 of FL3	Ground	37	−53	*a.* Check circuit from FL3 to J4. *b.* Check filter FL3.
6	98*b*	Terminal 0 or 3 of P1 on 12–68kc amplifier AR3.	Ground	37	−54	*a.* Check circuit from FL3 to J4. *b.* Check resistor R14. *c.* Check capacitor C3.
7	98*b*	Terminal 14 or 17 of P1 on 12–68 kc amplifier AR3.	Ground	37	.5	*a.* Replace 12–68 kc amplifier AR1 or AR2 and repeat test No. 2. *b.* If normal indication is not obtained in step *a*, check for +200 volts dc from terminal 9 to terminal 12 of J4. *c.* If normal indication in step *b* is not obtained, check the +200-volt distribution circuit (fig. 74). *d.* Check for 6.3 volts ac between terminals 10 and 11 of J4. *e.* If normal indication in step *d* is not obtained, check the 6.3-volt ac distribution circuit (fig. 7). *f.* Check the circuit from terminal 7 of J4 to terminal 6 of J4.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
						g. Check resistors R15 and R16.
						h. Check capacitor C6.
8	98*b*	TR AMP OUT jack (tip).	TR AMP OUT jack (ring).	37	−38.5	*a.* Replace 12–68 kc amplifier AR3 with a spare 12–68 kc amplifier or the AR1 or AR2 12–68 kc amplifier, and repeat test No. 8.
						b. If normal indication is not obtained in step *a*, check circuit from J4 to J12.
						c. Check resistors R17 and R18.
9	98*b*	TR 62 KC jack (tip).	TR 62 KC jack (ring).	37	−1	*a.* Check circuit from J4 to J13.
						b. Check resistor R19.
10	98*b*	Terminal 3 of Z1	Ground	37	+.5	Check circuit from J4 to Z1.
11	98*b* TR CABLE REELS TO FIRST AN/TCC–11 in position 23.	Terminal 1 of Z1	Ground	37		
					+.5	*a.* Check circuits between Z1 and S6.
	20	″	″	″	−2.5	
	17	″	″	″	−5.5	*b.* Check TR CABLE REELS TO FIRST AN/TCC–11 switch S6.
	14	″	″	″	−8.5	
	11	″	″	″	−11.5	
	8	″	″	″	−14.5	
	5	″	″	″	−17.5	*c.* Check cable building-out network Z1.
	2	″	″	″	−20.5	
	Return switch to position 23.	″	″	″	+.5	
12	98*b*	Terminal F of J1	Terminal S of J1	37	+.5	Check circuit from Z1 to J1.
13	98*c*	SPL SERV 60–108 KC IN jack (tip).	SPL SERV 60–108 KC IN jack (ring).	83	−11	*a.* Check circuit from SPECIAL SERVICE 60–108KC IN binding posts to J7.
						b. Check resistors R2 and R3.
14	98*c*	Terminal 4 of P1 on modem and amplifier AR4.	Terminal 5 of P1 on modem and amplifier AR4.	83	−48.5	*a.* Check circuit from SPECIAL SERVICE 60–108KC IN binding posts to J2.
						b. Check resistors R2 through R6.
15	98*d*	SPL SERV 12–60 KC IN jack (tip).	SPL SERV 12–60 KC IN jack (ring).	37	0	Check circuit from SPECIAL SERVICE 12–60KC IN binding posts to J9.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
16	98*d*	Terminal 1 of FL3	Ground	37	−50	*a.* Check circuit from SPECIAL SERVICE 12-60KC IN binding posts to FL3. *b.* Check resistors R8 through R10.
17	98*c*	TR AMP OUT jack (tip).	TR AMP OUT jack (ring).	68	−38.5	*a.* Replace 12-68 kc amplifier AR3. Repeat test 17. *b.* If normal indication is not obtained in step *a*, check circuit from terminal minal K and W of J1 to J4. *c.* Check resistors R46 through R48.

b. Signal Substitution Chart, Receiving Direction.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
1	99*a* and *b* and test No. 1 of *b*(3).	Terminal 1 of Z5	Ground	68	−23	Check circuit from terminals C and P of J1 to Z5.
2	99*a* and *b* and test No. 1 of *b*(3).	Terminal 3 of Z5	Ground	68		*a.* Check circuits from Z5 to S5. *b.* Check REC CABLE REELS TO FIRST AN/TCC-11 switch S5. *c.* Check cable building-out network Z5.
	REC CABLE REELS TO FIRST AN/TCC-11 switch in positions:					
	23	----	----	----	−23	
	20	----	----	----	−26	
	17	----	----	----	−29	
	14	----	----	----	−32	
	11	----	----	----	−35	
	8	----	----	----	−38	
	5	----	----	----	−41	
	2	----	----	----	−44	
	Return switch to position 23.	----	----	----	−23	
3	99*a* and *b* and test No. 2 of *b*(3).	REC IN jack (tip)	REC IN jack (ring)	68	−28.5	*a.* Check circuits from Z5 to J15 and Z4.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
						b. Check resistors R52 and R53.
4	99*a* and *b* and test No. 2 of *b*(3).	Terminal 1 of Z4	Ground	68		*a*. Check circuits from Z5 to Z4. *b*. Check resistors R36 through R38.
	FLAT ADJ 68 KC GAIN control in extreme clockwise position.				−23.5	
	In extreme counterclockwise position.				−50.0	
	Adjust FLAT ADJ 68 KC gain control for normal.				−34	
5	99*a* and *b* and test No. 2 of *b*(3).	Terminal 3 of Z4	Ground	68	−41	Perform test No. 32.
6	99*a* and *b* and test No. 2 of *b*(3).	Terminal 3 of Z3	Ground	68	−45	*a*. Check circuit from Z4 to Z3. *b*. Perform test No. 33.
7	99*a* and *b* and test No. 2 of *b*(3).	Terminal 3 of delay equalizer EQ3.	Ground	68	−45	*a*. Check circuit from Z3 to delay equalizer EQ3. *b*. Check delay equalizer EQ3.
8	99*a* and *b* and test No. 2 of *b*(3).	Terminal 3 of basic equalizer EQ2.	Ground	68	−50	*a*. Check circuit from delay equalizer EQ3 to basic equalizer EQ2. *b*. Check basic equalizer EQ2.
9	99*a* and *b* and test No. 2 of *b*(3).	Terminal 0 or 3 of P1 on 12–68 kc amplifier AR1.	Ground	68	−50	Check circuit from basic equalizer EQ2 to J5.
10	99*a* and *b* and test No. 2 of *b*(3).	REC AMP 1 OUT jack (tip).	REC AMP 1 OUT jack (ring).	68	−38.5	*a*. Perform test No. 11. *b*. If normal indication is obtained in step *a*, check circuit from J5 to J14. *c*. Check resistors R29 and R30.
11	99*a* and *b* and test No. 2 of *b*(3).	Terminal 14 or 17 of P1 on 12–68 kc amplifier AR1.	Ground	68	−5	*a*. Replace 12–68 kc amplifier AR1. Repeat test No. 11. *b*. If normal indication is not obtained in step *a*, check for +200 volts dc from terminal 9 to terminal 12 of J5. *c*. If normal indication in step *b* is not obtained, check the +200-volt distribution circuit (fig. 74).

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
						d. Check for 6.3 volts ac between terminals 10 and 11 of J5. *e.* If normal indication in step *d* is not obtained, check the 6.3-volt ac distribution circuit (fig. 7).
12	99*a* and *b* and test No. 2 of *b*(3).	Terminal 1 of T3	Ground	68	−14	*a.* Check circuit from J5 to T3. *b.* Check resistors R45, R49, R50, and R51. *c.* Check capacitor C14.
13	99*a* and *b* and test No. 2 of *b*(3).	Terminal 3 of T3	Ground	68	−28	*a.* Check circuit from T3 to Z2 and C7. *b.* Check resistor R27. *c.* Check transformer T3.
14	99*a* and *b* and test No. 3 of *b*(3).	Terminal 2 of Z2	Ground	68		*a.* Check circuit from T3 to J3. *b.* Check resistor R28. *c.* Check capacitors C4, C5, and C7 through C10. *d.* Check regulator network Z2.
	MAN REG OUTPUT control in extreme clockwise position.				−43	
	In extreme counterclockwise position.				−62.5	
15	99*a* and *b* and test No. 3*d* of *b*(3).	Terminal 1 or 4 of P1 on 12–68 kc amplifier AR2.	Ground	68	−43	*a.* Check circuit from T3 to J3. *b.* Check resistor R28. *c.* Check capacitors C4, C5, and C7 through C10. *d.* Check regulator network Z2.
16	99*a* and *b* and test No. 3*d* of *b*(3).	REC AMP 2 OUT jack (tip).	REC AMP 2 OUT jack (ring).	68	−38.5	*a.* Perform test No. 17. *b.* If normal indication is obtained in step *a*, check resistors R22 and R23.
17	99*a* and *b* and test No. 3*d* of *b*(3).	Terminal 14 or 17 of P1 on 12–68 kc amplifier AR2.	Ground	68	+5	*a.* Replace 12–68 kc amplifier AR2 with a spare 12–68 kc amplifier or the AR3 12–68 kc amplifier and repeat this test.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
						b. If normal indication is not obtained in step *a*, check for +200 volts dc from terminal 9 to terminal 12 of J3. *c.* If normal indication in step *b* is not obtained, check the +200-volt distribution circuit (fig. 74). *d.* Check for 6.3 volts ac between terminals 10 and 11 of J3. *e.* If normal indication in step *d* is not obtained, check the 6.3-volt ac distribution circuit. *f.* Check circuit from terminal 13 to terminals 19 and 16 of J3. *g.* Check resistor R26. *h.* Check capacitor C12.
18	99*a* and *b* and test No. 3*d* of *b*(3).	REC 62 KC jack (tip).	REC 62 KC jack (ring).	68	+3.5	*a.* Check circuit from J3 to J10. *b.* Check resistor R20.
19	Connect regulator and alarm unit Z6 to GROUP PANEL with extension cable 99*a* and *b* and test No. 3 of *b*(3).	Terminal 6 of T1 on regulator and alarm unit Z6.	Ground	68	−3	Check resistors R12, R13 and R34.
20	99*a* and *b* and test No. 3*d* of *b*(3).	Terminal 1 of FL1	Ground	68	+5	Check circuit from J3 to FL1.
21	99*g*	Terminal 1 of FL1	Ground	37	0	Perform tests No. 20 and 32 through 40.
22	99*g*	Terminal 3 of FL1	Ground	37	−2	Check filter FL1.
23	99*g*	Terminal 19 of P1 on modem and amplifier AR4.	Ground	37	−2	Check circuit from FL1 to terminals 16 and 19 of J2.
24	99*g*	Terminal 17 of P1 on modem and amplifier AR4.	Terminal 14 of P1 on modem and amplifier AR4.	83	−11.6	*a.* Replace modem and amplifier AR4. Repeat test No. 24. *b.* Perform test No. 25 if normal indication is not obtained in step *a*.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
						c. If normal indication is obtained in step *b*, and is not obtained in step *a*, check for +200 volts dc from terminal 3 to terminal 6 of J2. *d.* If normal indication in step *c* is not obtained, check the +200-volt distribution circuit (fig. 74). *e.* Check for 6.3 volts ac between terminals 7 and 8 of J2. *f.* If normal indication in step *e* is not obtained, check the 6.3-volt ac distribution circuit.
25	99*a*	Terminal 10 of P1 on modem and amplifier AR4.	Terminal 11 of P1 on modem and amplifier AR4.	120	−2.5	Check circuit from terminals H and R of P2 to terminals 10 and 11 of J2.
26	99*g*	DEM OUT jack (tip).	DEM OUT jack (ring).	83	−11.5	Check circuit from terminals 14 and 17 of J2 to DEM OUT binding posts.
27	99*g*	DEM OUT binding post E3.	DEM OUT binding post E4.	83	−11.5	Check circuit from terminals 14 and 17 of J2 to DEM OUT binding posts.
28	99*g*	DEM OUT ALT binding post E5.	DEM OUT ALT binding post E6.	83	−11.5	*a.* Check circuit from terminals 15 and 18 of J2 to DEM OUT ALT binding posts. *b.* Check resistor R1.
29	99*g*	Terminal H of P1	Terminal R of P1	83	−11.5	Check circuit from terminals 15 and 18 of J2 to terminals H and R of P1.
30	99*g*	SPECIAL SERVICE 60–108KC OUT binding post E9.	SPECIAL SERVICE 60–108KC OUT binding post E10.	83	−11.5	Check circuit from terminals 14 and 17 of J3 to SPECIAL SERVICE 60–108KC OUT binding posts.
31	99*g*	SPECIAL SERVICE 12–60KC OUT binding post E13.	SPECIAL SERVICE 12–60KC OUT binding post E14.	37	−9	*a.* Check circuit from FL1 to SPECIAL SERVICE 12–60KC OUT binding posts. *b.* Check transformer T2.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
32	99*e* SLOPE ADJ 12 KC control position:	Terminal 3 of Z4	Ground	28		*a.* Perform test No. 5 and if normal indication is not obtained, check circuit from Z4 to R35. *b.* Check R35. *c.* Check slope network Z4.
	+5				−44	
	+4				−45	
	+3				−46	
	+2				−47	
	+1				−48	
	0				−49	
	−1				−50	
	−2				−51	
	−3				−52	
	−4				−53	
	−5				−54	
	Return to position 0					
33	99*e* BULGE ADJ 28 KC control position:	Terminal 3 of Z3	Ground	28		*a.* Perform test No. 6 and if normal indication is not obtained, check circuit from Z3 to R34. *b.* Check R34. *c.* Check bulge network Z3.
	−5				−48	
	+4				−48.75	
	+3				−49.5	
	+2				−50.25	
	+1				−51	
	0				−51.75	
	−1				−52.5	
	−2				−53.25	
	−3				−54	
	−4				−54.75	
	−5				−55.5	
	Return to position 0				−51.75	
34	99*e*	Terminal 3 of delay equalizer EQ3.	Ground	28	−51	Perform tests No. 7, 32, and 33.
35	99*e*	Terminal 3 of basic equalizer EQ2.	Ground	28	−60	Perform tests No. 8, 32, and 33.
36	99*e*	Terminal 14 or 17 of P1 on 12–68 kc amplifier AR1.	Ground	28	−17.5	Perform tests No. 11, 32, and 33.
37	99*e*	Terminal 1 of T3	Ground	28	−28	Perform tests No. 12, 32, and 33.
38	99*e*	Terminal 1 or 4 of P1 on 12–68 kc amplifier AR2.	Ground	28	−55	Perform tests No. 15, 32, and 33.
39	99*e*	Terminal 14 or 17 of P1 on 12–68 kc amplifier AR2.	Ground	28	−13	Perform tests No. 17, 32, and 33.
40	99*e*	REC AMP 2 OUT (tip).	REC AMP 2 OUT (ring).	28	−38.5	Perform tests No. 16, 32, and 33.
41	99*d*	Terminal 1 of FL2	Ground	68	−8	*a.* Check circuit from J3 to FL2. *b.* Check resistor R2.
42	99*d*	Terminal 3 of FL2	Ground	68	−9	Check filter FL2.
43	99*d*	Terminal 6 of T4	Ground	68	+25	*a.* Check circuit from FL2 to T4.

Test No.	Signal generator (for hookup in circuit, see par.)	Audio level meter probe connections		Audio level meter normal indication		Corrective measures
		Positive	Negative	Frequency (kc)	Output (db)	
						b. Check tube socket XV1 voltages (TM 11–2139–20, fig. 13). Check resistors and capacitors associated with the tube socket terminals which have abnormal dc voltages. *c.* Check tube socket XV1 resistances (TM 11–2139–20, fig. 13). Check resistors and capacitors associated with the tube socket terminals which have abnormal resistance indications. *d.* Check capacitors C11 and C13.
44	99*d*	Terminal F of P2----	Terminal P of P2----	68	0	*a.* Check circuit from T4 to P2. *b.* Check transformer T4.

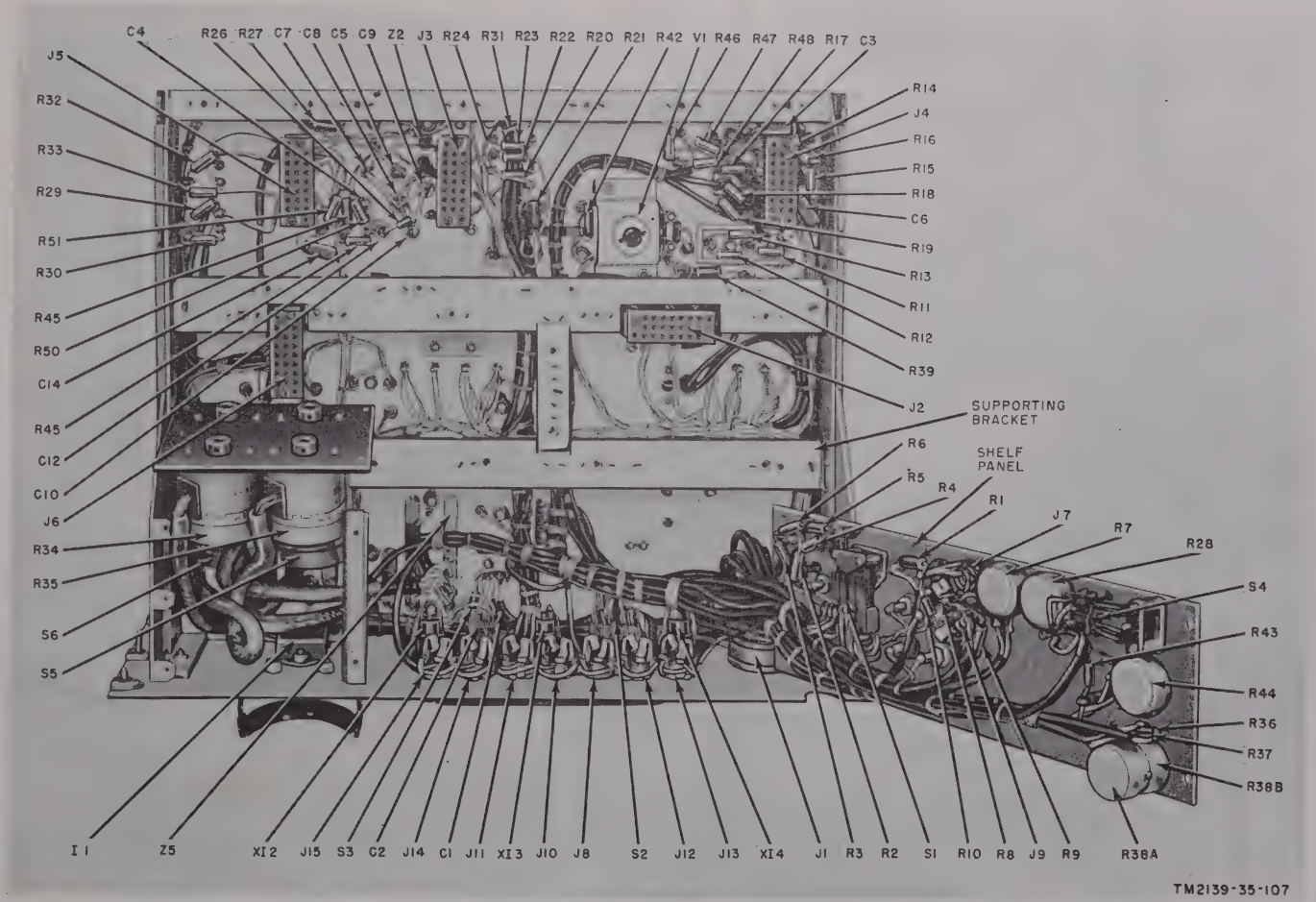


Figure 62. GROUP PANEL, pluck-out assemblies removed and top panel raised.

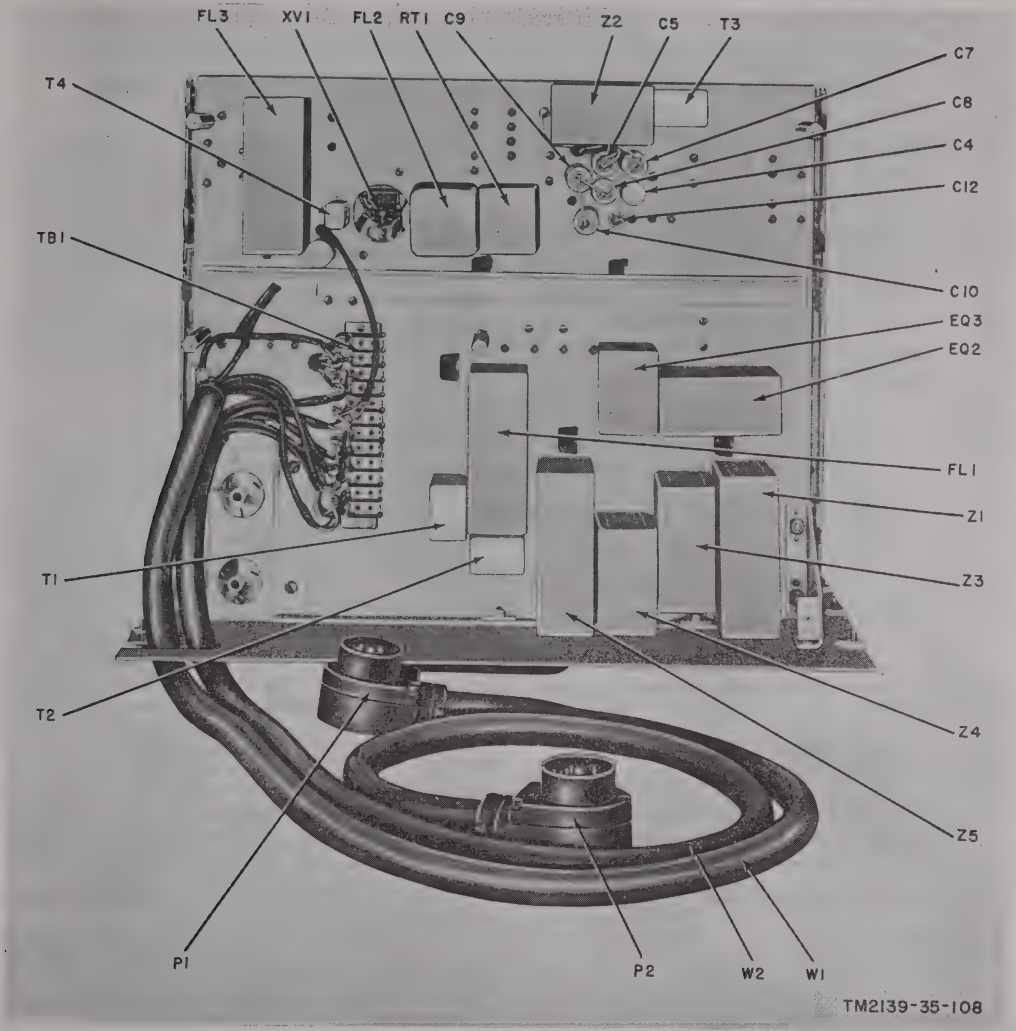


Figure 63. GROUP PANEL, bottom view with cover removed.

103. 12–68 Kc Amplifier Test
(fig. 64)

a. Initial Procedures.

(1) Connect the 600-ohm resistor, modem and amplifier and carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, and 12–68 kc amplifier as shown in figure 64.

(2) Connect the signal generator, resistors R1 through R3, attenuator, and transformer T108 to terminals 0 and 2 of the modem and amplifier test cable assembly. Adjust the signal generator for an output frequency of 68 kc at a voltage of .0022 volt measured across terminals 0 and 2 of the modem and amplifier test cable assembly.

b. 12–68 Kc Amplifier Gain Test.

(1) Connect the voltmeter across ter-

minals 17 and 19 of the modem and amplifier test cable assembly; the voltmeter should indicate 3.25 ±.5 volts.

(2) Connect the voltmeter across terminals 15 and 18 of the modem and amplifier test cable assembly; the voltmeter should indicate .1 ±.02 volt.

(3) Remove the power from the 200 volt power supply. Arrange the multimeter to measure resistance; connect the multimeter to terminals 1 and 2 of the modem and amplifier test cable assembly. The multimeter should indicate zero resistance.

104. 12–68 Kc Amplifier, Signal Substitution Chart

The signal substitution chart is used to supplement the operational tests in paragraph 103. This chart will help isolate a defective stage or circuit. Voltage and resistance measurements taken at the defective stage or circuit will usually isolate the defective part. The signal substitution procedures at each step are based on the assumption that all previous steps have been completed satisfactorily. Use the initial procedures (par. 98*a*).

Test No.	Voltmeter connections		Meter indication (ac)	Corrective measures
	High side probe	Ground probe		
1	Terminal 4 of transformer T1.	Terminal 1 of transformer T1.	0.0022	Check wiring from connector P1 to transformer T1. Check transformer T1 for short circuits. Measure dc resistance of transformer T1 primary (par. 111*b*).
2	E3	Ground	.015	Check transformer T1 and wiring. Check capacitors C3 and C11. Check resistors R13 and R14.
3	Terminal 5 of tube socket XV1.	Ground	.4	Check tube V1. Check network Z1. Check capacitors C5 through C7. Check resistors R8 and R7.
4	Terminal 3 of Z1	Ground	.4	Check network Z1.
5	Terminal 1 of tube socket XV2.	Ground	.4	Check wiring from network Z1 to tube V2. Check resistor R10.
6	Terminal 5 of tube socket XV2.	Ground	2.0	Check tube V1. Check capacitors C8 through C10. Check resistors R11 and R15. Check transformer T2.
7	Terminal 4 of transformer T2.	Ground	3.25	Check transformer T2 and wiring.
8	E7	Ground	3.25	Check inductor L1. Check resistors R16, R19, and R18. Check capacitor C13.
9	Terminal 14 of modem and amplifier test cable assembly.	Ground	3.25	Check wiring from E7 to connector P1.
10	Terminal 1 of transformer T2.	Ground	.1	Check transformer T2 and wiring.
11	Terminal 15 of modem and amplifier test cable assembly.	Ground	.1	Check wiring to connector P1. Check capacitor C12.
12	E5	Ground	.015	Check capacitor C11 and resistors R14 and R13. Check wiring.

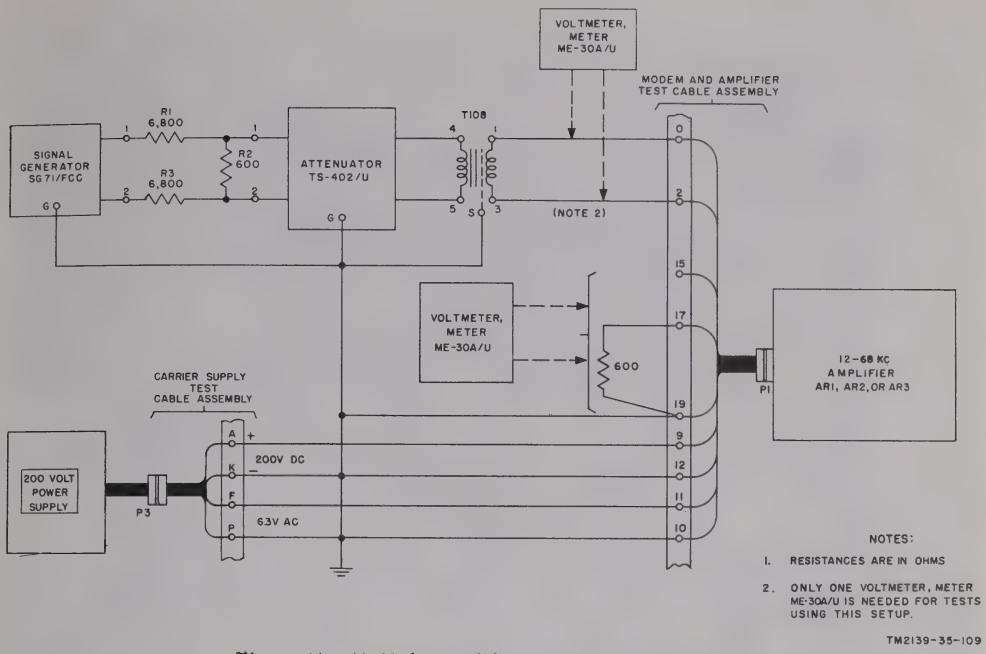


Figure 64. 12–68 kc amplifier, operational test setup.

105. Regulator and Alarm Unit Z6 Tests
(fig. 67)

a. Initial Procedures.

(1) Connect the 200 VOLT POWER SUPPLY, 10K-, 20K-, and 1,500-ohm resistors, modem and amplifier and carrier supply test cable assemblies, and regulator and alarm unit Z6 as shown in figure 67.

(2) Connect the signal generator, resistors R1 through R3, attenuator, and transformer T108 across terminals 0 and 3 of the modem and amplifier test cable assembly. Set the attenuator for a 3-db loss and adjust the output frequency of the signal generator to 68 kc at a voltage of .25 volt measured across terminals 0 and 3 of the modem and amplifier test cable assembly.

(3) Adjust the ADJ HIGH and ADJ LOW alarm controls to the extreme counterclockwise position.

b. Regulator and Alarm Unit Z6, Regulator Test.

(1) Connect the multimeter to REG VOLTS jacks J1 and J2 and adjust the 20K-ohm resistor until the multimeter indicates 3.5 volts dc.

(2) Set the attenuator for a 4-db loss. The multimeter indication should be greater than 5 volts dc.

(3) Set the attenuator for a 2-db loss. The multimeter indication should be less than 2 volts dc.

(4) Set the attenuator for a 3-db loss. The multimeter indication should return to about 3.5 volts dc.

c. Regulator and Alarm Unit Z6, Alarm Test. Arrange the regulator and alarm circuit for testing as described in *a* above.

(1) Connect the multimeter to terminals 1 and 16 of the modem and amplifier test cable assembly. Operate and hold the ALARM TEST switch to the 1 HIGH position; adjust the ADJ HIGH control until the multimeter

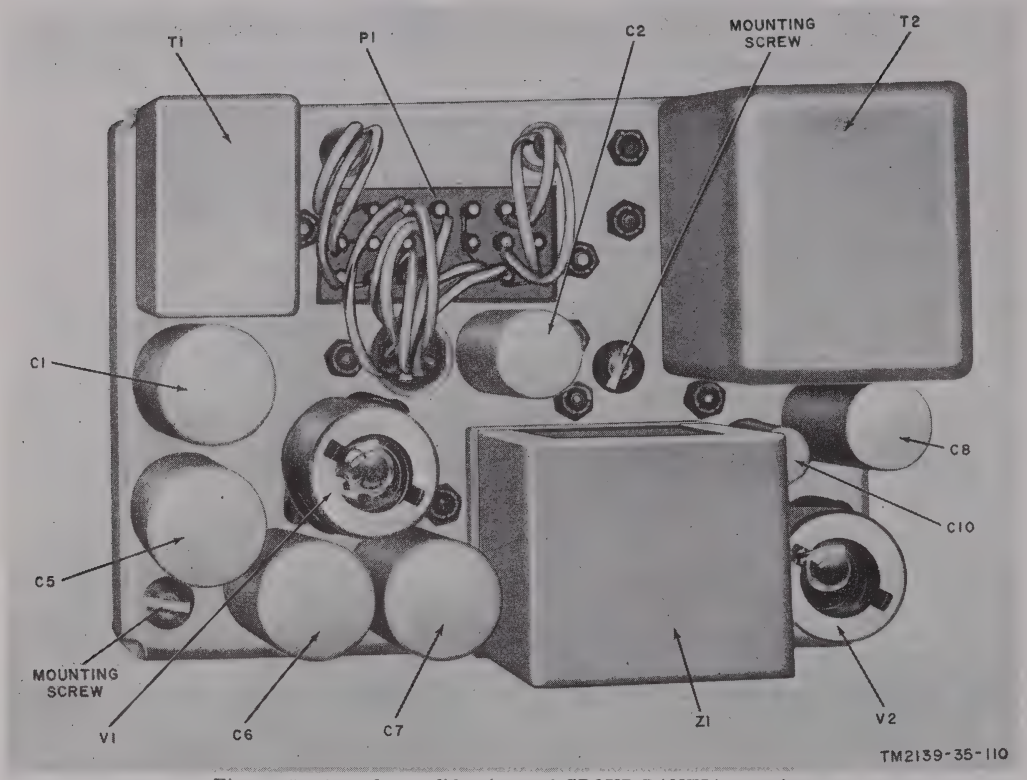


Figure 65. 12-68 kc amplifier (part of GROUP PANEL), top view.

indicates zero resistance. Release the ALARM TEST switch; the multimeter should indicate infinite resistance.

(2) Connect the multimeter to terminals 1 and 13 of the modem and amplifier test cable assembly. Operate and hold the ALARM TEST switch to the 2 LOW position; adjust the ADJ LOW control until the multimeter indicates zero resistance. Release the ALARM TEST switch; the multimeter should indicate infinite resistance.

(3) Set the attenuator for a 5-db loss. Connect the multimeter to terminals 1 and 2 and then to terminals 1 and 11 of the modem and amplifier test cable assembly; the multimeter should indicate zero resistance for both connections.

(4) Set the attenuator for a 3-db loss. Connect the multimeter to terminals 1 and 13 of the modem and amplifier test cable assembly; the multimeter should indicate infinite resistance.

(5) Set the attenuator for a 1-db loss. Connect the multimeter to terminals 1 and 16, then 1 and 5, and then 1 and 8 of the modem and amplifier test cable assembly; the multimeter should indicate zero resistance in each test.

(6) Set the attenuator for a 3-db loss. Connect the multimeter across terminals 1 and 16 of the modem and amplifier test cable assembly; the

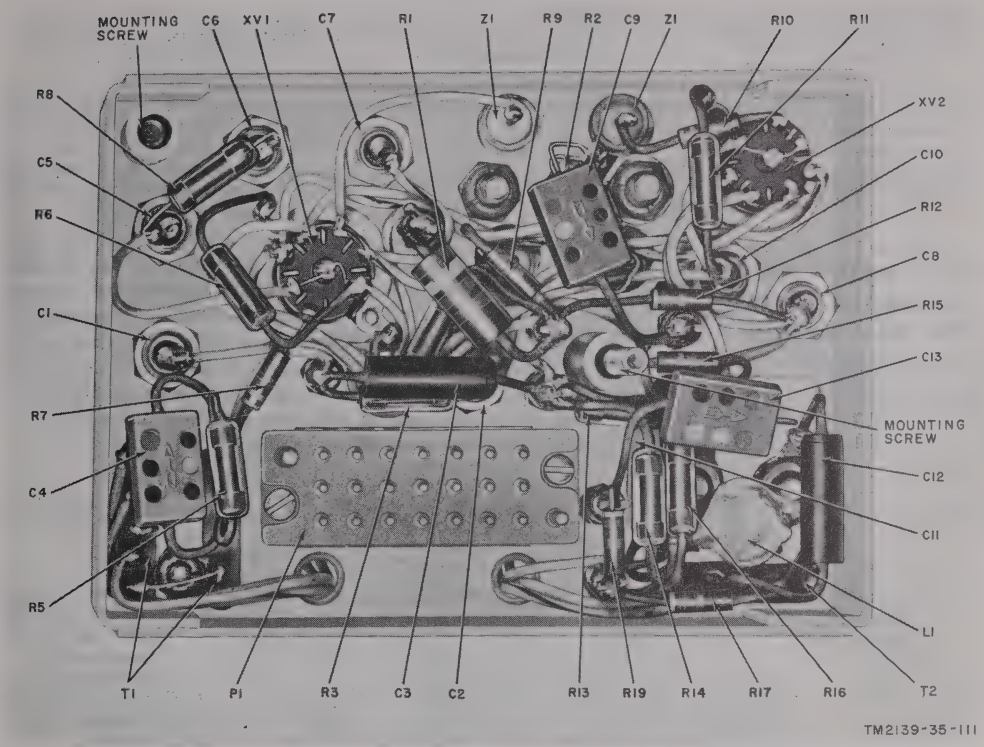


Figure 66. 12–68 kc amplifier (part of GROUP PANEL), bottom view.

multimeter should indicate infinite resistance.

106. Regulator and Alarm Unit Z6 Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in regulator and alarm unit Z6. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). Normal tube socket voltage and resistance measurements are provided in TM 11–2139–20, figure 15. Prepare regulator and alarm unit Z6 for troubleshooting tests as described in paragraph 105*a*.

Symptom	Probable trouble	Corrective measures
1. Improper voltage at REG VOLTS jacks. All dc and ac power voltages normal at P1, and the ac input voltage normal at T1.	Defect in regulator circuit	Check tubes V1 through V5. Measure dc voltages and resistances at tube sockets XV1 through XV3 (TM 11–2139–20, fig. 15). If this does not locate the trouble, apply signal substitution procedures (par. 107, tests No. 1 through 5 and 9).
2. Proper voltage at REG VOLTS jacks, improper alarm circuit behavior. All dc and ac power voltages are normal at P1, and ac input voltage normal at T1.	Defect in alarm circuit	Check tubes V1 through V5. Measure dc voltages and resistances at tube sockets XV1, XV4, and XV5 (TM 11–2139–20, fig. 15). If this does not locate the trouble, apply signal substitution procedures (par. 107, tests No. 6 through 8 and 10 through 13).

Symptom	Probable trouble	Corrective measures
3. Improper voltage at REG VOLTS jacks, improper alarm behavior. All dc and ac power voltages normal at P1. Ac input voltage normal at T1.	Defect in both alarm and regulator circuits.	Check tubes V1 through V5. Measure dc voltages and resistances at tube socket (TM 11-2139-20, fig. 15). If this does not locate the trouble, apply signal substitution procedures (par. 107, tests No. 1 through 13).

107. Regulator and Alarm Unit Z6 Signal Substitution Chart

The following signal substitution chart is used to supplement the troubleshooting chart (par. 106). This chart will help isolate the defective stage or circuit. Voltage and resistance measurements taken at the defective stage or circuit should isolate the defective part. The signal substitution procedures at any step are based on the assumption that all previous steps were satisfactorily completed. Use the voltmeter for ac measurements and the multimeter for dc measurements.

Test No.	Conditions	Voltmeter or multimeter			Corrective measures
		Connections		Indication (volts)	
		Positive probe	Negative probe		
1	Perform initial procedures (par. 105) for ac measurements.	Terminal 6 of transformer T1.	Ground	.35 ac	*a.* Check transformer T1. *b.* Check wiring from connector P1 to transformer T1. *c.* Check resistor R1. *d.* Check wiring from transformer T1 to filter FL1.
2	Same as for test No. 1	Terminal 3 of filter FL1.	Ground	.35 ac	Same as *d* above.
3	Same as for test No. 1	Terminal 1 of filter FL1.	Ground	.55 ac	*a.* Check filter FL1. *b.* Check resistor R2. *c.* Check wiring for short circuits.
4	Same as for test No. 1	Terminal 1 of tube socket XV1.	Ground	.55 ac	Check resistor R3 and wiring.
5	Same as for test No. 1	Terminal 5 of tube socket XV1.	Ground	24 ac	Check resistors R5 and R4 and capacitor C2.
6	Same as for test No. 1	E8	Ground	23 ac	Check capacitor C8 and wiring.
7	Same as for test No. 1	Terminal 3 of tube socket XV4.	Ground	9 ac	Check resistor R16.
8	Same as for test No. 1	Terminal 4 of tube socket XV4.	Ground	7.5 ac	Check resistors R22 and R21, and capacitors C9 and C10.
9	Same as for test No. 1, except measurement is dc.	Terminal 2 or 8 of tube socket XV3.	Ground	3.5 dc	Check resistors R9 and R33 and capacitors C5 and C6.
10	Same as for test No. 9, with HIGH and LOW alarm controls in extreme counterclockwise position and switch S1 in normal position.	Terminal 4 of tube socket XV5.	Ground	110 dc	Check resistor R26, and capacitors C9, C11, C12, and C15.

Test No.	Conditions	Voltmeter or multimeter			Corrective measures
		Connections		Indication (volts)	
		Positive probe	Negative probe		
11	Same as for test No. 10, with switch S1 depressed to test HIGH position.	Terminal 4 of tube socket XV5.	Ground	115 dc or slight increase relative to reading in test No. 10.	Check switch S1 and wiring.
12	Same as for test No. 10	Terminal 6 of tube socket XV5.	Ground	102 dc	Check capacitor C13 and wiring to tube socket XV5.
13	Same as for test No. 10, with switch S1 depressed to test LOW position.	Terminal 6 of tube socket XV5.	Ground	105 dc or slight increase relative to reading in test No. 12.	*a.* Check switch S1. *b.* Check resistor R14. *c.* Check wiring to switch S1.

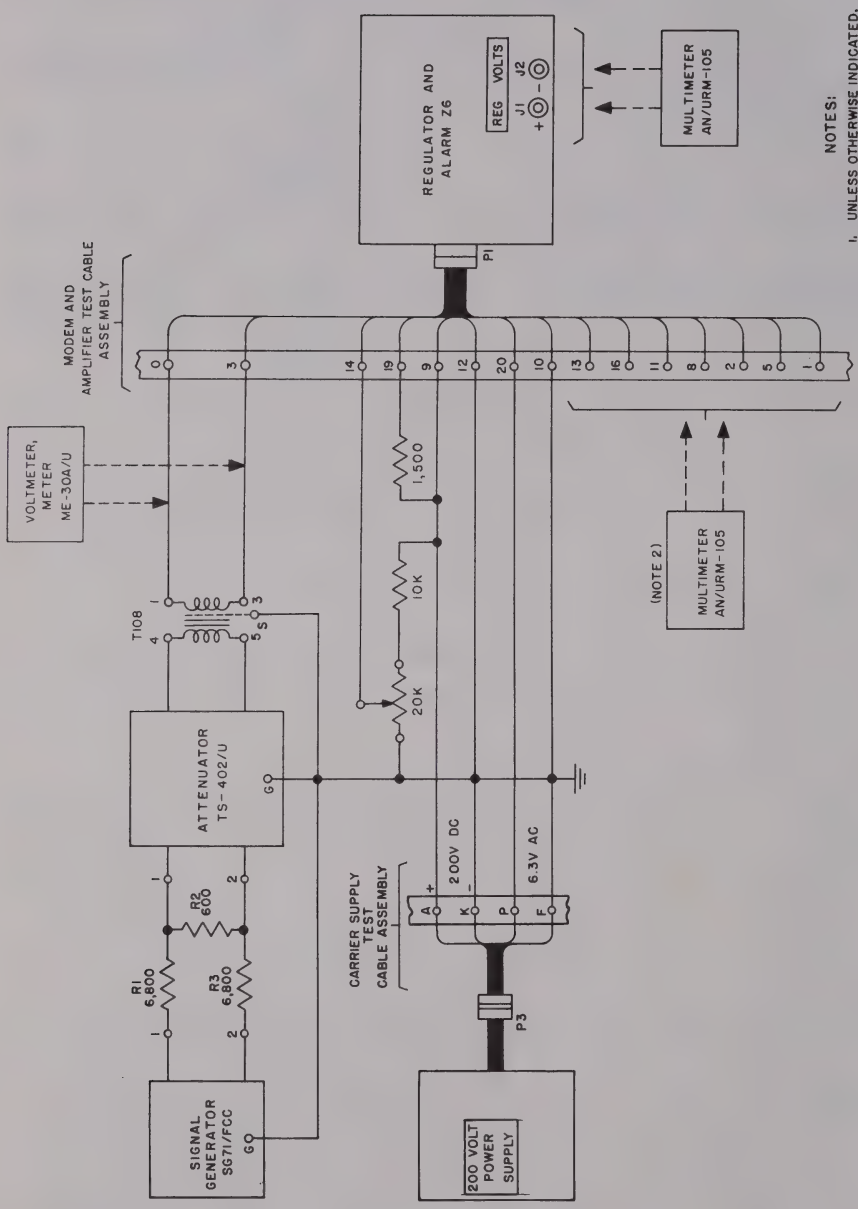


Figure 67. Regulator and alarm unit Z6, operational and final test setup.

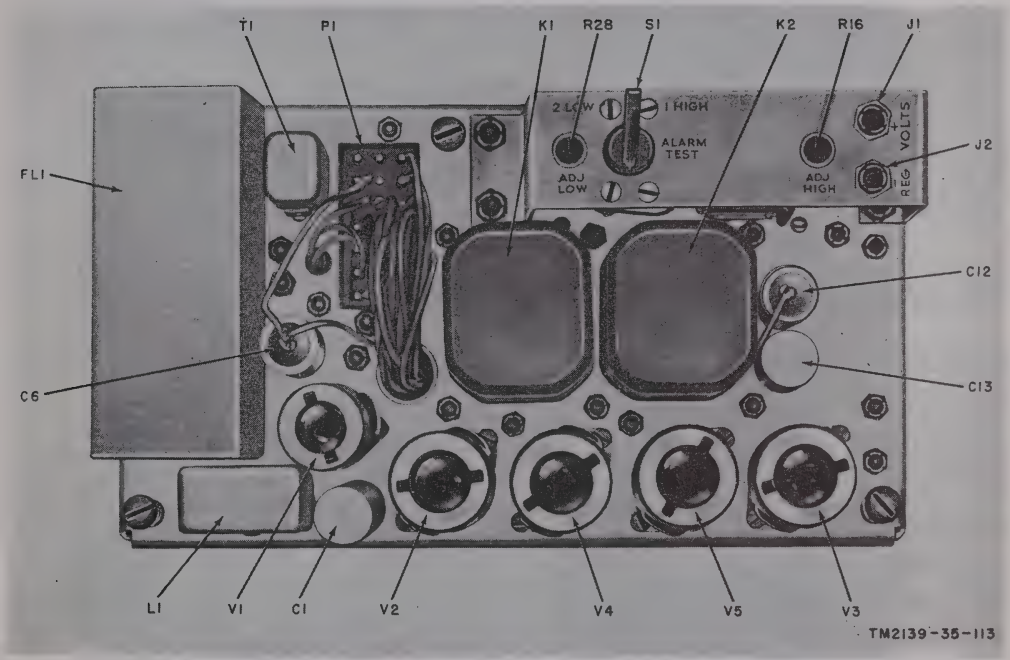


Figure 68. Regulator and alarm unit Z6 (part of GROUP PANEL), top view.

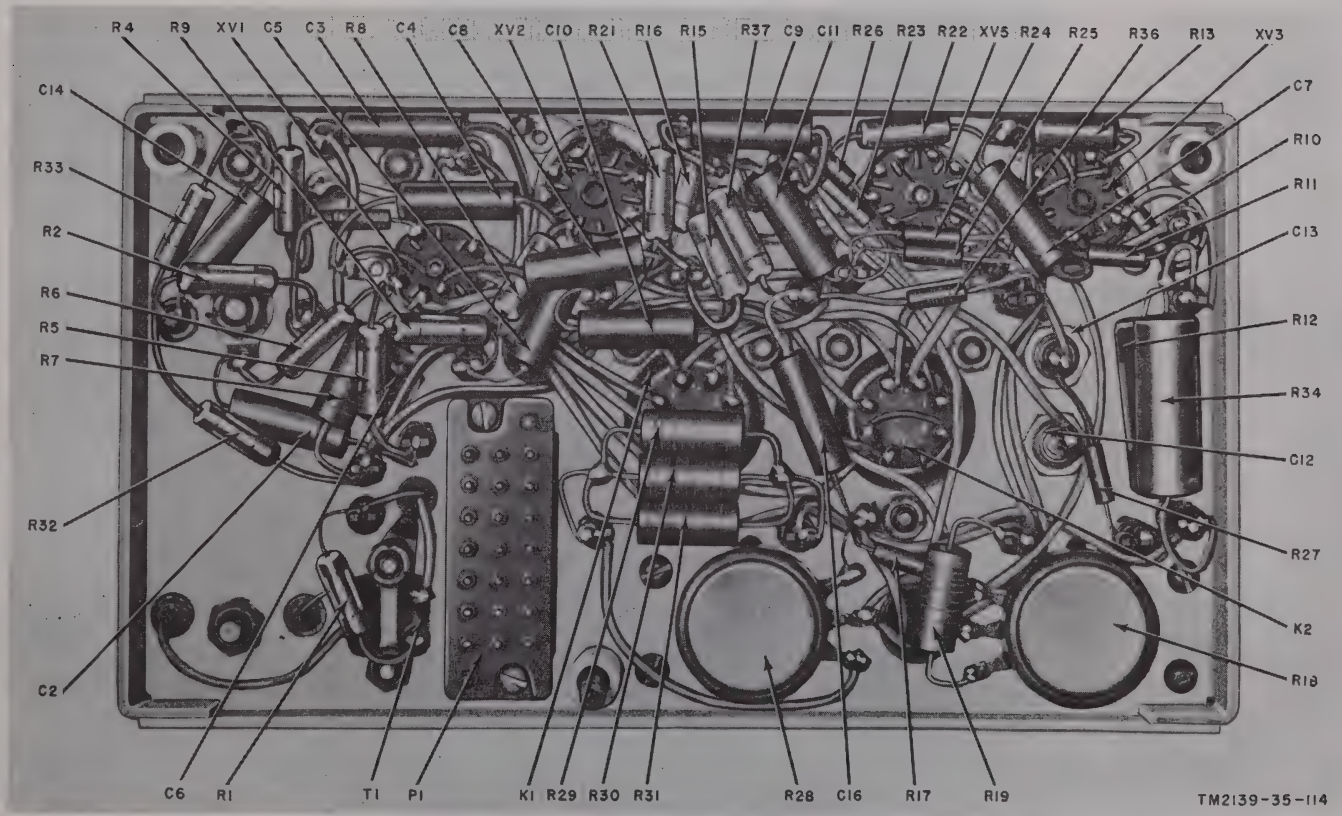


Figure 69. Regulator and alarm unit Z6 (part of GROUP PANEL), bottom view.

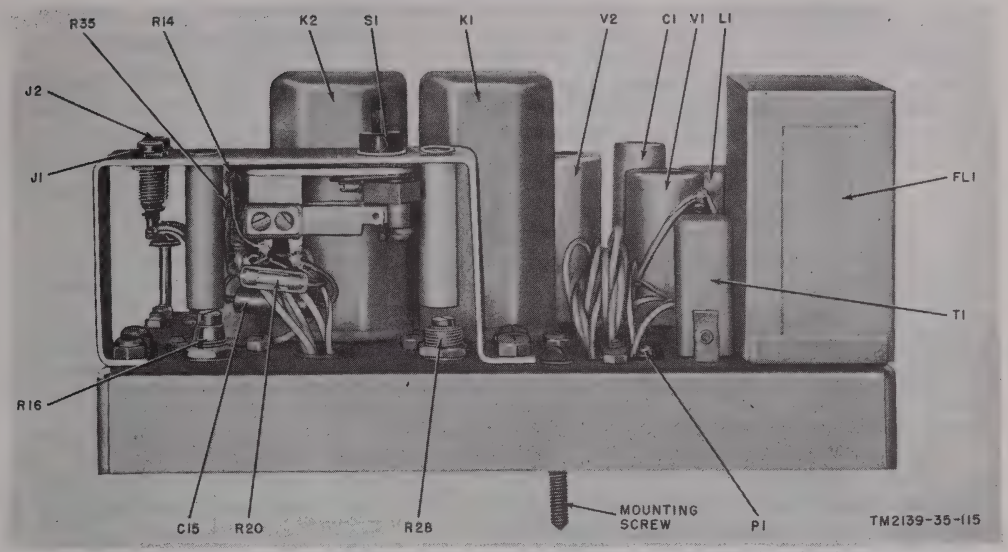


Figure 70. Regulator and alarm unit Z6 (part of GROUP PANEL), side view.

108. Modem and Amplifier Unit AR4 Tests

(fig. 71)

a. Initial Procedures.

(1) Connect the two 135- and one 600-ohm resistors, 200-ohm variable resistor, modem and amplifier and carrier supply test cable assembly, modem and amplifier unit AR4, and the 200 VOLT POWER SUPPLY as shown in figure 71.

(2) Connect signal generator No. 1 to terminals 10 and 11 of the modem and amplifier test cable assembly. Adjust the signal generator for an output frequency of 120 kc at an output level of —2.5 db measured across terminals 10 and 11.

(3) Connect signal generator No. 2, resistors R1 through R3, attenuator, and transformer T107 as shown in figure 71.

b. Modem and Amplifier Unit AR4, Transmitting Test.

(1) Set the attenuator for a 40-db loss. Connect signal generator No. 2 with associated components (*a*(3) above) to terminals 4 and 5 of the modem and amplifier test cable assembly. Adjust the signal generator for an output frequency of 83 kc at an output level of —48.5 db measured across terminals 4 and 5.

(2) Connect the audio level meter across terminals 1 and 2 of the modem and amplifier test cable assembly. Arrange the audio level meter to measure a frequency of 37 kc at a level of —46.5 ±1 db.

c. Modem and Amplifier Unit AR4, Receiving Test.

(1) Replace transformer T107 (*a*(3) above) with transformer T108.

(2) Connect signal generator No. 2 with associated components to terminals 19 and 16 of the modem and amplifier test cable assembly. Set the attenuator for a 0-db loss. Adjust the signal generator for an output frequency of 37 kc at output level of —10 db measured across terminals 19 and 16.

(3) Arrange the audio level meter to measure a frequency of 83 kc at a level of —3.5 db. Connect the audio level meter across terminals 14 and 17, and then 15 and 18 of the modem and amplifier test cable assembly. The audio level meter should indicate —3.5 ±1.5 db for each measurement.

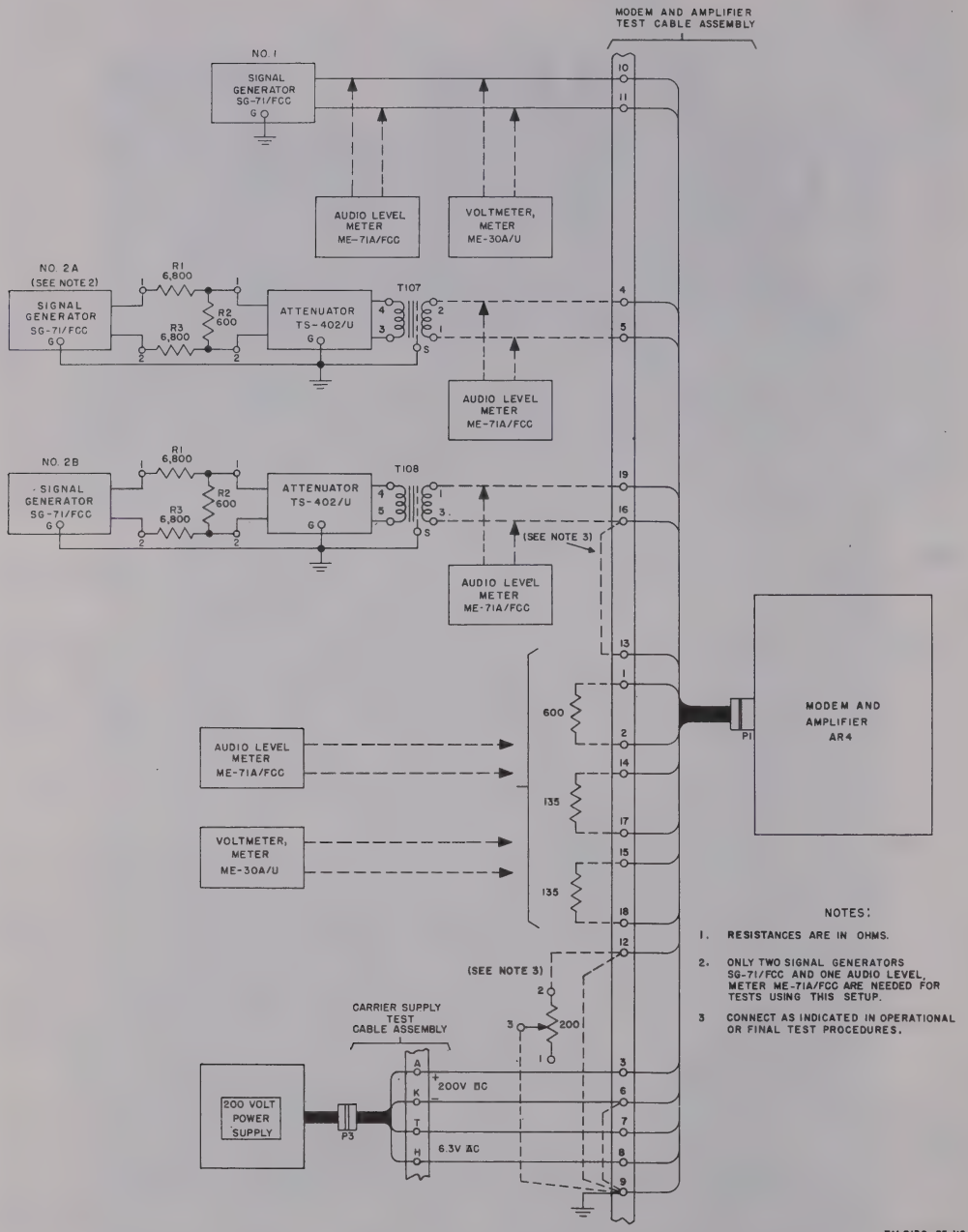


Figure 71. Modem and amplifier unit AR4 (part of GROUP PANEL), operational and final test setup.

109. Modem and Amplifier Unit AR4 Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in modem and amplifier unit AR4. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11-2139-20). Voltage and resistance measurements of this stage or circuit should isolate the defective part. Normal tube socket voltage and resistance measurements appear in TM 11-2139-20, figure 16.

Symptom	Probable trouble	Corrective measures
1. No transmission through modem and amplifier AR4 in transmitting and receiving directions.	Failure of 120-kc carrier distribution circuits.	Use signal substitution procedures (par. 110, tests No. 2 and 5) to localize trouble.
2. No transmission through modem and amplifier AR4 in transmitting direction.	Failure of transmission circuits between terminals 4 and 5 and terminals 1 and and 2 of connector P1.	Use signal substitution procedures (par. 110, test No. 1) to localize trouble.
3. No transmission through modem and amplifier AR4 in receiving direction.	Failure of transmission circuits between terminals 16 and 19, and terminals 14 and 17 of connector P1.	Check tube socket XV1 and XV2 voltages. Use signal substitution procedures (par. 110, tests No. 3 through 14) to localize trouble.

110. Modem and Amplifier Unit AR4, Signal Substitution Chart

The following signal substitution chart is used to supplement the troubleshooting procedures in paragraph 109. This chart will help isolate the defective stage or circuit. Voltage and resistance measurements taken at the defective stage or circuit should isolate the defective part. Follow the signal substitution procedures in the order given. These tests require the same equipment test setup as the operational tests (par. 108).

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
1	Terminal 2 of connector P1.	Terminal 1 of connector P1.	37	−46.5	*a.* Check circuit from terminals 10 and 11 of connector P1 to transformers T3 through T6. *b.* Check circuit from terminals 4 and 5 of connector P1 to terminals 1 and 2 of connector P1 (fig. 8). *c.* Check transformers T3 and T4. *d.* Check varistor CR1.
2	Terminal 2 of transformer T3.	Terminal 2 of transformer T4.	120	−2.5	Check circuit from terminals 10 and 11 of connector P1 to transformers T3 through T6 (fig. 8).
3	Terminal 4 of transformer T6.	Ground	37	−36	Check circuit from terminals 16 and 19 of connector P1 to transformer T6 (fig. 8).
4	Terminal 4 of transformer T5.	Ground	83	−44	*a.* Perform test No. 1*a*. *b.* Check circuit from transformer T6 to transformer T5 (fig. 8). *c.* Check transformers T5 and T6. *d.* Check varistor CR2.
5	Terminal 2 of transformer T6.	Terminal 2 of transformer T5.	120	−2.5	Check circuit from terminals 10 and 11 of connector P1 to transformers T3 through T6 (fig. 8).

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
6	Terminal 3 of filter FL1	Ground	83	−48.5	*a.* Check circuit from transformer T5 to filter FL1 (fig. 8). *b.* Check resistors R13 and R14.
7	Terminal 1 of filter FL	Ground	83	−51	*a.* Check circuit from filter FL1 to transformer T2 (fig. 8). *b.* Check inductor L1. *c.* Check capacitor C10. *b.* Check filter FL1.
8	Terminal 1 of transformer T2.	Ground	83	−51.5	*a.* Check circuit from filter FL1 to transformer T2 (fig. 8). *b.* Check inductor L1. *c.* Check capacitor C10.
9	Terminal 6 of transformer T2.	Ground	83	−37	*a.* Check circuits associated with terminals 5 and 6 of transformer T2 (fig. 8). *b.* Check resistor R12. *c.* Check transformer T2.
10	Terminal 1 of network Z1.	Ground	83	−14	*a.* Check voltages at tube socket XV2 (TM 11–2139–20, fig. 16). Check resistors and capacitors associated with tube socket terminals that have abnormal dc voltages. *b.* Check resistances at tube socket XV2 (TM 11–2139–20, fig. 11). Check resistors and capacitors associated with the tube socket terminals that have abnormal resistance indications. *c.* Perform test No. 12.
11	Terminal 3 of network Z1.	Ground	83	−14	*a.* Perform tests No. 10 and 12. *b.* Check network Z1.
12	Terminal 6 of transformer T1.	Ground	83	+22	*a.* Check voltages at tube socket XV1 (TM 11–2139–20, fig. 16). Check resistors and capacitors associated with tube socket terminals that have abnormal dc voltage. *b.* Check resistances at tube socket XV1 (TM 11–2139–20, fig. 16). Check resistors and capacitors associated with tube socket terminals that have abnormal resistance indications.

Test No.	Audio level meter probe connections		Audio level meter indication		Corrective measures
	Positive	Negative	Frequency (kc)	Output (db)	
13	Terminal 14 of connector P1.	Terminal 17 of connector P1.	83	−3.5	*c.* Check resistors R1, R2, R3, R12, and R18 (fig. 8). *d.* Check capacitors C1 through C9. *a.* Check circuit from transformer T1 to terminals 14 and 17 of connector P1. *b.* Check transformer T1.
14	Terminal 15 of connector P1.	Terminal 18 of connector P1.	83	−3.5	*a.* Check circuit from transformer T1 to terminals 15 and 18 of connector P1. *b.* Check transformer T1.

111. GROUP PANEL, Dc Resistance of Transformers, Coils and Thermistor

Note. Test the thermistor with an ohmmeter. Because the resistance of the thermistor varies with temperature, check the thermistor at a room temperature between 70° and 80° F.

a. Main Chassis.

Item	Terminals	Resistance (ohms)
T1 and T2	1–2	1.15
	3–4	3.12
T3	1–2	2.98
	3–4	.41
T4	1–3	.81
	4–6	876
RT1		30K

b. 12–68 Kc Amplifier.

Item	Terminals	Resistance (ohms)
T1	1–2	7.8
	3–4	43
	5–6	241
T2	1–2	3.8
	3–4	12.4
	5–6	216
L1		3.62

c. Regulator and Alarm Unit Z6.

Item	Terminals	Resistance (ohms)
T1	1–3	32
	4–6	1,370
L1		21

d. Modem and Amplifier AR4.

Item	Terminals	Resistance (ohms)
T1 and T2	1–2	2.47
	3–4	2.47
	5–6	140
T3	1–2	.85
	2–3	.85
	4–5	.622
T4	1–2	1.45
	2–3	1.45
	4–5	10.8
T5	1–2	.88
	3–4	.88
	4–5	1.37
T6	1–2	1.45
	3–4	1.45
	4–5	10.8
L1		4.8

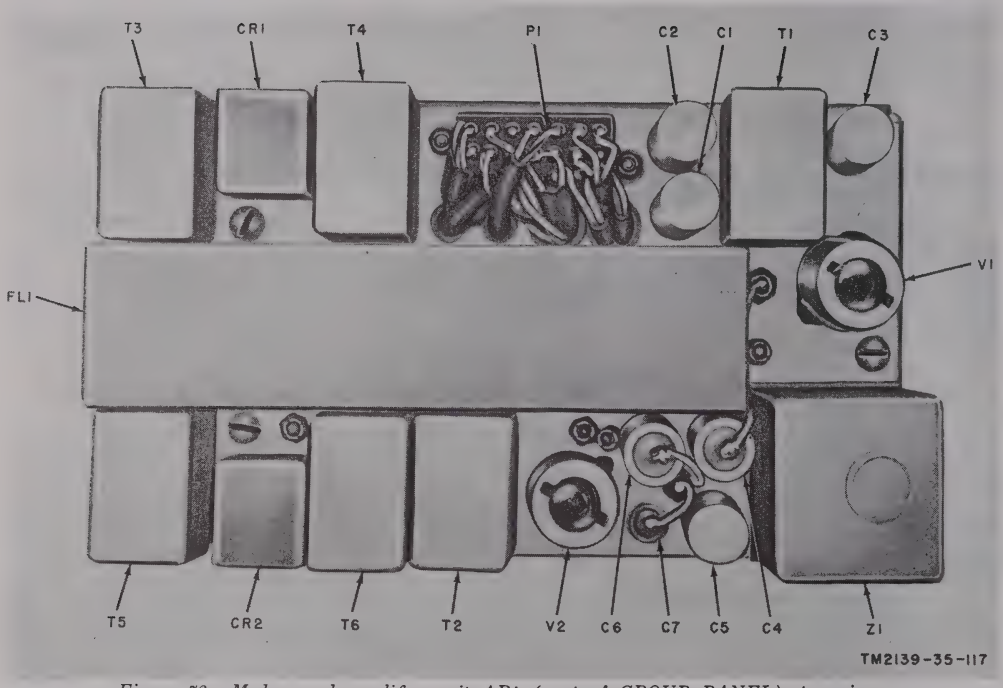


Figure 72. Modem and amplifier unit AR4 (part of GROUP PANEL), top view.

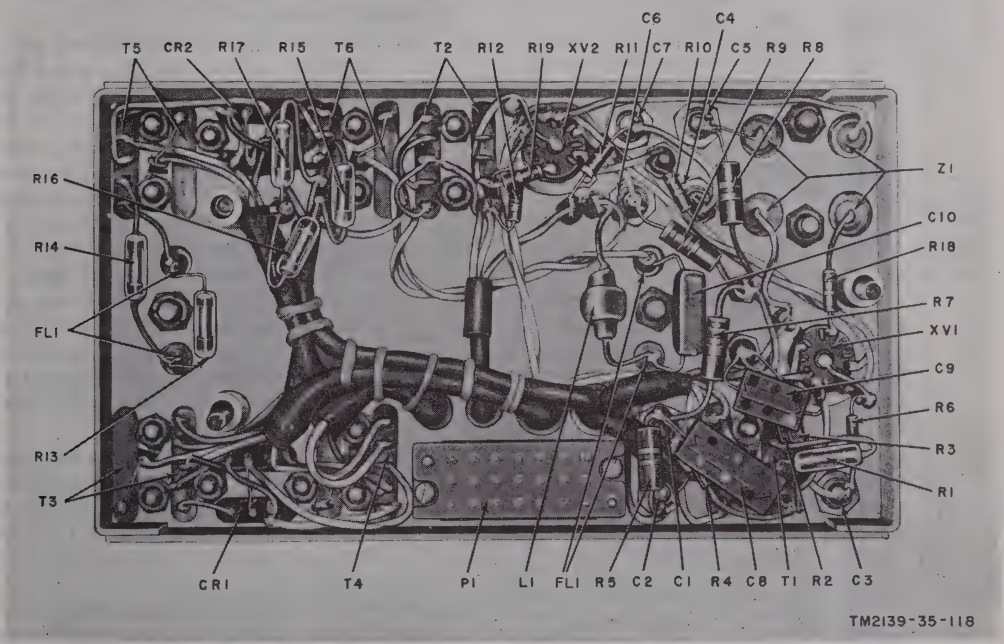


Figure 73. Modem and amplifier unit AR4 (part of GROUP PANEL), bottom view.

Figure 74. GROUP PANEL, B+ distribution diagram.

(Contained in separate envelope)

Section V. JUNCTION PANEL (PART OF AMPLIFIER-PILOT REGULATOR AM–707/TCC–7)

112. JUNCTION PANEL Troubleshooting Data

Fig. No.	Par. No.	Description
18		JUNCTION PANEL, schematic diagram.
76		JUNCTION PANEL, bottom view, location of parts.
77		JUNCTION PANEL, top view, location of parts.
		JUNCTION PANEL, wiring diagram.
	116	JUNCTION PANEL, dc resistance of transformer.

113. Carrier Circuit Tests (fig. 75)

a. Initial Procedures.

(1) Connect the junction panel test cable assembly, 135-ohm resistor, and the JUNCTION PANEL as shown in A, figure 75.

(2) Connect the signal generator, resistors R1 through R3, attenuator, transformer T108, carrier test cable assembly, and 600-ohm resistor as shown in B, figure 75.

b. Carrier Transmitting Circuit Test.

(1) Set the attenuator for a 0-db loss; adjust the signal generator for an output frequency of 30 kc at an output level of .755 volt measured across terminals F and S with terminal S as ground.

(2) Connect the voltmeter across terminals 1 and 2 of the junction panel test cable assembly (A, fig. 75). The voltmeter should indicate .34 ±.05 volt.

c. Carrier Receiving Circuit Test.

(1) Replace transformer T108 (*a*(2) above) with transformer T107.

(2) Connect the signal generator and the associated components across terminals 3 and 4 of the junction panel test cable assembly as shown in A, figure 75. Adjust the signal generator for an output frequency of 37 kc at an output level of .185 volt as measured across terminals 3 and G (ground).

(3) Connect the voltmeter across terminals C and P of the carrier test cable assembly (B, fig. 75); the meter should indicate .7 ±.1 volt.

114. Order Wire Circuit Tests

a. Initial Procedures.

(1) Connect the junction panel test cable assembly, 135-ohm resistor, and the JUNCTION PANEL as shown in A, figure 75.

(2) Connect the signal generator, resistors R1 through R3, attenuator, transformer T108, carrier test cable assembly, and 301- and 1,300-ohm resistors as shown in C, figure 75.

b. Order Wire Transmitting Circuit Test.

(1) Set the attenuator for a 0-db loss and adjust the signal generator for an output frequency of 3 kc at an output level of .775 volt measured across terminals L and M of the carrier test cable assembly.

(2) Arrange the voltmeter to measure .25 volt. Connect the voltmeter to terminals 1 and 2 of the junction panel test cable assembly (A, fig. 75). The voltmeter should indicate .25 ±.05 volt.

c. Order Wire Receiving Circuit Test.

(1) Connect the signal generator, resistors R1 through R3, attenuator, and transformer T107 to terminals 3 and 4 of the junction panel test cable assembly (A, fig. 75). Adjust the output level of the signal generator to .185 volt measured across terminals 3 or 4 and G (ground).

(2) Adjust the voltmeter to measure .57 volt. Connect the voltmeter across terminals F and S of the carrier test cable assembly (B, fig. 75) with terminal S as ground. The voltmeter should indicate .57 ±.07 volt.

115. Miscellaneous Continuity Tests

a. Use the chart in *b*(3) below to check the continuity of the circuits not checked when

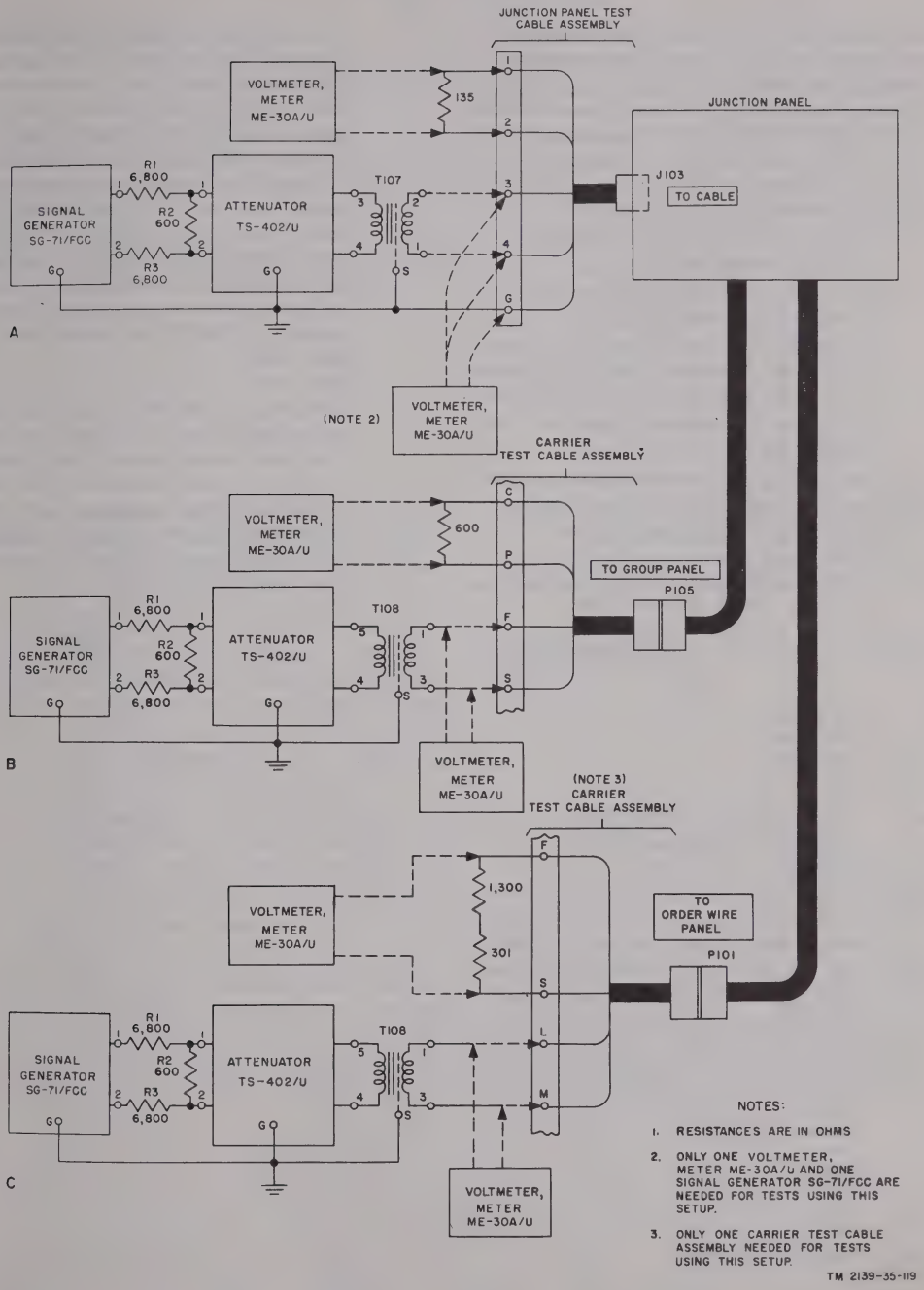


Figure 75. JUNCTION PANEL, operational test setup.

performing the carrier and order wire circuit tests (pars. 113 and 114). The procedure for checking the 200-volt distribution circuit is covered in *c* below. To make the continuity tests, connect the test cable assemblies to the JUNCTION PANEL as indicated in (1) through (4) below. Refer to the JUNCTION PANEL schematic diagram (fig. 18).

(1) Connect the supply test cable assembly to connector J101.

(2) Connect the connector test cable assembly to connector J102.

(3) Connect the carrier test cable assemblies to connector P101, P102, P104, or P105, as required during the tests.

(4) Connect the carrier supply test cable assembly to connector P103.

b. The chart in (3) below outlines the continuity measurements. Use the multimeter to make these measurements as follows:

(1) Measure the resistance between all the terminals in a horizontal row. The multimeter should read zero resistance. An asterisk in the ground column indicates that a measurement must also be made between the terminals and chassis ground. The multimeter should read zero resistance.

(2) Measure the resistance, where applicable, between the *a* and *b* lead for each test. The multimeter should read infinite resistance for measurement except for test No. 14, K and W of the carrier test cable assembly connected to P104, which should indicate 135 ohms.

(3) Measure the resistance between the terminals of one test number and the terminals of the other test numbers. The multimeter should read infinite resistance except in cases where both terminals being measured are connected to chassis ground. Ground connections are indicated by an asterisk in the *ground* column.

Test No.	Circuit	Supply test cable assembly (J101)	Connector test cable assembly (J102)	Carrier test cable assemblies				Carrier supply test cable assembly (P103)	Ground
				(P101)	(P102)	(P104)	(P105)		
1*a*	Filament	L			B				
b	Ground	B			N				(*)
2*a*	Filament	P					B		
b	Ground	F					N		(*)
3	Ground	R							(*)
4*a*	Filament	M		B				M and C.	
b	Filament	N		N				N and D.	
5*a*	Filament	J				B	H	P and E.	
b	Ground	E							(*)
6*a*	−10	D		A					
b	Ground	H							(*)
7*a*	600 V meas		D		A				
b	Ground		C						(*)
8*a*	Mod talk			C		C			
b	Mod talk			P		P			
9*a*	Dem talk			D		D			
b	Dem talk			R		R			
10	Ground			E					(*)
11*a*	1 KC			K	C				
b	1 KC			W	P				
12*a*	Meas				U	U			
b	Meas				H	H			
13*a*	Send				S	S			
b	Send				F	F			
14*a*	Pilot				K		K	H	
b	Pilot				W		W	J	
15*a*	Ground				J and E.				(*)
16	Shield				E. T	T			

Test No.	Circuit	Supply test cable assembly (J101)	Connector test cable assembly (J102)	Carrier test cable assemblies				Carrier supply test cable assembly (P103)	Ground
				(P101)	(P102)	(P104)	(P105)		
17*a*	65 KC				D		D		
b	65 KC				R		R		
18*a*	Buzzer						U	B	
b	Ground							F	(*)
19	Ground							F	(*)
20*a*	60–108 KC TR					A	A		
b	60–108 KC TR					L	L		
21	Shield					M	M		
22	Ground					J, N and E.			(*)
23	Ground						J, T and E.		(*)

c. Use the following procedure to check the 200-volt circuit in the JUNCTION PANEL.

(1) Connect the supply test cable assembly to connector J101.

(2) Connect a carrier test cable assembly to connector P101.

(3) Connect the multimeter between terminal A of the supply test cable assembly and terminal V of the carrier test cable assembly. The multimeter should read zero resistance.

(4) Repeat (1) through (3) above with the carrier test cable assembly connected to P102, P104, and P105. The multimeter should read zero resistance for each test.

(5) Connect the multimeter between terminal K of the supply test cable assembly and chassis ground. The multimeter should read zero resistance.

(6) Connect the multimeter between terminals A and K of the supply test cable assembly. The multimeter should read infinite resistance.

116. JUNCTION PANEL, Dc Resistance of Transformers

Transformers	Terminals	Resistance (ohms)
T101 and T102	1–2	2.27
	3–4	2.27
	5–6	11.1
	7–8	11.1

117. JUNCTION PANEL Troubleshooting Chart

The chart below is supplied as an aid in locating trouble in the JUNCTION PANEL. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). Once the trouble has been localized to a defective circuit, continuity and resisistance measurements of the circuit should ordinarily be sufficient to isolate the defective part.

Symptom	Probable trouble	Corrective measures
1. Short circuit or open circuit through distribution paths.	Failure of circuit in distribution path.	Check for open or short circuit to localize faulty distribution path.
2. Improper 37-kc test signal level at terminals 1 and 2 of junction panel test cable assembly.	Failure in circuit between terminals F and S of connector P105 and spiral-four connector J103 female terminals.	Use signal substitution procedures (par. 118, tests No. 1 through 3) to localize trouble.
3. Improper 37-kc test signal level at terminals 3 and 4 of junction panel test cable assembly.	Failure in circuit between spiral-four connector J103 male terminals and terminals C and P of connector P105.	Use signal substitution procedures (par. 118, tests No. 4 through 8) to localize trouble.
4. Improper 3-kc test signal level at terminals 1 and 2 of junction panel test cable assembly.	Failure in circuit between terminals L and M of connector P101 and spiral-four connector J103 female terminals.	Use signal substitution procedures (par. 118, tests No. 9 through 11) to localize trouble.
5. Improper 3-kc test signal level at terminals 3 and 4 of junction panel test cable assembly.	Failure in circuit between spiral-four connector J103 male terminals and terminals F and S of connector P101.	Use signal substitution procedures (par. 118, tests No. 12 through 14) to localize trouble.

118. JUNCTION PANEL Signal Substitution Chart

Use the signal substitution chart below to supplement the troubleshooting chart outlined in paragraph 117. This chart will help to determine the defective circuit in the JUNCTION PANEL. Continuity and resistance measurements should then be sufficient to isolate the defective part. Follow the signal substitution procedures in the order given. For location of parts on the JUNCTION PANEL, refer to figures 76 and 77. These tests are set up in the same manner as the operational tests (pars. 113 and 114).

Test No.	For SG,71/FCC hookup in circuit see par.	Voltmeter connections		Meter indication	Corrective measures
		Positive probe	Negative probe		
1	113*b*	Terminal 5 of filter FL101.	Ground	.775	Check circuit from terminals F and S of connector P105 to filter FL101.
2	113*b*	Terminal 1 of filter FL101.	Ground	.83	*a.* Check protector E101. *b.* Check filter FL101.
3	113*b*	Terminal 1 of the junction panel test cable assembly.	Terminal 2 of the junction panel test cable assembly.	.34	*a.* Check circuit from filter FL101 to connector J103. *b.* Check protector E103. *c.* Check transformer T101.
4	113*c*	Terminal 1 of transformer T102.	Ground	.185	Check circuit from connector J103 to transformer T102.
5	113*c*	Terminal 4 of transformer T102.	Ground	.185	Check circuit from connector J103 to transformer T102.
6	113*c*	Terminal 1 of filter FL102.	Ground	.72	*a.* Check circuit from transformer T102 to filter FL102. *b.* Check protector E102.
7	113*c*	Terminal 5 of filter FL102.	Ground	.7	Check filter FL102.
8	113*c*	Terminal C of the carrier test cable assembly.	Terminal P of the carrier test cable assembly.	.7	Check circuit from filter FL102 to terminals C and P of connector P105.
9	114*b*	Terminal 3 of filter FL101.	Ground	.755	Check circuit from terminals M and L of plug 101 to filter FL101.

Test No.	For SG-71/FCC hookup in circuit see par.	Voltmeter connections		Meter indication	Corrective measures
		Positive probe	Negative probe		
10	114*b*	Terminal 1 of filter FL101.	Ground	.58	*a.* Check protector E101. *b.* Check filter FL101.
11	114*b*	Terminal 1 of the junction panel test cable assembly.	Terminal 2 of the junction panel test cable assembly.	.25	*a.* Check circuit from filter FL101 to connector J103. *b.* Check protector E103. *c.* Check transformer T101.
12	114*c*	Terminal 1 of transformer T102.	Ground	.185	Check circuit from connector J103 to transformer T102.
13	114*c*	Terminal 4 of transformer T102.	Ground	.185	Check circuit from connector J103 to transformer T102.
14	114*c*	Terminal 1 of filter FL102.	Ground	.78	*a.* Check filter from transformer T102 to filter FL102. *b.* Check protector E102.
15	114*c*	Terminal 3 of filter FL102.	Ground	.84	Check filter FL102.
16	114*c*	Terminal F of the carrier test cable assembly.	Terminal S of the carrier test assembly.	.57	Check circuit from filter FL102 to connector P105.

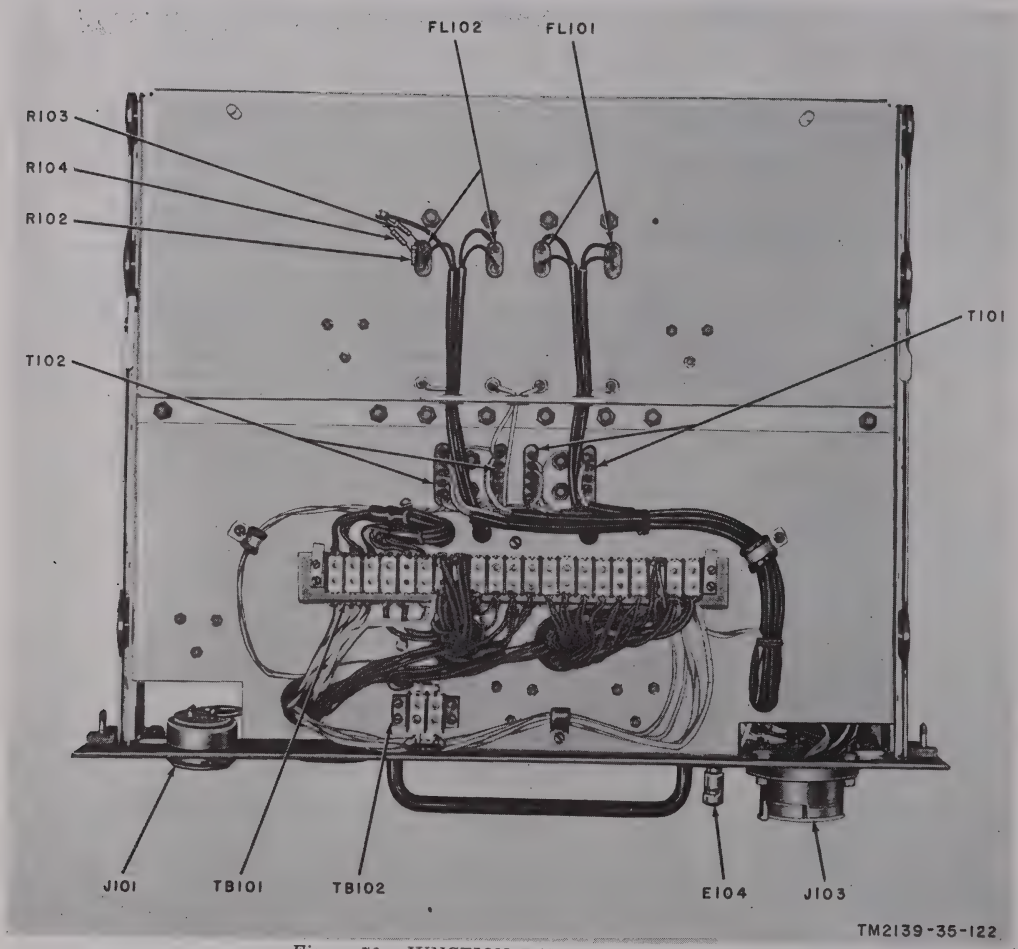


Figure 76. JUNCTION PANEL, bottom view.

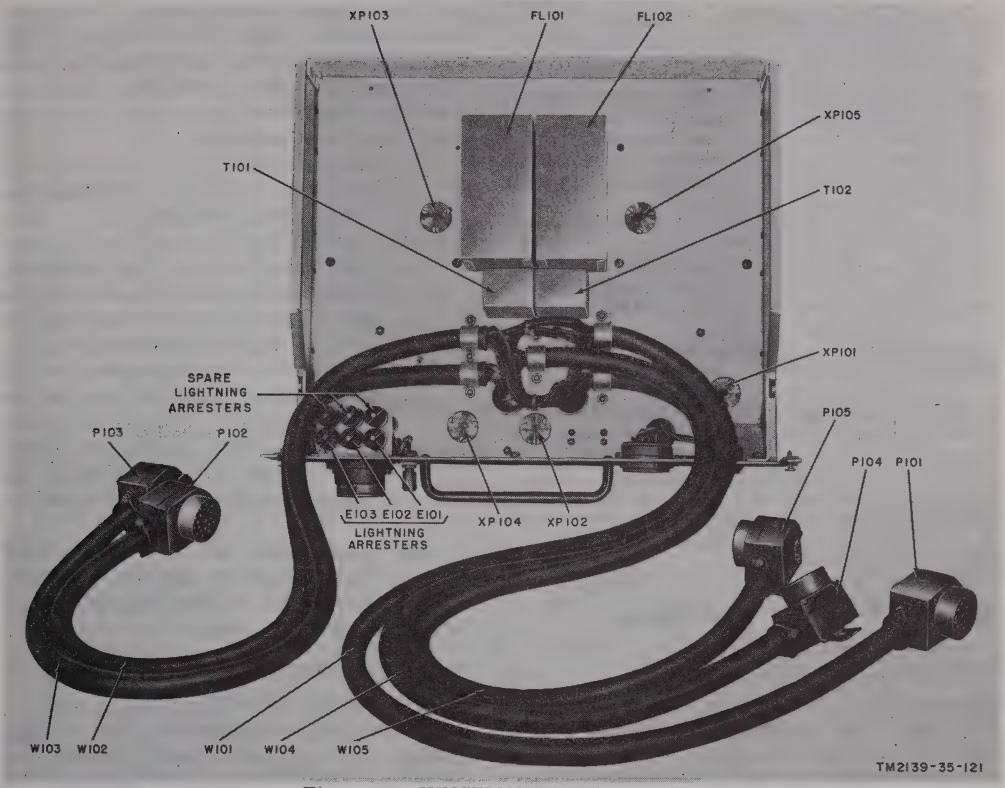


Figure 77. JUNCTION PANEL, top view.

Section VI. TELEPHONE TEST SET TS–760/TCC–7 (PART OF RECEIVER-TRANSMITTER TEST SET GROUP OA–443/TCC–7)

119. TEST PANEL Troubleshooting Data

Fig. No.	Par. No.	Description
29		Telephone Test Set TS–760/TCC–7, schematic diagram.
79		Switch S2, wiring diagram.
80		Switch S3, wiring diagram.
81		Switch S4, wiring diagram.
82		Switch S5, wiring diagram.
83		Switch S6, wiring diagram.
30		IF amplifier AR1, schematic diagram.
31		Flat amplifier AR2, schematic diagram.
(TM 11–2139–20, fig. 7).		Telephone Test Set TS–760/TCC–7, tube socket voltage and resistance diagram.
(TM 11–2139–20, fig. 8).		IF amplifier AR1, tube socket voltage and resistance diagram.
(TM 11–2139–20, fig. 9).		Flat amplifier AR2, tube socket voltage and resistance diagram.
84		Telephone Test Set TS–760/TCC–7, covers removed, top view.
(TM 11–2139–20, fig. 3).		Telephone Test Set TS–760/TCC–7, plug-in assemblies removed but shown, top view.

Fig. No.	Par. No.	Description
85		Telephone Test Set TS-760/TCC-7, cover removed, bottom view.
87		IF amplifier AR1 and flat amplifier AR22 top view.
88		Flat amplifier AR2, bottom view.
89		Flat amplifier AR2, side view.
155		Telephone Test Set TS-760/TCC-7, wiring diagram.
156		IF amplifier AR1, wiring diagram.
157		Flat amplifier AR2, wiring diagram.
	134*a*	Telephone Test Set TS-760/TCC-7, dc resistance of transformers and coils, main chassis.
	134*b*	IF amplifier AR1, dc resistance of coil.
	134*c*	Flat amplifier AR2, dc resistance of coil.

120. TEST PANEL Test Setup Procedures

Follow the procedures given below to prepare the TEST PANEL for troubleshooting.

a. Test Cable Assembly Connections. Connect the resistors, test cable assemblies, 200 VOLT POWER SUPPLY, and TEST PANEL as shown in figure 78.

b. Test Signal Source Connections. Connect the signal generator, resistors R1 through R3, attenuator, transformer T107, and the 135-ohm resistor to terminals T and R of the test jack assembly as shown in figure 78.

c. Test Lead Connections. Connect test leads A and B to the test plug assembly as shown in figure 78.

d. Test Signal Requirements. Adjust the output frequency and the output level of the signal generator to the limits specified in the troubleshooting chart (par. 122). Follow the procedure given below when adjusting the output of the signal generator.

(1) Disconnect the TEST PANEL measure plug or test plug assembly from the test jack assembly.

(2) Connect the frequency meter across the input leads of the attenuator. Adjust the output frequency of the signal generator to the frequency specified in the troubleshooting chart.

(3) Connect the voltmeter across the 135-ohm resistor connected to the test jack assembly. Set the attenuator for a 0-db loss. Adjust the output level of the signal generator to the voltage specified in the troubleshooting chart.

(4) Connect the test jack to the TEST PANEL circuits and set the attenuator to the loss specified in the troubleshooting chart.

121. TEST PANEL Troubleshooting Chart, General

The following troubleshooting charts (pars. 122–124) are supplied to aid in locating trouble in the TEST PANEL flat amplifier AR2, and IF amplifier AR1. The charts list the symptoms which the repairman may observe while performing the tests listed in the *test* column. A tube check and voltage and resistance measurements at the defective stage or circuit will usually isolate the defective part. Normal tube socket voltage and resistance measurements appear in TM 11-2139-20, figures 7 through 9.

Figure 78. TEST PANEL, operational and final test setup.

(Contained in separate envelope)

122. TEST PANEL Troubleshooting Chart

Test	Symptom	Probable trouble	Corrective measures
1. Operate MEASURE switch to 200 VOLTS and observe TEST PANEL meter indication (normal indication between −.5 db and +.5 db).	TEST PANEL meter M1 gives no indication.	*a.* Open circuit in 200-volt wiring.	*a.* Check for 200 volts between terminal 2, section 2, of MEASURE switch S1 and chassis ground (fig. 29). If no reading is obtained, check wiring.

Test	Symptom	Probable trouble	Corrective measures
		b. MEASURE switch defective.	*b.* Check for 200 volts between terminal 11, section 2, and terminal 11, section 1, of MEASURE switch S1. If 200-volt reading is not obtained, check the MEASURE switch.
		c. Resistor R11 or R12 defective.	*c.* Check resistors R11 and R12 with an ohmmeter. Replace defective parts.
		d. Meter M1 defective	*d.* Check meter M1 by substituting meter known to be good; replace if defective.
2. Operate MEASURE switch to 200 VOLTS and observe TEST PANEL meter indication (normal indication between −.5 db and +.5 db).	TEST PANEL meter gives an indication below −.5-db or above +.5-db scale markings.	*a.* Resistor R11 or R12 defective.	*a.* Check resistors R11 and R12. Replace if defective.
		b. Meter M1 defective.	*b.* Check meter M1 by substituting meter known to be good; replace if defective.
3. Operate MEASURE switch to 600 VOLTS. Check to see that no voltage is applied to terminal A of power test cable assembly (fig. 78). Observe TEST PANEL meter indication. (No indication should be observed.)	TEST PANEL meter gives an indication with no voltage applied to terminal A of TO JUNCTION PANEL connector J2.	MEASURE switch defective.	Check for short circuit between terminals 2 and 4, section 2, of MEASURE switch S1. If short circuit exists, replace the switch.
4*a*. Operate MEASURE switch to 200 VOLTS and observe TEST PANEL meter indication (normal indication between −.5 db and +.5 db).	TEST PANEL meter M1 indicates between −.5-db and +.5-db scale markings for test *a*, but TEST PANEL meter gives no indication for test *b*.	*a.* Open circuit between terminal A of TO JUNCTION PANEL connector J2 and MEASURE switch.	*a.* Check for 200 volts between terminal 4, section 2, of MEASURE switch S1 and ground. If 200-volt reading is not obtained, check wiring from terminal A of connector J2 and the switch.
b. Operate MEASURE switch to 600 VOLTS. Connect clip lead from terminal A to terminal V of power test cable assembly (fig. 78). Observe TEST PANEL meter indication (normal indication between −.5 db and +.5 db). Remove clip leads.	----------	*b.* MEASURE switch defective.	*b.* See correction 1*b*.
5. Operate MEASURE switch to TRANSMISSION. Operate MEASURE SELECTIVE switch to OFF. Operate MEASURE NONSELECTIVE switch to CHECK 1 KC CHECK HF.	TEST PANEL meter indicates an output with no test input.	Flat amplifier AR2 oscillating.	Use troubleshooting chart (par. 123) to check flat amplifier AR2.

Test	Symptom	Probable trouble	Corrective measures
Make no connection to measure plug. Observe TEST PANEL meter indication. (No indication should be observed.)			
6. Operate MEASURE switch to TRANSMISSION. Operate MEASURE NONSELECTIVE switch to OFF. Operate MEASURE SELECTIVE switch to any position. Make no connection to measure plug. Observe TEST PANEL meter indication. (No meter indication should be observed.)	TEST PANEL meter indicates an output with no test input. The indication is not present when CARR OSC tube V2 is removed from its socket.	*a.* Shields missing or loose. *b.* Defect in carrier oscillator circuit. *c.* Defect in varistor CR1, filter FL2, or filter FL3.	*a.* Check to see that all shields are present and tightly connected. Check to see that IF amplifier AR1 and flat amplifier AR2 are securely in place. *b.* Use signal substitution test (par. 127) to isolate faulty part. *c.* Check varistor CR1 and filters FL2 and FL3 one at a time, rechecking each time for the trouble symptom. Replace defective part.
7*a.* Same as test 5 *b.* Same as test 6	*a.* Indication for test 5 normal. *b.* Abnormal indication for test 6 persists after removal of CARR OSC tube V2.	IF amplifier AR1 oscillating.	Use troubleshooting chart (par. 124) to check IF amplifier AR1.
8. Operate MEASURE switch to TRANSMISSION. Operate MEASURE SELECTIVE switch to OFF. Operate MEASURE NONSELECTIVE switch to CHECK 1 KC CHECK HF. Operate SEND switch to CHECK GAIN CHECK HF. *a.* Insert measure plug into CHECK HF jack. Operate HF control to obtain 0-db indication on TEST PANEL meter. *b.* Insert measure plug into CHECK 1 KC jack. Operate 1 KC control to obtain 0-db indication on TEST PANEL meter.	Inability to adjust HF control for 0-db indication on TEST PANEL meter for test *a*, and inability to adjust 1 KC control for 0-db indication on TEST PANEL meter for test *b*. If either part of test indicates normal operation, and other part indicates trouble, refer to tests 16 and 17.	Defect in rectifier circuit V3.	Use signal substitution procedures (par. 126) to localize trouble and to find the defective part. Replace defective part.
9. Same as test 8*a*. Measure the ac voltage across terminals R and D (ground) of transmission test cable assembly (fig. 78). (Normal indication should be between .049 and .062 volt.)	The HF control can be adjusted to obtain 0-db indication on TEST PANEL meter, but voltage measured is less than .049 volt or greater than .062 volt.	Defect between TO TS-712/TCC-11 TEST SET connector J5 and CHECK HF jack J6.	Check resistors R45, R46, and R80 and wiring to terminal R of connector J5. Replace defective part.

Test	Symptom	Probable trouble	Corrective measures
10. Measure the resistance between terminals D and L and between D and A of transmission test cable assembly (fig. 78). (Normal indication should be between 612 and 748 ohms.)	Resistance measured is less than 612 ohms or greater than 748 ohms.	Resistor R24 defective.	Check resistor R24 and replace if defective.
11. Adjust frequency and output of test jack (par. 120, fig. 78) to 68 kc and .775 volt. Set the attenuator for 46-db loss. Operate the controls as outlined in test 8. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±.5 db).	TEST PANEL meter indicates less than −.5 db or more than +.5 db.	Defect in rectifier V3 circuit.	Use signal substitution procedures (par. 126) to localize trouble and to locate the defective part. Replace the defective part.
12. If test 11 is satisfactory (TEST PANEL meter indicates between −.5 and +.5 db), adjust the output of the signal generator to obtain a 0-db indication on the TEST PANEL meter. Check the attenuator loss to 41 db. Operate the 5db push button of the ATTENUATOR switch. Observe TEST PANEL meter indication (normal indication, 0 db ±.5 db).	TEST PANEL meter indicates less than −.5 db or more than +.5 db.	Defect in 5db section of ATTENUATOR switch.	Check resistors R25 through R27, wiring, and ATTENUATOR switch S2 (fig. 79). Replace defective part (par. 165).
13. If test 12 is satisfactory, change the attenuator loss to 36 db. Operate the 10db push button of the ATTENUATOR switch. Observe TEST PANEL meter indication (normal indication, 0 db ±.5 db).	TEST PANEL meter indicates less than −.5 or more than +.5 db	Defect in 10db section of ATTENUATOR switch.	Check resistors R28 through R30, wiring, and ATTENUATOR switch S2 (fig. 79). Replace defective part (par. 165).
14. If test 13 is satisfactory, change the attenuator loss to 26 db. Operate the 20db push button of the ATTENUATOR switch. Observe TEST PANEL meter indication (normal indication, 0 db ±.5 db).	TEST PANEL meter indicates less than −.5 db or more than +.5 db.	Defect in 20db section of ATTENUATOR switch.	Check resistors R31 through R33, wiring, and ATTENUATOR switch S2 (fig. 79). Replace defective part (par. 165).

Test	Symptom	Probable trouble	Corrective measures
15. If test 11 is satisfactory (TEST PANEL meter indicates between −.5 and +.5 db), set the attenuator for 46-db loss. Adjust the output of the signal generator to obtain a 0-db indication on the TEST PANEL meter. Change the attenuator loss to the values indicated below. The TEST PANEL meter indication should be within the limits specified.	TEST PANEL meter indication is outside the limits given in the *Test* column.	*a.* Defective rectifier V3 circuit.	*a.* Check tube V3 and make tube-socket voltage and resistance measurements. Check resistors R22 and R23 and capacitors C16 and C18.
		b. Defective TEST PANEL meter M1.	*b.* Check meter M1 by substituting a meter known to be good; replace if defective.
16. Same as test 8	The HF control can be adjusted to obtain a 0-db indication on TEST PANEL meter, but the 1 KC control cannot be adjusted to obtain a 0-db indication.	Defect in 1-kc oscillator circuit.	Use signal substitution procedures (par. 131) to localize trouble and to find defective part. Replace the defective part.
17. Same as test 8	The 1 KC control can be adjusted to obtain a 0-db indication on TEST PANEL meter, but HF control cannot be adjusted to obtain a 0-db indication.	Defect in hf oscillator circuit.	Use signal substitution procedures (par. 132) to localize trouble and to find defective part. Replace the defective part.
18. Adjust the HF control as outlined in test 8. Adjust frequency and output at test jack (par. 120), to 1 kc and .870 volt. Set the attenuator for 0-db loss. Operate MEASURE switch to TRANSMISSION.	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2 of MEASURE NONSELECTIVE switch in CHANNEL OUT position.	Check resistors R58 and R95 and continuity through MEASURE NONSELECTIVE switch S4 (fig. 81). Replace defective part (par. 165).

ATTENUATOR setting (*db*)	*Meter reading limits* (*db*)
39	+7±.5
40	+6±.5
41	+5±.5
42	+4±.5
43	+3±.5
44	+2±.5
45	+1±.5
46	0
47	−1±.5
48	−2±.5
49	−3±.6
50	−4±.7
51	−5±.8
52	−6±.9
53	−7±1.0

Test	Symptom	Probable trouble	Corrective measures
Operate MEASURE SELECTIVE switch to OFF. Operate MEASURE NON-SELECTIVE switch to CHANNEL OUT. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).			
19. Adjust the HF control as outlined in test 8. Adjust frequency and output at test jack (par. 120, fig. 78) to 10 kc and .775 volt. Set the attenuator for 39-db loss. Operate TEST PANEL controls as in test 18, except operate MEASURE NON-SELECTIVE switch to SUB GRP MOD IN. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2, of MEASURE NON-SELECTIVE switch in SUB GRP MOD IN position.	Check resistors R60 through R62, filter FL4, and continuity through MEASURE NON-SELECTIVE switch S4. Replace defective part (par. 165).
20. Adjust the HF control as outlined in test 8. Adjust frequency and output at test jack (par. 120, fig. 78) to 68 kc and .731 volt. Set the attenuator for 11-db loss. Operate TEST PANEL controls as in test 18, except operate MEASURE NON-SELECTIVE switch to GRP DEM OUT. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2, of MEASURE NON-SELECTIVE switch in GRP DEM OUT position.	Check resistors R63 and R64 and continuity through MEASURE NON-SELECTIVE switch S4. Replace defective part (par. 165).
21. Adjust frequency and output at test jack (par. 120) to 68 kc and .775 volt. Set the attenuator for 0-db loss.	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2 of MEASURE NON-SELECTIVE switch in SUB GRP DEM OUT position.	Check resistors R85 and R86 and continuity through MEASURE NON-SELECTIVE switch S4. Replace defective part (par. 165).

Test	Symptom	Probable trouble	Corrective measures
Operate TEST PANEL controls as in test 18, except operate MEASURE NON-SELECTIVE switch to SUB GRP DEM OUT. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).			
22. Adjust frequency and output at test jack (par. 120) to 1 kc and .699 volt. Set the attenuator for 13-db loss. Operate TEST PANEL controls as outlined in test 18. Operate MEASURE NON-SELECTIVE switch to OW TR AMP OUT. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2, of MEASURE NON-SELECTIVE switch in OW TR AMP OUT position.	Check resistors R65 and R66 and continuity through MEASURE NON-SELECTIVE switch S4 (fig. 81). Replace defective part (par. 165).
23. Adjust frequency and output at test jack (par. 120), to 1 kc and .757 volt. Set the attenuator for 46-db loss. Operate TEST PANEL controls as outlined in test 18. Operate MEASURE NON-SELECTIVE switch to OW REC AMP. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2 of MEASURE NON-SELECTIVE switch in OW REC AMP position.	Check continuity through MEASURE NON-SELECTIVE switch S4. Replace defective part (par. 165).
24. Adjust frequency and output at test jack (par. 120, fig. 78) to 68 kc and .749 volt. Set the attenuator for 0-db loss. Operate TEST PANEL controls as outlined in test 18. Operate MEASURE NON-SELECTIVE switch to CARR SUPPLY.	TEST PANEL meter indication other than 0 db ±1 db.	Defect between terminal 12, section 1, and terminal 12, section 2, of MEASURE NON-SELECTIVE switch in CARR SUPPLY position.	Check resistors R67 and R68 and continuity through MEASURE NON-SELECTIVE switch S4. Replace defective part (par. 165).

Test	Symptom	Probable trouble	Corrective measures
Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±1 db).			
25. Adjust frequency and output at test jack (par. 120) to 83 kc and .707 volt. Set the attenuator for 41-db loss. Operate TEST PANEL controls as outlined in test 18. Operate MEASURE NON-SELECTIVE switch to FAULT TEST. Insert measure plug into test jack (fig. 78). Observe TEST PANEL meter indication (normal indication, 0 db ±2 db). Repeat the above test at frequencies of 91 kc and 99 kc and .707 volt.	TEST PANEL meter indication below −2 db or above +2 db.	Defect between terminal 12, section 1, and terminal 12, section 2, of MEASURE NON-SELECTIVE switch in FAULT TEST position.	Check filter FL5 and continuity through MEASURE NON-SELECTIVE switch S4. Replace defective part (par. 165).
26. If test 8*a* is satisfactory, operate MEASURE NON-SELECTIVE switch to OFF. Operate MEASURE SELECTIVE switch to CHECK GAIN. Operate COARSE TUNE and FINE TUNE controls to obtain a maximum indication on the TEST PANEL meter.	TEST PANEL meter gives no indication.	*a.* Hf oscillator off frequency.	*a.* Realine hf oscillator for CHECK GAIN CHECK HF position of SEND switch S5 (par. 167*e*). If unable to aline, check capacitors C23, C24, C49, C50, C51, and continuity through FAULT TEST switch S6 to terminal 3 of T5. Replace defective part (par. 165).
		b. Defect in carrier oscillator, input circuit, modulator, or IF amplifier circuit of selective measurement circuit detector.	*b.* Use signal substitution procedures (pars. 127 through 130) to localize the trouble and to isolate defective part. Replace defective part.
27. If test 26 is satisfactory, operate GAIN control, and AMP GAIN control of IF amplifier to obtain a 0-db indication on TEST PANEL meter.	TEST PANEL meter indication can be maximized by operation of COARSE TUNE and FINE TUNE controls, but the indication cannot be adjusted to 0 db by operation of the GAIN control and AMP GAIN control of IF amplifier.	Defect in carrier oscillator input circuit, modulator, or IF amplifier circuit of selective measurement circuit detector.	Use signal substitution procedures (pars. 127 through 130) to localize trouble and to isolate defective part. Replace defective part.

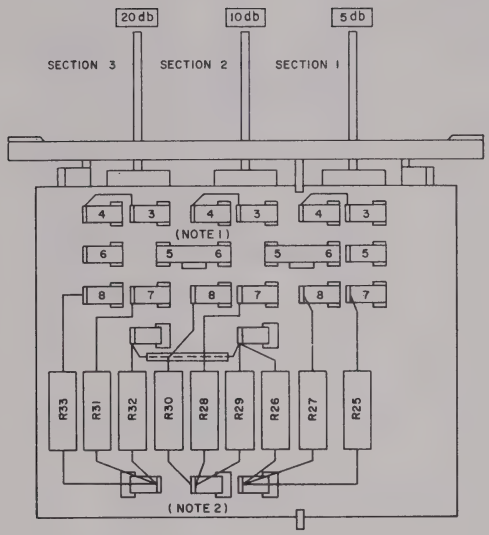
Test	Symptom	Probable trouble	Corrective measures
28. If test 27 is satisfactory, adjust frequency and output at test jack (par. 120, fig. 78) to 12 kc and .731 volt. Set the attenuator for 48-db loss. Operate MEASURE SELECTIVE switch to 12KC. Insert measure plug into test jack (fig. 78). Operate the COARSE TUNE and FINE TUNE controls to obtain a maximum indication on the TEST PANEL meter (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	*a.* Defect between terminal 1, section 3, and terminal 12, section 2, of MEASURE SELECTIVE switch. *b.* Defect in carrier oscillator circuit.	*a.* Check continuity through MEASURE SELECTIVE switch S3. Replace defective part (par. 165). *b.* Use signal substitution procedures (par. 127) to localize trouble and to isolate defective part. Replace defective part.
29. If test 27 is satisfactory, adjust frequency and output at test jack (par. 120, fig. 78) to 28 kc and .731 volt. Set the attenuator for 48-db loss. Insert measure plug into test jack (fig. 78). Operate MEASURE NON-SELECTIVE switch to OFF. Operate MEASURE SELECTIVE switch to 28KC. Operate the COARSE TUNE and FINE TUNE controls to obtain a maximum indication on the TEST PANEL meter (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 28KC position.	See corrective measures for test No. 28.
30. If test 27 is satisfactory, adjust frequency and output at test jack (par. 120), to 67 kc and .731 volt. Set the attenuator for 48-db loss. Insert measure plug into test jack. Operate TEST PANEL controls as outlined in test 29. Operate MEASURE SELECTIVE switch to 67KC (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 67KC position.	See corrective measure for test No. 28.

Test	Symptom	Probable trouble	Corrective measures
31. If test 27 is satisfactory, adjust frequency output at test jack (par. 120) to 83 kc and .731 volt. Set the attenuator for 48-db loss. Insert measure plug into test jack (fig. 78). Operate TEST PANEL controls as outlined in test 29. Operate MEASURE SELECTIVE switch to 83-KC (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 83KC position.	See corrective measure for test No. 28.
32. If test 27 is satisfactory, adjust frequency and output at test jack (par. 120) to 99 kc and .731 volt. Set the attenuator for 48-db loss. Insert measure plug into test jack (fig. 78). Operate TEST PANEL controls as outlined in test 29. Operate MEASURE SELECTIVE switch to 99-KC (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 99KC position.	See corrective measure for test No. 28.
33. If test 27 is satisfactory, adjust frequency and output at test jack (par. 120) to 68 kc and .731 volt. Set the attenuator for 38-db loss. Operate TEST PANEL controls as outlined in test 29. Operate MEASURE SELECTIVE switch to 68-KC (normal indication 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 68KC position.	See corrective measure for test No. 28, and check resistors R40 through R42. Replace if defective.
34. If test 27 is satisfactory, adjust frequency and output at test jack (par. 120) to 65 kc and .731 volt. Set the attenuator for 38-db loss. Insert measure plug into test jack (fig. 78). Operate TEST PANEL controls as outlined in test 29. Operate MEASURE SELECTIVE switch to 65-KC (normal indication 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 65KC position.	See corrective measure for test No. 28, and check resistors R40 through R42. Replace if defective.

Test	Symptom	Probable trouble	Corrective measures
35. If test 27 is satisfactory, adjust frequency output at test jack (par. 120) to 37 kc and .173 volt. Set the attenuator for 38-db loss. Insert measure plug into test jack (fig. 78). Operate TEST PANEL controls as in test 29. Operate MEASURE SELECTIVE switch to 37-KC (normal indication, 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Same as for test No. 28, except MEASURE SELECTIVE switch in 37KC position.	See corrective measure for test No. 28, and check resistors R40 through R42. Replace if defective.
36. If test 27 is satisfactory, adjust the frequency and output at the test jack to 62 kc ±100 cps and .775 volt (par. 120). Set the attenuator for 70-db loss. Insert the measure plug into the test jack. Operate MEASURE NON-SELECTIVE switch to GRP PANEL 62KC. Operate MEASURE SELECTIVE switch to GR PANEL 62KC. Operate the COARSE TUNE and FINE TUNE controls to obtain a maximum indication on the TEST PANEL meter (normal indication 0 db ±1 db).	TEST PANEL meter indication other than 0 db ±1 db.	Defect in selective circuit for 62-kc measurement.	Use signal substitution procedures (pars. 127 through 130) to localize trouble and to isolate defective part. Replace defective part.
37. If test 8*b* is satisfactory, connect the voltmeter from each of terminals C, F, P, and S of power test cable assembly (fig. 78), to chassis ground. Measure the voltage. (The voltage should be between 0.46 and 0.51 volt.)	The 1 KC control can be adjusted to obtain 0-db indication on TEST PANEL meter, but voltage measured is less than .46 volt or greater than .51 volt.	*a.* Defect in wiring between TO JUNCTION PANEL connector J2 terminals F and S and terminals E3 and E4. *b.* Defect between transformer T1 and CHECK 1 KC jack J1.	*a.* Check wiring. *b.* Check resistors R7 through R10, and R75. Replace defective part.
38. Measure the resistance between terminals H and U of power test cable assembly (fig. 78) and between tip and ring springs of CHANNEL OUT jack J7 (normal resistance between 594 ohms and 606 ohms).	Resistance measured is less than 594 ohms or greater than 606 ohms.	Defect between TO JUNCTION PANEL connector J2 and CHANNEL OUT jack J7.	Check wiring and resistor R73. Replace defective part.

Test	Symptom	Probable trouble	Corrective measures
39. If test 8*a* is satisfactory, measure the frequency connected between terminal 6, section 1, of SEND switch, and chassis ground. (Frequency should be 68 kc ±200 cps.)	The frequency is less than 67.8 kc or greater than 68.2 kc.	Hf oscillator out of alinement at 68 kc.	See corrective measure for test No. 26.
40. If test 39 is satisfactory, operate SEND switch to 65 KC TR OR FAULT TEST. Measure the frequency meter connected as in test 39. (Frequency should be 65 kc ±200 cps.)	The frequency measured with the SEND switch in 65 KC TR OR FAULT TEST position is less than 64.8 kc or greater than 65.2 kc.	Hf oscillator out of alinement at 65 kc.	Realine hf oscillator for 68 kc (par. 167*e*). If unable to aline at 65 kc, check capacitors C58 and C59 and continuity through section 2 of SEND switch S5 (fig. 82). Replace defective part (par. 165).
41. If test 40 is satisfactory, with same conditions as in test 40, operate REP 1 push button of FAULT TEST switch. (The frequency meter should indicate 99 kc ±400 cps.)	The frequency measured is less than 98.6 kc or greater than 99.4 kc.	Hf oscillator out of alinement at 99 kc.	Realine hf oscillator for 99 kc (par. 167*e*). If unable to aline, check capacitors C52 and C53 and continuity through FAULT TEST switch S6 (fig. 83). Replace defective part (par. 165).
42. If test No. 40 is satisfactory, with same conditions as in test 40, operate REP 2 push button of FAULT TEST switch. (Frequency meter should indicate 91 kc ±400 cps.)	The frequency measured is less than 90.6 kc or greater than 91.4 kc.	Hf oscillator out of alinement at 91 kc.	Realine hf oscillator for 91 kc (par. 167*e*). If unable to aline, check capacitors C54 and C55 and continuity through FAULT TEST switch S6 (fig. 83). Replace defective aprt (par. 165).
43. If test No. 40 is satisfactory, with same conditions as in test 40, operate REP 3 push button of FAULT TEST switch. (Frequency meter should indicate 83 kc ±400 cps.)	The frequency measured is less than 82.6 kc or greater than 83.4 kc.	Hf oscillator out of alinement at 83 kc.	Realine hf oscillator for 83 kc (par. 167*e*). If unable to aline, check capacitors C56 and C57 and continuity through FAULT TEST switch S6 (fig. 83). Replace defective part (par. 165).
44. If test No. 8*a* is satisfac- operate SEND switch to 65KC REC. Operate 65 KC REC control to the extreme clockwise position. Connect the voltmeter between terminals D and R (ground) of power test cable assembly (fig. 78). Measure the voltage (normal voltage should be between limits of 0.32 volt and 0.42 volt).	The voltage measured with 65 KC REC control operated for maximum voltage is less than 0.32 volt or greater than 0.42 volt.	Defect between terminal 6, section 1, of SEND switch and TO JUNCTION PANEL connector J2, terminal D.	Check resistors R37 and R81 and continuity through SEND switch S5. Replace defective part (par. 165).

Test	Symptom	Probable trouble	Corrective measures
45. With other conditions the same as in test No. 44, adjust 65 KEC REC control to obtain a voltage of 0.12 volt.	It is not possible to adjust the 65 KC REC control to obtain a voltage of .12 volt.	See probable trouble for test No. 44.	See corrective measure for test No. 44.
46. If test No. 8*a* is satisfactory, operate SEND switch to 65 KC TR OR FAULT TEST. Connect the voltmeter between terminals K and W (ground) of power test cable assembly (fig. 78). Measure the voltage. Slowly operate the 65 KC TR OR FAULT TEST control from the extreme clockwise to the extreme counterclockwise positions. (Voltage should increase from .005 volt to .009 volt.)	Operation of the 65 KC TR OR FAULT TEST control does not enable adjustment of voltage over the range from .005 volt to .009 volt.	Defect between terminal 6, section 1, of SEND switch and TO JUNCTION PANEL connector J2, terminal K.	Check resistors R48 through R51 and continuity through SEND switch S5. Replace defective part (par. 165).
47. Use the test arrangement of test No. 46. Operate 65 KC TR OR FAULT TEST control to obtain a voltage of .007 volt. Operate, in turn, the REP 1, REP 2, and REP 3 push buttons of the FAULT TEST switch. Note the voltage as each push button is operated. (Normal voltage should be between limits of .0042 volt and .0054 volt.)	The operation of any FAULT TEST switch push button causes the voltage to drop to less than .0042 volt or to more than .0054 volt.	Resistor R38 out of adjustment.	Adjust resistor R38 in accordance with alinement procedure (par. 167). If unable to adjust, check resistors R38 and R79 and continuity through FAULT TEST switch S6. Replace defective part (par. 165).



NOTES:

1. TERMINAL NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.
2. TERMINALS WITHOUT REFERENCE NUMBERS ARE USED AS TIE POINTS.

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Figure 79. ATTENUATOR switch S2 (part of TEST PANEL), circuit element location and wiring diagram.

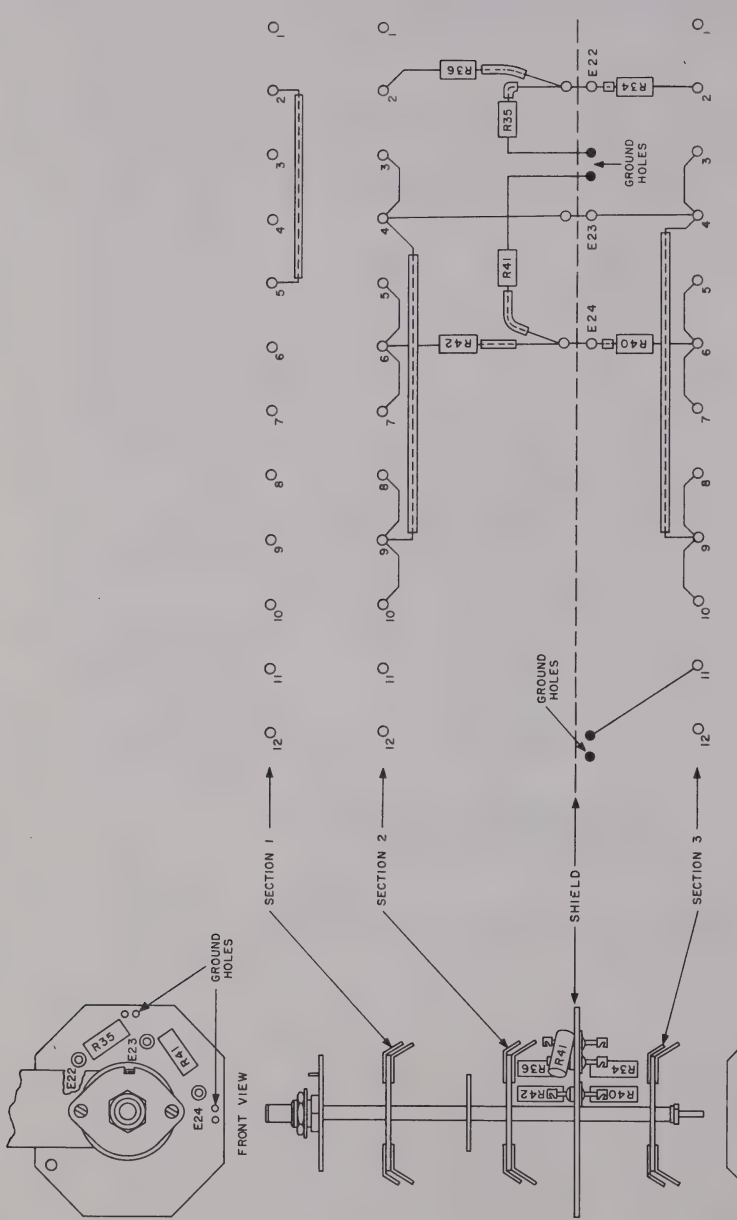
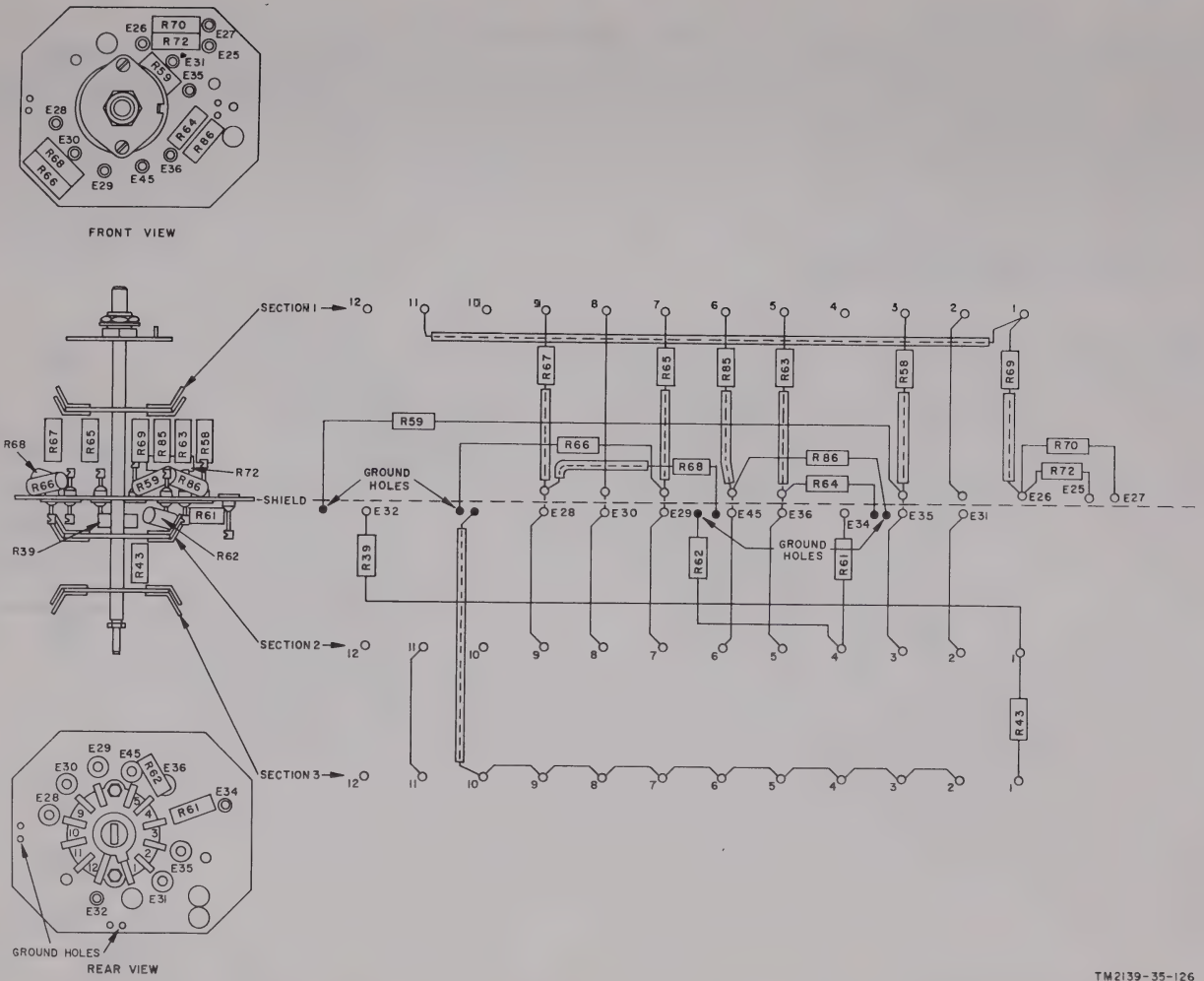


Figure 80. MEASURE SELECTIVE switch S3 (part of TEST PANEL), circuit element location and wiring diagram.



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Figure 81. MEASURE NON-SELECTIVE switch S4 (part of TEST PANEL), circuit element location and wiring diagram.

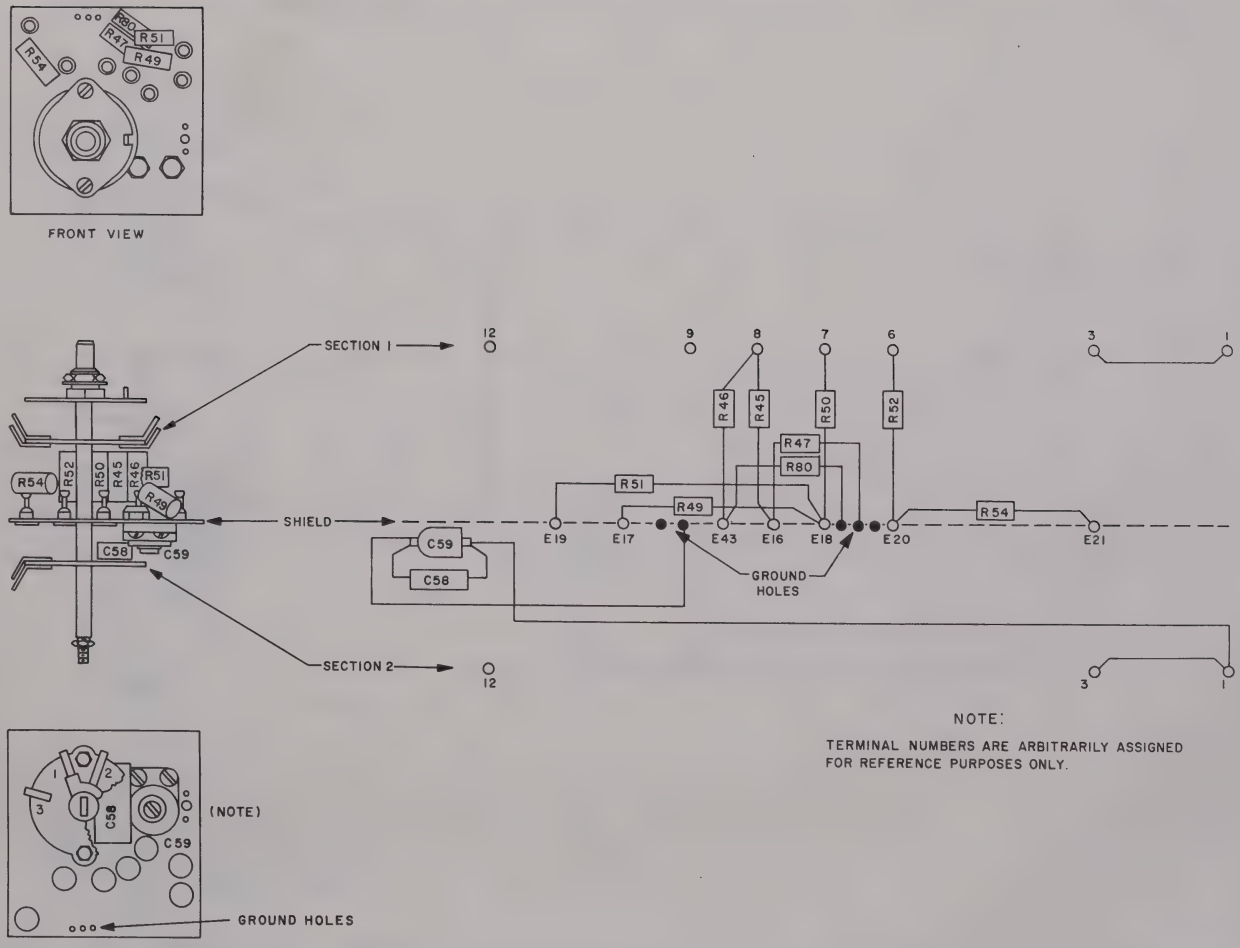
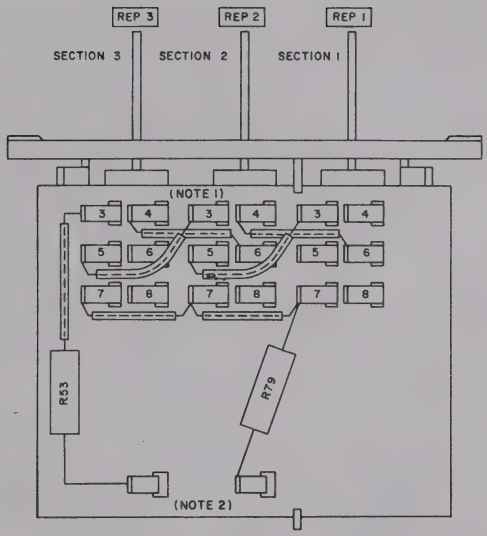


Figure 82. SEND switch S5 (part of TEST PANEL), circuit element location and wiring diagram.



NOTES

1. TERMINAL NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.
2. TERMINALS THAT DO NOT BEAR REFERENCE NUMBERS ARE USED AS TIE POINTS.

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Figure 83. FAULT TEST switch S6 (part of TEST PANEL), circuit element location and wiring diagram.

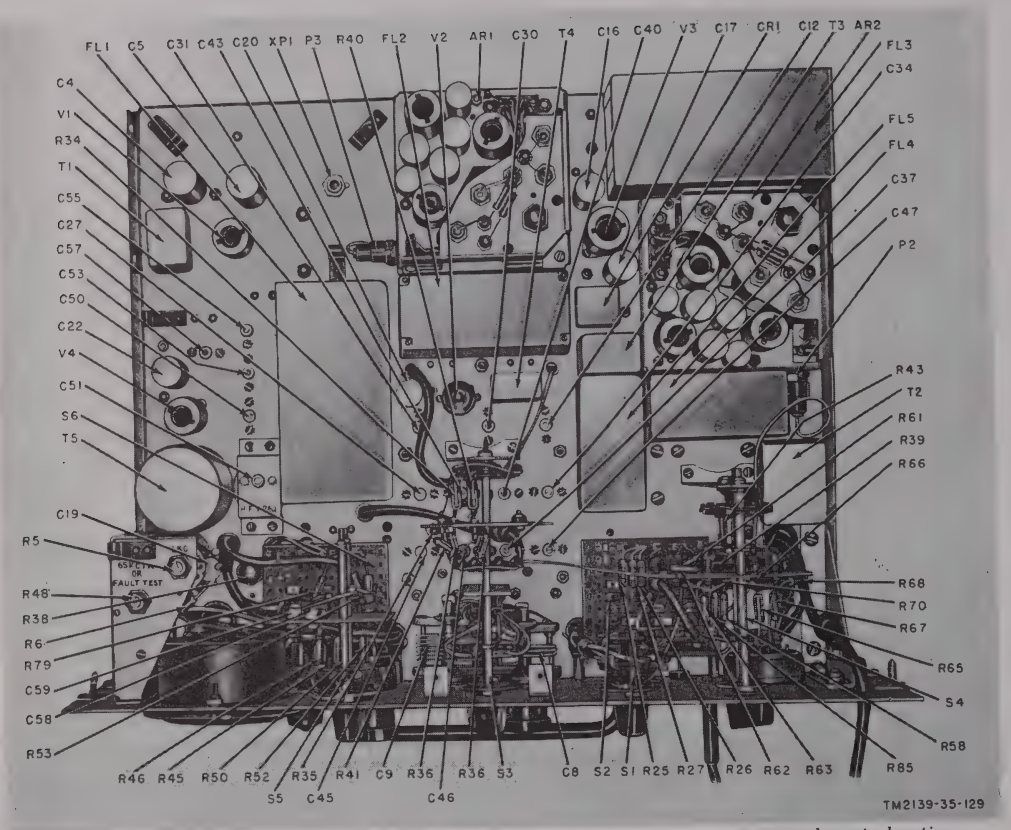


Figure 84. Telephone Test Set TS-760/TCC-7, top view of chassis, covers removed, parts location.

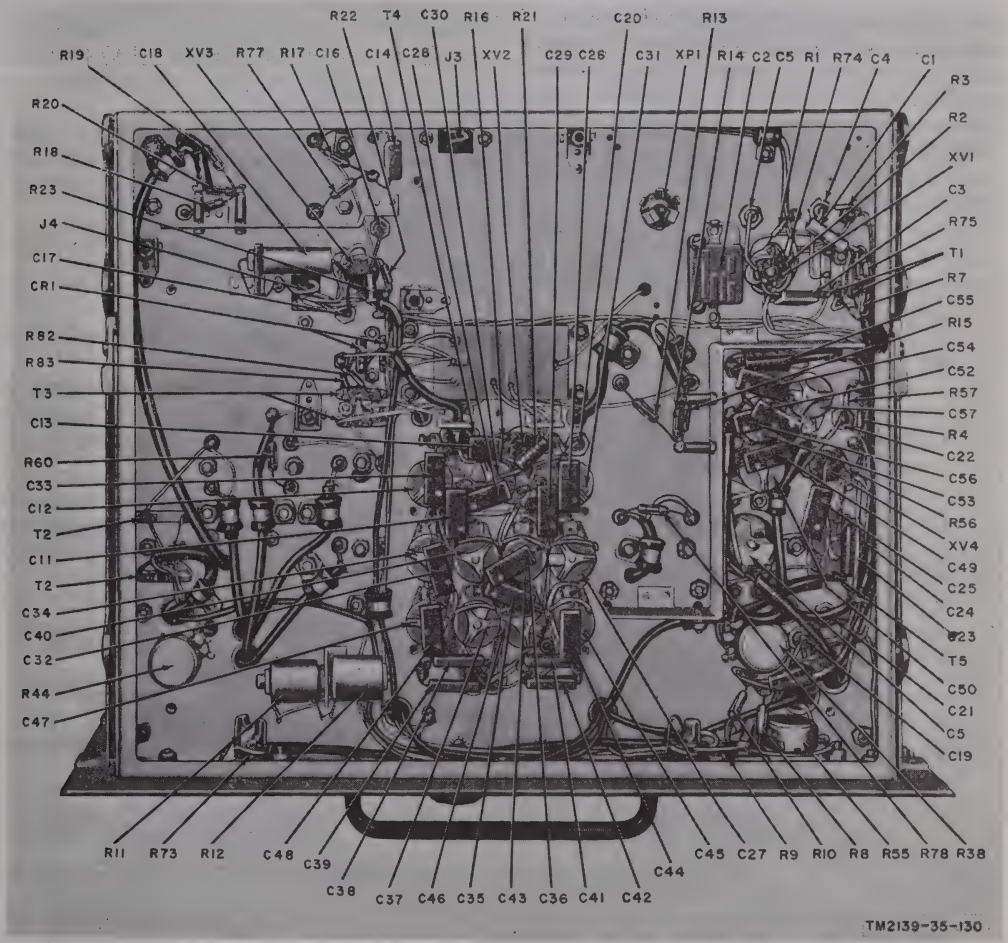


Figure 85. Telephone Test Set TS-760/TCC-7, bottom view of chassis, cover removed, parts location.

123. Flat Amplifier AR2 Troubleshooting Chart

a. The following troubleshooting chart is supplied to aid in locating trouble in flat amplifier AR2. The chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). A tube check and voltage and resistance measurements at the defective stage will usually isolate the defective part. Normal tube socket voltage and resistance measurements appear in TM 11–2139–20, figure 9.

b. If flat amplifier AR2 is part of a complete TEST PANEL, it may be tested in conjunction with the TEST PANEL (C, fig. 86). In this case, the following procedure should be followed to prepare the equipment for testing:

(1) Disconnect connector P2 from connector J1 of flat amplifier AR2.
(2) Loosen the two captive screws that hold the amplifier on the TEST PANEL chassis.
(3) Remove the amplifier from the chassis by lifting the amplifier straight up.
(4) Place the amplifier to the right of the TEST PANEL.
(5) Use the extension test cable assembly to connect connector J4 on the TEST PANEL to connector P1 on the amplifier.
(6) Connect power to the TEST PANEL as shown in figure 86.
(7) Operate the MEASURE switch to the TRANSMISSION position.

c. If flat amplifier AR2 is not part of a complete TEST PANEL and must be tested separately, connect the measuring set to connector P1 of the amplifier, and connect power as shown in B, figure 86.

d. Connect the signal generator, resistors R6 through R8, attenuator, transformer T107, 135-ohm resistor, and test plug and test jack assemblies as shown in A, figure 86.

e. Insert the test plug assembly into the test jack assembly.

f. Connect the GRD lead of the test plug assembly to the amplifier chassis.

g. Connect the test plug connector P675 to connector J1 on the amplifier.

h. Connect test lead B of the test plug assembly to terminal D of test plug connector P675 when an input is specified in the troubleshooting chart in *i* below.

Note. Before connecting a test signal input to flat amplifier AR2 as specified in the troubleshooting chart below, adjust the test signal as outlined in paragraph 120*d*.

Figure 86. Flat amplifier AR2 or IF amplifier AR1 (part of TEST PANEL), operational and final test setup.
(Contained in separate envelope)

Test	Symptom	Probable trouble	Corrective measures
1. No input connection.	With no input to connector J1, there is a meter indication.	*a.* Defective tube. *b.* Open bypass capacitors.	*a.* Check V1, V2, and V3, one at a time. *b.* Check C1, C2, C3, C5, C6, C7, C9, C10, C11, and C12. Replace defective parts.
2. Adjust the test signal for .775 volt at 68 kc. Set the attenuator for 49-db loss. Apply test signal to amplifier.	Meter reading is outside limit of 0 ±1 db and cannot be adjusted to 0 db by operation of control R17.	Defect in amplifier.	Use signal substitution procedures (par. 133) to localize the trouble and to find the faulty component.

124. IF Amplifier AR1 Troubleshooting Chart

a. The following troubleshooting chart is supplied to aid in locating trouble in IF amplifier AR1. The chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). A tube check and voltage and resistance measurements at the defective stage will usually isolate the defective part. Normal tube socket voltage and resistance measurements appear in TM 11–2139–20, figure 8.

b. If IF amplifier AR1 is part of a complete TEST PANEL, it may be tested in conjunction with the TEST PANEL (C, fig. 86). In this case, use the procedure given in paragraph 123*b* to prepare the equipment for testing.

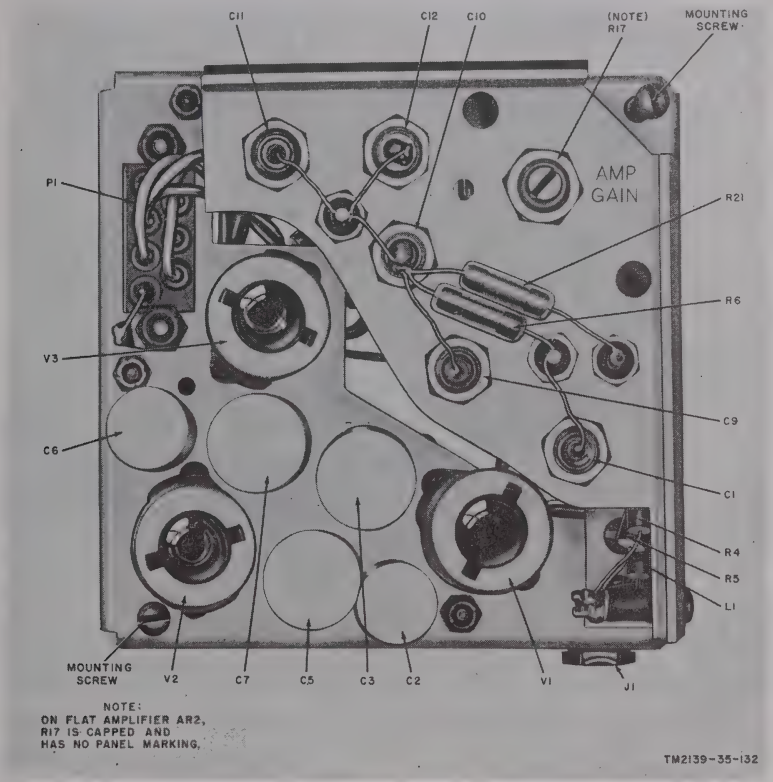


Figure 87. Flat amplifier AR2 or IF amplifier AR1 (part of TEST PANEL), top view.

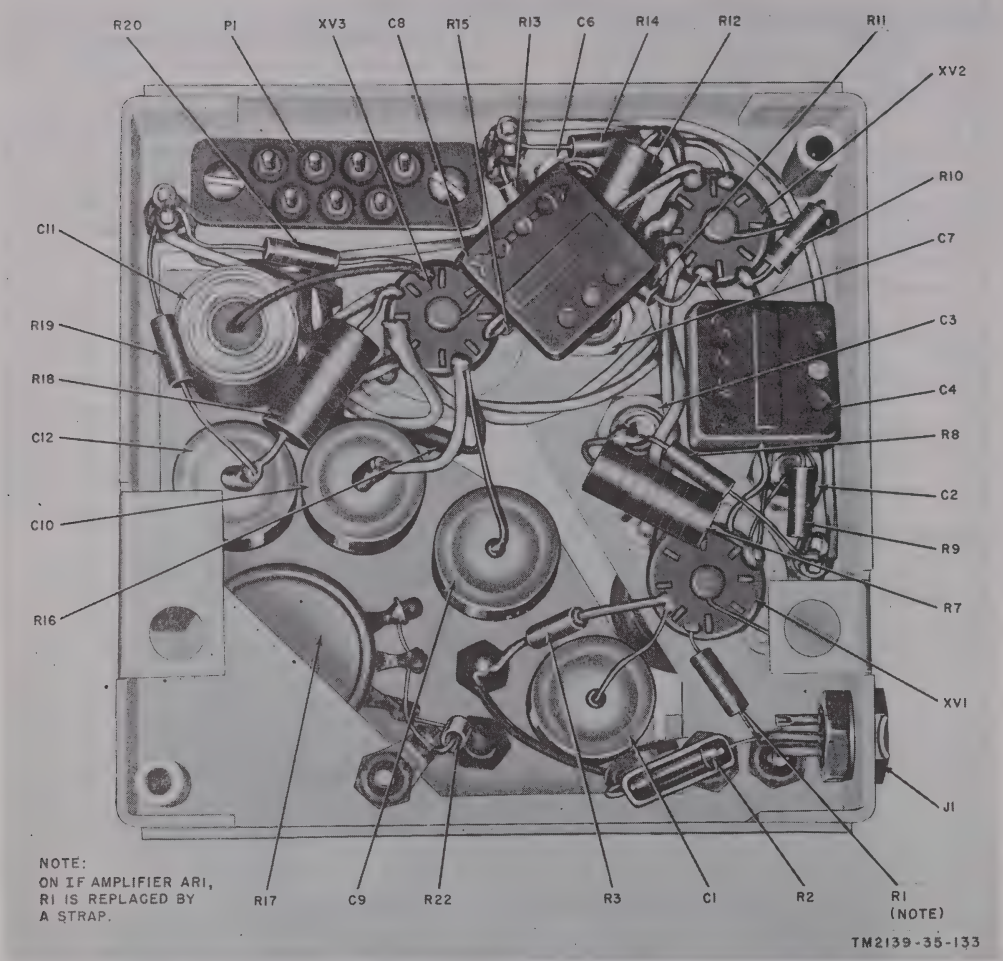


Figure 88. Flat amplifier AR2 or IF amplifier AR1 (part of TEST PANEL), bottom view, parts location.

c. If IF amplifier AR1 is not part of a complete TEST PANEL and must be tested separately, use the procedure given in paragraph 123*c* to prepare the equipment for testing.

d. Perform the same procedures as described in paragraph 123*d* through *h*.

Note. Before connecting a test signal input to IF amplifier AR1, as specified in the troubleshooting chart (*e* below), adjust the test signal source as outlined in paragraph 120*d*.

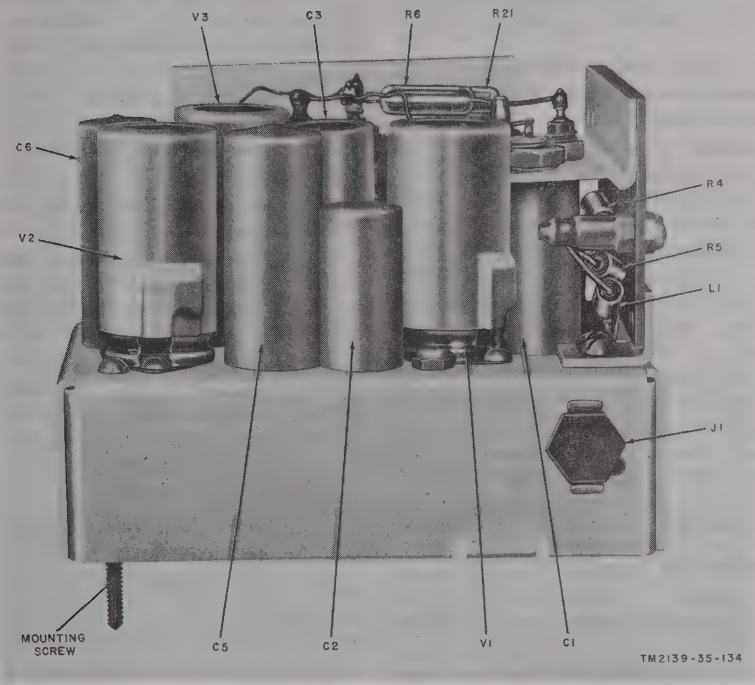


Figure 89. Flat amplifier AR2 or IF amplifier AR1 (part of TEST PANEL), side view, parts location.

Test	Symptom	Probable trouble	Corrective measures
1. No input connection	With no input to connector J1, there is a meter indication.	*a.* Defective tube.	*a.* Check V1, V2, and V3, one at a time. Replace defective tube.
		b. Open bypass capacitor.	*b.* Check C1, C2, C3, C5, C6, C7, C9, C10, C11, and C12. Replace defective part.
2. Adjust the test signal for 0.775 volt at 68 kc. Set the attenuator for 51-db loss. Apply test signal to amplifier.	Meter reading is outside limit of 0 ±1 db and cannot be adjusted to 0 db by operation of control R17.	Defect in amplifier.	Use signal substitution procedures (par. 134) to localize the trouble and find the defective component.

125. TEST PANEL Signal Substitution Setup

Use the following procedures to set up the TEST PANEL for the signal substitution tests.

a. Arrange the TEST PANEL and the test signal source as shown in figure 78.

b. The measuring set and the test arrangement shown in figure 86 must be provided when a complete TEST PANEL is not available for testing flat amplifier AR2 and IF amplifier AR1.

Note. Except where definite limits are given, the test values given in these procedures may vary somewhat from TEST PANEL to TEST PANEL. Sound judgment should be used in deciding when a trouble is indicated. After troubles have been cleared in a TEST PANEL, it is recommended that the TEST PANEL be realined completely as instructed in paragraph 167.

c. Adjust the test signal source inputs according to the procedures in paragraph 120*d*.

126. Detector for Nonselective Measurements, Signal Substitution Test

This procedure provides instructions for testing the detector for the CHECK 1 KC CHECK HF position of the MEASURE NON-SELECTIVE switch (fig. 29). When all troubles in this position of the switch have been cleared, the troubleshooting chart (par. 122, symptoms 18 through 25) should be used for locating troubles indicated on other positions of the switch.

a. Operate the switches listed below to the indicated positions.

Switch	Position
MEASURE	TRANSMISSION.
MEASURE NON-SELECTIVE.	CHECK 1 KC CHECK HF.
MEASURE SELECTIVE	OFF.

b. Use the test signal source shown in figure 78.

(1) Adjust the signal generator to deliver 68 kc ±100 cps as measured with the frequency meter.

(2) With no connection to the test jack, and with the attenuator set for 0 db, adjust the signal generator output for an indication of .775 volt as measured on the voltmeter.

c. Set the attenuator for a 46-db loss and insert the measure plug of the TEST PANEL into the test jack assembly.

d. Measure the voltage between terminal 6 of transformer T2 and chassis ground with the voltmeter. The voltmeter indication should be .00275 volt. If trouble is indicated, check transformer T2.

e. Measure the voltage between terminal D of connector P2 and chassis ground with the voltmeter. The indication on the voltmeter should be .00275 volt. If trouble is indicated, check the wiring from terminal 6 of transformer T2, through the ATTENUATOR and MEASURE NON-SELECTIVE switches to connector P2.

f. Use the voltmeter to measure the voltage between terminal B of connector P1 of flat amplifier AR2 and chassis ground. The voltmeter indication should be approximately .9 volt. If trouble is indicated, check flat amplifier AR2. Use the signal substitution procedure in paragraph 133 to find the faulty component.

g. Remove the bottom shield from the TEST PANEL chassis.

(1) Measure the voltage between terminal 3 of tube V3 and chassis ground. The meter indication should be approximately .9 volt. If trouble is indicated, check capacitor C18. If the voltage is .9 volt and the TEST PANEL meter gives no indication, the trouble is probably in rectifier circuit. V3.

(2) Check tube V3.

(3) Make tube-socket voltage and resistance measurements (TM 11–2139–20, fig. 7), and then check resistors R22, R23, R84, and capacitors C16 and C17 as indicated by measurements.

Note. The adjustment of potentiometer R17 is extremely important. Before making the adjustment, check to see that the input signal as set up in *b* and *c* above has not changed.

h. Remove the locking nut from potentiometer R17 on flat amplifier AR2 and adjust R17 for a 0-db indication on the TEST PANEL meter. Replace the locking nut after the adjustment has been made.

127. Detector and Carrier Oscillator Signal Substitution Test

The procedure outlined in *a* through *h* below provides information for testing the carrier oscillator in all positions of the MEASURE SELECTIVE switch.

a. Operate the MEASURE SELECTIVE switch to the OFF position. Disconnect the measure plug. Operate the COARSE TUNE and FINE TUNE controls to their midpositions. Remove the bottom shield plate from the TEST PANEL chassis.

b. Calibrate the audio level meter (par. 79)

and set the controls as indicated in the chart below:

Switch	Position
INJECTOR	REC.
METER	REC.
ATTENUATOR DB	0.
SELECTOR	VM-UNBAL 600 Ω BRG.

c. Connect the G binding post of the audio level meter to the TEST PANEL ground, and the unmarked binding post to terminal 2 of transformer T3. Adjust the audio level meter for maximum response in the vicinity of 304 kc. The reading on the audio level meter should be between —4 db and +4 db. If it is, note the reading and proceed to *f* below. If it is out of these limits, continue with *d* below.

d. Remove the small shield on the underside of the chassis. Measure the voltage from terminal 5 of carrier oscillator tube V2 to chassis ground with the voltmeter. The meter indication should be between 50 and 100 volts. (This reading may vary considerably with different meters as the frequency being measured is out of the normal frequency range of the meter.) If the meter indication appears reasonable, proceed to *e* below. If the meter indication is out of limits, or if there is no indication, check tube V2. Next, make tube socket voltage and resistance measurements (TM 11–2139–20, fig. 7) and check transformer T4, resistors R16, R21, and capacitors C7 through C11, C20, C12, and C13 as indicated by the measurements. To check some of these parts, remove the shield on the upper side of the chassis over the MEASURE SELECTIVE switch.

e. Replace the shields removed in *d* above and repeat the measurement described in *c* above. If the reading is still out of the limits, check resistors R82 and R83, and the output winding of transformer T4 (terminal 2 to terminal 1). Other possible sources of trouble are a defective modulator CR1 and a short to ground on the modulator side of transformer T3.

f. When the measurement of *c* above falls within the limits given, repeat the measurement for each of the other positions of the MEASURE SELECTIVE switch. As an aid in tuning the audio level meter, the frequencies for the various switch positions are given in the chart below. The audio level meter indications should be approximately the same for all positions of the MEASURE SELECTIVE switch (—4 db to +4 db). If there is no meter indication for any one switch position, a leaky or shorted capacitor associated with that switch position is the probable source of trouble. The chart also lists the capacitors that are associated with each switch position. To test these capacitors, remove the small shield on the under side of the chassis. The wiring through section 1 of the MEASURE SELECTIVE switch also should be checked. To do this, remove the shielding on the upper side of the chassis over the MEASURE SELECTIVE switch. When all switch positions have been cleared of trouble, remove the connections from the audio level meter to the TEST PANEL and replace any shields removed during test.

MEASURE SELECTIVE switch position	Audio level meter frequency (kc)	Associated capacitors	
		Fixed	Variable
CHECK GAIN	262	C35, C36	C37.
12KC	206	C28, C29	C30, C31.
28KC	222	C32, C33	C34.
68KC	262	C35, C36	C37.
65KC	259	C26	C27.
37KC	231	C38, C39	C40.
67KC	261	C41, C42	C43.
83KC	277	C44	C45.
99KC	293		C46.
62KC	256	C48	C47.

g. Connect the frequency meter between terminal 2 of transformer T3 and the TEST PANEL chassis ground. Operate the FINE TUNE control to its midrange position and the MEASURE SELECTIVE switch to the OFF position. Adjust the COARSE TUNE control for a frequency reading of 304 kc ±100 cycles on the frequency meter. If this cannot be done, or if the COARSE TUNE control is close to either end of its range, set the COARSE TUNE control to its midrange and adjust capacitor C12 to meet the frequency requirement. If this cannot be done, check capacitors C7 through C12. To test these capacitors, remove the small shield on the underside of the chassis and the shield on the upper side of the chassis, over the MEASURE

SELECTIVE switch. Replace these shields after the trouble is cleared and before the final frequency adjustment is made.

Note. During the test below, do not disturb the setting of the COARSE TUNE control as adjusted in *g* above.

h. At each position of the MEASURE SELECTIVE switch, adjust the FINE TUNE control for a frequency meter indication of within 50 cycles of the frequencies listed in the chart (*f* above). If this cannot be done for any position of the switch, or if the setting of the FINE TUNE control is close to either end of its range, operate the FINE TUNE control to its midposition and adjust the *variable* capacitor listed in the chart in *f* above associated with the defective switch position. If this does not correct the trouble, check the capacitors listed in the chart, which are associated with the defective switch position. To test these capacitors, remove the small shield on the underside of the chassis. Replace this shield after the trouble has been cleared and before the final frequency adjustment is made.

128. Detector Input Circuit Signal Substitution Test Selective Measurement

a. This procedure checks the detector input circuit for the CHECK GAIN and the GRP PANEL 62KC positions of the MEASURE SELECTIVE switch. When all troubles in these positions have been cleared, the trouble-shooting chart (par. 122, symptoms 28 through 35) should be used for troubles on other positions of the switch.

(1) Remove tubes V1, V2, and V4 to reduce cross talk from the oscillator circuits during these measurements.

(2) Remove the bottom shield from the TEST PANEL chassis.

(3) Connect the test equipment as shown in figure 78.

(4) Adjust the frequency of the signal generator to 62 kc ±50 cycles as measured with the frequency meter.

(5) With no connection to the test jack and with the attenuator set for 0 db, adjust the signal generator output for an indication of .5 volt on the voltmeter.

(6) Insert the TEST PANEL measure plug into the test jack.

(7) Operate the MEASURE SELECTIVE switch to the CHECK GAIN position, the MEASURE NON-SELECTIVE switch to the OFF position, and the GAIN control to its approximate midposition.

(8) Measure the voltages between chassis ground and the points indicated in the chart in *b* below.

b. The chart below lists the approximate voltage indications and the corrective measures to be applied.

Measuring point	Approximate voltage (ac)	Corrective measures
Terminal 4 of transformer T2	0.5	Check measure plug connections to T2.
Terminal 6 of transformer T2	.35	Check T2. Check wiring from T2 to R69 through switches S2 and S4. Repair defective wiring. Check R69.
Terminal E25	.105*	Check wiring through switch S3 from E25 to R36. Check R69 through R72. Check R36, R35, and R34. Replace defective parts.
Terminal 5 of transformer T3	.09	Check R34 through R36. Check wiring through switch S3 from R34 to terminal 5 of T3. Check for a short from terminal 5 of T3 to chassis ground.
Terminal 1 of T3 with terminal 2 grounded	.0066	Check T3 and CR1. Replace defective parts.
Terminal 4 of T3 with terminal 2 grounded	.0066	Check T3 and CR1.

c. Operate the MEASURE SELECTIVE switch to the GRP PANEL 62KC position. Leave the GAIN control adjustment as set in *a*(7) above. Make the measurements indicated in the following chart:

Measuring point	Approximate voltage (ac)	Corrective measures
Terminal 1 of filter FL1	.066	Check wiring through switch S3 from E25 to terminal 1 of FL1. Check R78. Check for a short circuit from terminal 1 of FL1 to chassis ground. Replace defective parts.
Terminal 3 of filter FL1	.048	Check FL1, R13 through R15. Replace defective parts.
Terminal 5 of transformer T3	.034	Check R13 through R15 and wiring from R15 through switch S3 to terminal 5 of T3.

129. Modulator Signal Substitution Test

a. This procedure outlines the tests necessary to check the operation of modulator CR1. It is assumed that any troubles in the carrier oscillator and the input circuit have been cleared as indicated in paragraphs 127 and 128.

(1) Do NOT change the GAIN control setting as adjusted in paragraph 128*b*.
(2) Replace carrier oscillator tube V2.
(3) Operate the MEASURE SELECTIVE switch to the GRP PANEL 62KC position.
(4) Remove tube V1 from IF amplifier AR1 (fig. 87).
(5) Connect the test signal source as shown in figure 78. Insert the measure plug into the test jack assembly.
(6) Adjust the output of the signal generator for 62 kc ±50 cycles as measured with the frequency meter.
(7) Set the attenuator for 0 db.
(8) Adjust the signal generator output for a reading of .775 volt on the voltmeter.
(9) Reset the attenuator for 4-db loss.

b. Calibrate the audio level meter and operate its switches as given in the chart below.

Switch	Position
INJECTOR	REC.
METER	REC.
ATTENUATOR DB	60.
SELECTOR	VM-UNBAL 600 Ω BRG.

(1) Connect the G binding post of the audio level meter to the TEST PANEL chassis ground.
(2) Connect the unmarked binding post to terminal 4 of 194-kc crystal filter FL2.
(3) Operate the frequency dial of the audio level meter to 194 kc.
(4) Very slowly operate the FINE TUNE control on the TEST PANEL and look for a response on the audio level meter. It may be necessary to repeat this adjustment several times, each time changing the frequency setting of the audio level meter slightly over the range of 190 kc to 198 kc in steps of approximately .5 kc.

c. If an indication can be obtained, carefully adjust the FINE TUNE control and the frequency dial for a maximum meter indication. The indication should be approximately −60 db.

(1) If there is no indication, or if trouble is suspected, check modulator CR1.
(2) If the indication appears to be satisfactory, make the same measurement at terminal 1 of filter FL2. The meter indication should be approximately the same as that for *c* above.
(3) If the indication is out of limits, check modulator CR1. When all troubles are cleared in the modulator, remove the measure plug from the test jack assembly and replace tube V1 of the IF amplifier.

130. IF Circuit Signal Substitution Test

a. This procedure outlines the tests necessary to check the operation of the 194-kc IF circuit up to the input of flat amplifier AR2 for all selective measurements. It is assumed that flat amplifier AR2 and the rectifier circuits are operating properly. Connect the test equipment as shown in figure 78.

(1) Adjust the frequency of the signal generator to 194 kc ±200 cps as measured with the frequency meter.
(2) Set the attenuator for a 41-db loss.
(3) Remove connector P2 from connector J1 on flat amplifier AR2.
(4) Connect test plug connector P675 to connector J1 on flat amplifier AR2.
(5) Insert the test plug assembly into the test jack assembly and connect the GRD lead to the TEST PANEL chassis. Connect test lead A to terminal D on test plug connector P675.
(6) Operate the MEASURE switch to the TRANSMISSION position, and adjust the signal generator output for a 0-db reading on the TEST PANEL meter.
(7) Remove the test plug assembly from the test jack.
(8) Set the attenuator for 0 db.
(9) Note carefully the indication on the voltmeter connected across the 135-ohm resistor. *This is the reference voltage.* It should be maintained at this value by readjusting the signal generator output as necessary during the remainder of this procedure. The indication will be .4 to .8 volt, but may vary considerably with different meters as the frequency being measured is outside the normal frequency range of the voltmeter.

b. After the reference voltage has been determined, reset the attenuator for a 41-db loss and reconnect the test plug assembly to the test jack assembly.

(1) Remove the test plug assembly connections and test plug connector P675 from connector J1 of flat amplifier AR2.
(2) Reconnect P2 to connector J1.
(3) Operate the MEASURE NON-SELECTIVE switch to the GRP PANEL 62KC position.
(4) Disconnect resistor R18 from terminal 3 of filter FL3.
(5) Connect test lead A of the test plug assembly (fig. 78) to the open end of resistor R18 and the GRD lead to the chassis.
(6) Adjust the attenuator for a meter reading as close to 0 db as possible. The attenuator setting should be approximately 34 db.
(7) If trouble is indicated, check resistors R18 through R20, and the wiring through switch S4 to connector P2 at flat amplifier AR2 input (fig. 81).

c. If no trouble is indicated, or after the trouble is found and cleared, proceed as follows:

(1) Operate the MEASURE NON-SELECTIVE switch to the OFF position.
(2) Change the attenuator setting to −3 db.
(3) Remove the locking nut from potentiometer R44 and adjust R44 for a 0-db meter indication. The adjustment range should be at least ±2 db.
(4) If trouble is indicated, check R43, R39, R44, and the wiring through switch S4.
(5) Remove the test plug assembly connections, reconnect resistor R18 to terminal 3 of filter FL3, and replace the locking nut on potentiometer R44.

d. Additional checks to be made of the IF circuit are as follows:

(1) Disconnect resistor R77 from terminal 1 of filter FL3.

(2) Operate the MEASURE NONSELECTIVE switch to the GRP PANEL 62KC position.
(3) Change the attenuator setting to —31 db.
(4) Connect test lead A of the test plug assembly to terminal 1 of filter FL3 and the GRD lead to the TEST PANEL chassis. The meter indication should be approximately 0 db. If it is not, check filter FL3. Remove the test plug assembly connections and reconnect resistor R77 to terminal 1 of filter FL3.
(5) Disconnect capacitor C14 from terminal E37.
(6) Connect test lead A of the test plug assembly to terminal E37 and the GRD lead to the TEST PANEL chassis.
(7) Change the attenuator setting to —22 db.
(8) The meter indication should be approximately 0 db. If it is not, check resistors R17 and R77.
(9) Remove the test plug assembly connections and reconnect capacitor C14 to terminal E37.

e. To check the adjustment of the AMP GAIN control, follow the procedure outlined in (1) through (8) below.
(1) Replace the bottom shield on the TEST PANEL chassis.
(2) Change the attenuator setting to —61 db.
(3) Operate the MEASURE NONSELECTIVE switch to the OFF position.
(4) Remove connector P3 from connector J1 of IF amplifier AR1.
(5) Connect test lead A of the test plug assembly to terminal D of test plug connector P675 and the GRD lead to the TEST PANEL chassis.
(6) Adjust AMP GAIN control R17 on IF amplifier AR1 for a meter indication of 0 db.
(7) If this cannot be done, test IF amplifier AR1 as instructed in paragraph 134.
(8) Remove the test plug assembly connections and plug connector P675 from connector J1 on IF amplifier AR1 and reconnect P3 to connector J1.

f. If the results of the test in *e* above and the tests in paragraph 134 are satisfactory, and trouble still exists in the circuit for selective measurements, the 194-kc crystal filter is probably faulty. Check filter FL2.

g. After all troubles have been cleared in the selective measurements circuit, realign the circuit as instructed in paragraph 167*a* through *d*.

131. 1-kc Oscillator Signal Substitution Test

a. The procedures below are for testing the output power and the frequency of the 1-kc oscillator circuit.
(1) Replace tube V1 (par. 128*a*(1)).
(2) Remove the bottom shield from the TEST PANEL chassis.
(3) Operate the 1 KC control to its extreme clockwise position.
(4) Use the voltmeter to measure the voltage from terminal 5 of tube V1 to chassis ground. The meter indication should exceed 50 volts.
(5) If the meter indication is less than 50 volts, check tube V1. Make tube socket voltage and resistance measurements (TM 11–2139–20, fig. 7). Check transformer T1, resistors R1 through R5 and R74, and capacitors C1 through C5 as indicated by the voltage and resistance measurements.

b. Measure the voltage from terminal 7 of T1 to chassis ground, and from terminal 6 of T1 to chassis ground. These voltages should be equal to, or greater than .4 volt. If trouble is indicated, check transformer T1, and resistors R7 and R75; check for a short between E3 or E4 and ground.

c. Operate the switches on the TEST PANEL to the positions given in the chart below.

Switch	Position
MEASURE	TRANSMISSION.
MEASURE SELECTIVE	OFF.
MEASURE NONSELECTIVE.	CHECK 1 KC CHECK HF.

d. Insert the measure plug into the CHECK 1 KC jack. If the circuit for selective measure-

ments has been properly adjusted (pars. 130 and 167*a*–*d*), the 1 KC control can be adjusted to obtain a TEST PANEL meter indication of 0 db. If a 0-db indication cannot be obtained, check resistors R8 through R10. If the operation of the 1 KC control does not vary the reading, check resistors R3 through R6.

e. After making the adjustments described in *c* above, measure the voltage from terminal S, F, P, or C of the power test cable assembly (fig. 78) and from E3 or E4 to the chassis. Each meter indication should be approximately .5 volt. If trouble is indicated, check resistors R8 through R10, and the wiring to connector J2.

f. Check the frequency of the 1-kc oscillator by connecting the frequency meter to terminal E3 and the chassis. If the indication on the frequency meter is not 1 kc ±20 cps, check transformer T1 and capacitors C2 and C3.

132. HF Oscillator Signal Substitution Test

The procedures in this paragraph are for testing the output power of the hf oscillator with the SEND switch in the CHECK GAIN CHECK HF position. When all troubles for this switch position have been cleared, use the troubleshooting chart (par. 122, symptoms 26 and 39–47) for any other troubles in the hf oscillator circuit.

a. Replace tube V4 (par. 128*a*(1)). Operate the SEND switch to the CHECK GAIN CHECK HF position. Measure the voltages between the points specified in the chart below and the chassis. The position of the HF control should have very little effect on the readings. If trouble is indicated, check tube V4. Then make tube socket voltage and resistance measurements (TM 11–2139–20, fig. 7). Check resistors R56 and R57, transformer T5, and capacitors C22 through C25 and C49 through C51 as indicated by voltage and resistance measurements.

Measuring point on transformer T5	Approximate reading (ac volts)
Terminal 3	95
Terminal 2	65
Terminal 6	1.95
Terminal 5	6.8

b. Use the voltmeter to measure the voltage between terminal 8 of section 1 of the SEND switch and the chassis. Adjust the HF control for an indication of 1.035 volts. If this indication cannot be obtained, check resistors R52 through R55, R45 through R47, and R80.

c. Connect the voltmeter between the tip and ring (ground) of the CHECK HF jack. The voltmeter indication should be approximately .004 volt. If it is not .004 volt, check resistors, R45 through R47, and R80.

d. If any of the parts have been changed or disturbed during the tests above, realine the hf oscillator (par. 167*e*).

133. Flat Amplifier AR2 or IF Amplifier AR1 Signal Substitution Test

a. If the amplifier is part of a complete TEST PANEL (C, fig. 86), use the procedure in (1) through (3) below to prepare the amplifier for testing, and perform the procedures in *c* through *g* below. Use the test signal source arrangement as shown in A, figure 86.

(1) Disconnect connector P2 from connector J1 of the amplifier and loosen the two captive screws that hold the amplifier on the TEST PANEL chassis. Remove the amplifier from the chassis by lifting it straight up. Place the amplifier to the right of the TEST PANEL.

(2) Use the extension test cable assembly to connect connector J4 on the TEST PANEL to connector P1 on the amplifier.

(3) Connect power to the TEST PANEL as shown in figure 86 and operate the MEASURE switch to the TRANSMISSION position.

b. If the amplifier is not part of a complete TEST PANEL and must be tested separately, connect the measuring set to connector P1 on the amplifier and connect power as shown in B, figure 86. Use the test signal source arrangement as shown in A, figure 86. Perform the procedures in *c* through *g* below.

c. Adjust the output frequency of the signal generator to 68 kc. Set the attenuator for 0 db. Adjust the output of the signal generator for an indication of .775 volt on the voltmeter. Use test lead B of the test plug assembly to connect the test signal to the various test points. Insert the plug of the test plug assembly into

the test jack assembly and connect the GRD lead to the amplifier chassis. Connect test lead B as indicated in *d* through *g* below.

d. Remove tubes V1 and V2 (fig. 87) and connect test lead B to terminal 1 of tube V3.

(1) Adjust the attenuator for an indication as close to 0 db as possible on the TEST PANEL meter or the meter of the measuring set.

(2) The approximate attenuator setting required is 15 db. If trouble is indicated, check tube V3 and make tube socket voltage and resistance measurements (TM 11–2139–20, fig. 8 or 9).

(3) Check resistors R15 through R22, and capacitors C9 through C12 as indicated by measurements.

e. Replace tube V2. Connect the T_1 test lead to terminal 1 of V2 and adjust the attenuator for a meter reading as close to 0 db as possible. The approximate attenuator setting required is 51 db. If trouble is indicated, check tube V2 and make tube socket voltage and resistance measurements. Check resistors R10 through R14, and capacitors C5 through C8.

f. Replace tube V1 and connect the T_1 test lead to terminal 1 of tube V1.

(1) Set the attenuator for a 49-db loss.

(2) Remove the locking nut from potentiometer R17 and adjust R17 for a meter indication of 0 db.

(3) If this cannot be done and the meter indication is off scale (high), the feedback path is probably open.

(4) Check resistor R6, coil L1, and the connections.

(5) If the meter indication is on scale but cannot be adjusted to 0 db, check tube V1 and resistors R4, R5, R6, R17, R21, and R22.

(6) If trouble is still indicated, make tube-socket voltage and resistance measurements (TM 11–2139–20, fig. 8 or 9).

(7) Check resistors R1, R2, R3, R7, R8, and R9, and capacitors C1 through C4 as indicated by the measurements.

(8) After the trouble is cleared, adjust R17 for a 0-db meter indication and replace the locking nut.

g. Change test lead B connection to terminal D on plug connector P675 which is connected to connector J. The meter indication should be 0 db. If it is not, check resistors R1 and R2.

134. Dc Resistance of Transformers and Coils

a. Main Chassis.

Transformers	Terminals	Resistance (ohms)
T1	1–3	290
	4–5	12.5
	6–7	.55
T2	1–2	102
	3–4	104
	5–6	70.9
T3	1–2	2.47
	3–4	2.4
	5–6	140
T4	1–2	.05
	3–4	.075
	5–6	1.1

b. IF Amplifier AR1 or Flat Amplifier AR2.

Coil	Resistance (ohms)
L1	Less than 1.

Section VII. ORDER WIRE RECEIVER-TRANSMITTER RT–280/TCC–7 (PART OF RECEIVER-TRANSMITTER TEST SET GROUP OA–443/TCC–7)

135. Troubleshooting Data

Fig. No.	Par. No.	Description
23		Receiver-Transmitter Order Wire RT–280/TCC–7, schematic diagram.
92		Switch S103, wiring diagram.
24		Transmitting amplifier AR-101, schematic diagram.
25		Receiving amplifier AR102, schematic diagram.
27		Ringer oscillator Y101, schematic diagram.
(TM 11–2139–20, fig. 17).		Transmitting amplifier AR-101, tube socket voltage and resistance chart.
(TM 11–2139–20, fig. 18).		Receiving amplifier AR102, tube socket voltage and resistance chart.
(TM 11–2139–20, fig. 19).		Ringer oscillator Y101, tube socket voltage and resistance chart.
(TM 11–2139–20, fig. 4).		Receiver-Transmitter Order Wire RT–280/TCC–7, top view.
93		Receiver-Transmitter Order Wire RT–280/TCC–7, bottom view.
95		Transmitting amplifier AR-101, top view.
96		Transmitting amplifier, AR-101, bottom view.
98		Receiving amplifier, AR102, top view.
99		Receiving amplifier AR102, bottom view.
101		Ringer oscillator Y101, top view.
102		Ringer oscillator Y101, bottom view.
151		Receiver-Transmitter Order Wire RT–280/TCC–7, wiring diagram.
152		Transmitting amplifier AR-101, wiring diagram.
153		Receiving amplifier AR102, wiring diagram.
154		Ringer oscillator Y101, wiring diagram.
	148*a*	ORDER WIRE PANEL, dc resistance of transformers and coils, main chassis.
	148*b*	Transmitting amplifier AR-101, ORDER WIRE PANEL, dc resistance of transformers.
	148*c*	Receiving amplifier AR102, ORDER WIRE PANEL, dc resistance of transformers.
	148*d*	Ringer oscillator Y101, ORDER WIRE PANEL, dc resistance of transformers and coil.

136. Initial Procedures for Transmitting Tests

(fig. 90)

Perform the procedures below prior to making the transmitting tests (par. 137).

a. Connect the power and carrier supply test cable assemblies, 301- and 1,300-ohm resistors, 200 VOLT POWER SUPPLY, and ORDER WIRE PANEL as shown in figure 90.

b. Connect the signal generator, resistors R4 and R5, attenuator, and transformer T109 as shown in figure 90.

137. Transmitting Circuit Tests

a. Ringing Signal Transmitting Test.

(1) Connect the 10-volt dc source available at terminals D and H of the carrier supply test cable assembly to terminals A and T respectively, of the power test cable assembly.

(2) Connect the voltmeter arranged to measure 18 volts across terminals L and M on the power test cable assembly terminal board with terminal M as ground.

(3) Operate CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 0–11 position.

(4) Operate the TR GAIN control to the extreme clockwise position.

(5) Operate the ORDER WIRE switch to the RING position. The voltmeter should indicate 18 volts, the CALL lamp should light, and the buzzer should sound.

(6) Disconnect the 10-volt dc source from the power test cable assembly.

Figure 90. ORDER WIRE PANEL, operational test setup, transmitting direction.
(Contained in separate envelope)

b. Handset Transmitting Test.

(1) Strap terminals A and T on the power test cable assembly terminal board.

(2) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 0–11 position.

(3) Operate the TR GAIN control to the extreme clockwise position and the ORDER WIRE switch to the TALK position.

(4) Connect the signal generator and associated components (par. 136*b*) across terminals 1 and 3 of TB101 in the ORDER WIRE PANEL. Set the attenuator for a 0-db loss; arrange the signal generator for an output frequency of 1 kc at an output level of 1 volt measured across terminals 1 and 3 with terminal 3 as ground.

(5) Connect the voltmeter, arranged to measure 11 volts, across terminals L and M on the power test cable assembly terminal board with terminal M as ground; the voltmeter should indicate 11 volts ±1.5 volts.

(6) Connect the voltmeter, arranged to measure 11 volts, across terminals T_1 and R of the test plug assembly with terminal R as ground. Insert the plug of the test plug assembly into the TR AMP OUT jack on the ORDER WIRE PANEL. The voltmeter should indicate 11 ±1.5 volts.

(7) Connect the voltmeter, arranged to measure .41 volt, across terminals C and P of the power test cable assembly terminal board; operate the CHANNEL TALK switch to the LINE position. The voltmeter should indicate .41 ±.04 volt. Operate the CHANNEL TALK switch to the TEST BD position; the voltmeter should indicate 0 volt.

(8) Connect the voltmeter across terminals D and R of the power test cable assembly terminal board. Operate the CHANNEL TALK switch to the TEST BD position; the voltmeter should indicate .41 ±.04 volt. Operate the CHANNEL TALK switch to the LINE position; the voltmeter should indicate 0 volt.

c. Test Signal Transmitting Test.

(1) Strap terminals A and T on the power test cable assembly terminal board.

(2) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 0–11 position.

(3) Operate the TR GAIN control to the extreme clockwise position.

(4) Connect the signal generator and associated components (par. 136*b*) across terminals K and W on the power test cable assembly terminal board. Adjust the attenuator for a 0-db loss; arrange the signal generator for an output frequency of 1 kc at an output level of .73 volt measured across terminals K and W.

(5) Connect the voltmeter across terminals L and M on the power test cable assembly terminal board with terminal M as ground. The voltmeter should indicate 11 volts ±.5 volt.

d. 2W EXT Binding Post Test.

(1) Strap terminals A and T on the power test cable terminal board.

(2) Connect the signal generator and the associated components (par. 136*b*) across the 2W EXT binding posts. Arrange the signal generator to supply 300, 1,000, or 1,700 cps, as required in (2), (5), and (6) below, at an output level of .55 volt measured across the 2W EXT binding posts.

(3) Connect the voltmeter across terminals L and M on the power test cable assembly terminal board.

(4) Operate the TR GAIN control to the extreme clockwise position. Adjust the signal generator for an output frequency of 300 cps. Set the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 104–126 position. The voltmeter should indicate 3.7 volts ±.8 volt.

(5) Readjust the signal generator for an output frequency of 1,000 cps. The voltmeter should indicate 11 ±2.5 volts.

(6) Readjust the signal generator for an output frequency of 1,700 cps. The voltmeter should indicate 12 ±3 volts.

(7) Readjust the signal generator for an output frequency of 1,000 cps and reset the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 0–11 position. The voltmeter should indicate 11 ±1.5 volts.

(8) Readjust the TR GAIN control to the extreme counterclockwise position. The voltmeter should indicate .14 ±.08 volt.

138. Receiving Circuit Tests
(fig. 91)

a. Initial Procedures. Perform the following procedures prior to making the receiving circuit tests (*b* through *d* below).

(1) Connect the power and carrier supply test cable assemblies, 75-, 121-, 301-, and 600-ohm resistors, ORDER WIRE PANEL, and 200 VOLT POWER SUPPLY as shown in figure 91.

(2) Connect the signal generator, resistors R1 through R3, attenuator, and transformer T109, with the two 511-ohm resistors *not* strapped out, as shown in figure 91.

b. Ringing Signal Receiving Test.

(1) Connect the 10-volt dc from the 200 VOLT POWER SUPPLY across terminals A and T of the power test cable assembly with terminal T positive.

(2) Operate the REC GAIN control on the ORDER WIRE PANEL to the extreme clockwise position.

(3) Connect the signal generator and the associated components (*a*(2) above) across terminals F and S of the power test cable assembly; adjust the signal generator output frequency to 1,600 cps at an output level of .007 volt measured across terminals F and S with the voltmeter. The CALL lamp should light and the buzzer should sound.

c. Receiving Maximum Gain Test.

(1) Strap terminals A and T on the power test cable assembly terminal board.

(2) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 0-11 position.

(3) Connect a 600-ohm resistor across the 2W EXT binding posts.

(4) Connect the signal generator and associated components (*a*(2) above) across terminals F and S on the power test cable assembly. Set the attenuator for a 30-db loss and adjust the signal generator for an output frequency of 1 kc at an output level of .007 volt measured across terminals F and S.

(5) Connect the voltmeter to terminals T_1 and R of the test plug assembly with terminal R as ground.

(6) Insert the plug of the test plug assembly into the REC AMP IN and REC AMP OUT jacks on the ORDER WIRE PANEL. The voltmeter should indicate .007 ±.003 volt at each jack.

Figure 91. ORDER WIRE PANEL, operational and final test setup, receiving direction.

(Contained in separate envelope)

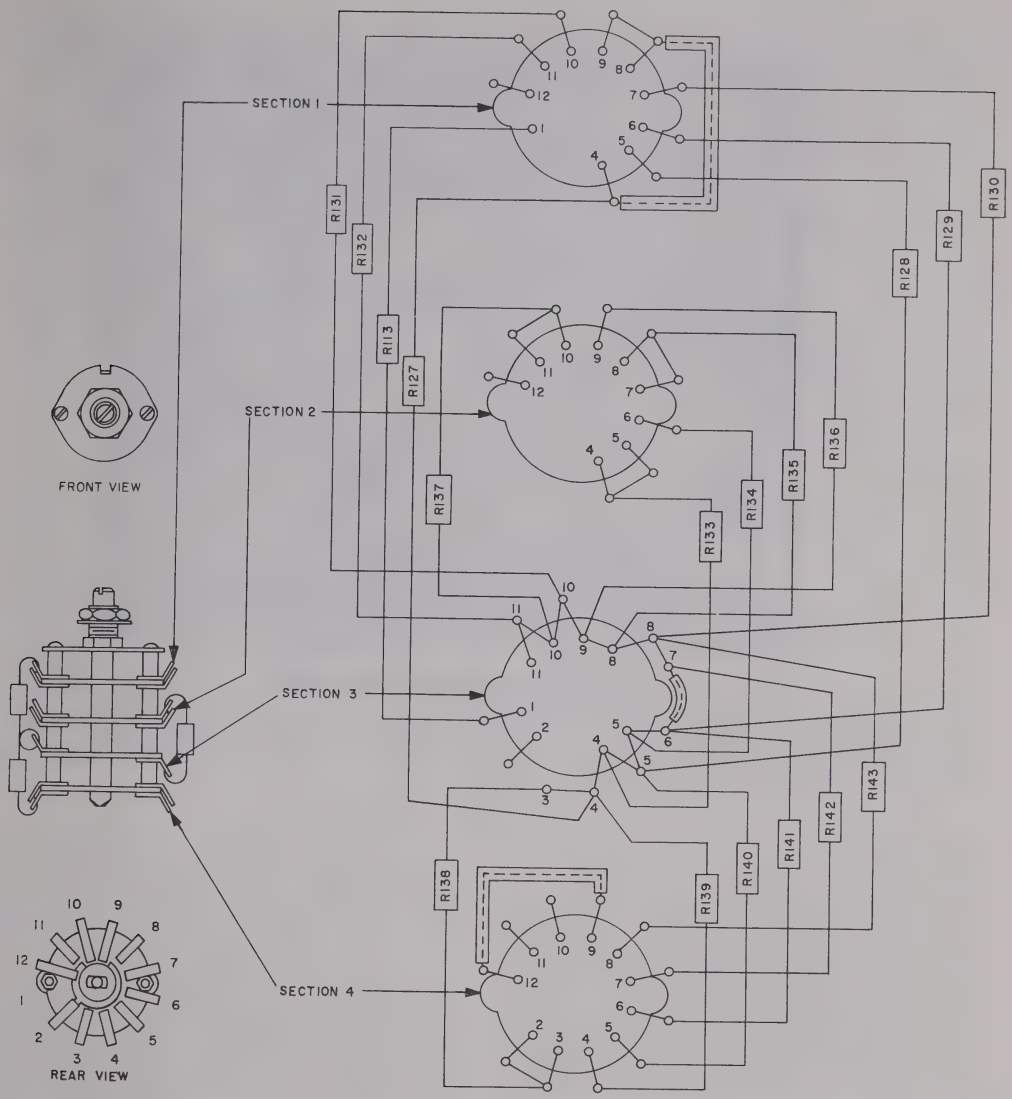


Figure 92. CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8 switch S103, (part of ORDER WIRE PANEL) circuit element location and wiring diagram.

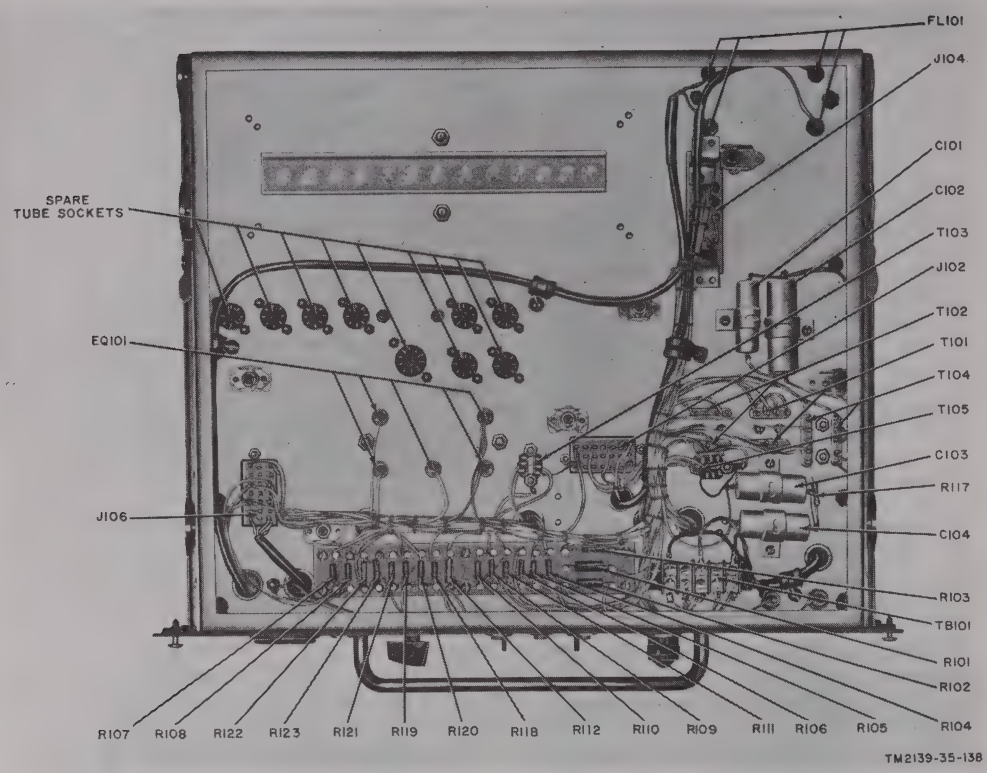


Figure 93. Receiver-Transmitter Order Wire RT–280/TCC–7, bottom view of chassis, parts location.

(7) Connect the voltmeter across terminals 3 and 5 of TB101 in the ORDER WIRE PANEL. The voltmeter should indicate .21 volt. Operate the ORDER WIRE switch to the TALK position; the voltmeter should indicate .21 volt ±.03 volt. Operate the CHANNEL TALK switch to the TEST BD position. There should be no change in the voltmeter indication.

(8) Connect the voltmeter across the 600-ohm resistor connected to the 2W EXT binding posts. Operate the ORDER WIRE switch to the normal position; the voltmeter should indicate .35 ±.05 volt.

d. Receiving Minimum Gain Test.

(1) Strap terminals A and T of the power test cable assembly.

(2) Adjust the REC GAIN control to the extreme counterclockwise position and operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to the 0–11 position.

(3) Connect the signal generator and associated components (*a*(2) above) across terminals F and S of the power test cable assembly. Set the attenuator for a 0-db loss and adjust the signal generator for an output frequency of 1 kc at an output level of .7 volt measured across terminals F and S.

(4) Connect the voltmeter across terminals T_1 and R of the test plug assembly with terminal R as ground.

(5) Insert the plug of the test plug assembly into the REC AMP IN jack on

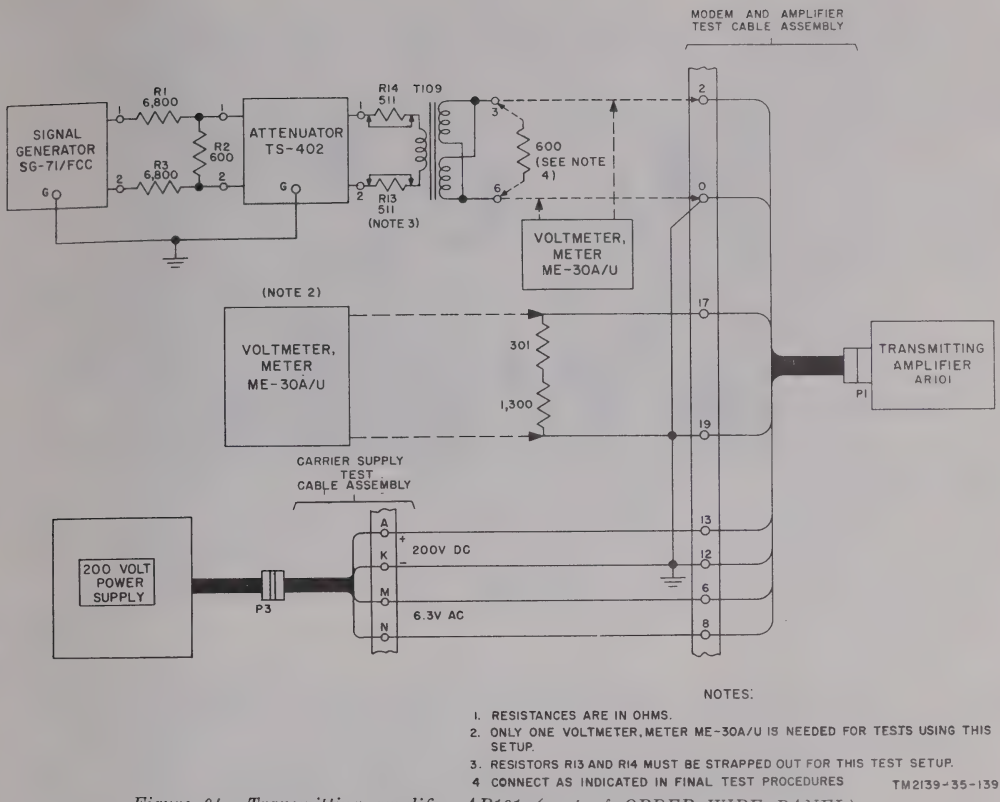


Figure 94. Transmitting amplifier AR101 (part of ORDER WIRE PANEL), operational and final test setup.

the ORDER WIRE PANEL; the voltmeter should indicate .007 ±.003 volt.

139. ORDER WIRE PANEL, Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the ORDER WIRE PANEL. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). When the trouble has been localized to a stage or circuit, a tube check or a voltage and resistance measurement of this stage or circuit should be sufficient to isolate the defective part. Normal voltage and resistance measurements are given in TM 11–2139–20, figures 17 through 19.

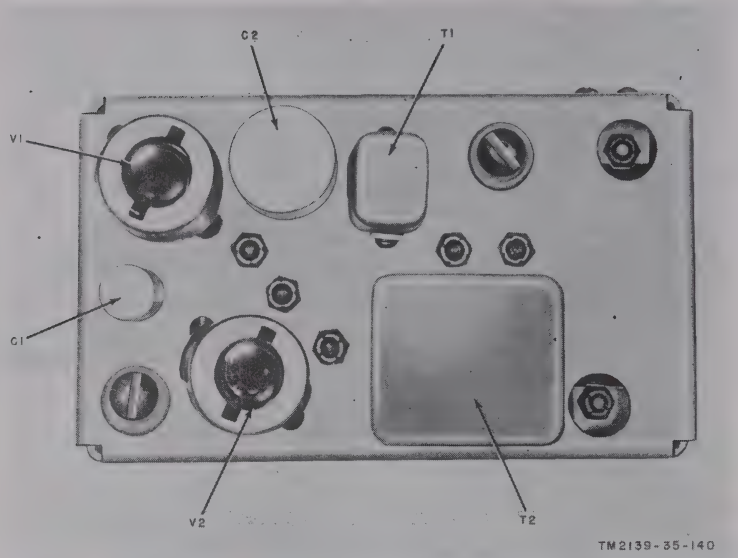


Figure 95. Transmitting amplifier AR101 (part of ORDER WIRE PANEL), top view, parts location.

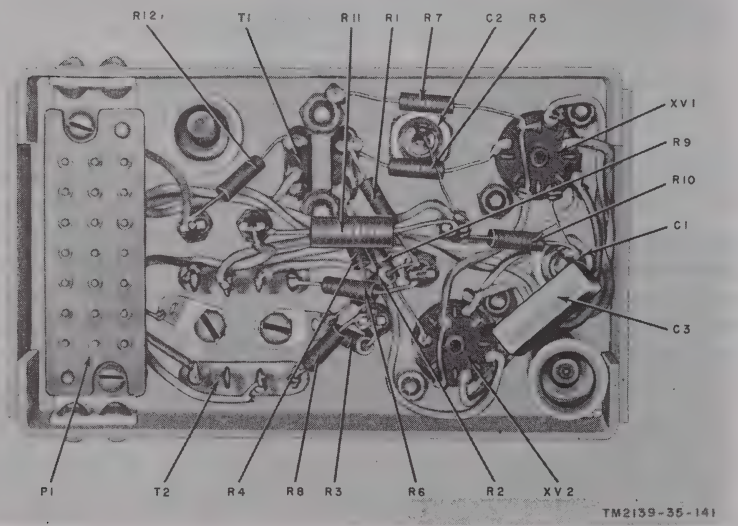


Figure 96. Transmitting amplifier AR101 (part of ORDER WIRE PANEL), bottom view, parts location.

Symptom	Probable trouble	Corrective measures
1. No transmission in either direction, no signal from ringer-oscillator Y101.	*a.* Failure of 200-volt dc distribution circuits.	*a.* Check for presence of 200 volts dc between terminals 13 of connector J102 or J106 and ground. If not present, check B+ distribution circuit and locate open or short circuits (fig. 23).
	b. Failure of 6.3-volt ac distribution circuits.	*b.* Check for presence of 6.3 volts ac across terminals 6 and 8 of connector J102 or J106. If not present, check the 6.3-ac volt ac distribution circuits and locate open or shorted circuits.
2. Transmission in transmitting direction from telephone handset, out of limits.		
a. Output at terminals L and M of connector J101 out of limits.	*a.* Failure of a component part between TR AMP OUT jack and terminals L and M of J101 connector.	*a.* Check output at TR AMP OUT jack (par. 137). If normal, use signal substitution procedures (par. 140*b*, test No. 13).
b. Output of TR AMP OUT jack, out of limits.	*b.* Failure of a component part between telephone handset and TR AMP OUT jack.	*b.* Proceed as in correction 2*a*. If signal is out of limits, replace AR101 amplifier. If still out of limits, use signal substitution procedures (par. 140*b*, tests No. 1 and 2 and 5 through 8).
c. Output at terminals C and P of connector J101, out of limits.	*c.* Failure of a component part between telephone handset and terminals C and P of connector J101.	*c.* Use signal substitution procedures (par. 140*b*, test No. 4).
d. Output at terminals D and R of connector J101, out of limits.	*d.* Failure of a component part between telephone handset and terminals D and R of J101.	*d.* Use signal substitution procedures (par. 140*b*, test No. 3).
3. Transmission in transmitting direction from test signal input, out of limits.	Failure of a component part between terminals K and W of connector J101 and terminals 3 and 4, and 5 and 6 of T103.	Proceed as in correction 2*a*. If signal is normal, use signal substitution procedures (par. 140*b*, test No. 14).
4. Transmission in transmitting direction from 2W EXT binding posts, out of limits.		
a. Output at terminals L and M of connector J101, out of limits.	*a.* Failure of a component part between 2W EXT binding posts and terminals L and M of connector J101.	*a.* Proceed as in correction 2*a*. If signal is normal, use signal substitution procedures (par. 140*b*, test No. 9).
b. Output at terminals L and M of connector J101 out of limits when transmitting a frequency of 300 cps or 1,000 cps; or 1,700 cps from 2W EXT binding posts through equalizer with CABLE REELS TO NEXT AN/TCC-7 or AN/TCC-8 switch in 104-126 position.	*b.* Failure of EQ101 or associated circuits.	*b.* Use signal substitution procedures (par. 140*b*, tests No. 10, 11, and 12).
5*a*. Transmitting signal from ringer oscillator Y101 out of limits at terminals L and M of connector J101.	*a.* Failure of a component part between ringer oscillator Y101 output connection and terminal L and M of connector J101.	*a.* Proceed as in correction 2*a*. If signal is normal, replace ringer oscillator Y101 and perform corrective measure in test No. 5*b*. If normal, check for shorted or open circuits from terminals 0 and 1 of connector J104 through switch S104 to terminals 5 and 6 of T103. Check to see that terminal 2 is connected to terminal 6 and terminal 5 to 8 of connector J104.

Symptom	Probable trouble	Corrective measures
b. Transmitting signal from ringer oscillator Y101 out of limits at terminals L and M of connector J101.	*b.* Failure of 10-volt dc distribution circuit.	*b.* Check for presence of 10 volts dc between terminals 13 and 11 of connector J104. If not present, check for open and short circuits from terminals 13 and 11 of J104 to terminals A and T of J101.
6. Transmission in receiving direction from terminals F and S of J101 connector, out of limits.		
a. Output at terminals 3 and 5 of TB101, out of limits.	*a.* Failure of a component part between REC AMP OUT jack and terminals 3 and 5 of TB101.	*a.* Check output at REC AMP IN jack (par. 138*c*). If normal, check output at REC AMP OUT jack. If normal, use signal substitution procedures (par. 140*a* tests No. 6, 7, and 9).
b. Output at REC AMP OUT jack, out of limits.	*b.* Failure of amplifier AR102	*b.* Check output at REC AMP IN jack (par. 138*c*). If normal, replace amplifier AR102.
c. Output at REC AMP IN jack, out of limits.	*c.* Failure of a component part between REC AMP IN jack and terminals F and S of J101.	*c.* Use signal substitution procedures (par. 140*a*, tests No. 1 through 5).
d. Output at 2W EXT binding posts, out of limits.	*d.* Failure of a component part between 2W EXT binding posts and terminals F and S of connector J101.	*d.* Proceed as in correction 6*a*. If normal, use signal substitution (par. 140*a*, test No. 8).
7. Receiving signal to ringer-oscillator Y101 does not light call lamp or sound buzzer.	*a.* Failure of a component part between terminals F and S of connector J101 and ringer oscillator Y101 input connection.	*a.* Proceed as in correction 6*a*. If normal, replace ringer-oscillator Y101 and perform correction 5*b*. If normal, check for shorted or open circuits from terminals 1 and 2 of T105 to terminals 0 and 1 of connector J104. Check to see that terminal 5 is connected to terminal 2 of connector J104.
	b. Failure of 10-volts dc distribution circuit.	*b.* Proceed as in correction 5*b*.

140. ORDER WIRE PANEL, Signal Substitution Charts

The following signal substitution charts (*a* and *b* below) are used to supplement the troubleshooting chart (par. 139). These charts will help to determine the defective stage or circuit. Voltage and resistance measurements taken at the defective stage should isolate the defective part. Normal voltage and resistance measurements appear in TM 11–2139–20, figures 17 through 19. The signal substitution procedures for each step assume that all previous steps have been satisfactorily completed. These tests use the same setup as the operational tests (pars. 136 and 138*a*). For the locations of the parts to be checked in the *Corrective measures* column of the following chart, refer to figures 93 and 94. The schematic diagram is figure 23.

a. ORDER WIRE PANEL, Receiving Direction, Signal Substitution Chart (fig. 23).

Test No.	For hookup of signal in circuit, see paragraph	Voltmeter probe connections		Meter indication (volts ac)	Corrective measures
		Positive	Negative		
1	138*c*	REC AMP IN jack (tip).	REC AMP IN jack (ring).	.007	*a.* Check circuit from terminals F and S of J101 to J107. *b.* Check resistors R124 through R126.
2	138*c*	Terminal 2 of J106	Ground	.007	*a.* Check circuit from terminals F and S of J101 to 2 and 0 of J106. *b.* Check resistors R124 through R126.
3	138*c*. Operate CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8 switch to RADIO position.	Terminal 2 of J106	Ground	.0015	*a.* Perform test No. 2. *b.* Check circuit from terminals F and S of J101 to S103. *c.* Check resistor R113.
4	138*c*	Terminal 17 of J106	Ground	2.2	*a.* Replace receiving amplifier AR102 and repeat test No. 4. *b.* Check circuit associated with terminals 17 and 19 of J106 for opens and shorts if normal indications are not obtained in test No. 4*a*. *c.* Check for 200 volts dc between terminals 12 and 13 of J106. *d.* If normal indication is not obtained in test No. 4*c*, check the 200-volt distribution circuit (TM 11-2139-20, fig. 25). *e.* Check for 6.3 volts ac between terminals 6 and 8 of J106. *f.* If normal indication in test No. 4*e* is not obtained, check the 6.3 volt ac distribution circuit.
5	138*d*	Terminal 17 of J106	Ground	.023	*a.* Check resistors R124 through R126. *b.* Perform test No. 4*a* through *f*.
6	138*c*	REC AMP OUT jack (tip).	REC AMP OUT jack (ring).	.0075	*a.* Check circuit from J106 to T105. *b.* Check resistors R122 and R123.

Test No.	For hookup of signal in circuit, see paragraph	Voltmeter probe connections		Meter indication (volts ac)	Corrective measures
		Positive	Negative		
7	138*c*	Terminal 2 of T105	Ground	.72	*a.* Check circuit between J106 and T105. *b.* Check resistors R119 through R121.
8	138*c*	2W EXT binding post (E101).	2W EXT binding post (E102).	.35	*a.* Check circuits between T105 and 2W EXT binding posts. *b.* Check transformers T104 and T105. *c.* Check resistor R117. *d.* Check capacitors C101 through C104.
9	138*c*	Terminal 5 of TB101	Terminal 3 of TB101	.21	*a.* Check circuits between T105 and TB101. *b.* Check resistors R104 through R106. *c.* Check transformer T102.

b. ORDER WIRE PANEL, Transmitting Direction, Signal Substitution Chart (fig. 23).

Test No.	For hookup of signal in circuit, see paragraph	Voltmeter probe connections		Meter indication (volts ac)	Corrective measures
		Positive	Negative		
1	137*b*	Terminal 1 of T101	Terminal 4 of T101	.195	*a.* Check circuit from TB101 to T101. *b.* Check resistor R101.
2	137*b*	Terminal 5 of T101	Terminal 6 of T101	.41	*a.* Check circuits associated with terminals 5 and 6 of T101. *b.* Check transformer T101.
3	137*b*	Terminal D of J101	Terminal R of J101	.41	Check circuits from T101 to J101 terminals D and R.
4	137*b*	Terminal C of J101	Terminal P of J101	.41	Check circuits from T101 to J101 terminals C and P.
5	137*b*	Terminal 6 of T103	Terminal 5 of T103	.41	Check circuits from T101 to T103.
6	137*b*	Terminal 2 of T103	Ground	.35	*a.* Check circuits associated with terminals 2 and 1 of T103. *b.* Check transformer T103.
7	137*b*	Terminal 2 of EQ101	Ground	.255	*a.* Check circuits from T103 to EQ101. *b.* Check resistors R109 through R111.
8	137*b*	Terminal 2 of J102	Ground		*a.* Check circuits from EQ101 to J102. *b.* Check circuits from EQ101 to S103. *c.* Check resistors R127 through R143.

Test No.	For hookup of signal in circuit, see paragraph	Voltmeter probe connections		Meter indication (volts ac)	Corrective measures
		Positive	Negative		
					d. Check equalizer network EQ101.
	CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch position:				
	RADIO			.092	
	0–11			.092	
	12–13			.092	
	35–57			.084	
	58–80			.084	
	81–103			.088	
	104–126			.084	
	127–149			.084	
	150–160			.088	
	150–160 (Hot).			.175	
9	137*e*	Terminal 2 of J102	Ground		*a.* Perform corrective measures in test No. 8. *b.* Check circuit from 2W EXT binding posts to T103. *c.* Check transformer T104. *d.* Check resistor R117. *e.* Check capacitors C101 through C104.
	Operate CABLE REELS TO NEXT AN/TCC–7 OR AN–TCC–8 switch to 104–126 position. Input frequency:				
	300 cps			.031	
	1,700 cps			.1	
10	137*e*	Terminal 17 of J102	Ground	11	*a.* Check circuit associated with terminals 17 and 19 of J102. *b.* Replace transmitting amplifier AR101, and repeat test No. 10*b*. *c.* If normal indications are not obtained in test No. 10*b*, check for 200 volts dc between terminals 12 and 13 of J102. *d.* If normal indication is not obtained in test No. 10*c*, check the 200-volt distribution circuit (TM–11–2139–20, fig. 25).

Test No.	For hookup of signal in circuit, see paragraph	Voltmeter probe connections		Meter indication (volts ac)	Corrective measures
		Positive	Negative		
					e. Check for 6.3 volts ac between terminals 6 and 8 of J102. *f.* If normal indication is not obtained in test No. 10*e*, check the 6.3-volt ac distribution circuit.
11	137*e*	TR AMP OUT jack (tip).	TR AMP OUT jack (ring).	11	*a.* Check circuit from J102 to J103. *b.* Check resistors R114 through R116.
12	137*e*	TR AMP OUT jack (tip).	TR AMP OUT jack (ring).	.136	Perform corrective measures in test No. 11.
13	137*e*	Terminal L of J101	Ground	11	*a.* Check circuit from terminal 17 of J102 and ground to terminals L and M of J101. *b.* Check filter FL101.
14	137*d*	Terminal L of J101	Ground	11	*a.* Check circuit from terminals K and W of J101 to T103. *b.* Check resistors R107 and R108.

141. Transmitting Amplifier AR101, Test
(fig. 94)

a. Connect the modem and amplifier and carrier supply test cable assemblies, 301- and 1,300-ohm resistors, 200 VOLT POWER SUPPLY, and transmitting amplifier as shown in figure 94.

b. Connect the signal generator, resistors R1 through R3, attenuator, and transformer T109 as shown in figure 94. Connect the output of the transformer across terminals 0 and 2 of the modem and amplifier test cable assembly.

c. Set the attenuator for a 0-db loss and adjust the signal generator for an output frequency of 1 kc at an output level of .077 volt across terminals 0 and 2 as measured with the voltmeter.

d. Connect the voltmeter across the 301- and 1,300-ohm resistors. The voltmeter indication should be 10 $\pm$1.25 volts.

142. Transmitting Amplifier AR101, Signal Substitution Tests

The setup for making signal substitution measurements is the same as that described for the operational test (par. 141). To perform the test outlined in the signal substitution chart below, use the same attenuator setting and signal generator frequency and output level as in paragraph 141*c*.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
1	Term. 1, T1	Term. 3, T1	.077	Check resistor R12 and wiring from connector P1 to transformer T1.
2	Term. 1, V1	Ground	.30	Check resistor R5 and wiring to tube V1
3	Term. 1, V2	Ground	.30	Check resistor R9 and wiring to tube V2.
4	Term. 5, V1	Ground	40	Check capacitors C1 and C2 and connections to T2 and V1.
5	Term. 5, V2	Ground	40	Check capacitors C1 and C2 and connections to T2 and V2.
6	Term. E1	Ground	.8	Check resistors R6, R2, and wiring.
7	Term. E2	Ground	.8	Check resistors R8, R3, and wiring.
8	Term. 1, T2	Term. 3, T2	10	Check transformer T2.
9	Term. 17, P1	Term. 19, T1	10	Check wiring from transformer T2 to connector P1.

143. Receiving Amplifier AR102, Test (fig. 97)

a. Connect the carrier supply, and modem and amplifier test cable assemblies, 825-ohm resistor, 200 VOLT POWER SUPPLY and receiving amplifier as shown in figure 97.

b. Connect the signal generator, resistors R1 through R3, attenuator, and transformer T109 together as shown in figure 97. Connect the secondary output of the transformer across terminals 0 and 2 of the modem and amplifier test cable assembly.

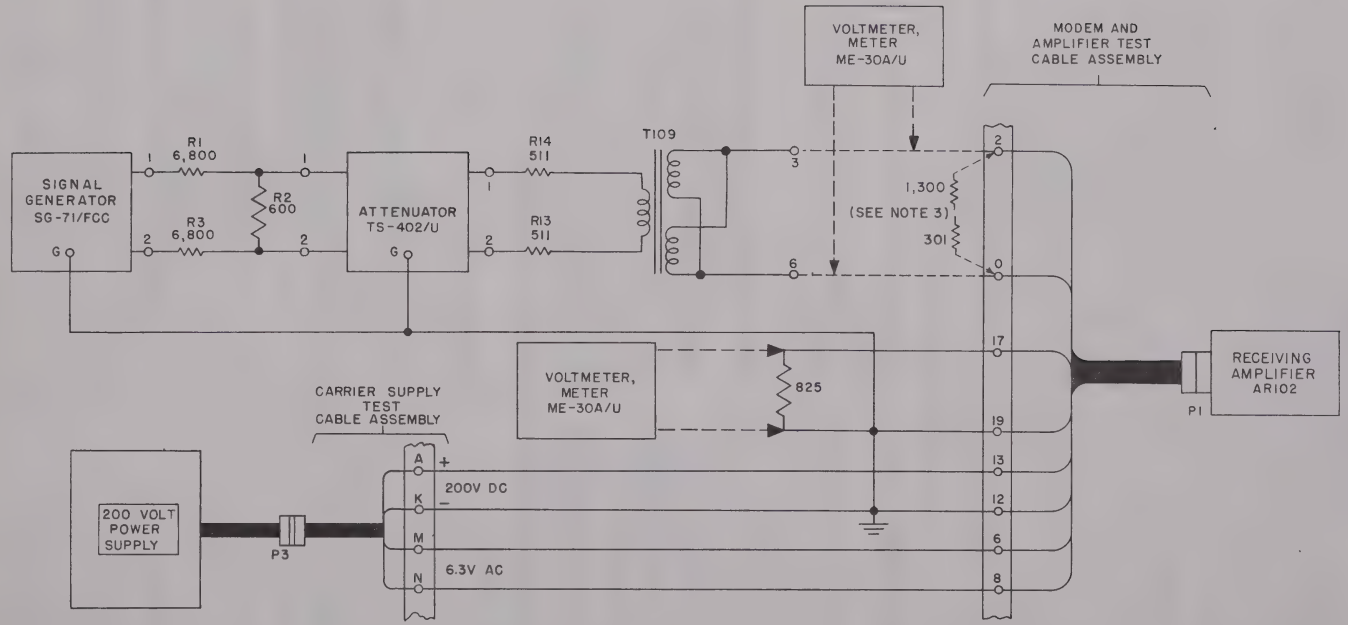
c. Set the attenuator for a 30-db loss and adjust the signal generator for an output frequency of 1 kc at an output level of .007 volt as measured across terminals 0 and 2 with the voltmeter.

d. Connect the voltmeter across the 825-ohm resistor. The voltmeter indication should be 2.2 ±.275 volt.

144. Receiving Amplifier AR102, Signal Substitution Tests

The procedure for making the signal substitution tests is the same as that described for the operational test (par. 143). To perform the tests outlined in the signal substitution chart below, use the same attenuator setting and signal generator frequency and output level as in paragraph 143*c*.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
1	Term. 1, T1	Term. 3, T1	0.007	Check wiring to transformer T1. If wiring is not defective, the trouble may be on the secondary side of T1.
2	Term. 4, T1	Ground	.06	Check transformer T1, the wiring, capacitor C1, and resistor R1.
3	Term. 1, VI	Ground	.06	Check wiring from transformer T1 to tube V1.
4	Term. 5, V1	Ground	.55	Check capacitor C2. Check to see that the tube is properly seated in its socket. Check R5 and wiring from T2 through R5 to E1.
5	Term. 1, V2	Ground	.45	Check capacitor C3 and wiring to tube V2.
6	Term. 6, T2	Ground	17	Check to see that tube V2 is properly seated in its socket. Check C4, C5, and T2.
7	Term. 3, T2	Term. 1, T2	2.2	Check transformer T2.
8	Term. 17, P1	Term. 19, P1	2.2	Check wiring to connector P1.



NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY ONE VOLTMETER, METER ME-30A/U IS NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT AS INDICATED IN FINAL TEST PROCEDURES.

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Figure 97. Receiving amplifier AR102 (part of ORDER WIRE PANEL), operational and final test setup.

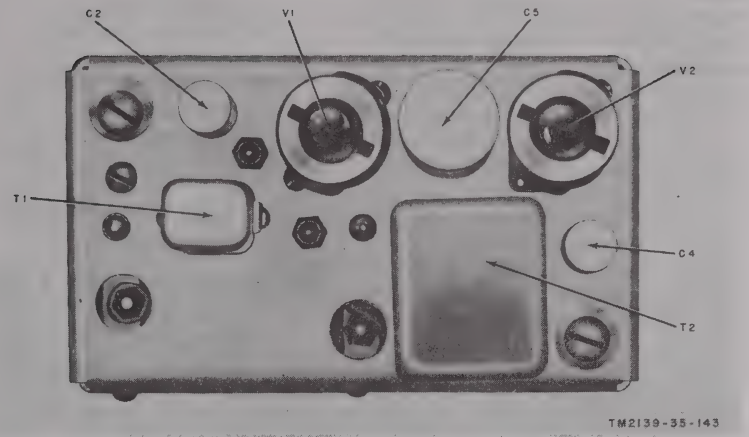


Figure 98. Receiving amplifier AR102 (part of ORDER WIRE PANEL), top view, parts location.

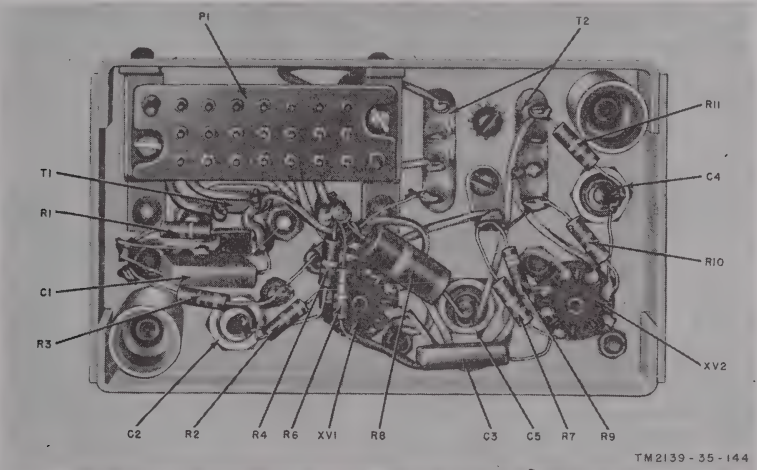


Figure 99. Receiving amplifier AR102 (part of ORDER WIRE PANEL), bottom view, parts location.

145. Ringer-Oscillator Y101, Test
(fig. 100)

a. Initial Procedures.

(1) Connect the carrier supply, and modem and amplifier test cable assemblies, 200 VOLT POWER SUPPLY, and ringer-oscillator as shown in figure 100.

(2) Connect the signal generator, resistors R1 through R3, attenuator, and transformer T109 as shown in figure 100.

b. Receiving Test.

(1) Strap terminals 2 and 5 and connect the 600-ohm resistor across terminals 0 and 1 on the modem and amplifier test cable assembly.

(2) Set the attenuator for a 30-db loss and adjust the signal generator for an output frequency of 1.6 kc at an output level of .31 volt as measured with the voltmeter across the *input* to the attenuator.

(3) Connect the signal generator and associated components (*a*(2) above) across terminals 0 and 1 of the modem and amplifier test cable assembly. The buzzer should operate.

(4) Readjust the attenuator for a 0-db loss and readjust the signal generator for an output frequency 300 cps at an output level of .16 volt measured across terminals 0 and 1 of the modem and amplifier test cable assembly.
(5) Connect the *multimeter,* arranged as a dc voltmeter, across terminal E2 and ground; it should indicate between 5.5 and 13.5 volts dc.
(6) Remove the strap and the 600-ohm resistor ((1) above).
(7) Readjust the signal generator for an output frequency of 1 kc; the multimeter should indicate between 6 and 9 volts dc.
(8) Readjust the signal generator for an output frequency of 3 kc; the multimeter should indicate between 8.5 and 12.5 volts dc.

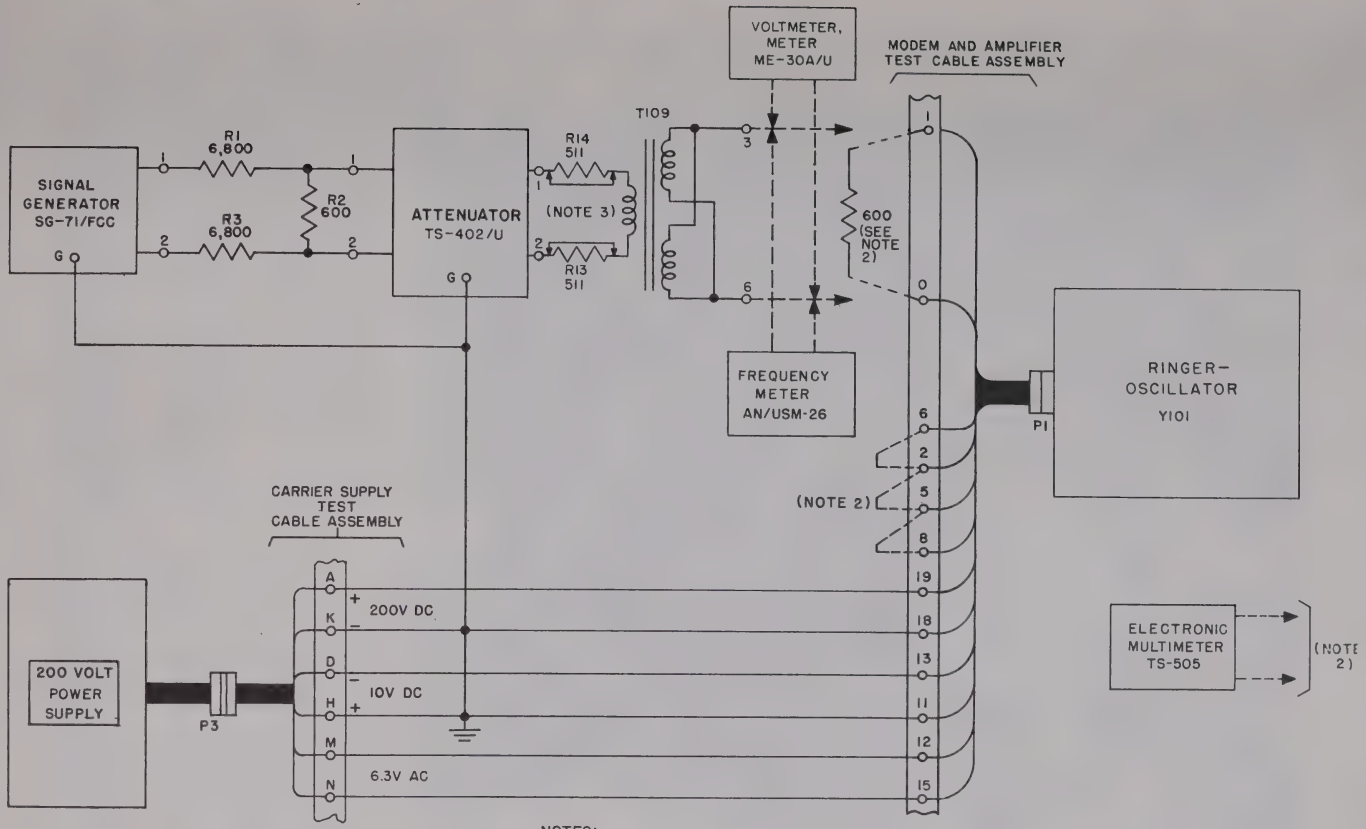
c. Oscillating Test.

(1) Connect the 600-ohm resistor across terminals 0 and 1 and strap terminals 2 and 6 and 5 and 8 on the modem and amplifier test cable assembly.
(2) Connect the frequency meter across terminals 0 and 1 of the modem and amplifier test cable assembly.
(3) The frequency meter indication should be 1.6 kc.
(4) Connect the voltmeter across terminals 0 and 1 of the modem and amplifier test cable assembly. The voltmeter should indicate .275 ±.05 volt.
(5) Remove the 600-ohm resistor and the straps ((1) above).

146. Ringer-Oscillator Y101, Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in ringer-oscillator Y101. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). Once the trouble has been localized to the proper circuit, a tube check and voltage and resistance measurements (TM 11–2139–20, fig. 19) of this circuit should be sufficient to isolate the defective part.

Item No.	Symptom	Probable trouble	Corrective measures
1	No ac voltage measured at terminals 1 and 0.	Defective component part or wiring in oscillator circuits.	Make operational tests in paragraph 145. If these checks indicate normal circuit behavior, check R11 and wiring from terminal 4 of T3 to terminals 6 of P1. Check wiring to terminals 1 and 0 of P1. Check T1 (measure primary and secondary resistances).
2	Voltage measured at terminals 1 and 0 out of limits.	Feedback path of oscillator	Check CR3, CR4, R12, R13, and wiring. Replace defective parts.
3	Frequency measured at terminals 1 and 0 incorrect (par. 145).	Tuned circuit of oscillator	Adjust capacitor C5 and attempt to bring frequency into correct range of 1.6 ±4 cps. If adjustment is impossible, check C5 through C9, and wiring. Replace defective parts.
4	The buzzer does not operate when 1.6 kc is applied to the circuit under the conditions described in paragraph 145*a* through *c* (oscillator frequency and voltage normal as determined from previous tests).	Guard circuit of oscillator	Apply signal substitution tests (par. 147, tests No. 1 through 9).
5	Dc voltage at terminal E2 for 1-kc input incorrect (or excessive talk-up reported from the field).	Defective component part in guard circuit transmission path.	Apply signal substitution tests (par. 147, tests No. 10 through 12).
6	Dc voltage at terminal E2 for 300-cps input incorrect.	Defective capacitor C12 in signal transmission path.	Check capacitor C12. Replace if defective.
7	Dc voltage at terminal E2 for 3-kc input incorrect.	Defective capacitor C13 in guard circuit transmission path.	Check capacitor C13. Replace if defective.



NOTES:

1. RESISTANCES ARE IN OHMS.
2. CONNECT AS INDICATED IN OPERATIONAL OR FINAL TEST PROCEDURES.
3. RESISTORS R13 AND R14 MUST BE STRAPPED OUT FOR THIS SETUP

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Figure 100. Ringer oscillator Y101 (part of ORDER WIRE PANEL), operational and final test setup.

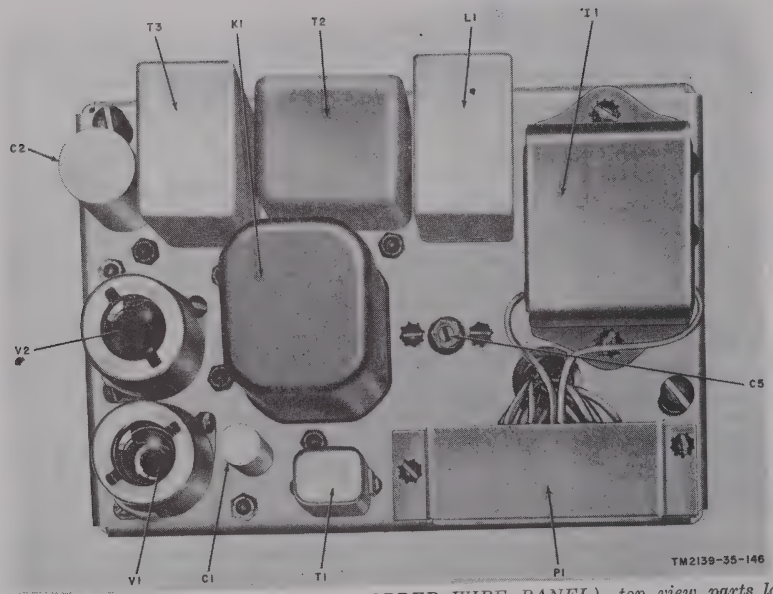


Figure 101. Ringer oscillator Y101 (part of ORDER WIRE PANEL), top view, parts location.

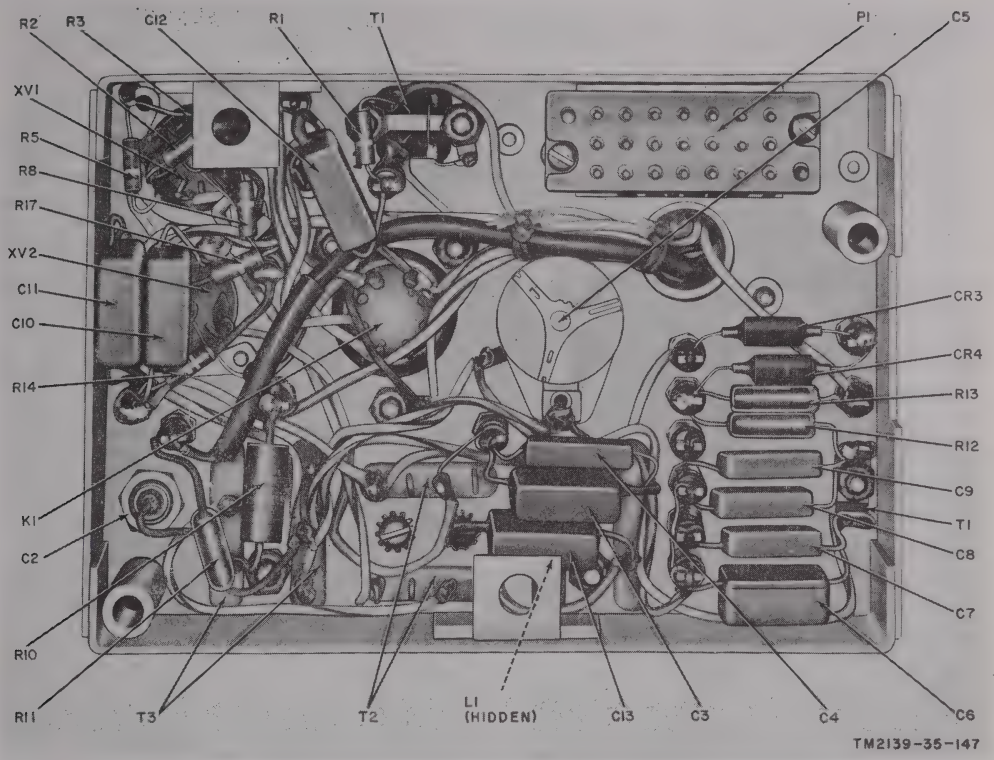


Figure 102. Ringer oscillator Y101 (part of ORDER WIRE PANEL), bottom view, parts location.

147. Ringer Oscillator Y101, Signal Substitution Tests

The signal substitution tests given in the following chart are used to supplement the troubleshooting chart in paragraph 146. Once the trouble has been localized to a specific stage, voltage and resistance measurements should be sufficient to isolate the defective part. The procedure for preparing ringer oscillator Y101 for the signal substitution tests is given in *a* through *e* below.

a. Follow the pretest setup procedure (par. 145*a*) and short terminal 2 to terminal 5 on the modem and amplifier test cable assembly (fig. 100).

b. Connect the signal generator to the attenuator through a protective pad consisting of one 600-ohm resistor and two 6,800-ohm resistors (fig. 100). Set the attenuator for 30-db loss.

c. Connect the output binding posts of the attenuator to the transformer primary winding. Connect the transformer secondary winding to terminals 0 and 1 of the modem and amplifier test cable assembly.

d. Connect the voltmeter to terminals 0 and 1 of the modem and amplifier test cable. Adjust the output of the signal generator for the proper frequency and adjust the voltmeter for an indication as determined by the *Conditions* column of the signal substitution chart.

e. Use the voltmeter for ac test measurements and the multimeter for dc test measurements.

Note. Adjust the attenuator to any setting necessary to obtain the required signal generator output reading as measured on the voltmeter.

Test No.	Conditions	Voltmeter or multimeter probe connections		Meter indication (volts)	Corrective measures
		Positive	Negative		
1	1.6-kc input at .025 volt	Term. 4, T1	Ground	0.23 ac	Check transformer T1 and associated wiring (fig. 27).
2	Same as for test No. 1	Term. E3	Ground	0.20 ac	Check resistor R1. Check for short circuits from E3 to ground.
3	Same as for test No. 1	Term. E1	Ground	0.19 ac	Check resistor R3. Replace if defective.
4	Same as for test No. 1	Pin 4, tube VI	Ground	1.1 ac	Check to see that tube V1 is seated securely in its socket. If the tube is operating properly, the trouble is probably with T2, T3, or the connections to the secondaries of these transformers.
5	Same as for test No. 1	Term. 1, T3	Ground	1 ac	Check transformer T3 and connection to secondary winding.
6	Same as for test No. 1	Term. E7	Ground	8 ac	Check transformer T3; measure resistance of secondary winding. Check wiring from T3 to E7 and capacitors C5 through C9.
7	Same as for test No. 1	Term. E10	Ground	4.9 ac	Check continuity of wiring to terminal E10. Check rectifiers CR3 and CR4, resistors R12 and R13, and wiring to P1.
8	Same as for test No. 1	Term. E6	Ground	−6.1 dc	Check resistor R15 and capacitor C11. Replace if defective.
9	Same as for test No. 1	Term. E2	Ground	−6.1 dc	Check C10, R17, R14; check continuity of connection from E6 to C10, R14, C13, terminal 8 of T2, and terminal 1 of L1.
10	1-kc input at .1 volt	Pin 4, tube V1	Ground	1.5 ac	Check to see that tube V1 is seated securely in its socket. Check connections to primary of T2. If connections to primary are normal and primary is not short-circuited, proceed to next test.
11	1-kc input at .1 volt with external ground on terminal E6.	Term. E15	Term. E6	9.4 ac	Check T2, L1, C3, C4, C13, and associated wiring. Replace defective part.
12	Same as for test No. 11	Term. E2	Term. E6	3.8 dc	Check R17, R14, C10, and tube V2.

148. Dc Resistance of Transformers and Coil

a. Main Chassis.

Transformers	Terminals	Resistance (ohms)
T101 and T102	1–2	10
	3–4	11.5
	5–6	44.5
T103	1–2	61.5
	3–4	75.5
	5–6	90
T104	1–3	51.5
	4–6	51.5
	7–8	27.5
	9–10	27.5
T105	1–2	61.5
	3–4	75.5
	5–6	90

b. Transmitting Amplifier AR101.

Transformers	Terminals	Resistance (ohms)
T1	1–3	100
	4–6	4,300
T2	1–3	57
	4–5	235
	6–8	2,850

c. Receiving Amplifier AR102.

Transformers	Terminals	Resistance (ohms)
T1	1–3	100
	4–6	4–300
T2	1–3	57
	4–5	235
	6–8	2,850

d. Ringer Oscillator Y101.

Transformers	Terminals	Resistance (ohms)
T1	1–3	100
	4–6	4,300
T2	1–3	54
	4–5	215
	6–8	2,570
T3	1–2	25
	3–4	100
	4–5	210
	3–5	310
L1		740

Section VIII. TELEPHONE CARRIER FREQUENCY SUPPLY TA–228/TCC–7

149. Troubleshooting Data

Fig. No.	Par. No.	Description
20		Schematic diagram.
(TM 11–2139–20, fig. 11).		Tube socket voltage and resistance diagram.
104		Resistor board, physical and wiring diagram.
105 and 106		Top view, location of parts.
107, 108, and 109.		Bottom view, location of parts.
150		Wiring diagram.
	153	Dc resistance of transformers and coils.

150. Carrier Supply Panel Tests (fig. 103)

a. Initial Procedures.

(1) Connect the carrier supply transmission, and supply test cable assemblies to the CARRIER SUPPLY PANEL as shown in figure 103.

(2) Connect the resistors across the appropriate terminals of the test cable assemblies as shown in figure 103.

Note. Throughout the following tests, the CARR SYNC switch should be operated to the LOCAL position unless otherwise specified.

Figure 103. CARRIER SUPPLY PANEL, operational and final test setup.

(Contained in separate envelope)

b. Carrier Frequency Output Test.

(1) Connect the voltmeter to terminals C and L, A and J, D and E, and H and R on the transmission test cable assembly. The voltmeter should indicate .75 ±.25 volt for each test.

(2) Connect the voltmeter to terminals C and M, D and N, E and P, and F and R on the carrier supply test cable assembly. The voltmeter should indicate .82 ±.25 volt for each test.

c. Pilot Frequency Output Test.

(1) Adjust the 68KC control to its extreme clockwise position.

(2) Connect the voltmeter across terminals H and J on the supply test cable assembly with terminal J as ground; the voltmeter should indicate at least .0075 volt.

d. 12 and 28 Kc Test Frequency Output Test.

(1) Operate the 12 & 28KC switch to the ON position and operate the 12KC control to its extreme clockwise position.

(2) Strap terminals 3 and 4 on filter FL4 and FL5 (fig. 105).

(3) Connect the voltmeter across terminals H and J on the supply test cable assembly (fig. 103) with terminal J as ground; the voltmeter should indicate at least .003 volt.

(4) Operate the 12KC control to its extreme counterclockwise position and adjust the 28KC control to its extreme clockwise position. The voltmeter ((3) above) should indicate at least .003 volt.

e. Test Jack Test.

(1) Connect the voltmeter across terminals T_1 and R of the test plug assembly with terminal R as ground.

(2) Insert the plug of the test plug assembly into each jack on the CARRIER SUPPLY PANEL except the SYNC jack. The voltmeter should indicate .75 ±.25 volt for each jack tested.

f. Local Oscillator Frequency Test.

(1) Connect the frequency meter across the T_1 and R terminals of the test plug assembly.

(2) Insert the plug of the test plug assembly into the 64KC LOCAL jack on the CARRIER SUPPLY PANEL. The frequency meter should indicate an output of 64 kc ±5 cps.

g. Test Jack Test for Remote Control.

(1) Operate the CARR SYNC switch to the REMOTE position.

(2) Connect the signal generator across terminals F and P on the transmission test cable assembly. Adjust the signal generator for an output frequency of 68 kc at an output level of .75 volt measured across terminals F and P.

(3) Connect the voltmeter across terminals T_1 and R of the test plug assembly with terminal R as ground. Insert the plug of the test plug assembly into the jacks listed in the chart below. The voltmeter indication for each test jack is given in the following chart.

Test jack	Volts (ac)
64KC LOCAL	Less than .2
SYNC	.75 ± .25
64KC REM	.75 ± .25
DIV 1	.75 ± .25

h. Miscellaneous Continuity Tests.

(1) Remove power from the CARRIER SUPPLY PANEL.

(2) Use the multimeter arranged as an ohmmeter to perform the following tests.

(3) Connect the test leads of the multimeter between the supply test cable assembly terminals and the terminals of the other test cable assemblies. The multimeter should indicate zero resistance for each check.

Supply test test cable assembly	Carrier supply test cable assembly connected to		
	(P1)	(P2)	(P3)
C			B
D			L
A	A	A	A
K	K	K	K
M	B	B	
N	L	L	

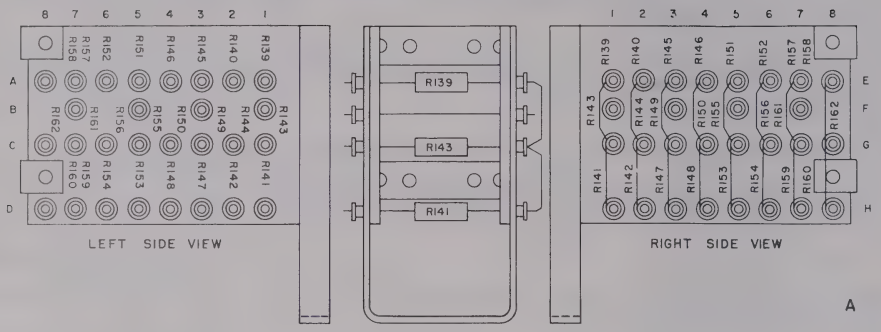
151. CARRIER SUPPLY PANEL
Troubleshooting Chart

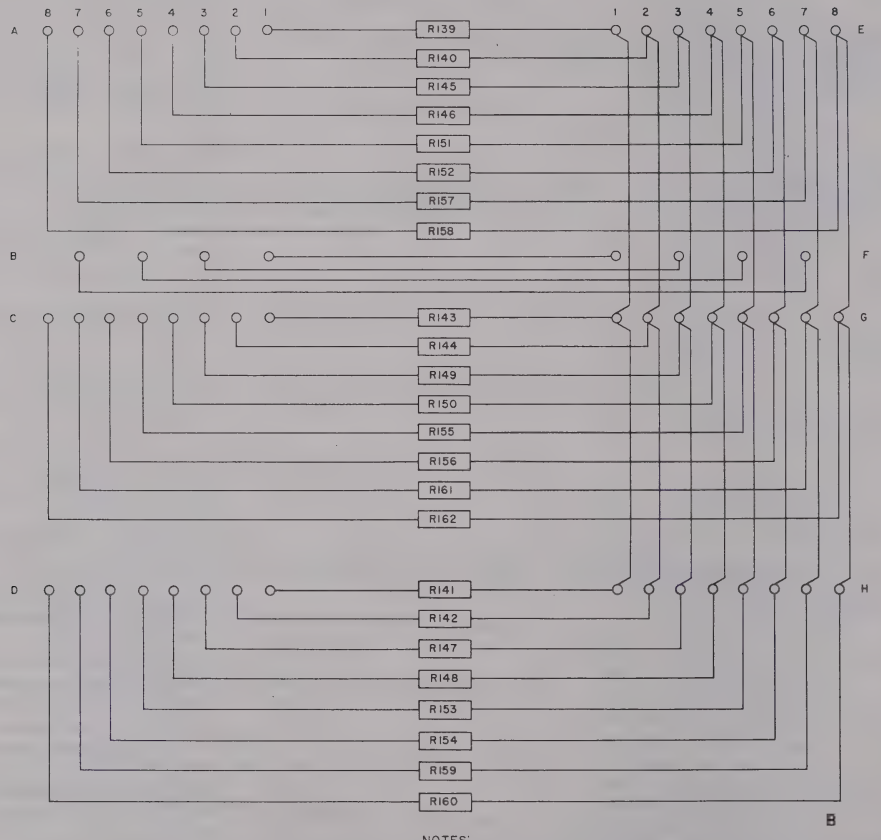
The following chart is supplied as an aid in locating trouble in the CARRIER SUPPLY PANEL. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). Once the trouble has been localized to the proper circuit, a tube check and a voltage and resistance measurement (TM 11–2139–20, fig. 11) should be sufficient to isolate the defective part.

Symptom	Probable trouble	Corrective measures
1. No carrier or pilot or test signal outputs (par. 150*b* through *e*).	*a.* Failure of +200-volt dc distribution circuits.	*a.* Check for presence of 200 volts dc between standoff terminal E2 and ground. If not present, refer to figure 20.
	b. Failure of 6.3-volt ac distribution circuits.	*b.* Check for presence of 6.3 volts ac across terminals 3 and 4 of V2 tube socket with terminal 3 ground. If voltage is not present, check the 6.3-volt ac distribution circuits and locate open or shorted circuits.
	c. Failure of 64-kc oscillator divider, or 4-kc amplifier circuits.	*c.* Follow procedures in symptoms 2, 3, and 4.
2. Output at 64KC LOCAL jack, out of limits (par. 150*e*).	Failure of 64-kc oscillator or local amplifier circuits.	*a.* Check V1 and V2 tube socket voltages. *b.* Use signal substitution procedures (par. 152, tests No. 1, 2, and 3) to localize trouble.
3. Output at DIV 1 jack out of limits.	Failure of first divider circuits	*a.* Check output at 64KC LOCAL jack. *b.* Check V4 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 4 through 9) to localize the trouble.
4. Output at DIV 2 jack out of limits.	Failure of second divider circuit	*a.* Check output at DIV 1 jack. *b.* Check V5 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 10 through 14) to localize the trouble.
5. Output at 4 KC jack out of limits.	Failure of 4-kc amplifier circuit	*a.* Check output at DIV 2 jack. *b.* Check V6 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 15 through 19) to localize the trouble.
6. Output at 8 KC, 12 KC, 16 KC, 20 KC, 56 KC, 72 KC, 88 KC, and 120 KC jacks out of limits.	Failure of odd harmonic generator circuit.	*a.* Check output at 4 KC jack. *b.* Use signal substitution procedures (par. 152, tests No. 20, 21, and 22) to localize the trouble.
7. Output at 8 KC, 16 KC, 56 KC, 72 KC, 88 KC, and 120 KC jacks out of limits.	Failure of even harmonic generator circuit.	*a.* Check output at jacks listed in symptom No. 6. *b.* Use signal substitution procedures (par. 152, test No. 23) to localize the trouble.
8. Output at 8 KC jack out of limits.	Failure of 8-kc filter and amplifier circuit.	*a.* Check output at 4 KC jack. *b.* Check V11 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 24 through 28) to localize the trouble.
9. Output at 12 KC jack out of limits.	Failure of 12-kc filter and amplifier circuit.	*a.* Check output at 4 KC jack. *b.* Check V10 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 29 through 34) to localize trouble.

Symptom	Probable trouble	Corrective measures
10. Output at 16 KC jack out of limits.	Failure of 16-kc filter and amplifier circuit.	*a.* Check V12 tube socket voltages. *b.* Use signal substitution procedures (par. 152, tests No. 35 through 41) to localize trouble.
11. Output at 20 KC jack out of limits.	Failure of 20-kc filter and amplifier circuit.	*a.* Check output at 4 KC jack. *b.* Check V9 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 42 through 47) to localize trouble.
12. Output at 56 KC jack out of limits.	Failure of 56-kc filter and amplifier circuit.	*a.* Check output at 4 KC jack. *b.* Check V13 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 48 through 53) to localize trouble.
13. Output at 72 KC jack out of limits.	Failure of 72-kc filter and amplifier circuit.	*a.* Check V14 tube socket voltages. *b.* Use signal substitution procedures (par. 152, tests No. 54 through 59) to localize trouble.
14. Output at 88 KC jack out of limits.	Failure of 88-kc filter and amplifier circuit.	*a.* Check output at 4 KC jack. *b.* Check V15 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 59 through 65) to localize trouble.
15. Output at 120 KC jack out of limits.	Failure of 120-kc filter and amplifier circuit.	*a.* Check output at 4 KC jack. *b.* Check V16 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 66 through 71) to localize trouble.
16. Output at terminals C and M of carrier supply test cable assembly out of limits.	Failure of output circuits of 8-kc carrier frequency.	*a.* Check output at 8 KC jack. *b.* Check circuits between T19 and P1, P2, and P3 for open or shorted circuits.
17. Output at terminals D and N of carrier supply test cable assembly out of limits.	Failure of output circuits of 12-kc carrier frequency.	*a.* Check output at 12 KC jack. *b.* Check circuits between T17 and P1, P2, and P3 for open or shorted circuits.
18. Output at terminals E and P of carrier supply test cable assembly out of limits.	Failure of output circuits of 16-kc carrier frequency.	*a.* Check output at 16 KC jack. *b.* Check circuits between T20 and P1, P2, and P3 for open or shorted circuit.
19. Output at terminals F and R of carrier supply test cable assembly out of limits.	Failure of output circuits of 20-kc carrier frequency.	*a.* Check output at 20 KC jack. *b.* Check circuits between T15 and P1, P2, and P3 for open or shorted circuits.
20. Output at terminals C and L of transmission test cable assembly.	Failure of output circuits of 56-kc carrier frequency.	*a.* Check output at 56 KC jack. *b.* Check circuits between T21 and J15 for open or shorted circuits.
21. Output at terminals A and J of transmission test cable assembly.	Failure of output circuits of 72-kc carrier frequency.	*a.* Check output at 72 KC jack. *b.* Check circuits between T22 and J15 for open or shorted circuits.
22. Output at terminals D and E of transmission test cable assembly.	Failure of output circuits of 88-kc carrier frequency.	*a.* Check output at 88 KC jack. *b.* Check circuits between T23 and J15 for open or shorted circuits.
23. Output at terminals H and R of transmission test cable assembly.	Failure of output circuits at 120-kc carrier frequency.	*a.* Check output at 120 KC jack. *b.* Check circuits between T24 and J15 for open or shorted circuits.
24. Pilot frequency output at terminals H and J of supply test cable assembly out of limits.	Failure of filter FL5 or 68-kc output circuits.	*a.* Check output at 4 KC jack. *b.* Use signal substitution procedures (par. 152, tests No. 75 and 76) to localize trouble.

Symptom	Probable trouble	Corrective measures
25. 12-kc test frequency output at terminals H and J of supply test cable assembly out of limits.	Failure of filter FL3 or 12-kc output circuits.	*a.* Check output at 4 KC jack. *b.* Use signal substitution procedures (par. 152, tests No. 74 and 75) to localize trouble.
26. 28-kc test frequency output at terminals H and J of supply test cable assembly out of limits.	Failure of filter FL4 or 28-kc output circuits.	*a.* Check output at 4 KC jack. *b.* Use signal substitution procedures (par. 152, tests No. 72 through 75) to localize trouble.
27. Synchronizing signal output at SYNC jack out of limits.	Failure of synchronizing signal input circuits.	Check circuits between J15 and J6 (SYNC) for open or shorted circuits
28. Synchronizing signal output at 64KC REM jack out of limits.	Failure of synchronizing signal modulator and 64-kc remote amplifier circuits.	*a.* Check output at SYNC jack. *b.* Check V7 tube socket voltages. *c.* Use signal substitution procedures (par. 152, tests No. 80 through 87) to localize trouble.
29. Output from synchronizing signal at DIV 1 jack out of limits.	Failure of connections between 64-kc remote amplifier and divider circuits.	*a.* Check output from local oscillator at DIV 1 jack. *b.* Check circuits between T13 and standoff terminals E10 and E11 for open or shorted circuits.
30. Output at 64KC LOCAL jack out of limits (par. 150*g*)) (CARR SYNC switch in REMOTE position).	Failure of blocking circuit for 64-kc local signal.	*a.* Check output at 64KC REM jack. *b.* Check V3 tube socket voltages. *c.* Check resistors R16 through R19 and capacitor C9. Replace defective parts. *d.* Check circuits associated with tube V3 for open or shorted circuits.
31. 68-kc visual or audible alarm indication. No 120-kc alarm indication.	Failure of 68-kc distribution circuit or alarm circuit associated with tube V8.	*a.* Check the 68-kc output at terminals H and J of J16. *b.* If normal indication is obtained in correction *a*, use signal substitution procedures (apr. 152, test No. 77). *c.* If normal indication is obtained in correction *b*, check V7 tube socket voltages and resistances. Check resistors and capacitors associated with the tube socket terminals. Replace defective parts. *d.* Check resistors R64 and R65. Replace if defective. *e.* Check capacitors C23 through C26. Replace if defective. *f.* Check varistors CR6 and CR7. *g.* Check relay K1.
32. 120-kc visual or audible alarm indication. No 68-kc alarm indication.	Failure of 120-kc distribution circuit associated with tube V8.	*a.* Check output at 120 KC jack. *b.* If normal indication is obtained in correction *a*, use signal substitution procedures (par. 152, tests No. 78 and 79) to localize trouble. *c.* If normal indication is obtained in correction *b*, check V7 tube socket voltages and resistances. Check resistors and capacitors associated with the tube socket terminals. Replace defective parts. *d.* Check relay K2. Replace if defective.
33. 68-kc and 120-kc visual or audible alarm indications.	Failure of the carrier and pilot producing circuits or alarm circuits associated with tube V8.	*a.* Check output of test jacks. *b.* If normal indications are obtained in correction *a*, follow procedures in symptoms 31 and 32 of this chart.





NOTES:

1 SECTION A SHOWS PICTORIAL VIEWS OF THE RESISTOR BOARD ASSEMBLY; SECTION B SHOWS A PROJECTION OF THE RESISTOR BOARD ASSEMBLY.

2 SIMILAR ARBITRARY REFERENCES A THROUGH H, AND 1 THROUGH 8, HAVE BEEN ASSIGNED ON BOTH SECTIONS, FOR EXAMPLE, SECTION A IS IDENTICAL TO A1 ON SECTION B.

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Figure 104. CARRIER SUPPLY PANEL, resistor board wiring diagram.

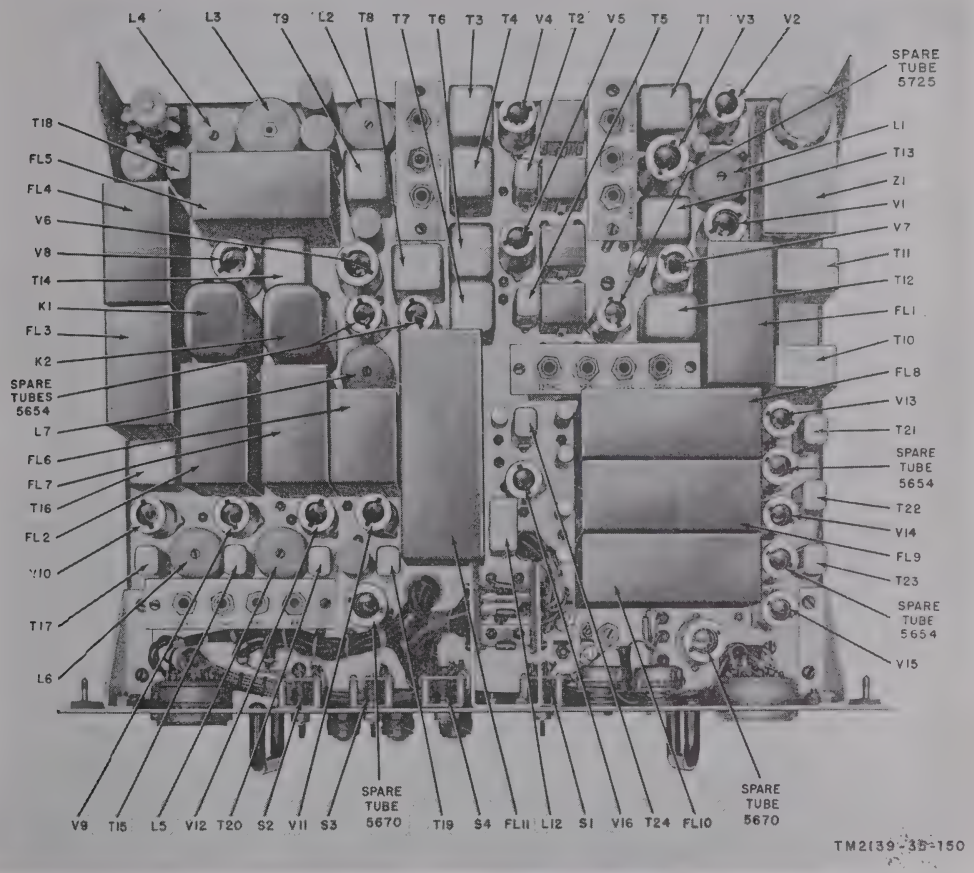


Figure 105. Telephone Carrier Frequency Supply TA-228/TCC-7, removed from transit case, top view, parts location.

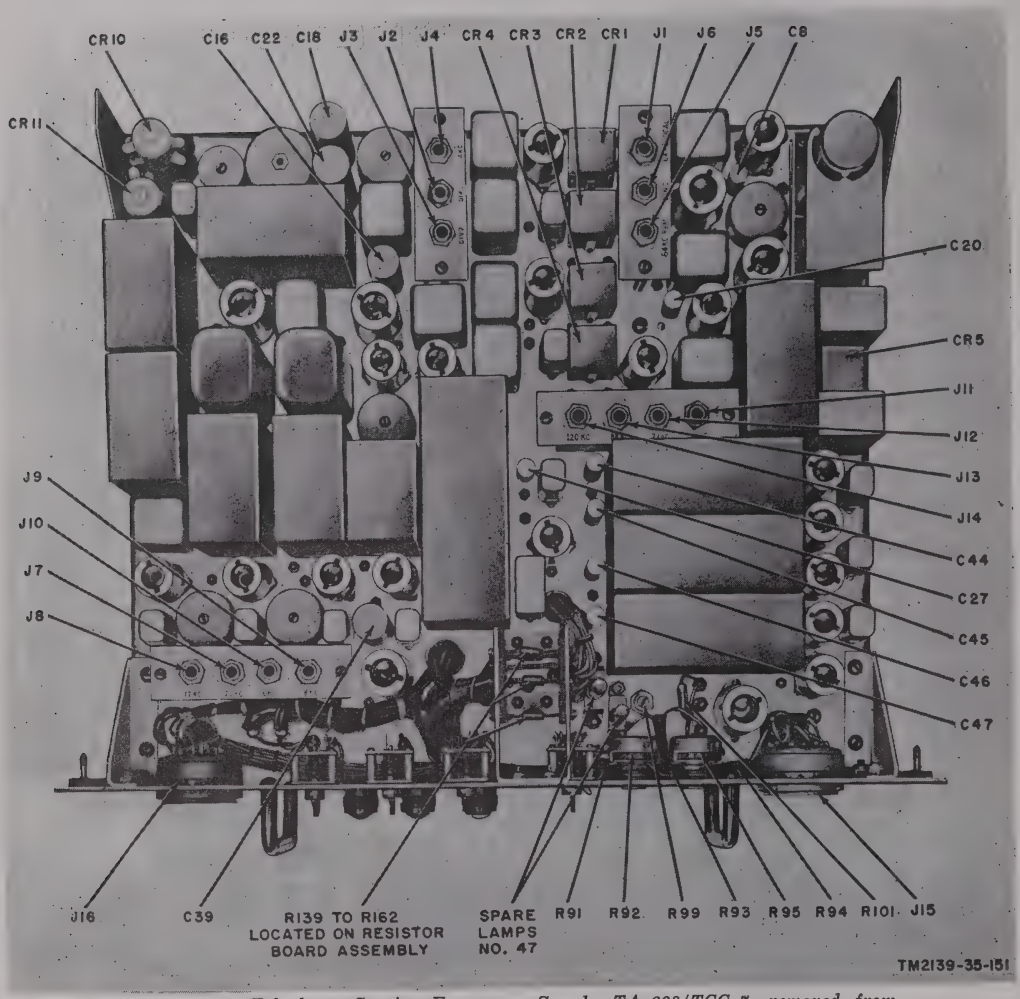


Figure 106. Telephone Carrier Frequency Supply TA-228/TCC-7, removed from transit case, top view, showing location of capacitors and test jacks.

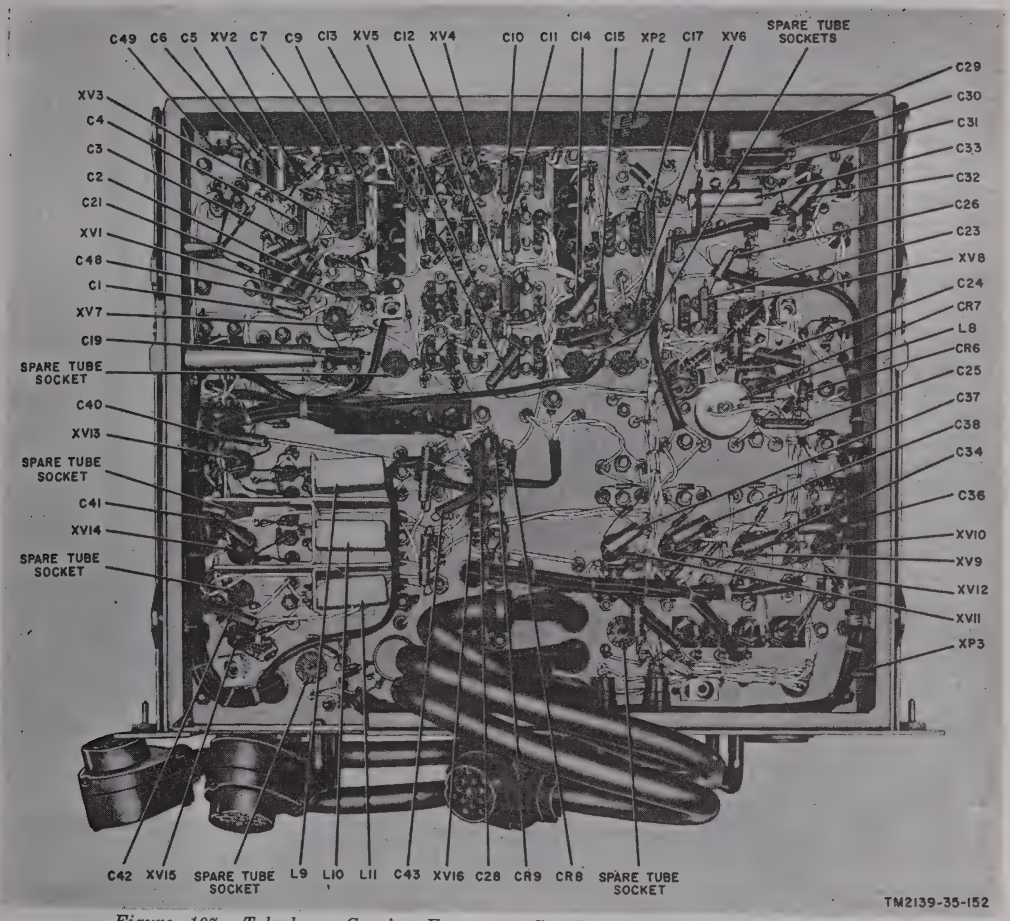


Figure 107. Telephone Carrier Frequency Supply TA-223/TCC-7, bottom view, showing location of coils, capacitors and tube sockets.

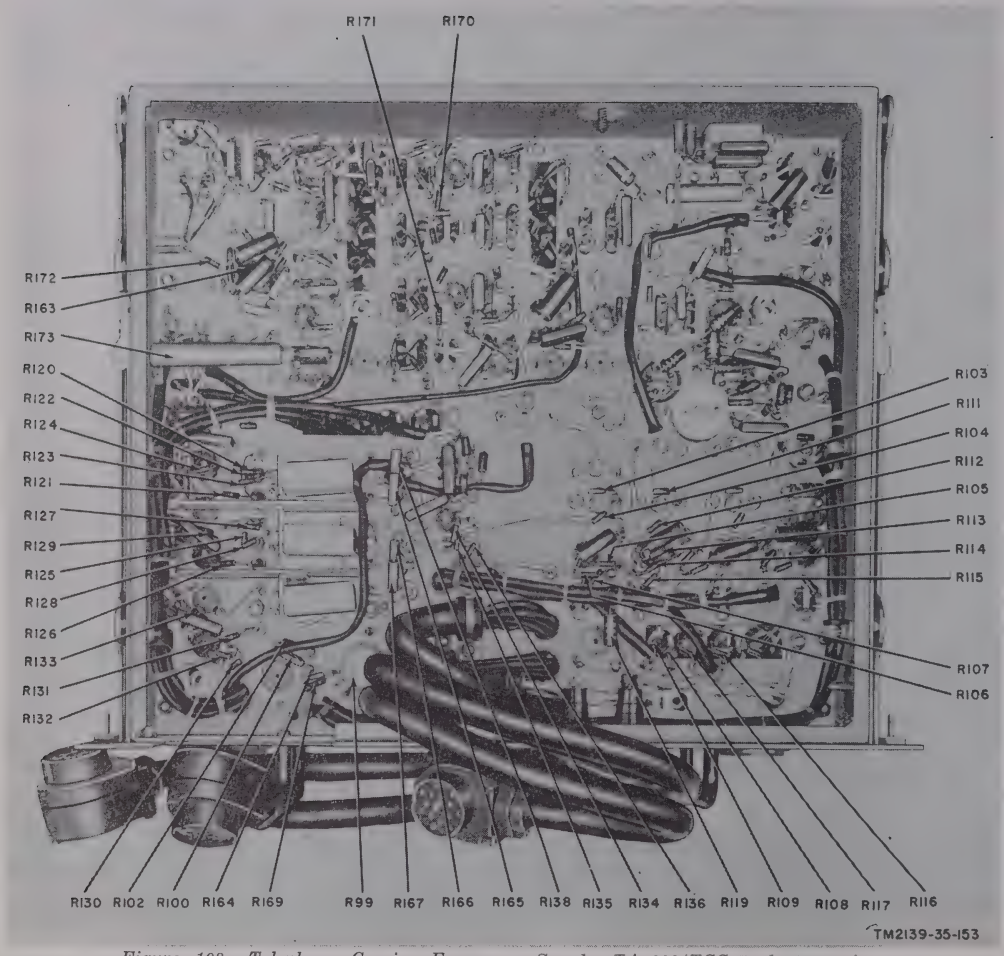


Figure 108. Telephone Carrier Frequency Supply TA-228/TCC-7, bottom view, showing location of resistors from R99 to R173.

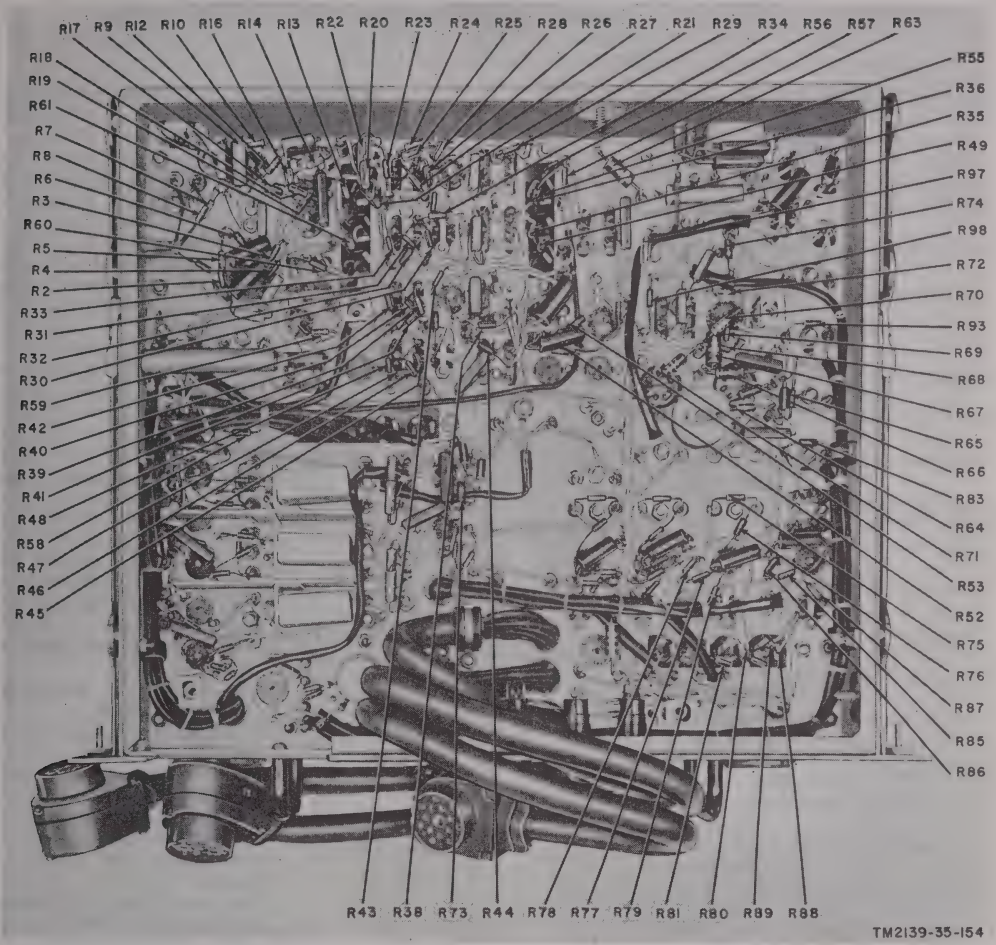


Figure 109. Telephone Carrier Frequency Supply TA-228/TCC-7, bottom view, showing location of resistors up to R98.

152. CARRIER SUPPLY PANEL Signal Substitution Chart

The signal substitution chart is used to supplement the troubleshooting procedures outlined in paragraph 151. The chart will aid in determining the defective stage or circuit. Voltage and resistance measurements are ordinarily sufficient to isolate the defective part in the defective stage or circuit. In each step of the signal substitution procedure, it is assumed that all previous steps have been satisfactorily completed. Use the pretest setup given in paragraph 150*a* except where indicated.

Test No	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
1	Terminal E4	Ground	30	*a.* Check V1 tube socket voltages and resistances. *b.* Check resistors R2, and R5 through R8. Replace if defective. *c.* Check capacitors C1 through C5, and C48, and C49. Replace if defective. *d.* Check inductor L1. *e.* Disconnect the wire at terminal E61 connected to terminal 1 of frequency stabilizing network Z1. Disconnect the wire at terminal E62 connected to terminal 2 of network Z1. Connect a 100K, ½-watt resistor between terminals E61 and E62. Repeat *a* through *d* above. *f.* If a normal voltage indication is obtained in step *e*, replace network Z1.
2	Terminal 6 of T1	Ground	80	*a.* Check V2 tube socket voltages and resistances. *b.* Check resistor R9. Replace if defective. *c.* Check capacitors C6 through C8. Replace if defective. *d.* Check V3 tube socket voltages and resistances. *e.* Check resistors R16 through R18. Replace if defective. *f.* Check capacitor C9. Replace if defective.
3	64KC LOCAL jack (tip).	64KC LOCAL jack (ring).	.75	*a.* Check circuit from T1 to J1 and to terminals E6 and E7. *b.* Check resistors R13 through R15. Replace if defective. *c.* Check transformer T1. Replace if defective.
4	Terminal E7	Terminal E9	2.7	*a.* Check circuit from T1 to terminals E7 and E9 and to T13. *b.* Check resistors R20 through R23. Replace if defective.
5	Terminal E10	Terminal E11	2.7	*a.* Check circuit from terminals E7 and E9 to terminals E10 and E11. *b.* Check resistors R24 through R27. *c.* Check varistor CR1. Replace if defective.
6	Terminal 1 of CR1	Terminal 4 of CR1	.45	*a.* Check circuit from terminals E7 and E9 to terminals E13 and E14. *b.* Check V4 tube socket voltages and resistances. *c.* Check resistors R23 through R27 and R29 and R170. Replace if defective. *d.* Check capacitors C10 and C22. Replace if defective. *e.* Check transformers T2 and T3. Replace if defective. *f.* Check varistor CR1. Replace if defective.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
7	Terminal E13	Terminal E14	3.8	*a.* Check circuit from T3 to terminals E13 and E14. *b.* Check resistors R30 through R33. Replace if defective. *c.* Check varistor CR2. Replace if defective.
8	Terminal 1 of CR2	Terminal 4 of CR2	.5	*a.* Perform test No. 7. *b.* Check resistor R34. Replace if defective. *c.* Check capacitor C11. Replace if defective. *d.* Check transformer T4. Replace if defective.
9	DIV 1 jack (tip)	DIV 1 jack (ring)	.75	*a.* Check circuit from T4 to J2 and terminals E16 and E17. *b.* Check resistors R35 through R37. Replace if defective.
10	Terminal E16	Terminal E17	2.7	*a.* Check circuit from T4 to terminals E16 and E17. *b.* Check resistors R39 through R42. Replace if defective. *c.* Check varistor CR3. Replace if defective.
11	Terminal 1 of CR3	Terminal 4 of CR3	.55	*a.* Check circuit from T4 to terminals E19 and E20. *b.* Check V5 tube socket voltages and resistances. *c.* Check resistors R39 through R42 and R171. Replace if defective. *d.* Check capacitor C12. Replace if defective. *e.* Check transformers T5 and T6. Replace if defective. *f.* Check varistor CR3. Replace if defective.
12	Terminal E19	Terminal E20	3	*a.* Check circuit from T6 to terminals E19 and E20. *b.* Check resistors R45 through R48. Replace if defective. *c.* Check varistor CR4. Replace if defective.
13	Terminal 1 of CR4	Terminal 4 of CR4	.6	*a.* Perform test No. 12. *b.* Check resistor R44. Replace if defective. *c.* Check capacitor C13. Replace if defective. *d.* Check transformer T7. Replace if defective.
14	DIV 2 jack (tip)	DIV 2 jack (ring)	.75	*a.* Check circuit from T7 to J3 and T8. *b.* Check resistors R49 through R51. Replace if defective.
15	Terminal 4 of T8	Terminal 1 of T8	26.2	*a.* Check circuit from T7 to T8. *b.* Check capacitor C14. Replace if defective.
16	Terminal 3 or 7 of V6 tube socket.	Ground	23	*a.* Check circuit from T8 to V6 tube socket. *b.* Check resistors R52 and R53. Replace if defective. *c.* Check capacitor C15. Replace if defective.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
17	Terminal 7 of V6 tube socket.	Ground	23	See corrective measures for test No. 16*a* through *c*.
18	Terminal 7 or terminal 5 of T9.	Ground	82	*a*. Check V6 tube socket voltages and resistances. *b*. Check capacitors C16, C17, and C18. Replace if defective. *c*. Check inductor L2. Replace if defective.
19	Terminal 4 of T9	Ground	9.2	*a*. Check circuit from T9 to J4, T10, and CR10. *b*. Check transformer T9. Replace if defective.
20	4 KC jack (tip)	4 KC jack (ring)	8.5	*a*. See corrective measures for test No. 19*a* and *b*. *b*. Check resistors R55 and R56. Replace if defective.
21	Terminal 1 of L4	Ground	8.5	*a*. See corrective measures for test No. 19*a* and *b*. *b*. Check circuit from L4 to FL2, FL3, FL4, FL5, and T18. *c*. Check resistor R74. Replace if defective. *d*. Check capacitors C29 through C33. Replace if defective. *e*. Check inductors L3 and L4. Replace if defective.
22	Terminal 1 of FL5	Ground	1.3	See corrective measures for test No. 21*a* through *e*.
23	Terminal 6 of T18	Ground	3.3	*a*. Follow test No. 21*a* through *e*. *b*. Check circuits from T18 to FL6, FL7, FL8, FL9, FL10, and FL11. *c*. Check transformer T18. Replace if defective.
24	Terminal 1 of V11 tube socket.	Ground	15	*a*. Check circuit from FL6 to V11. *b*. Check resistors R103 and R104. Replace if defective. *c*. Check filter FL6.
25	Terminal 6 of T19	Ground	40	*a*. Check V11 tube socket voltages and resistances. *b*. Check resistors R106 and R107. Replace if defective. *c*. Check inductor L7. Replace if defective. *d*. Check capacitor C37. Replace if defective.
26	Terminal 3 of T19	Terminal 1 of T19	1.4	*a*. Check circuit from T19 to J9, P1, P2, and P3. *b*. Check transformer T19. Replace if defective.
27	8 KC jack (tip)	8 KC jack (ring)	.75	*a*. Check circuit from T19 to J9. *b*. Check resistors R108 through R110. Replace if defective.
28	Terminal C of P1, P2, and P3.	Terminal M of P1, P2, and P3.	.82	*a*. Check circuit from T19 to P1, P2, and P3. *b*. Check resistors R151 through R156. Replace if defective.
29	Terminals 3 of FL3	Ground	.52	*a*. Check circuit from FL3 to T16 and S4.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
				b. Check resistor R83. Replace if defective. *c.* Check filter FL3. Replace if defective.
30	Terminal 1 of V10 tube socket.	Ground	15	*a.* Check circuit from T16 to V10. *b.* Check resistor R84. Replace if defective. *c.* Check capacitor C35. Replace if defective. *d.* Check transformer T16. Replace if defective.
31	Terminal 6 of T17	Ground	40	*a.* Check V10 tube socket voltages and resistances. *b.* Check resistors R86 and R87. Replace if defective. *c.* Check capacitors C35 and C36. Replace if defective. *d.* Check inductor L6. Replace if defective.
32	Terminal 3 of T17	Terminal 1 of T17	1.4	*a.* Check circuit from T17 to J8, P1, P2, and P3. *b.* Check transformer T17. Replace if defective.
33	12 KC jack (tip)	12 KC jack (ring)	.75	*a.* Check circuit from T17 to J8. *b.* Check resistors R88 through R90. Replace if defective.
34	Terminal D of P1, P2, and P3.	Terminal N of P1, P2, and P3.	.82	*a.* Check circuit from T17 to P1, P2, and P3. *b.* Check resistors R145 through R150. Replace if defective.
35*	Terminal H of J16	Terminal J of J16	.003	*a.* Check circuit from FL3 to terminals H and J of J16. *b.* Check resistors R91, R92, R96, R100, R101, and R102. Replace if defective. *c.* Check switch contacts of S4. Replace switch if defective.
36	Terminal 3 of FL7	Ground	14	*a.* Check circuit from FL7 to V12. *b.* Check resistors R111 and R112. Replace if defective. *c.* Check filter FL7. Replace if defective.
37	Terminal 1 of V12	Ground	14	See corrective measures for test No. 36*a* through *c*.
38	Terminal 6 of T20	Ground	40	*a.* Check V12 tube socket voltages and resistances. *b.* Check resistors R114 and R115. Replace if defective. *c.* Check capacitor C38. Replace if defective. *d.* Check inductor L8. Replace if defective.
39	Terminal 3 of T20	Terminal 1 of T20	1.4	*a.* Check circuit from T20 to J10, P1, P2, and P3. *b.* Check transformer T20. Replace if defective.
40	16 KC jack (tip)	16 KC jack (ring)	.75	*a.* Check circuit from T20 to J10. *b.* Check resistors R116, R117, and R118. Replace if defective.

* See paragraph 150*d*(1) and (2), test setup.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
41	Terminal E of P1, P2, and P3.	Terminal P of P1, P2, and P3.	.82	*a.* Check circuit from T20 to P1, P2, and P3. *b.* Check resistors R157 through R162. Replace if defective.
42	Terminal 3 of FL2	Ground	9.2	*a.* Check circuit from FL2 to V9. *b.* Check resistors R75 and R76. Replace if defective. *c.* Check filter FL2. Replace if defective.
43	Terminal 1 of V9	Ground	9.2	See corrective measures for test No. 42*a* through *c*.
44	Terminal 6 of T15	Ground	41	*a.* Check V9 tube socket voltages and resistances. *b.* Check resistors R78 and R79. Replace if defective. *c.* Check capacitor C34. Replace if defective. *d.* Check inductor L5. Replace if defective.
45	Terminal 3 of T15	Terminal 1 of T15	1.4	*a.* Check circuits from T15 to J7, P1, P2, and P3. *b.* Check transformer T15. Replace if defective.
46	20 KC jack (tip)	20 KC jack (ring)	.75	*a.* Check circuit from T15 to J7. *b.* Check resistors R80 through R82. Replace if defective.
47	Terminal F of P1, P2, and P3.	Terminal R of P1, P2, and P3.	.82	*a.* Check circuit from T15 to P1, P2, and P3. *b.* Check resistors R139 through R144. Replace if defective.
48	Terminal 3 of FL8	Ground	5	*a.* Check circuit from FL8 to V13. *b.* Check resistors R120 and R121. Replace if defective. *c.* Check filter FL8.
49	Terminal 1 of V13	Ground	5	See corrective measures for test No. 48*a* through *c*.
50	Terminal 6 of T21	Ground	38	*a.* Check V13 tube socket voltages and resistances. *b.* Check resistors R123, R124, and R165. Replace if defective. *c.* Check capacitors C40 and C45. Replace if defective. *d.* Check inductor L9. Replace if defective.
51	Terminal 3 of T21	Terminal 1 of T21	.75	*a.* Check circuit from T21 to J11 and J15. *b.* Check transformer T21. Replace if defective.
52	56 KC jack (tip)	56 KC jack (ring)	.75	See corrective measures for test No. 51*a* and *b*.
53	Terminal C of J15	Terminal L of J15	.75	See corrective measures for test No. 51*a* and *b*.
54	Terminal 3 of FL9	Ground	5	*a.* Check circuit from FL9 to V14. *b.* Check resistors R125 and R126. Replace if defective. *c.* Check filter FL9. Replace if defective.
55	Terminal 1 of V14	Ground	37	See corrective measures for test No. 54*a* through *c*.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
56	Terminal 6 of T22	Ground	37	*a.* Check V14 tube socket voltages and resistances. *b.* Check resistors R128, R129, and R166. Replace if defective. *c.* Check capacitor C41 and C46. Replace if defective. *d.* Check inductor L10. Replace if defective.
57	Terminal 3 of T22	Terminal 1 of T22	.75	*a.* Check circuit from T22 to J12 and J15. *b.* Check transformer T22. Replace if defective.
58	72 KC jack (tip)	72 KC jack (ring)	.75	See corrective measures for test No. 57*a* and *b*.
59	Terminal A of J15	Terminal J of J15	.75	See corrective measures for test No. 57*a* and *b*.
60	Terminal 3 of FL10	Ground	3.8	*a.* Check circuit from FL10 to V15. *b.* Check resistor R130. Replace if defective. *c.* Check filter FL10. Replace if defective.
61	Terminal 1 of V15	Ground	3.8	See corrective measures for test No. 60*a* through *c*.
62	Terminal 6 of T23	Ground	32	*a.* Check V15 tube socket voltages and resistances. *b.* Check resistors R132, R133, and R167. Replace if defective. *c.* Check capacitors C42 and C47. Replace if defective. *d.* Check inductor L11. Replace if defective.
63	Terminal 3 of T23	Terminal 1 of T23	.75	*a.* Check circuit from T23 to J13 and J15. *b.* Check transformer T23. Replace if defective.
64	88 KC jack (tip)	88 KC jack (ring)	.75	See corrective measures for test No. 63*a* and *b*.
65	Terminal D of J15	Terminal E of J15	.75	See corrective measures for test No. 63*a* and *b*.
66	Terminal 3 of FL11	Ground	2.8	*a.* Check circuit from FL11 to V16. *b.* Check resistors R134 and R174. Replace if defective. *c.* Check filter FL11. Replace if defective.
67	Terminal 1 of V16	Ground	2.8	See corrective measures for test No. 66*a* through *c*.
68	Terminal 6 of T24	Ground	28	*a.* Check V16 tube socket voltages and resistances. *b.* Check resistors R136 through R138. Replace if defective. *c.* Check capacitors C43 and C44. Replace if defective. *d.* Check inductor L12. Replace if defective.
69	Terminal 3 of T24	Terminal 1 of T24	.75	Check circuit from T24 to J14 and J15.
70	120 KC jack (tip)	120 KC jack (ring)	.75	See corrective measures for 68*a* and *b*.
71	Terminal H of J15	Terminal R of J15	.75	See corrective measures for 68*a* and *b*.
72*	Terminal 3 of FL4	Ground	.46	*a.* Check circuit from FL4 to S4.

* See paragraph 150*d*(1) and (2), test setup.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
				b. Check resistors R93 through R96. Replace if defective. *c.* Check filter FL4. Replace if defective.
73*	Terminal 1 of R95	Ground	.085	See corrective measure for test No. 72*a* through *c*.
74*	Terminal E33	Ground	.003	*a.* Check circuit from FL4 to J16. *b.* Check resistors R100 through R102. Replace if defective. *c.* Check switch S4 contacts. Replace switch if defective.
75*	Terminal H of J16	Terminal J of J16	.003	See corrective measures for test No. 74*a* through *c*.
76*	Terminal 3 of FL5	Ground	.42	*a.* Check circuit from FL5 to J16 and T14. *b.* Check resistors R97, R98, R99, R164, R169, R100, R101, and R102. Replace if defective. *c.* Check switch contacts of S4. Replace switch if defective.
77*	Terminal 6 of T14	Terminal 5 of T14	1.2	*a.* Check circuit from FL5 to T14. *b.* Check capacitors C23 and C26. Replace if defective.
78	Terminal E31	Ground	22.5	*a.* Check circuit from T24 to V8. *b.* Check resistors R72 and R73. Replace if defective. *c.* Check capacitors C27 and C28. Replace if defective. *d.* Check varistors CR8 and CR9. Replace if defective.
79	Terminal 30	Ground	2.9	See corrective measures for test No. 78*a* through *d*.
80†	SYNC jack (tip)	SYNC jack (ring)	.75	*a.* Check circuit from terminals F and P of J15 to J6, T10, and T11. *b.* Check S1 switch contacts. Replace switch if defective.
81†	Terminal 5 and T10	Ground	1.4	Check connections from T9 to T10.
82†	Terminal 2 of T11	Ground	.6	*a.* See corrective measures for test No. 74*a* through *c*. *b.* Check circuit from J6 to T10 and T11. *c.* Check circuit from T10 to T11. Replace if defective. *d.* Check transformers T10 and T11. Replace if defective. *e.* Check varistor CR5.
83†	Terminal 3 of FL1	Ground	.1	*a.* Check circuit from FL11 to T12. *b.* Check resistor R58. Replace if defective. *c.* Check filter FL1. Replace if defective.
84†	Terminal 6 of T12	Ground	.15	*a.* Check circuit from FL1 to V7. *b.* Check capacitor C19. Replace if defective. *c.* Check transformer T12.
85†	Terminal 6 of T13	Ground	95	*a.* Check V7 tube socket voltages and resistances. *b.* Check circuit from V7 to E5.

* See paragraph 150*d*(1) and (2), test setup.
† See paragraph 150*g*(1) and (2), test setup.

Test No.	Voltmeter probe connections		Meter indication (ac)	Corrective measures
	Positive	Negative		
				c. Check capacitors C19 through C21. Replace if defective.
86†	Terminal 4 of T13	Ground	6.6	a. Check circuit from T13 to J5 and terminals E8 and E9. b. Check transformer T13. Replace if defective.
87†	64KC REM jack (tip)	64KC REM jack (ring)	.75	a. Check circuit from T13 to J5. b. Check resistors R60 through R62. Replace if defective.

† See paragraph 150g(1) and (2), test setup.

153. Dc Resistance of Transformers and Coils

Transformers and coils	Terminals	Resistance (ohms)
T1, T3, T12, T13, T14	1–2	1.5
	3–4	1.65
	5–6	160
T2, T5	1–3	32
	4–6	1,370
T4, T6, T16	1–2	3
	3–4	3.2
	5–6	150
T7, T8, T9	1–2	8.7
	3–4	8
	5–7	1,700
T10	1–3	3.5
	4–5	9
T11	1–2	1.16
	3–5	2.85
T15, T17, T19, T20	1–3	1.7
	4–6	765
T18	1–3	.7
	4–6	4
T21, T22, T23, T24	1–3	.81
	4–6	876
L1		3
L3		8.4
L4		2
L2, L5, L6, L7, L8		52
L9, L10, L11, L12		21

Section IX. POWER SUPPLY PP–827/U

154. Troubleshooting Data

Fig. No.	Par. No.	Description
33		Schematic diagram.
(TM 11–2139–20, fig. 20).		Tube socket voltage and resistance diagram.
110		Top view, location of parts.
111, 115		Bottom view, location of parts.
112		Right side view, location of parts.
113		Left side view, location of parts.
158		Wiring diagram.
	157	Dc resistance of transformers and coils.

155. 200-Volt Power Supply Test (fig. 134)

a. Initial Procedures.

(1) Connect the carrier supply test cable assembly to connector P3 on the 200 VOLT POWER SUPPLY; connect a resistance of 445 ohms (four parallel 1800-ohm 38 w resistors) and a 160-ohm (2 w) resistor across terminals A and K and D and H respectively of the carrier supply test cable assembly.

(2) Connect P2 on the 200 VOLT POWER SUPPLY to an outlet that supplies either 115 or 230 volts at 60 cps.

(3) Operate the 115V–230V switch to the appropriate position.

b. Operational Test for 115- or 230-Volt Source.

(1) Operate the AC POWER switch to the ON position.

(2) Check the dc output indicated in the chart below with the multimeter and check the ac ripple voltage with the voltmeter.

Test conditions	Output taken at carrier supply test cable assembly terminals	Output voltage	Maximum ripple voltage (ac)
200V ADJ control fully counterclockwise	A and K	190 dc (max).	
200V ADJ control fully clockwise	A and K	210 dc (min).	
200V ADJ control adjusted for 200 volts	A and K	200 dc	.007
	D and H	9 ±1 dc	.002
No external filament load	B and L	7.2 ±5 ac.	
	E and J	7.2 ±5 ac.	
	F and P	7.2 ±5 ac.	
	M and N	7.2 ±5 ac.	

(3) Connect the multimeter, arranged to measure ac voltage, to the 115V CONVENIENCE OUTLET and then to the TO 600V POWER SUPPLY receptacle. The multimeter should indicate 115 volts for both tests when the input voltage is 115 volts; the multimeter should indicate 230 volts at the 600V POWER SUPPLY receptacle and 0 at the 115V CONVENIENCE OUTLET when the input voltage is 230 volts.

c. 230-Volt Test.

(1) Disconnect the power supply from the ac power source.

(2) Operate the AC POWER switch to the ON position and operate the 115V–230V switch to the 230V position.

(3) Connect the mutimeter, arranged as an ohmmeter, across terminals 2 and 3 of transformers T1, T2, and T3; the multimeter should indicate 0 ohm for each test.

(4) Connect the multimeter across the TO 600V POWER SUPPLY receptacles; the multimeter should indicate 3 ohms.

(5) Connect the multimeter across the 115V CONVENIENCE OUTLET; the multimeter should indicate infinite resistance.

d. Blower Motor Test.

(1) Replace the chassis in the transit case and apply power to the 200 VOLT POWER SUPPLY.

(2) Allow the power supply to remain in operation long enough to cause the blower motor to start. While the blower motor is operating, check to see that air is being moved out through the front grill.

e. High-Voltage Rectifier and Regulator Tests. Perform the tests indicated in the chart below to check the high-voltage rectifier circuit and the regulator circuit for troubles that were not located during the operational tests (*a* through *d* above). Prepare the 200 VOLT POWER SUPPLY for testing as explained in *a*(2) and (3) above. Operate the AC POWER switch to the ON position. Use the multimeter arranged as a voltmeter to make the following tests.

Test No.	Test conditions	Multimeter test jack connection		Meter indication (dc volts)
		Positive probe	Negative probe	
1	200V ADJ control adjusted for 200 volts.	J8	J6	200
		J9	J6	96
		J10	J6	95
		J11	J6	118
		J12	J6	180
		J13	J6	355
		J14	J8	1.75
		J15	J8	1.75
		J16	J8	1.75
		J17	J8	1.75
		J18	J8	1.75
		J19	J8	1.75
		J20	J8	1.75
		J21	J8	1.75
		J12	J8	−18
		J9	J8	110
		J10	J8	110
		J11	J8	88
		J22	J7	9
2	200V ADJ control fully counterclockwise.	J12	J8	−26.5
3	200V ADJ control fully clockwise.	J12	J8	−4

156. 200-VOLT POWER SUPPLY Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the 200 VOLT POWER SUPPLY. This chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance of the organizational level (TM 11–2139–20). Once the trouble has been localized to the proper circuit, a tube check and a voltage and resistance measurement (TM 11–2139–20, fig. 20) of the defective circuit should be sufficient to isolate the defective part. Arrange the 200 VOLT POWER SUPPLY for testing according to the operational test procedure (par. 155*a*).

Symptom	Probable trouble	Corrective measures
1. No dc output voltage (par. 155*b* (2)). Fuse F1 or F2 blows if 115-volt power source is used; fuse F4 blows if 230-volt power source is used.	*a.* Short circuit in the ac input circuit.	*a.* Check from J6 to J13 and from J6 to J8 for short circuits. Capacitor C1, C2, or C7 may be shorted (fig. 33). To locate short circuits in transformers, unsolder wires from taps 2 and 4 on transformer T2. Place switch S3 in the 115V position. Check for 2 ohms on windings 1–2 and 3–4 on transformer T1 or T3. Check windings 1–2 and 3–4 for 2 ohms on transformer T2. Place switch S3 in the 230V position and check between taps 1–4 for 8 ohms on transformer T1 or T3. Check for short circuits across input plug P2.
	b. Failure in high-voltage rectifier circuits V1, V2, and V3, or inductor L1.	*b.* Check for lighted filaments in tubes V1, V2, and V3. If not lighted, check tube wiring and transformer T1. If filaments do light, check from J6 to J13 for 495 ±10 volts dc. If voltage is not present, check for 35 ±10 ohms (inductor L1) from J13 to pin 8 of tube V1. Check for continuity from J6 to tap 6 on transformer T2. Check tube socket voltages and resistances on V1, V2, or V3. On transformer T2, check for continuity of primary windings and from each blade of input plug P2 to taps 1–2 and 3–4. If J6 to J13 voltage is 495 ±10 volts dc then check for 1,800 ohms from J13 to pin A of connector P3, and for continuity from J6 to pin K of connector P3.
2. Low dc output voltage and high output ripple voltage.	*a.* Failures in circuits associated with tubes V1 through V9.	*a.* Check tube socket voltage and resistances on tubes V1 through V9. Where trouble exists, check for tube failures and for opens in resistors R1, R2, R4, R21, R23, and R25 or capacitors C1, C2, and C4. Replace defective parts.

Symptom	Probable trouble	Corrective measures
	b. Failure in filament supply for tubes V4 through V8.	*b.* Check to see that AC POWER lamp lights. If lamp lights, check filaments of tubes V4 through V8 for 6.3 volts. Check for open or shorted circuits where no voltage is present. If lamp does not light, check lamp and wiring for open circuits. Unsolder wires from either tap 5 or tap 6 on transformer T1. Turn on ac power and check for 7.2 volts ±.5 volts ac on winding 5–6 and 115V on winding 3–4 of T1. If no voltage is present, the winding is open or shorted. Check transformer T1. Replace if defective.
3. High dc output voltage and high output ripple voltage.	Tubes V4 through V9 not functioning properly.	Check tube socket voltages and resistances for tubes V4 through V9. Where trouble exists, checks for opens in resistors R5 through R12, and R22, R24, R26, or R27. Replace if defective.
4. Erratic dc output voltage and high output ripple voltage.	*a.* Flicker in tube V9 due to trouble in capacitor C6.	*a.* Check for loose connections at capacitor C6. Check and replace C6 if necessary.
	b. Loose connections at one of the capacitors, at 200-volt adjustment control, or at tube sockets. Capacitor C3, C5, or C7 open.	*b.* Inspect for loose connections. Replace capacitor C3, C5, or C7 if trouble has not been located.
5. Output ripple too high with 95-volt line voltage. Normal dc output voltage, output ripple within limits with 115-volt line voltage.	Cathode circuits of tubes V4 through V7 open or contain aged resistors. Tubes V1 through V3 may be aged or inoperative.	Check dc voltages across resistors R13 through R20, from J8 to each of the connectors J14 through J21 (fig. 33). Turn off power supply and check resistors R13 through R20. Replace open resistors. Resistors R13 through R20 should be replaced if they deviate ±15 percent from 27 ohms. Apply power and check tube socket voltages for tubes V1, V2, and V3. Where deviations exist, change tubes one at a time and recheck voltages. Reject aged tubes.
6. No. −10-volt dc output voltage.	Failure in low-voltage rectifier CR1, inductor L2, or a shorted output.	Operate AC POWER switch to OFF. Check from J7 to J22 for short circuits (fig. 33). If no short circuits are indicated, apply power to power supply. Check from J7 to J22 for −16 to −22 volts. If proper voltage is present, check continuity from J7 to pin D of connector P3, and from J22 to pin H of connector P3. If voltage is not present, operate the AC POWER switch to OFF. Check for 45 ±10 ohms from J7 to terminal 1 of CR1; and check continuity from J22 to terminal 3 of CR1. Apply power to power supply. Check for 14 ±3 volts ac across terminals 2 and 4 of CR1 and taps 7 and 8 on T1. If present, and no dc voltage is present at terminals 1 and 3, CR1 is defective and must be replaced.

Symptom	Probable trouble	Corrective measures
7. Low dc output voltage at −10-volt supply, normal output ripple voltage.	Aged varistor CR1	Carefully check J7 to J22 for 9 ±1.5 volts with 115-volt line and 160-ohm load. If dc voltage is below 7 volts, CR1 has aged and must be replaced.
8. Normal (−10) dc output voltage, high output ripple voltage.	Capacitor C9 open	Check for −10 volts dc on terminals of capacitors C9. If dc voltage at C9 is not present, check for open circuits from J7 and J22 to capacitor terminals. If dc voltage is present at C9, replace capacitor C9.
9. No ac output at terminals B and L, J and E, F and P, or M and N.	Failure in transformer T3 windings or ac distributing and cable wiring.	Check for 7.2 ±.5 volts ac on corresponding windings with no voltage present at output terminals. Operate the AC POWER switch to OFF. On windings where voltage is present, check for opens in the distributing and cable wiring. On windings with no voltage, check for open windings or short circuits. To isolate trouble, unsolder one wire from either tap. Apply ac power and check windings for 7.2 ±.5 volt, with 115-volt input. If voltage is present, check distributing wiring for short circuits. If 7.2 ±.5 volt is not present, the transformer should be replaced.
10. Power supply does not operate with the 230-volt input. Operation satisfactory for 115-volt input.	Failure in input wiring, or transformer T1, T2, and T3 primary windings. Switch S3 may be defective.	Check for 115 volts on windings 1 to 2 and 3 to 4 of transformers T1, T2, and T3. Refer to symptom No. 1 for circuit trouble analysis. Symptoms Nos. 1 through 9 are applicable for 230-volt ac input.
11. Blower inoperative (par. 155*d*)	*a.* Thermostat S2 inoperative	*a.* Short-circuit the terminals on thermostat S2 and check for blower operation. If blower operates, thermostat S2 is defective. Replace thermostat S2 and repeat test given in paragraph 155*d*.
	b. Open circuit	*b.* Short theromstat S2 and check for 115 volts across connector J1. If not present, inspect for open circuits.
	c. Blower B1 inoperative	*c.* Replace blower B1. Short-circuit thermostat S2 terminals to check blower operation.
	d. Capacitor C8	*d.* Replace capacitor C8. Short thermostat S2 to check blower operation. If blower operates, capacitor C8 was defective and should be replaced.
12. No voltage at TO 600V POWER SUPPLY connectors (J2 and J3) and 115V CONVENIENCE OUTLETS (J4 and J5).	Failure in wiring to connectors J2 through J5.	Disconnect input plug P2 from input power source. Short-circuit the male contacts on plug P2. Connect the multimeter to the female contacts on connectors J2, J3, J4, and J5. The meter should indicate 0 ohm at each connector. Where no short is present, check for open circuits. Check fuse F3 and switch S3 if outlets J4 and J5 do not indicate a short.

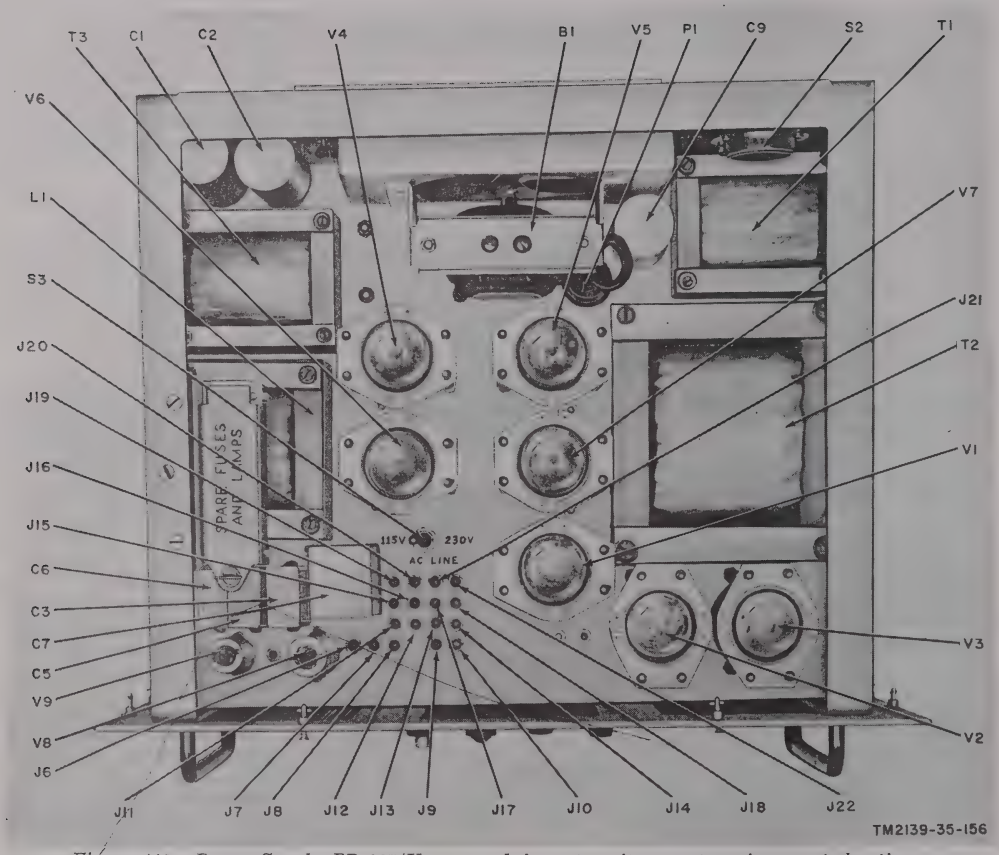


Figure 110. Power Supply PP-827/U, removed from transit case, top view, parts location.

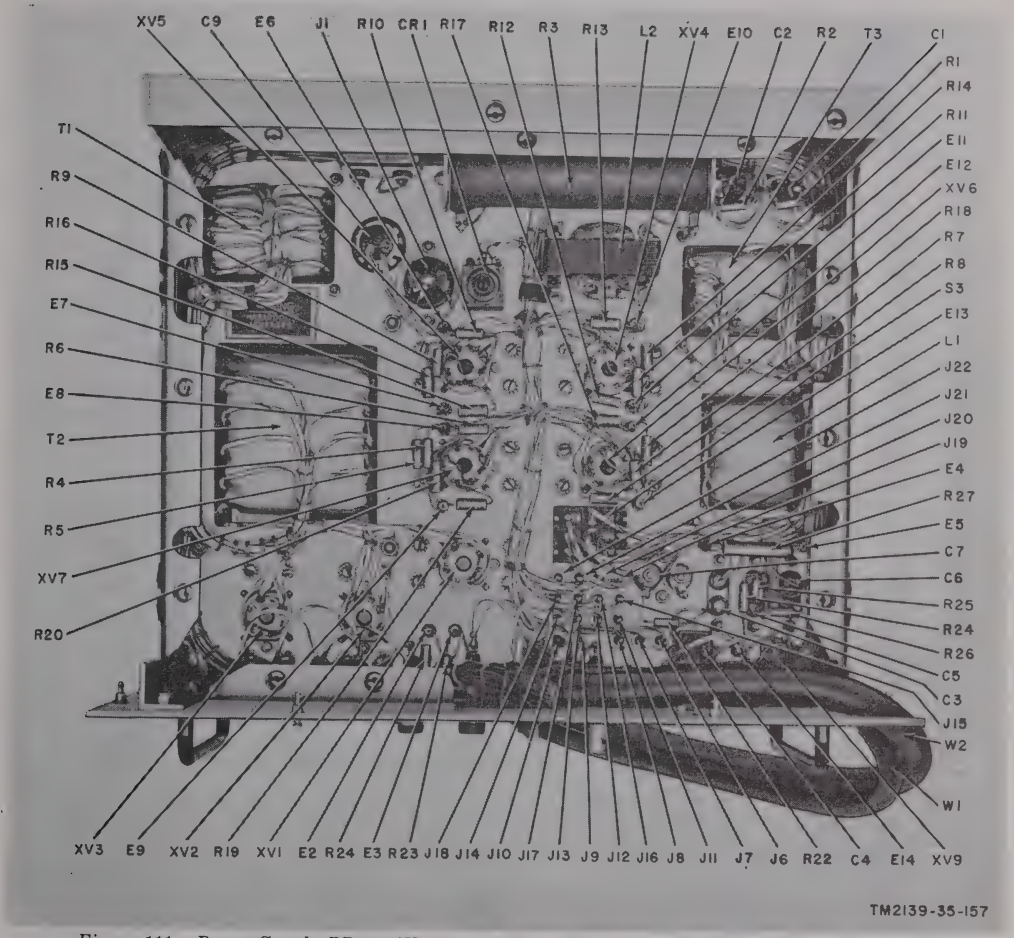


Figure 111. Power Supply PP-827/U, removed from transit case, bottom view, parts location.

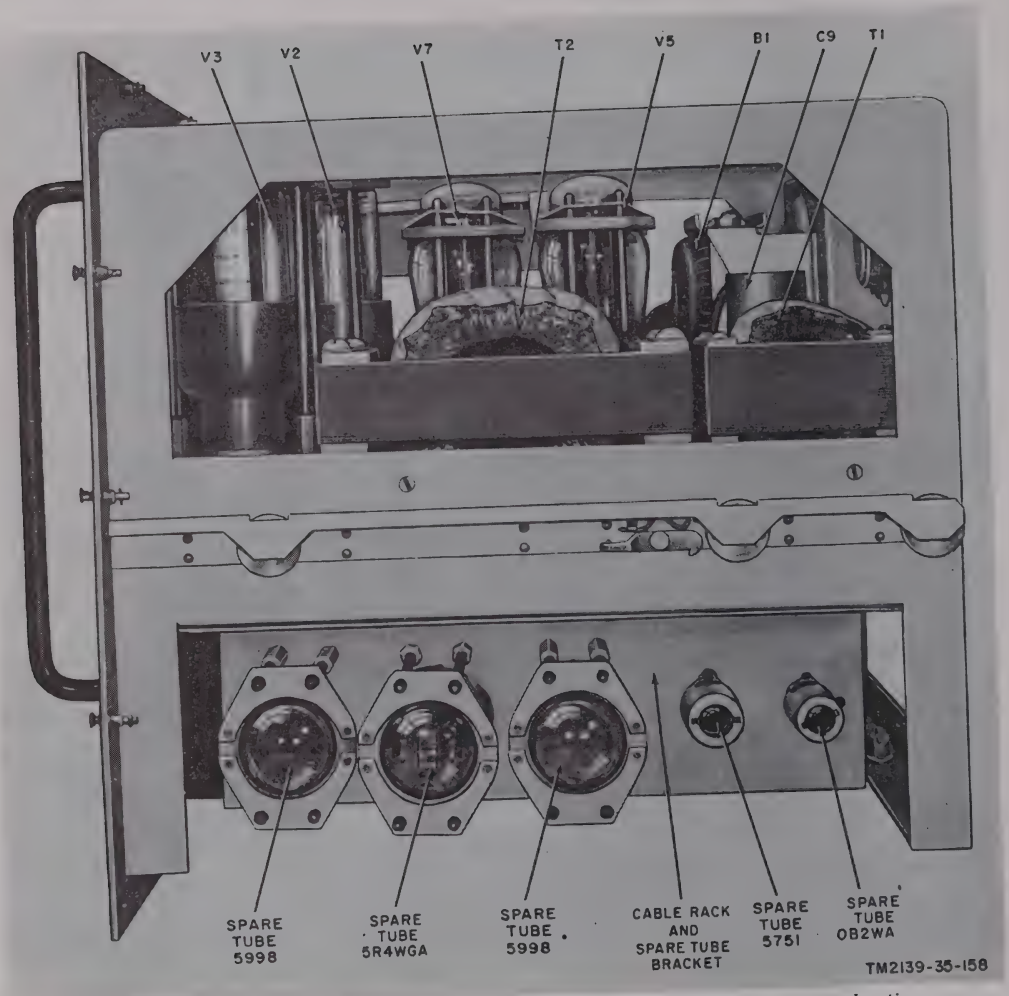


Figure 112. Power Supply PP–827/U, removed from transit case, right side view, parts location.

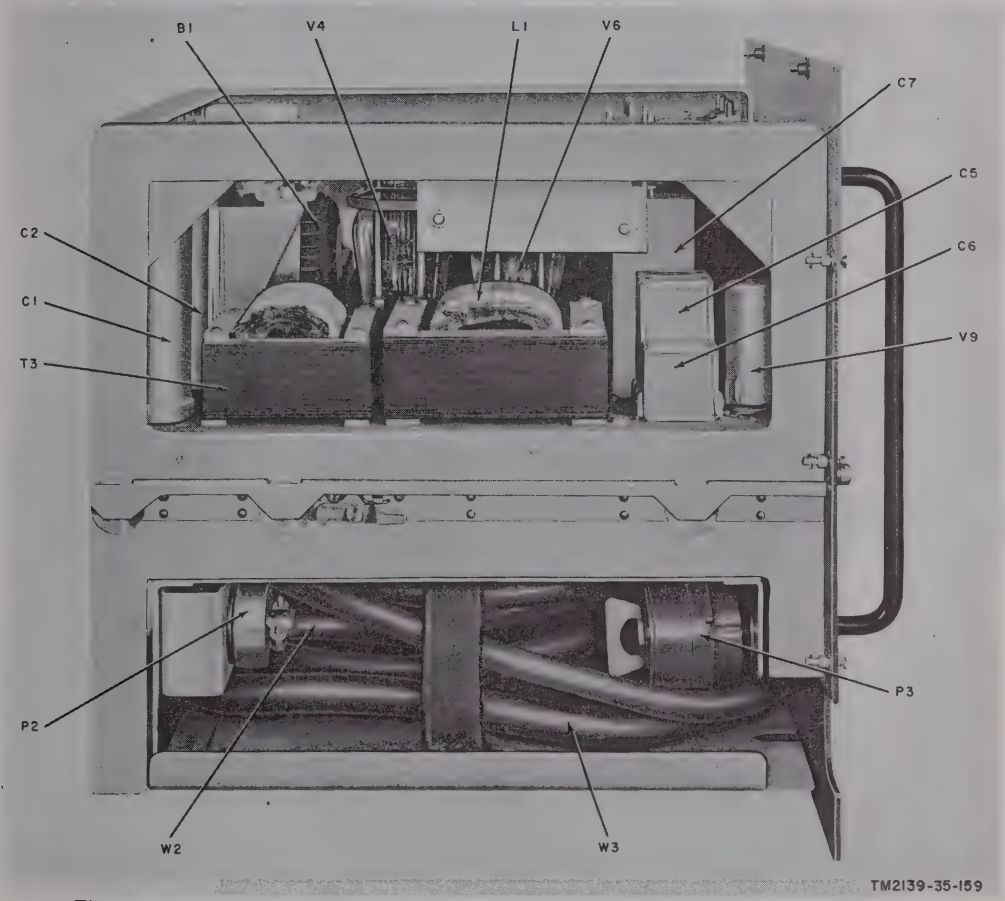


Figure 113. Power Supply PP–827/U, removed from transit case, left side view, parts location.

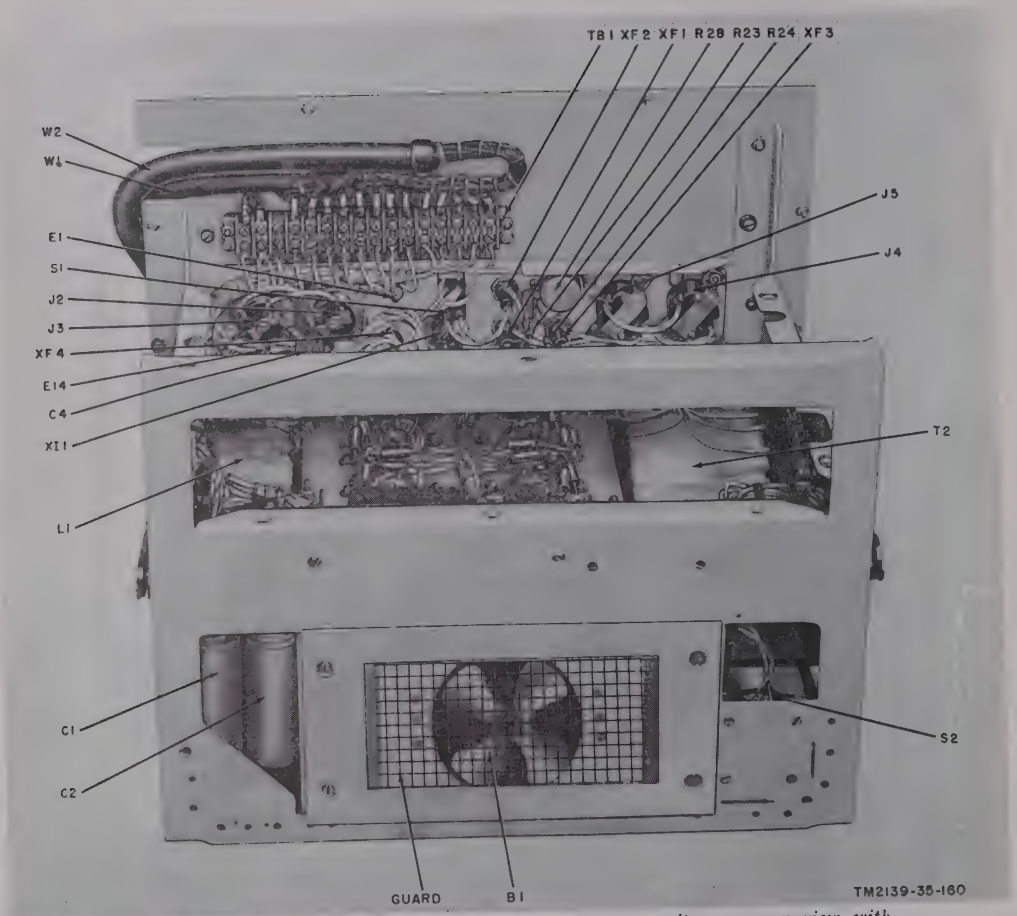


Figure 114. Power Supply PP-827/U, removed from transit case, rear view with cable rack and spare tube bracket removed, parts location.

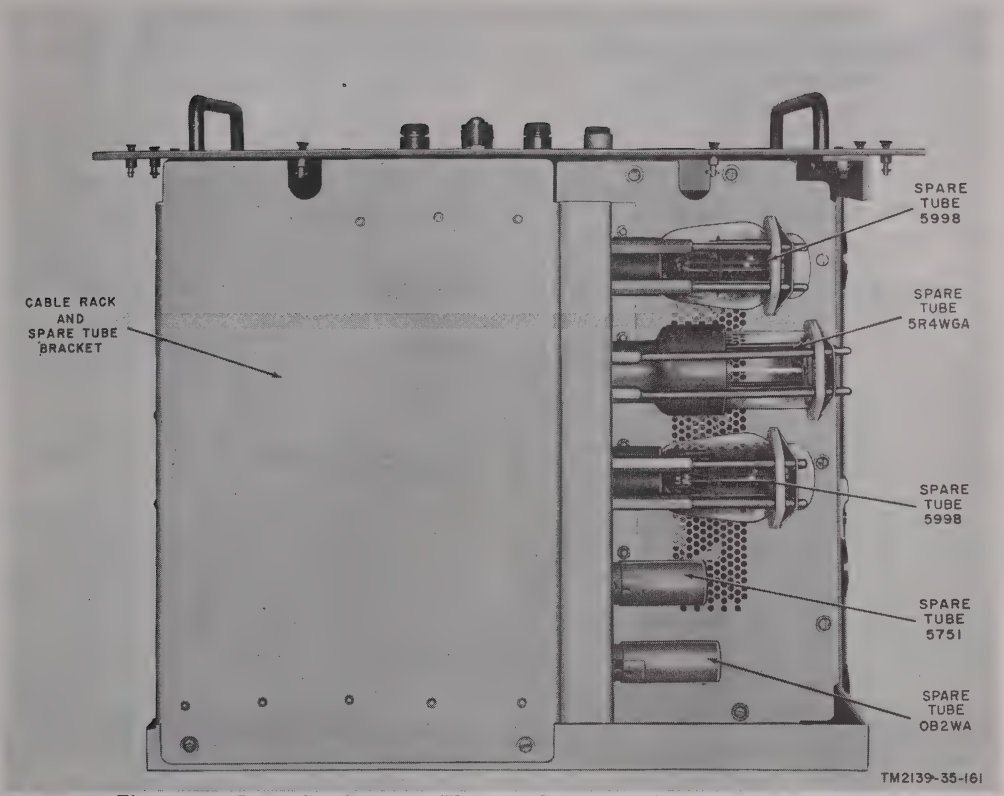


Figure 115. Power Supply PP-847/U, removed from transit case, bottom view with cable rack and spare tube bracket in place, parts location.

157. Dc Resistance of Transformers and Coils

Transformers	Terminals	Resistance (ohms)
T1	1–2	7.4
	3–4	8.4
	5–6	.05
	7–8	13
	9–10	.07
T2	1–2	1.7
	3–4	2
	5–6	29
	6–7	29
	5–7	58
T3	1–2	7.2
	3–4	7.9
	5–6	.074
	7–8	.154
	9–10	.131
	11–12	.069
	12–13	.069
	11–13	.138
L1		37
L2		33

Section X. POWER SUPPLIES PP–826/U AND PP–826A/U

158. 600-VOLT POWER SUPPLY Troubleshooting Data

Fig. No.	Par. No.	Description
39		Power Supply PP–826/U (original units), schematic diagram.
40		Power Supply PP–826/U, (revised units), schematic diagram.
35		Power Supply PP–826A/U, schematic diagram.
(TM 11–2139–20, fig. 21).		Power Supply PP–826/U, tube socket voltage and resistance diagram.
116		Power Supply PP–826/U (original units), bottom view, parts location.
117		Power Supply PP–826/U (revised units), bottom view, parts location.
118		Power Supplies PP–826/U (revised units serial No. 1170 through 2964 only) and PP–826A/U, bottom view, parts location.
119		Power Supplies PP–826/U and PP–826A/U, removed from transit case, top view, parts location.
120		Low-voltage rectifier and alarm unit Z1, top view, parts location.
121		Low-voltage rectifier and alarm unit Z1, controls and parts location.
122		Low-voltage rectifier and alarm unit Z1, cover removed, bottom view, parts location.
123		Low-voltage rectifier and alarm unit Z2, top view, parts location.
124		Low-voltage rectifier and alarm unit Z2, side view, parts location.
125		Low-voltage rectifier and alarm unit Z2, bottom view, parts location.
159		Power Supply PP–826/U (original units), wiring diagram.
161		Power Supply PP–826/U (revised units), wiring diagram.
163		Power Supplies PP–826/U (revised units serial No. 1170 through 2964 only) and PP–826A/U, wiring diagrams.
162		Low-voltage rectifier and alarm unit Z1, wiring diagram.
164		Low-voltage rectifier and alarm unit Z2, wiring diagram.
	162*a*	600 VOLT POWER SUPPLY, dc resistance of transformers and coils, main chassis.
	162*b*	Low-voltage rectifier and alarm units Z1 and Z2, dc resistance of transformers and coils.

159. Power Supply PP–826/U Tests

a. Initial Procedures.

(1) Connect the 600V power supply test cable assembly to connector P3 on the 600 VOLT POWER SUPPLY.

(2) Strap terminals A and B on the 600V power supply test cable assembly; connect terminal C to ground.

(3) Set the REPEATER switch to the 0 position and set the 115V–230V switch to the 115V position. Set the 600V ADJ control to the center of the adjustment range.

(4) Loosen the locking nuts and set the LOAD CURRENT, LOW-VOLT ALARM, and HIGH-VOLT ALARM controls fully clockwise.

(5) Connect P1 to a 115-volt ac 60 cps power.

Warning: **Be careful when making the tests described in *b* through *i* below. Dangerous voltages are present throughout the equipment.**

b. Normal Output Voltage Output Test.

(1) Operate the ALARM CUTOFF switch to the horizontal position; operate the AC POWER switch to the ON position. The LOAD ALARM lamp should light and the buzzer should sound. Operate ALARM CUTOFF switch to the vertical position; the buzzer should be silenced.

(2) After 8 seconds, the CURRENT meter should indicate 80 ma ±10 ma

immediately. The LOAD ALARM lamp should go out 20 seconds later. Adjust the LOAD CURRENT control for an indication of 100 ma on the meter.

(3) Connect the multimeter, arranged for a 1,000-volt input, across test jacks J1 and J10; adjust the 600V ADJ control for a 600-volt indication on the multimeter.

(4) Connect the multimeter across terminals D and C of the power test cable assembly; the meter should indicate approximately 275 volts.

c. Output Ripple Test.

(1) Connect one side of a .5 μf capacitor to jack J1 on low-voltage rectifier and alarm unit Z1; connect a 1-megohm resistor across the binding posts on the voltmeter.

(2) Connect the voltmeter across the other side of the .5-μf capacitor and jack J10 on low-voltage rectifier and alarm unit Z1.

(3) The voltmeter should indicate a ripple voltage of less than 100 millivolts ripple.

d. Low Output Voltage Cutoff Test.

(1) Connect the multimeter across jacks J1 and J10 on low-voltage rectifier and alarm unit Z1. Adjust the LOAD CURRENT control for an indication of 535 volts on the multimeter.

(2) Adjust the LOW-VOLT ALARM control until the power output is cut off; lock the control in this position. The LOAD ALARM and LOW VOLTAGE lamps should light and the buzzer should sound.

(3) Operate the RESTORE switch; the dc output should return to the level indicated in (1) above.

(4) Adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter.

e. High Output Voltage Cutoff Test.

(1) Connect the multimeter across jacks J1 and J10 on low-voltage rectifier and alarm unit Z1. Adjust the LOAD CURRENT control for a reading of 670 volts on the multimeter.

(2) Adjust the HIGH-VOLT ALARM control until the power output is cut off; lock the control in this position. The LOAD ALARM and HIGH VOLTAGE lamps should light and the buzzer should sound. The multimeter should indicate 0 volt and the CURRENT meter should indicate 0 ma.

(3) Depress the RESTORE switch; the dc power should return to the level indicated in (1) above.

(4) Adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter.

f. Load Detection Test.

(1) Operate the AC POWER switch to the OFF position; operate the REPEATER switch to position 1 and adjust the 600V ADJ control to the extreme counterclockwise position.

(2) Connect the multimeter across jacks J1 and J10 on low-voltage rectifier and alarm unit Z1. Operate the AC POWER switch to the ON position. There should be no dc voltage output; the multimeter should indicate 0 volt and the CURRENT meter should indicate approximately 10 ma.

(3) Adjust the 600V ADJ control until the dc voltage is restored. The indication on the CURRENT meter should drop to 0 and then rapidly build up to 100 ma. The multimeter should indicate 480 $\pm$10 volts dc. The voltage output should be cut off within 1 minute from the time that the power came on.

(4) Readjust the REPEATER switch to the 0 position, adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter, and adjust the 600V ADJ control for an indication of 600 volts on the multimeter.

g. 230-Volt Line Test.

(1) Operate the AC POWER switch to the OFF position.

(2) Operate the 115V–230V switch to the 230V position.

(3) Connect the multimeter, arranged as an ohmmeter, across terminals 2 and 3 of transformer T1 on the main

chassis. The multimeter should indicate 0 ohm.

(4) Connect the multimeter across terminals 2 and 3 of transformer T1 on low-voltage rectifier and alarm unit Z1. The multimeter should indicate 0 ohm.

h. Blower Motor Test.

(1) Install the 600 VOLT POWER SUPPLY chassis in the carrying case and reconnect the power source to receptacle P1.

(2) Operate the AC POWER switch to the ON position.

(3) Allow the 600 VOLT POWER SUPPLY to remain in operation long enough to cause thermostat S3 to operate the blower motor. The blower motor should start about 20 minutes after the power has been turned on if the room temperature is approximately 60° F. Check to see that air is being moved out through the front grill.

160. Power Supply PP–826A/U, Tests

The operational tests for Power Supply PP–826A/U are the same as those for Power Supply PP–826/U (par. 159) except for the low output voltage cutoff test (*b* below) and the load detection test (*c* below).

a. Initial Procedure. Perform the initial procedures given in paragraph 159*a*.

b. Low Output Voltage Cutoff Test.

(1) Operate the AC POWER switch to the ON position.

(2) Connect the multimeter arranged as a voltmeter across jacks J1 and J10 on low-voltage rectifier and alarm unit Z2. Adjust the LOAD CURRENT control for an indication of 535 volts on the multimeter.

(3) Adjust the LOW-VOLT ALARM control so that the LOAD ALARM and LOW VOLTAGE lamps light and the buzzer sounds. Lock the control in this position.

(4) Operate and hold the RESTORE switch; the dc power should be interrupted. The CURRENT meter should indicate 15 ma.

(5) Release the RESTORE switch; the CURRENT meter should indicate 80 ma ±10 ma.

(6) Adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter.

c. Load Detection Test.

(1) Operate the AC POWER switch to the OFF position; operate the REPEATER switch to position 3 and adjust the 600V ADJ control to the extreme clockwise position.

(2) Connect the multimeter across jacks J1 and J10 on low-voltage rectifier and alarm unit Z2. Operate the AC POWER switch to the ON position. The multimeter should indicate 0 volt and the CURRENT meter should indicate more than 5 ma. The LOAD ALARM lamp should light and the buzzer should sound.

Note. The LOW VOLTAGE lamp will light approximately one second before the LOAD ALARM lamp lights. The LOW VOLTAGE lamp will then become extinguished.

(3) Operate and hold the RESTORE switch until the LOAD ALARM lamp goes out and the buzzer stops sounding. The *minimum* indication on the CURRENT meter should be 15 ma.

(4) Release the RESTORE switch; the LOAD ALARM lamp will light but the dc power should not come on.

(5) Readjust the REPEATER switch to position 1 and hold the RESTORE switch in the operated position until the LOAD ALARM lamp is extinguished; release the RESTORE switch. The indication on the CURRENT meter should drop to 0 and then rapidly build up to 100 ma.

(6) The multimeter should indicate 480 volts ±10 volts.

(7) Operate the AC POWER switch to the OFF position and readjust the REPEATER switch to the 0 position.

(8) Operate the AC POWER switch to the ON position and adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter. Adjust the 600V ADJ control for an indication of 600 volts on the multimeter.

161. Power Supplies PP–826/U and PP–826A/U Troubleshooting Chart

This chart is supplied as an aid in locating trouble in the 600 VOLT POWER SUPPLY. In the troubleshooting chart, all references to Power Supply PP–826/U and low-voltage rectifier and alarm unit Z1 also apply to Power Supply PP–826A/U and low-voltage rectifier and alarm unit Z2 unless otherwise indicated. The chart lists the symptoms that may be reported on the equipment repair tag or observed when performing maintenance at the organizational level (TM 11–2139–20). After the trouble has been localized to the proper circuit, a tube check and a voltage and resistance measurement (TM 11–2139–20, fig. 21) of the stage or circuit should be sufficient to isolate the defective part.

Note. Relays K6 and K7 on some units (Order No. 14181–Phila–51, serial Nos. 1 through 799) may fail to operate properly due to contact wear and aging of the relay.

Caution: **Do not strap contacts 2 and 3 or 4 and 5 of relay K1.**

Symptom	Probable trouble	Corrective measures
1. Absence of normal dc output. CURRENT meter reads zero, LOAD ALARM lamp unlighted. LOW VOLTAGE lamp unlighted. HIGH VOLTAGE lamp unlighted. Buzzer silent. When AC POWER switch is operated to ON position, and with 115-volt input, fuses F1 and F2 blow; or with 230-volt input, fuses F3 and F4 blow.	*a.* Defective transformers T1 and T2, or transformer T1 on low-voltage rectifier and alarm unit Z1, or associated circuits. Defective 115V-230V switch S2.	*a.* Operate AC POWER switch to OFF position and 115V–230V switch to 115V position. Check resistance between terminals 1 and 2, and 3 and 4 of transformer T1 on low-voltage rectifier and alarm unit Z1. Resistance should be 30 ohms ±10 ohms. Operate 115V–230V switch to 230V position. Check resistance between terminals 1 and 4 of transformer T1. Resistance should be 125 ohms ±15 ohms. Check resistance between terminals 1 and 4 on transformers T1 and T2. Resistance should be 8 ohms ±1 ohm. Operate 115V–230V switch to 115V position. Check resistance between terminals 1 and 2, and 3 and 4 of transformers T1 and T2. Resistance should be 2 ohms ±.5 ohm. If readings are not normal, unsolder leads from terminals, one at a time, to isolate each transformer winding. Determine whether trouble is in transformer, or 115–to 230V switch by performing resistance checks (par. 162).
	b. Open connection between connectors J11 and P11.	*b.* Operate AC POWER switch to ON position. Check voltage between terminals 1 and 2, and between 3 and 4 of transformer T1 on low-voltage rectifier and alarm unit Z1. It should be 115 volts ac. If voltage is not present, check to see that connectors J11 and P11 are correctly seated. Check for opens in windings 1–2, 3–4, and 11–12. Check continuity from terminals 1, 2, 3, and 4 to input connector P1. If 115 volts ac is present, check voltage between terminals 11 and 12 for 7 volts ac. If 7 volts

Symptom	Probable trouble	Corrective measures
		ac is not present, replace transformer T1 (par. 166*f*). If 7 volts ac is present, unsolder a wire from either terminal 11 or 12 and check for opens in LOAD ALARM lamp circuit, LOW VOLTAGE lamp circuit, HIGH VOLTAGE lamp circuit, buzzer, relays K7 and K8 contacts 6 and 11, and ALARM CUTOFF switch S4. The connections to the alarm lamps and the buzzer from low-voltage rectifier and alarm unit Z2 are made through contacts 1–2–9 of relay K2, 1–2–9 of relay K5, 1–3 of relay K10, and 5–6–11 of relay K7. (1) On low-voltage rectifier and alarm unit Z1, check voltage between test jacks J9 and J10 for 155 volts. If voltage is present, operate AC POWER switch to OFF position, and check resistance between test jacks J1 and J9. Resistance should be 3,400 ohms ±100 ohms. If resistance is infinite, check for opens in resistor R18, relay K6 winding, relays K7 and K8 contacts 3 and 10, and relays K4 and K5 contacts 6 and 11. Check resistance between test jacks J1 and J10, with 600V ADJ control set to middle of adjustment range. Resistance should be 6,000 ohms ±100 ohms. If resistance is infinite, check for opens between terminal 29 on connectors P11 and J11, CURRENT meter, resistors R12 through R15, terminals A or B and C, and terminal 32 on connectors P11 and J11. (2) If previous troubles have been cleared and normal dc power output does not come on, trouble can be isolated to either main chassis or to subchassis by substituting a good subchassis and repeating operational tests given in paragraph 159 to insure that main chassis is operating properly. If trouble still exists, inspect main chassis in accordance with applicable items of this chart. When all troubles are cleared from main chassis, reconnect original subchassis and repeat operational tests given

Symptom	Probable trouble	Corrective measures
		in paragraph 159*d* through *g* to isolate trouble in subchassis. Inspect subchassis for troubles in accordance with applicable items of this chart.
2. Absence of normal dc output. CURRENT meter reading between 5 and 20 ma. LOAD ALARM lamp lighted. LOW VOLTAGE lamp unlighted. HIGH VOLTAGE lamp unlighted. Buzzer sounds.	*a.* Relay K6 does not release. Defective REPEATER switch. Shorted capacitor C1, C2, or C3.	*a.* On low-voltage rectifier and alarm unit Z1, check resistance between test jacks J1 and J10, with 600V ADJ control fully counterclockwise. Resistance should be 6,700 ohms. Relay K6 will not release if load is less than 4,800 ohms. If reading is low, check operation of REPEATER switch by observing change in load resistance at each tap position. Check for shorts between test jacks J1 and J10 and between test jacks J1 on main chassis and J10. If shorts are present, unsolder one lead at a time from capacitor C1, C2, or C3 to isolate each capacitor. Then determine if capacitor is shorted. On low-voltage rectifier and alarm unit Z2, relay K6 will release if the resistance measured between test jacks J1 and J10 is greater than 3,000 ohms. If this resistance is lower, perform the same checks as specified for Z1 above.
	b. On low-voltage rectifier and alarm unit Z1, either capacitor C4 or rectifier CR2 is defective.	*b.* On low voltage rectifier and alarm unit Z1, check capacitor C4 for an open. Check rectifier CR2 for defects. Remove tube V1; adjust load (R12, R13, R14, and R15 in series) with 600V ADJ control to 6,000 ohms. Operate AC POWER switch to ON. Measure voltage between test jacks J9 and J10 for approximately +174 volts. If voltage is below +125 volts, capacitor C4 is open and must be replaced. Before replacing C4, check continuity of capacitor wiring. If voltage is below +157 volts with a good capacitor in the circuit, rectifier CR2 is defective and must be replaced. Replace tube V1 after checks are completed.
	c. Defective relay K7	*c.* On low-voltage rectifier and alarm unit Z1, check voltage between test jacks J7(−) and J8(+) for an indication of 40 volts ±4 volts. (Voltage is higher than 24 volts because of absence of load.) If voltage is not present, check for opens in winding of relay K7 and resistor R23. Then check to see that contacts 3 and 10 are not

Symptom	Probable trouble	Corrective measures
		sticking. Normal relay operation is as follows: When relay K7 operates, relay K6 releases and opens contacts 3 and 10 of relay K7. This places resistors R16 and R17 in series with winding of relay K6. Check adjustment of resistor R16. On low-voltage rectifier and alarm unit Z2, resistor R17 is not in series with variable resistor R16. Check the adjustment of variable resistors R16.
	d. On low-voltage rectifier and alarm unit Z1, capacitor C3 is open, or rectifier CR1 is defective.	*d.* On low-voltage rectifier and alarm unit Z1, if 40 volts is not present between test jacks J7(−) and J8(+), check voltage between terminals 9 and 10 of transformer T1 for 33 volts ±3 volts ac. If voltage is not present, replace transformer T1 (par. 166*f*). If voltage is present, check for its presence between terminals 2 and 4 of rectifier CR1. If 33 volts ac is present, check for 40 volts dc between terminals 1(−) and 3(+) of rectifier CR1. If 40 volts is not present, replace rectifier CR1 (par. 166*f*). Check capacitor C3 for an open. Check rectifier CR1 for defects. If voltage between test jacks J7(−) and J8(+) is below 31 volts, capacitor C3 is open and must be replaced. Before replacing C3, check continuity of capacitor wiring. If voltage is below 36 volts with a good capacitor in the circuit, rectifier CR1 is defective and must be replaced.
3. Absence of normal dc output. CURRENT meter reads zero. LOAD ALARM lamp lighted. LOW VOLTAGE lamp unlighted. HIGH VOLTAGE lamp unlighted. Buzzer sounds.	*a.* Failure in load detecting circuit-----	*a.* On low-voltage rectifier and alarm unit Z1, check voltage between test jacks J9 and J10. Voltage indication should be 155 volts dc. If voltage is present, operate AC POWER switch to OFF position. Check resistance between test jacks J1 and J9. Resistance should be 3,400 ohms ±100 ohms. If resistance is infinite, check for opens in resistor R18, relay K6 winding, relays K7 and K8 contacts 3 and 10, and relays K4 and K5 contacts 6 and 11. Set 600V ADJ control to middle of adjustment range and check resistance between test jacks J1 and J10. Resistance should be 6,000 ohms. If resistance is infinite, check for opens between terminal 29 on connectors P11 and J11, CURRENT meter M1, resistors R12

Symptom	Probable trouble	Corrective measures
		through R15, terminals A or B and C, and terminal 32 of connectors P11 and J11. If 155 volts is not present, check voltage across winding 5–6 of transformer T1. Voltage indication should be 140 volts ±10 volts ac. If 140 volts ac is not present, replace transformer T1 (par. 166*f*). If voltage is present, check for its presence across yellow terminals of rectifier CR2. If voltage is not present, replace rectifier CR2. If voltage is present across yellow terminals, check for presence of dc voltage across red and black terminals of rectifier CR2. If no dc voltage is present, replace rectifier CR2.
		On low-voltage rectifier and alarm unit Z2, check for continuity from terminal 7 of relay K6 through contacts 3–10 of relay K7, and contacts 6–11 of relay K2 to test jack J1. Relays K4 and K8 are not used in low-voltage rectifier and alarm unit Z2.
	b. Failures in main rectifier circuits associated with tubes V1 and V2 and inductor L1.	*b.* If low-voltage rectifier and alarm unit Z1 is good, line voltage will be supplied to primaries of transformers T1 and T2. Check voltage across primary windings for presence of 115 volts ac. If 115 volts is present, check for lighted filaments in tubes V1 through V6 on main chassis. If tubes are not lighted, check tubes, socket wiring, and T2 windings 8 to 9 and 10 to 11 for open circuits. If 115 volts ac is not present on primary windings, check for opens between winding 7–8 of relay K1, between connectors P11 and J11, and in the 115V–230V switch. Since V1 and V2 operate at hazardous voltages, perform resistance continuity analysis in preference to other methods. If trouble is not located, check resistance between test jacks J1 and J3 for 7,100 ohms. If resistance is infinite, check resistor R7 and wiring for opens. Operate 600V ADJ control fully clockwise and check resistance between test jacks J1 and J4. Resistance should be 14,300 ohms. If resistance is infinite, check for opens across resistors R6, R12, R13, R14, and R15, CURRENT meter, and connecting wiring.

Symptom	Probable trouble	Corrective measures
		If trouble is not located, check resistance of L1 between test jack J1 and pin 4 of tube V1. Resistance should be 580 ohms. If resistance is infinite, check resistance across terminals 1 and 2 of inductor L1. Resistance should be 580 ohms. If resistance is infinite, replace choke L1. Check resistance between cap of tube V1 and terminal 6 of transformer T1, chassis ground, and test jack J10 on low-voltage rectifier and alarm unit Z1. Resistance should be 330 ohms ±20 ohms. Repeat resistance check from cap of tube V2 to same points. Resistance should be 330 ohms ±20 ohms. If resistance is infinite between terminal 5 or 7 and terminal 6, replace transformer T1 (par. 166*f*).
4. High output ripple voltage alarms normal.		Pin C of connector P3 not grounded. Strap between terminals B and C on terminal block TB1 is open. Capacitor C1, C2, or C3 may be open.
5. No low-voltage cutoff (PP–826/U only). CURRENT meter indication 100 ma. LOAD ALARM lamp remains lighted. LOW VOLTAGE lamp unlighted. HIGH VOLTAGE lamp unlighted. Buzzer sounds.	Failures in circuits associated with tubes V5 and V6 and relays K2 and K3 located on low-voltage rectifier and alarm unit Z1.	On low-voltage rectifier and alarm unit Z1, use tube socket voltage and resistance diagrams (TM 11–2139–20), and check for opens in resistors R6, R8, R9, R10, R11, and R13. Check for open in capacitor C5. Check relay K2 winding and contacts 3 and 10 for sticking. Check to see that connectors P11 and J11 are properly seated. Refer to circuit description paragraphs.
6. Same as 5 except that LOAD ALARM lamp is unlighted.	*a.* Failures in relay K2, K4, K7, or K8 contacts and wiring associated with low-voltage cutoff operation.	*a.* Refer to circuit description paragraphs. Check for opens in the operate and lockup paths of relay K4.
	b. On low-voltage rectifier and alarm unit Z1, either capacitor C3 is open or rectifier CR1 is defective.	*b.* Same as 2*d* above.
7. Same as 5 except that LOAD ALARM lamp unlighted. LOW VOLTAGE lamp lighted.	*a.* Short between contacts 3 and 4 on relay K4.	Check for open between terminals 3 and 4 on relay K4. If a short exists, inspect relay base for solder shorts. If base is clear and trouble is still present, check the relay.
8. No low-voltage cutoff (PP–826/U only). CURRENT meter indicates between 80 and 85 ma. (Low-voltage cutoff occurs with LOW VOLTAGE control adjusted in accordance with paragraph 159*d*.) LOAD ALARM lamp lighted. LOW VOLTAGE lamp lighted. HIGH VOLTAGE lamp unlighted.	Failure in circuits associated with tubes V2, V3, and V4 located on low-voltage rectifier and alarm unit Z1.	On low-voltage rectifier and alarm unit Z1, check voltage between test jacks J3 and J4. Voltage should be 470 volts ±20 volts. If voltage is not present, check for open in choke L1 and in associated wiring. Check to see that connectors P11 and J11 are correctly seated. If voltage is present, check for opens in resistors R1, R2, R3, R5, and R14. On main chassis, check for opens in resistors R1, R2, R5, and R9.

Symptom	Probable trouble	Corrective measures
Buzzer sounds. Symptoms repeat when RESTORE switch is operated.		
9. No high-voltage cutoff	Troubles in symptom 5 have been repaired. Failures in relays K2, K3, K5, K6, K7, and K8 contacts or associated wiring.	Refer to the circuit description paragraph. Check for opens in the operate and lockup paths of relay K5.
Note. Relay K8 is not used in the low-voltage rectifier and alarm unit Z2 of the PP-826A/U power supply. However, except for this difference, the symptoms, probable troubles, and corrections of this item apply to both power supplies.		
CURRENT meter reads 100 ma. LOAD ALARM lamp unlighted. LOW VOLTAGE lamp unlighted. HIGH VOLTAGE lamp unlighted. Buzzer sounds.		
10. Same as 9 except that HIGH VOLTAGE lamp is lighted.	Short between contacts 3 and 4 on relay K5.	Same as 6*c* above.
11. No high-voltage cutoff (See note 9 above.) CURRENT meter indicates between 115 and 120 ma. (High-voltage cutoff occurs with HIGH VOLTAGE control adjusted in accordance with paragraph 195*e*). LOAD ALARM lamp lighted. LOW VOLTAGE lamp unlighted. HIGH VOLTAGE lamp unlighted. Buzzer sounds. Symptoms repeat when RESTORE switch is pressed.	Failures in circuits associated with tubes V3, V4, and V5 on main chassis; tube V2 and relay K3 on low-voltage rectifier and alarm unit Z1.	Check for opens in resistors R3 and R4 on main chassis and in resistors R4 and R14 on low-voltage rectifier and alarm unit Z1.
12. Load detection test requirements not met (par. 159*f* or 160*c*). Dc output current comes on. Improper reading across test jacks J1 and J10 on low-voltage rectifier and alarm unit Z1 (Power Supply PP-826/U only).	*a.* Variable resistor R16 out of adjustment or open. *b.* Relay K9 terminals 1 and 2 or 5 and 6 are shorted.	*a.* Readjust R16 in accordance with final testing. If adjustment is not possible, check for opens in resistors R16 and R17. *b.* Check for opens across terminals 1 and 2, and 5 and 6. If either pair is shorted, inspect relay base for solder shorts. If base is clear and trouble is still present, check relay K9.
13. Load detection test requirements not met (par. 159*f*). Power did not cut off (Power Supply PP-826/U only).	Resistor R22 in low voltage rectifier and alarm unit Z1 open.	Check for open in resistor R22 for continuity of connecting wiring.
14. Power supply fails to start (Power Supply PP-826A/U only).	Resistor R16 in low voltage rectifier and alarm unit Z2 out of adjustment or defective.	Adjust or replace resistor R16.
15. Low line power cutoff test requirements not met. Power supply did not cut off when line voltage was reduced (Power Supply PP-826A/U only).	Variable resistor R20 out of adjustment or shorted. Relay K2 contacts 6 and 11 sticking.	Refer to the circuit description. Readjust R20 as instructed in paragraph 194*j*. If adjustment is not possible, check for opens in resistor R20. Check to see that relay K2 contacts are not sticking.

Symptom	Probable trouble	Corrective measures
16. Load detection test requirements not met (par. 160*c*). LOW VOLTAGE AND LOAD ALARM lamps do not light, buzzer does not sound, and the dc output is not interrupted (Power Supply PP-826A/U only).	Relay K2 has not released. Defective connections to relays K2, K5, and K7.	Check for 7 volts ac between terminal 11 of transformer T1 of the low-voltage rectifier and alarm unit Z2, and terminal 1 of relay K2. If voltage is zero, measure the voltage between terminal 11 of transformer T1 and terminal 2 of relay K2. If voltage is 7 volts, relay K2 has not released; check the adjustment of the LOW-VOLT ALARM control (par. 160*b*).
17. Power supply cycles on and off. LOAD ALARM lamp flashes on and off. Ac input 97 volts or higher.	Variable resistor R20 out of adjustment or open.	Check for open in resistor R20, wiring to relay K2 contacts 6 and 11.
18. 230-volt line test requirements not met (par. 159*h*). Operational tests (par. 159*b* through *g*) were satisfactory.	Failure in input wiring, in primary windings of transformers T1 and T2 on main chassis, or in primary windings of transformer T1 on low-voltage rectifier and alarm unit Z1. Defective 115 V–230V switch S2.	Check voltage across primary windings of transformers T1 and T2 on main chassis and T1 on low-voltage rectifier and alarm unit Z1. If 115 volts ac is not present, check fuses F3 and F4 and associated wiring. Check for opens in input wiring through switch S2. See symptoms Nos. 1 through 17.
19. Blower unoperative	*a*. Defective thermostat S3	*a*. Short terminals on thermostat and check for blower operation. If blower operates, replace thermostat S3 and repeat blower test (par. 159*c*).
	b. Open circuit	*b*. Short thermostat and check voltage. The voltage across connector J2 should be 115 volts. If voltage is not present, inspect for open circuits. Check to see that connectors J2 and P2 are properly seated.
	c. Defective blower B1	*c*. Substitute good blower. Short thermostat to check blower operation.
	d. Defective capacitor C6	*d*. Replace capacitor C6 and perform blower operational test (par. 159*c*).
20. Equipment meets all requirements, but tube V1, V2, V3, or V4 appears to be inoperative.	*a*. Defective rectifier tube V1 or V2	*a*. Operate AC POWER switch to the OFF position and remove the plate cap from an apparently operative tube. Operate AC POWER switch to ON and check for normal operation. (Equipment is capable of normal operation for a short period of time with only one tube operating.) **Caution: Hazardous voltages are present when power is on. Check voltages and resistances at tube sockets. Replace tube if necessary.**
	b. Defective series-regulator tube V3 or V4.	*b*. Repeat procedures given in *a* above for tubes V3 and V4.
	c. Defective voltage regulator tube V4 on low-voltage rectifier and alarm unit Z1.	*c*. On low-voltage rectifier and alarm unit Z1, check voltage across test jacks J4 and J5. It should be 40 volts ±15 volts. If voltage is 90 volts, replace tube V4. If 90 volts is still present, check for opens in associated wiring.

Symptom	Probable trouble	Corrective measures
	d. Failure in time-delay circuit (capacitors C4 and C5 and resistor R9 and main chassis).	*d.* Check voltage across terminals of capacitors C4 and C5 for an exponentially increasing voltage. This voltage should rise to 125 volts ±5 volts in 15 seconds. If voltage does not have this exponential characteristic, replace capacitors C4 and C5. If voltage is not present, check for open circuits in associated wiring. Check resistance between test jacks J1 and J3. Resistance should be 7,100 ohms. If resistance is infinite, check resistance across terminals of resistor R7. Resistance should be 7,100 ohms. Replace resistor R7 if defective.
	e. Defective capacitor C1 or C2 on main chassis.	*e.* On low-voltage rectifier and alarm unit Z1, check high-voltage filter output ripple across test jacks J1 and J10. It should be 8 volts ac (par. 159*c*). **Caution: Use dc blocking network to protect the voltmeter from 1,000 volts.** If 14 volts ac is present, replace capacitor C2. If 21 volts ac is present, replace capacitor C1.
21. After AC POWER switch is operated to ON, LOAD ALARM lamp does not light, and buzzer does not sound. CURRENT meter reads 100 (Power Supply PP–826/U only).	Failure in transformer T1, contacts 6 and 11 of relays K7 and K8, or associated wiring, on low-voltage rectifier and alarm unit Z1.	On low-voltage rectifier and alarm unit Z1, check voltage across terminals 11 and 12 of transformer T1. Voltage should be 7 volts ac. If voltage is absent, replace transformer T1 (par. 166*f*). If voltage is present, check for opens in LOAD ALARM lamp, buzzer, relays K7 and K8 contacts 6 and 11, ALARM CUTOFF switch, and connectors P11 and J11 pins 31 and 35.
22. After AC POWER switch is operated to ON, the LOAD ALARM and LOW VOLTAGE lamps light and the buzzer does not sound (Power Supply PP–826A/U only).	Failure in transformer T1. Contacts 1–9 of relay K2 are open, contacts 5–11 of relay K7 are open, or contacts 1–9 of relay K5 are open.	On low-voltage rectifier and alarm unit unit Z2, check the voltage across terminals 11–12 of transformer T1. If voltage is present, check for opens in relays K2, K7, and K5.
23. When low-voltage cutoff occurs, LOW VOLTAGE alarm lamp does not light. LOAD ALARM lamp lights. Buzzer sounds.	Failure in LOW VOLTAGE alarm lamp circuit.	On low-voltage rectifier and alarm unit Z1, check resistance across terminals 2 and 9 of relay K4. Resistance should be 10 to 15 ohms. If resistance is infinite, check for opens in LOW VOLTAGE alarm lamp, connectors P11 and J11 pins 35 and 2, and associated wiring. Check to see that relay K4 winding and contacts 2 and 9 are not sticking.

Symptom	Probable trouble	Corrective measures
24. When the output voltage decreases below approximately 530 volts, the LOAD ALARM and LOW VOLTAGE lamps do not light and the buzzer does not sound (Power Supply PP–826A/U only).	Failure in transformer T1, contacts of relay K2, or associated wiring on low-voltage rectifier and alarm unit Z2.	On low-voltage rectifier and alarm unit Z2, check winding of transformer T1, contacts on relays K2, K5, and K7. Readjust variable resistor R16 (par. 194*a*).
25. When high-voltage cutoff occurs, HIGH VOLTAGE alarm lamp does not light. LOAD ALARM lamp lights. Buzzer sounds.	Failure in HIGH VOLTAGE alarm lamp circuit.	On low-voltage rectifier and alarm unit Z1, check resistance across terminals 2 and 9 of relay K5. Resistance should be 10 to 15 ohms. If resistance is infinite, check for opens in HIGH VOLTAGE alarm lamp, connectors J11 and P11 pins 35 and 30, and associated wiring. Check relay K5 winding. See that contacts 2 and 9 are not sticking.

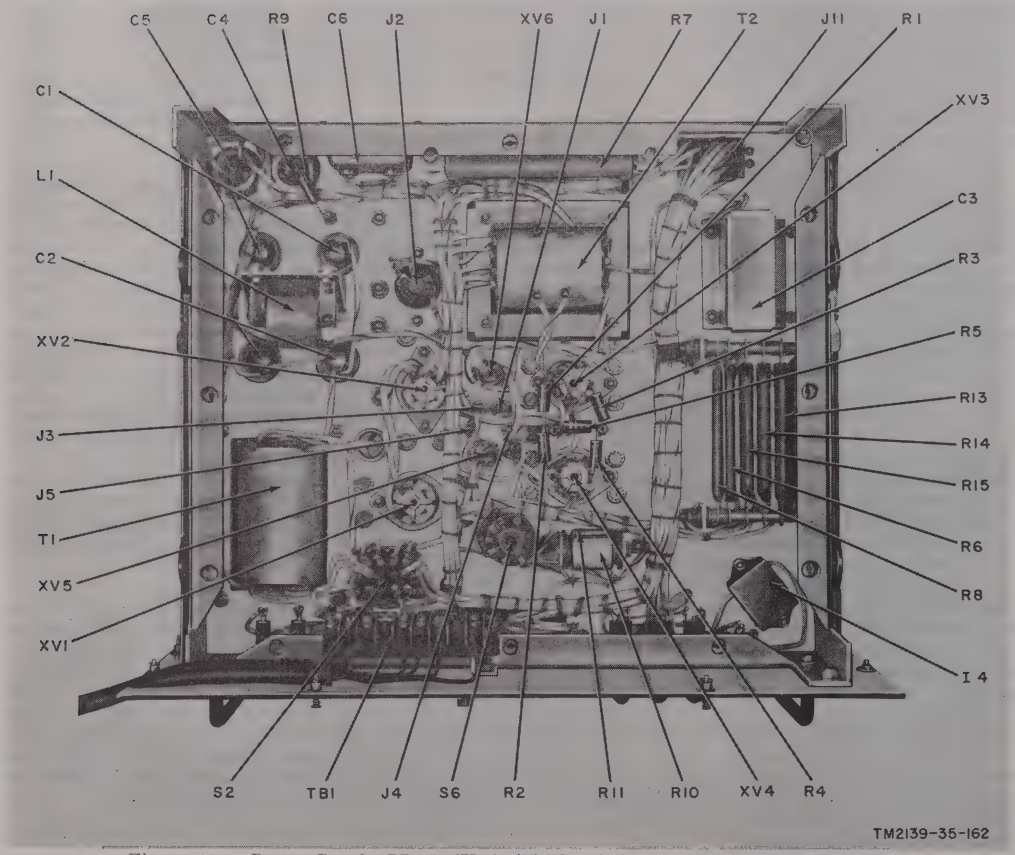


Figure 116. Power Supply PP–826/U (original units), removed from transit case, bottom view, parts location.

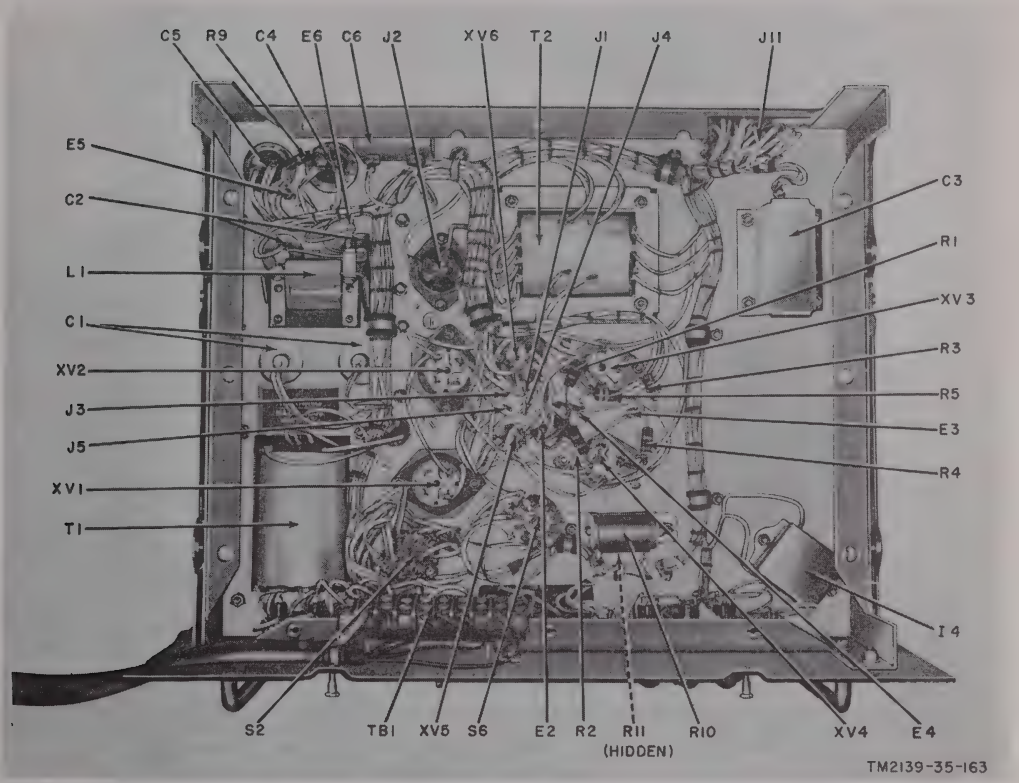


Figure 117. Power Supply PP-826/U (revised units), removed from transit case, parts location.

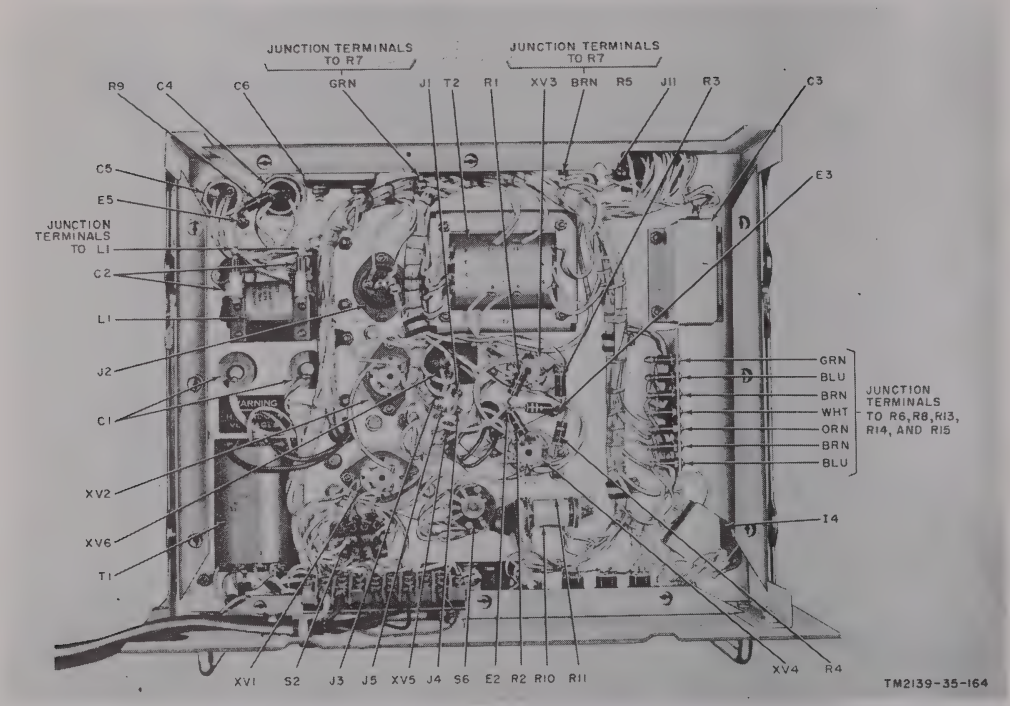


Figure 118. Power Supplies PP-826/U (serial Nos. 1170 through 2964) and PP-826A/U, removed from transit case, bottom view, parts location.

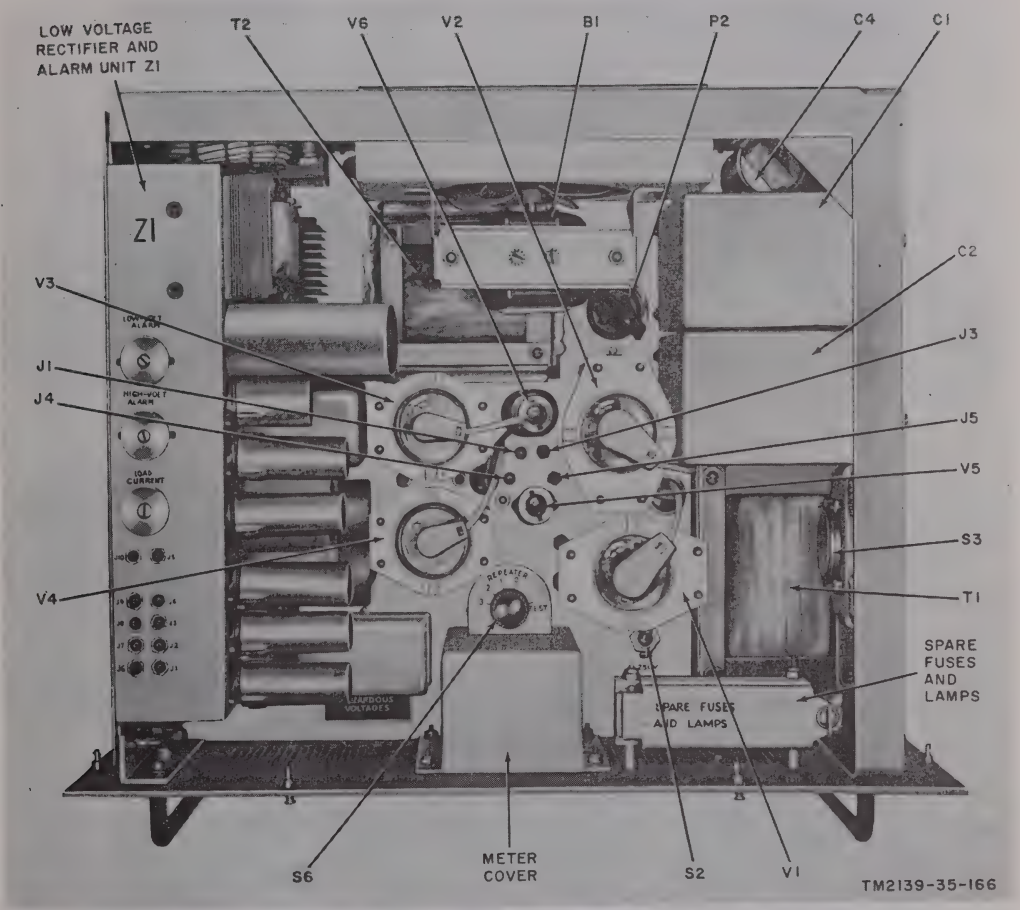


Figure 119. Power Supplies PP-826/U and PP-826A/U removed from transit case, top view, parts location.

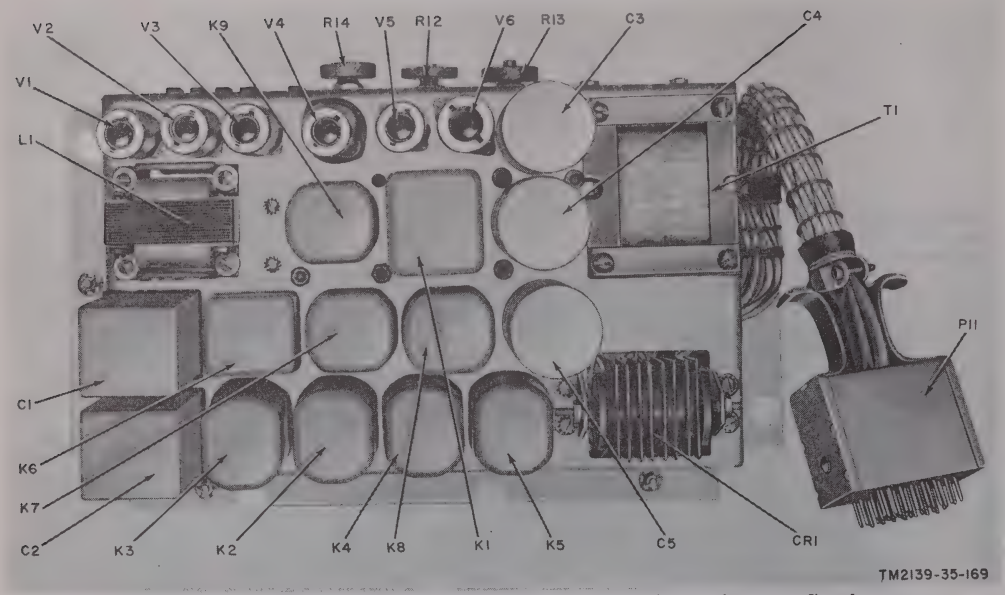


Figure 120. Low-voltage rectifier and alarm unit Z1 (part of Power Supply PP-826/U), top view, parts location.

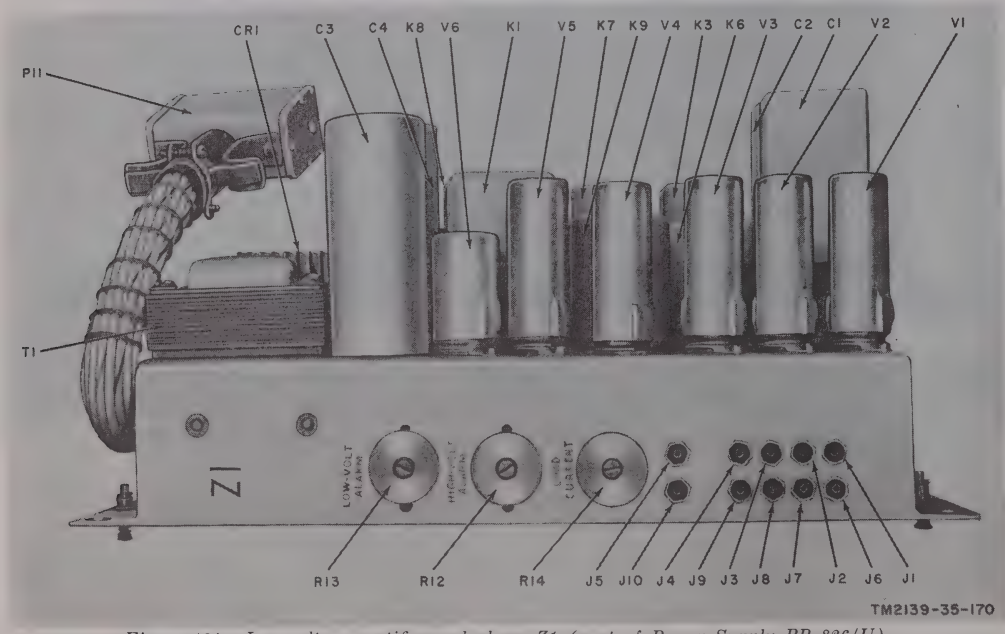


Figure 121. Low-voltage rectifier and alarm Z1 (part of Power Supply PP-826/U), side view, control and parts location.

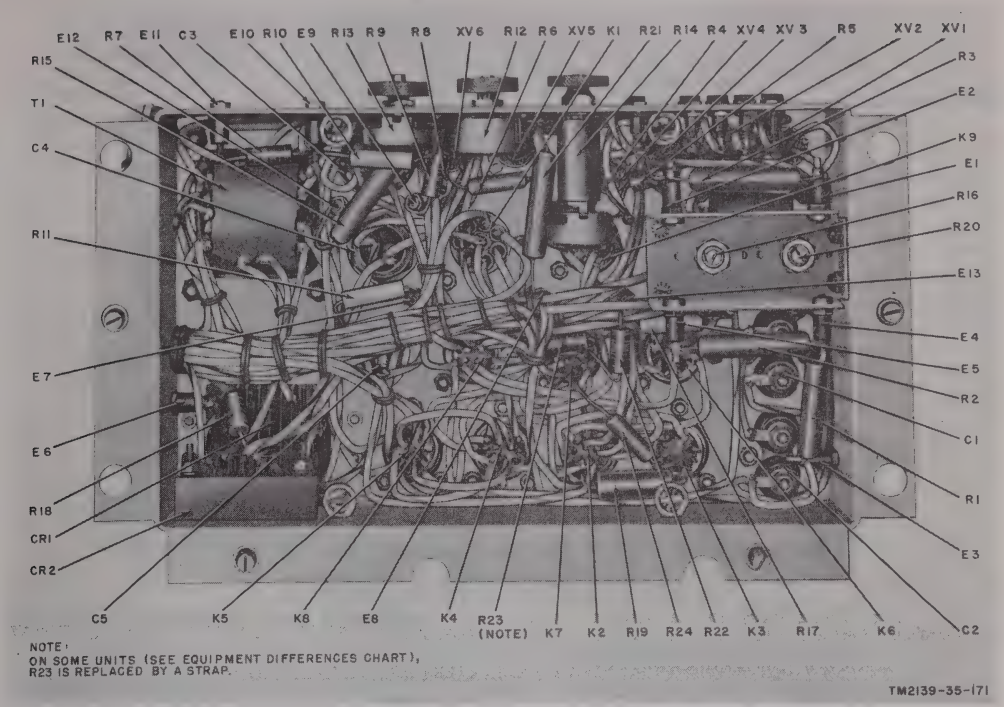


Figure 122. Low-voltage rectifier and alarm unit Z1 (part of Power Supply PP-826/U), bottom view, parts location.

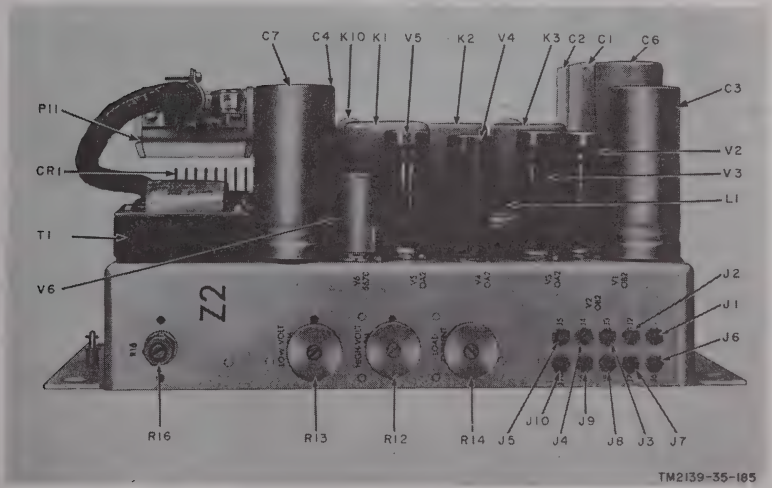


Figure 123. Low-voltage rectifier and alarm unit Z2 (part of Power Supply PP-826A/U), top view, parts location.

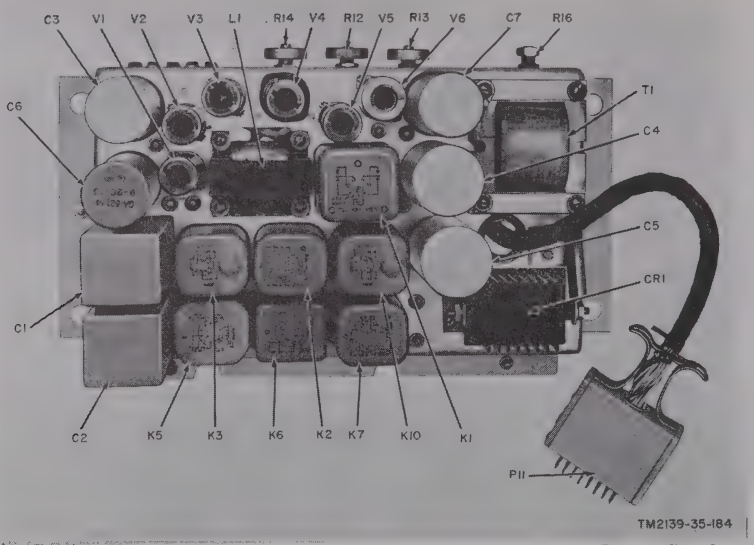


Figure 124. Low-voltage rectifier and alarm unit Z2 (part of Power Supply PP-826A/U), side view, control and parts location.

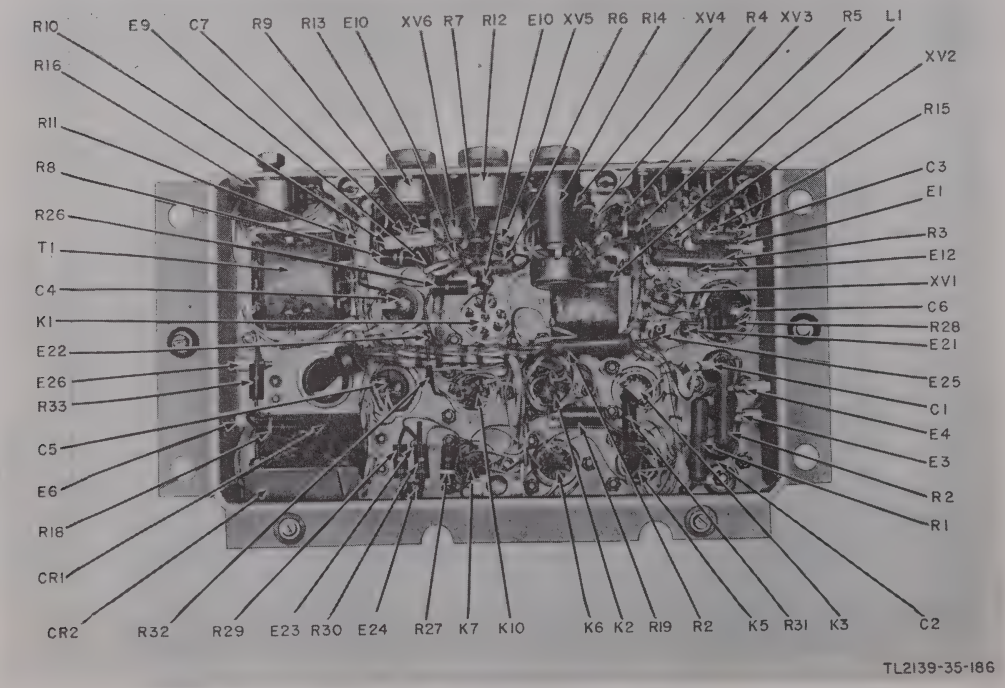


Figure 125. Low-voltage and rectifier and alarm unit Z2 (part of Power Supply PP-826A/U), bottom view, parts location.

162. Power Supplies PP–826/U and PP–826A/U, Dc Resistance of Transformers and Coils

a. Main Chassis.

Transformers and Coil	Terminals	Resistance (ohms)
T1	1–2	3.6
	3–4	3.9
	5–6	327.5
	6–7	327.5
	5–7	655
T2	1–2	6.6
	3–4	7.6
	5–6	513
	6–7	513
	5–7	1,026
	8–9	.33
	10–11	.036
L1		650

b. Low-Voltage Rectifier and Alarm Units Z1 and Z2.

Transformers and Coil	Terminals	Resistance (ohms)
T1	1–2	59
	3–4	66
	5–6	325
	7–8	2.6
	9–10	13.8
	11–12	.96
L1		650

Section XI. FILTER, NETWORK, EQUALIZER, AND RELAY TEST PROCEDURES

163. Filter, Network, and Equalizer Tests

a. General. A filter, network, or equalizer is tested by removing it from its respective panel and measuring its loss at specified frequencies. These components are complete assemblies and must be replaced as such if found to be defective; they cannot be repaired.

b. Initial Procedure.

(1) Locate the designation of the component to be tested in the *filter, equalizer, or network* column of the test procedures chart (*e* below).

(2) Connect the resistors, signal generator, and output meter specified in the *add. connect. info.* column as shown in A, figure 126. Values for resistors A through G are given in the filter, equalizer, and network pretest setup chart (*c* below).

(3) Adjust the signal generator for the output frequency and the output level given in the *signal generator test frequency* and the *pretest output* columns respectively (*e* below).

(4) Connect the component to be tested in the appropriate test setup as referenced in the *test figures* column. Refer to the additional connection information (*d* below) specified in the *add. connect. info.* column (*e* below).

(5) The *test output* column lists the output meter indication across resistor F for the components being tested.

c. Filter, Equalizer, and Network Pretest Setup Chart. Use the following chart to select the proper resistance values for the filter, equalizer, or network under test. The required resistor arrangement is referenced in the *resistor arrangement* column (*e* below).

Note. Many of the resistors required are not provided in the test facilities kit. If resistors of the proper value cannot be obtained locally, use combinations of the resistors provided with the test facilities kit to provide the required resistance values.

Arrangement	Impedance (ohms)	Resistor values* (ohms)						
	Input-output	A	B	C	D	E	F	G
1	15–15	0	191	261	15.4	0	15.4	0
2	75–75	0	191	261	75	0	75	0
3	75–27K	0	191	261	75	0	Not used	17K
4	135–135	0	191	261	261	0	135	0
5	135–40K	0	191	261	261	0	Not used	30K
6	135–40K	0	191	261	261	0	40K	0
7	200–27K	0	191	261	261	64.9	Not used	17K
8	240–240	0	191	261	261	105	240	0
9	600–600	470	365	470	2,200	0	600	0
10	1,500–1,500	470	365	470	2,200	910	1,500	0
11	13K–13K	0	0	Not used	Not used	13K	Not used	300
12	13K–20K	0	0	Not used	Not used	13K	Not used	10K
13	27K–27K	0	0	Not used	Not used	27K	Not used	17K
14	60K–10K	0	0	Not used	Not used	60K	Not used	0
15	100K–100K	0	0	Not used	Not used	100K	Not used	100K

* A strap is used for resistors A, B, E, and G when *0 ohm* is specified.

d. Additional Connection Information for Filter, Equalizer, and Network Tests. The following connection information is used when referenced in the *add. connect. info.* column of the test procedures chart (*e* below). Instructions for the use of the procedures in (1) through (9) below are given in *b*(4) above.

(1) Use the audio level meter for the pretest setup and the test measurements.
(2) Use the voltmeter for the pretest setup and the test measurements.
(3) Connect a 15-μμf capacitor across terminals 3 and 4 of the filter to be tested.
(4) Strap terminals 1 and 5 together on the equalizer to be tested.
(5) Connect 600 ohms across terminals 2 and 3.
(6) Connect terminal 4 to the case. Do not connect it to ground.
(7) Strap terminal 4 to 5; no connection between terminals 6 and 7.
(8) Strap terminal 6 to 7; no connection between terminals 4 and 5.
(9) Strap terminal 1 to 3.

e. Test Procedures Chart.

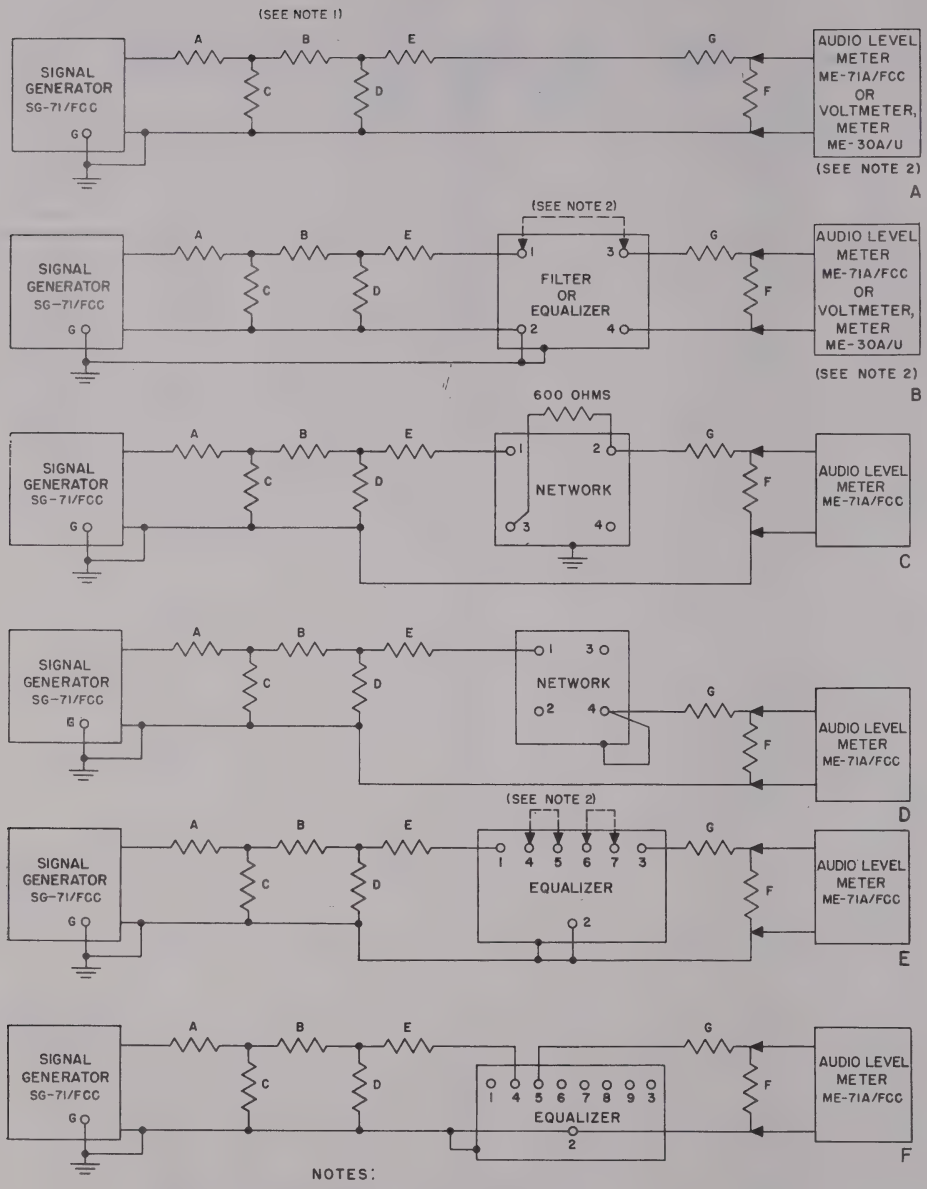
Note. Do not adjust the signal generator after it has been set up for a test unless a new pretest setup is required.

Panel or assembly	Filter, equalizer, or network	Pretest setup					Add. connect. info. (sub par. *d*)	Test output (db)
		Resistor arrangement (sub par. *c*)	Signal generator test frequency (kc)	Pretest output (db)	Test setup figures			
					126	127		
CHAN 1	FL104	9	7	10	B		(2)	−27.8 max.
	FL102, FL103	9	5	10	B		(2)	−16.8±1.5.
			7	10				−16.8±1.5.
			7.5	10				−16.8±1.5.
	FL101	9	1	10	B		(2)	−6.8 min.
CHAN 2	FL204	9	7	10	B		(2)	−27.8 max.
	FL202, FL203	9	9	10	B		(2)	−16.8±1.5.
			11	10				−16.8±1.5.
			11.5	10				−16.8±1.5.
	FL201	9	1	10	B		(2)	−6.8 min.
CHAN 3	FL304	9	7	10	B		(2)	−27.8 max.
	FL302, FL303	9	13	10	B		(2)	−16.8±1.5.
			15	10				−16.8±1.5.
			15.5	10	B			−16.8±1.5.
	FL301	9	1	10	B		(2)	−6.8 min.

Panel or assembly	Filter, equalizer, or network	Pretest setup					Add. connect. info. (sub par. d)	Test output (db)
		Resistor arrangement (sub par. c)	Signal generator test frequency (kc)	Pretest output (db)	Test setup figures			
					126	127		
CHAN 4	FL404	9	7	10	B		(2)	−27.8 max.
	FL402, FL403	9	17	10	B		(2)	−17.8±1.5.
			19	10				−17.8±1.5.
			19.5	10				−17.8±1.5.
	FL401	9	1	10	B		(2)	−6.8 min.
SUBGROUP PANEL.	FL1, FL2, FL3	11	20	−10	B		(1)	−12 min.
			56	0				−50 max.
			72	0				−50 max.
	FL4, FL5	4	70	0	B		(1)	−60 max.
			88	0				−65 max.
			92.5	−10				−21 min.
			99	−10				−19 min.
			107	−10				−21 min.
			120	0				−15 max.
	FL6, FL7	4	64	0	B		(1)	−65 max.
			72	0				−65 max.
			76.5	−10				−20 min.
			83	−10				−18 min.
			91	−10				−20 min.
			120	0				−35 max.
	FL8, FL9	4	52	0	B		(1)	−70 max.
			56	0				−55 max.
			60.5	−10				−18 min.
			67	−10				−16.5 min.
			75	−10				−18 min.
			95	0				−65 max.
GROUP PANEL	EQ2	9	40	0	B		(1)	−8±3.
			68					−4±3.
	EQ3	9	55	0		E	(1), (9)	−35 max.
			55	0	B		(1), (9)	−35 max.
	FL1	9	60	−10	B		(1)	−15 min.
			68	−10				−55 max.
			85	−10				−35 max.
	FL2	15	67	0	B		(1)	−45 max.
			68	−10				−14 min.
			69	0				−35 max.
	FL3	9	60	−10	B		(1), (9)	−5.5 min.
			64	−10				−30 max.
			85	−10				−50 max.
	Z1	9	25	0	F			−9±3.
			68	0	F			−12±3.
			25	0		A		−4±3.
			68	0		A		−6±3.
			25	0		B		−2±3.
			68	0		B		−3±3.
	Z2	1	30	0	C		(5)	−30 to −40.
			65	0				−30 to −40.
	Z3	9	28	0	E		(7)	−7±3.
			68	0			(7)	−4±3.
			28	0			(8)	0±3.
			68	0			(8)	−4±3.
	Z4	9	28	0	E		(7)	−2±3.
			68	0				−7±3.
	Z5	9	25	0	F			−9±3.
			68	0	F			−12±3.
			25	0		A		−4±3.

Panel or assembly	Filter, equalizer, or network	Pretest setup					Add. connect. info. (sub-par. *d*)	Test output (db)
		Resistor arrangement (sub par. *c*)	Signal generator test frequency (kc)	Pretest output (db)	Test setup figures			
					126	127		
			68	0		A		−6±3.
			25	0		B		−2±3.
			68	0		B		−3±3.
12–68 kc amplifier	Z1	2	62	0	D		(6)	−50 to −60.
Regulator and alarm Z6.	FL1	14	62	0	B		(1)	−45 max.
			65	0				−40 max.
			68	−10				−15 minimum.
Modem and amplifier AR4.	FL1	8	108	−10	B		(1)	−12.9±2.
			120	0				−55 max.
			200	−10				−55 max.
	Z1	2	110	0	D		(6)	−45 to −60.
JUNCTION PANEL.	FL101, FL102	10	4	10		C		−11.8 min.
			12	10				−57.8 max.
		9	6	10		D		−21.8 max.
			12	10				−9.8 min.
TEST PANEL	FL1	12	58	0	B		(1)	−45 max.
			62	−10				−19.5 min.
			65	0				−45 max.
	FL3	3	193	0	B		(1), (3)	−20 max.
			194	−10				+4 min.
			195	0				−20 max.
	FL3	13	180	0	B		(1)	−20 max.
			194	−10				−16 min.
			206	0				−45 max.
			250	0				−50 max.
	FL4	11	20	−10	B		(1)	−12 min.
			56	0				−50 max.
			72	0				−50 max.
	FL5	7	68	−10	B		(1), (3)	−30 max.
			83	−10				−17.5 min.
			91	−10				−17.5 min.
			99	−10				−17.5 min.
			120	−10				−25 max.
ORDER WIRE PANEL.	FL101	10	6	10	B		(2)	−11.8 min.
			9	10				−37.8 max.
			20	10				−37.8 max.
	EQ101	9	.2	10		F		−45.8±5.
			1	10				−13.8±3.
			1.4	10				−15.3±4.
			1	10			(4)	−13.8±3.
CARRIER SUPPLY PANEL.	FL1	4	60	−10	B		(1)	−45 max.
			64	−10				−21 min.
			68	−10				−55 max.
	FL2	5	16	10	B		(2)	−42.8 max.
			20	10				2 min.
			24	10				−42.8 max.
	FL3	4	12	10	B		(2)	−14.8 min.
			15	10				−47.8 max.
	FL4	4	24	0	B		(1)	−45 max.
			28	−10				−19.5 min.
			32	0				−40 max.
	FL5	4	60	−10	B		(1)	−60 max.
			68	−10				−18 min.
			76	−10				−55 max.
	FL6	5	4	10	B		(2)	−17.8 max.
			8	10				3 min.
			12	10				−17.8 max.

Panel or assembly	Filter, equalizer, or network	Pretest setup					Add. connect. info. (sub. par. d)	Test output (db)
		Resistor arrangement (sub par. c)	Signal generator test frequency (kc)	Pretest output (db)	Test setup figures			
					126	127		
	FL7	5	12	10	B		(2)	−42.8 max.
			16	10				2 min.
			20	10				−42.8 max.
	FL8	5	52	0	B		(1)	−35 max.
			56	−10				−3 min.
			60	0				−35 max.
	FL9	5	68	0	B		(1)	−35 max.
			72	−10				−5 min.
			76	0				−35 max.
	FL10	5	84	0	B		(1)	−40 max.
			88	−10				−7 min.
			92	0				−40 max.
	FL11	5	116	0	B		(1)	−30 max.
			120	−10				−8 min.
			124	0				−30 max.

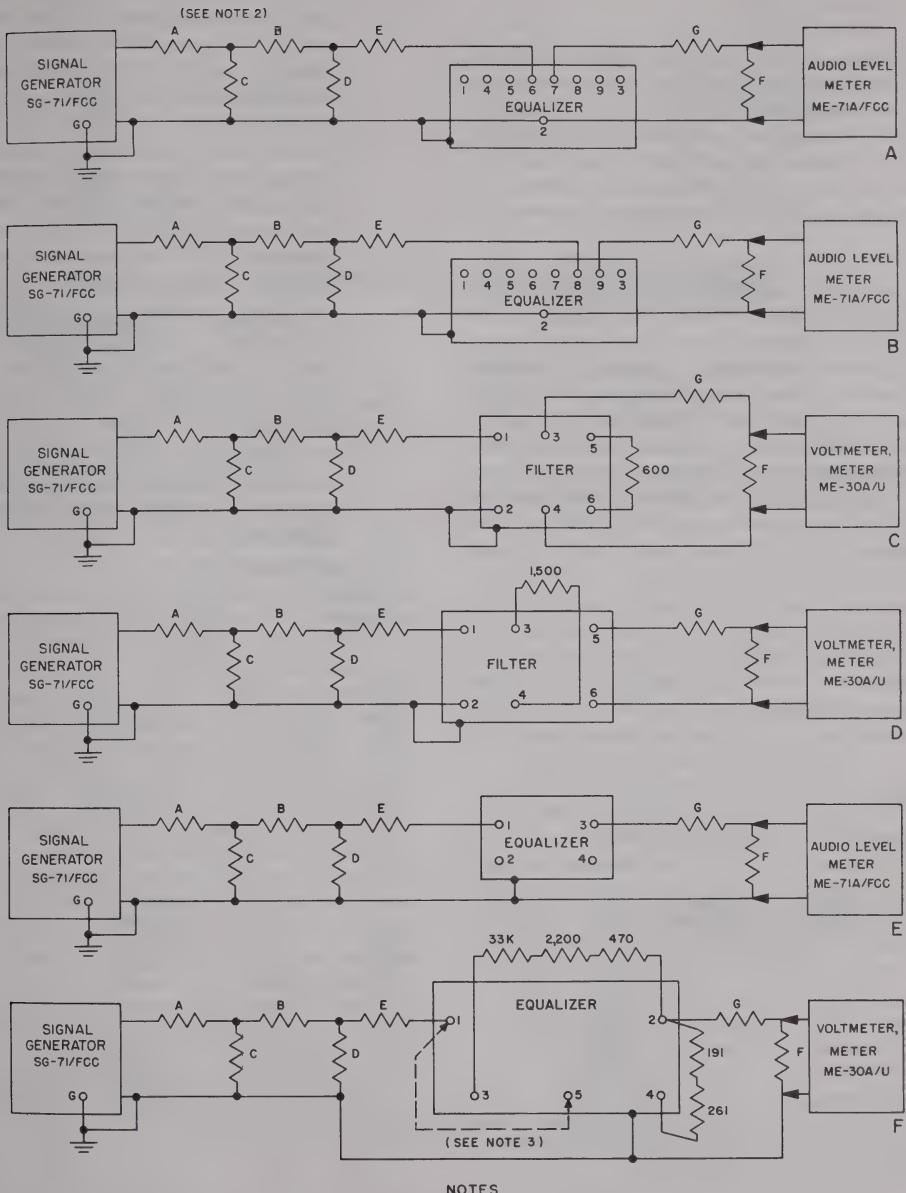


NOTES:

1. VALUES FOR RESISTORS USED IN TEST SETUPS ARE GIVEN IN THE FILTER, EQUALIZER, AND NETWORK PRETEST SETUP CHART.
2. CONNECTED AS INDICATED IN TEST PROCEDURES.

TM2139-35-172

Figure 126. Filter, network, and equalizer test setups.



NOTES

1. UNLESS OTHERWISE SHOWN, RESISTANCES ARE IN OHMS.
2. VALUES FOR RESISTORS USED IN TEST SETUPS ARE GIVEN IN THE FILTER, EQUALIZER, AND NETWORK PRETEST SETUP CHART.
3. CONNECT AS INDICATED IN TEST PROCEDURES.

TM2139-35-173

Figure 127. Filter and equalizer test setups.

164. Relay Tests
(fig. 128)

To test a relay, check the resistance of the relay winding, and the continuity of the relay contacts when the relay is in both the operated and the nonoperated condition. The following checks, however, do not assure that the relay is operating on the proper value of current. If the relay adjustment is suspected, replace the relay.

a. Winding Resistance Check. The resistances of the relay windings are given in the chart in *c* below. These readings are taken with the multimeter.

b. Contact Continuity. When the relay under test is in the nonoperated condition, check contacts for continuity. Use the appropriate schematic diagram to determine where continuity should exist. To check for continuity when the relay is in the operated condition, use the following procedures. The POWER switch on the AN/TCC–7 must be in the OFF position.

(1) A 25K, 2.25-watt variable resistor and a 200-volt power source are required for these tests. Connect terminals 1 and 3 of the 25K variable resistor across the voltage source as shown in figure 128.

(2) Before each relay test, connect the multimeter to ground and terminal 2 of the 25K variable resistor. Adjust the resistor to obtain 0 volt. Ground terminal Y of the relay and connect terminal X of the relay, as given in the chart (*c* below), to terminal 2 of the resistor. Connect the multimeter between terminal 2 and ground and adjust the resistor for the voltage as specified in the chart. The relay should operate at this voltage. Make a continuity check of the contacts in the closed position when the relay is operated.

c. Relay Chart.

Panel or unit	Relay designation	Winding terminals		Winding resistance (ohms)	Operating voltage (dc)
		X	Y		
Regulator and alarm unit Z6	K1	8	7	8K	80
	K2	8	7	8K	80
Ringer-oscillator Y101	K1	8	7	8K	80
CARRIER SUPPLY PANEL	K1	8	7	8K	80
	K2	8	7	8K	80
Low voltage rectifier and alarm Z1 (part of 600-VOLT POWER SUPPLY).	K1	8	7	230	18
	K2	22	21	2,550	28
	K3, K10[b]	8	7	2,550	18
	K4[c]	22	21	425	27
	K5	22	21	425	27
	K6	8	7	980	15
	K7[a]	22	21	425	27
	K8[c]	22	21	415	18
	K9[c]	8	7	425	27

[a] In Power Supplies PP–826/U, serial numbers 800 through 2964 and in Power Supplies PP–826A/U, serial numbers 2940 through 2964, relay K7 has a winding resistance of 415 ohms and an operating voltage of 18 volts.
[b] Used on Power Supply PP–826A/U only.
[c] Used on Power Supply PP–826/U only.

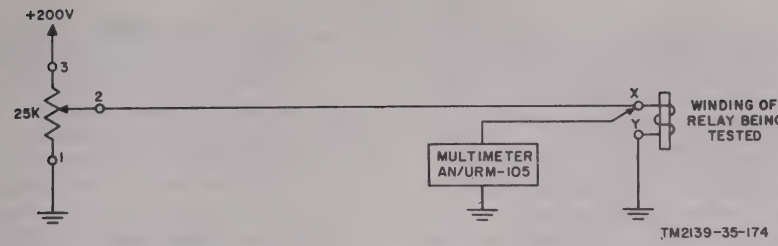


Figure 128. Relay test setup.

Section XII. REPAIRS AND ALINEMENT PROCEDURES

165. Replacement or Removal of Assemblies and Parts

Most of the parts of Telephone Terminal AN/TCC–7 are readily accessible and are replaced easily if found to be faulty. Refer to the applicable parts location diagrams when parts require replacement.

a. Replacement of Switch Assemblies. Switch assemblies are switches with circuit elements, such as resistors or capacitors, mounted on the switch terminals. To replace a switch assembly, first tag the wire connected to the switch and then remove the switch assembly from its mounting. Examine the switch assembly to note the physical placement of the circuit elements mounted on the switch. Remove the circuit elements which are mounted on the switch and connect those in good condition to the replacement switch; be careful to place them as nearly as possible in the same physical positions which they occupied on the original switch. References to wiring and circuit element placement diagrams for switch assemblies in the TEST PANEL appear in the chart below. See figure 155 for the external wiring to the switches. Figure 92 shows the placement and wiring of circuit elements mounted on CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch S103 in the ORDER WIRE PANEL.

Switch	Fig. No.
ATTENUATOR switch S2	79
MEASURE SELECTIVE switch S3.	80
MEASURE NON-SELECTIVE switch S4.	81
SEND switch S5	82
FAULT TEST switch S6	83

b. Removal of Channel Assembly Parts. To remove a lever switch or a variable resistor of a channel assembly, first remove the channel plug-in assembly from the combining frame of the CHAN MODEM (TM 11–2139–20, par. 14). Unscrew the three screws which hold the front plate of the channel assembly in place, and then remove the part in question.

c. Removal of 21-Pin Connectors. To gain access to the underside of a 21-pin connector on the CHAN MODEM combining frame, remove all four channel assemblies. Two screws hold each of the four 21-pin connectors in place in the frame (fig. 52). Remove the screws from *all* the connectors in order to lessen the strain on the wiring harness and withdraw the connectors from the frame as far as the attached cables will permit.

d. Removal of SUBGROUP PANEL Parts. To remove a faulty part on the shelf panel (fig. 60), turn the SUBGROUP PANEL upside down and remove the bottom cover plate. Unscrew the four screws that hold the cable clamp bracket in place (fig. 59). Move the cable clamp bracket to one side to reach the parts.

e. Removal of GROUP PANEL Parts.

(1) To remove a faulty part on the shelf panel, first remove the shelf mounting screws circled by a black ring. Then (facing the front panel) lift the panel up and to the right to expose the bottom of the shelf panel and provide access to the parts (fig. 62).

(2) To remove a faulty filter or equalizer network, it may be necessary to remove one or more of the supporting brackets to reach to the part in question.

f. Removal of TEST PANEL Parts. To remove a faulty part in the TEST PANEL, it is

necessary, in some cases, to remove one or more of the shields that cover the switches and capacitors on the TEST PANEL (fig. 3, TM 11–2139–20).

g. Replacement of CARRIER SUPPLY PANEL Resistor Board Assembly. Resistors R139 through R162 in the CARRIER SUPPLY PANEL (figs. 104 and 106) are mounted between two vertical boards. The resistors and the boards comprise a resistor board assembly. If necessary to replace the assembly, refer to figure 104 for the wiring and placement of the resistors between the mounting boards. Figure 150 shows the wiring external to the assembly.

166. Miscellaneous Alinement and Adjustment Procedures

a. General. Instructions for the alinement and adjustment of the components and assemblies of Telephone Terminal AN/TCC–7 appear in *b* through *f* below. Initial adjustment and tests of Telephone Terminal AN/TCC–7 appear in TM 11–2139–10. Refer to the appropriate troubleshooting chart if any trouble is encountered during alinement and adjustment.

b. CHAN MODEM. No alinement is necessary unless transformers, filters, or varistors are replaced. If these parts are replaced in any channel assembly, test the repaired component in accordance with the instructions given in the final tests (par. 170 or 171).

c. SUBGROUP PANEL. No alinement is necessary unless transformers, filters, or varistors are replaced. If these parts are replaced, test the subgroup (1, 2, or 3) being alined in accordance with the instructions given in the final tests (par. 172 or 173).

d. Ringer-Oscillator Y101, ORDER WIRE PANEL. No alinement is required unless transformer T1, T2, or T3 and capacitors and resistors associated with the oscillator circuit are replaced. If these parts are replaced, aline the ringer-oscillator in accordance with the instructions given in the final tests (par. 188).

e. CARRIER SUPPLY PANEL. No alinement is necessary unless the parts described in (1) through (3) below are replaced.

(1) *Oscillator frequency adjustments.* If network Z1 or the capacitors, resistors, or inductors associated with the 64-kc local oscillator stage are replaced, adjust capacitor C49 in accordance with the instructions given in the final tests (par. 189*a* and *b*).

(2) *4-kc output adjustment.* If transformer T8 or T9, inductor L3 or L4, or capacitors or resistors associated with the 4-kc amplifier stage are replaced, strap capacitors C30 and C31 in accordance with the instructions given in the final tests (par. 189*a* and *b*(4)).

(3) *Channel carrier output adjustments.* If the transformers, inductors, capacitors, or resistors associated with any carrier amplifier stage are replaced, install a resistor in parallel with the inductor associated with the carrier amplifier that was repaired in accordance with the instructions given in the final tests (par. 189*a* and *c*).

f. 600 VOLT POWER SUPPLY. No alinement is necessary unless the parts described in (1) and (2) below are replaced.

(1) If relay K9, transformer T1, varistor CR1, or resistor R15 is replaced, adjust resistor R20 in accordance with the instructions given in the final tests (PP–826/U, par. 194*a* and *j*).

(2) If relay K6, varistor CR2, transformer T1, capacitor C4, or resistor R16, R17, or R18 is replaced, adjust resistor R16 in accordance with instructions given in the final tests (PP–826/U, par. 194*a* and *i*) or (PP–826A/U, par. 195*a*).

167. TEST PANEL, Alinement Procedures
(fig. 78)

Before performing the alinement procedures on the TEST PANEL, perform the final test procedures on the flat amplifier AR2 and the IF amplifier AR1 (par. 183).

a. Initial Procedures.

(1) Connect the power, carrier supply, and transmission test cable assemblies as shown in figure 78.

(2) Turn the power on and allow the TEST PANEL to warm up for at least 1 hour before performing the alinement procedures.

(3) Connect a 135-ohm resistor across the tip and sleeve of the test jack assembly.

(4) Connect the signal generator, resistors R6 through R8, attenuator and transformer T107 as shown in figure 78.

(5) Set the attenuator for 0 db loss and adjust the signal generator to the output frequency and the output level indicated in the test procedures (*b* through *e* below). Check the output level across the 135-ohm resistor with the voltmeter.

(6) Connect the test jack assembly to the TEST PANEL after the test circuit has been connected and the signal generator has been set to the proper frequency and output level.

b. Circuit for Nonselective Measurements, TEST PANEL. To adjust the nonselective measurement circuits, use the initial procedures (*a* above) and the procedures below.

(1) Set the switches listed below to the positions indicated.

Switch	Position
MEASURE	TRANSMISSION.
MEASURE SELECTIVE	OFF.
MEASURE NON-SELECTIVE.	CHECK 1 KC CHECK HF.

(2) Adjust the signal generator to deliver 68 kc ±100 cps.

(3) Set the attenuator for 0-db loss.

(4) Adjust the signal generator output level to obtain a reading of .775 volt across the 135-ohm resistor.

(5) Set the attenuator for 42-db loss.

(6) Insert the TEST PANEL measure plug into the test jack assembly.

(7) Remove the cap nut from the R17 control on flat amplifier AR2, and adjust R17 for a 0-db meter reading on TEST PANEL meter M1. Replace the cap nut on R17, and remove the measure plug from the test jack assembly.

c. Circuit for Selective Measurements, TEST PANEL. Before adjusting the selective measurement carrier oscillator circuit, perform the initial procedures (*a* above) and aline the circuit for nonselective measurements (*b* above). Use the procedures listed below to aline the selective measurement carrier oscillator circuit.

(1) Set the switches and controls listed below to the positions indicated.

Control	Position
MEASURE	TRANSMISSION.
MEASURE SELECTIVE	OFF.
MEASURE NON-SELECTIVE.	OFF.
COARSE TUNE	Midposition.
FINE TUNE	Midposition
GAIN	Midposition.
AMP GAIN (IF AMP)	Midposition.
Resistor R44	Midposition.

(2) Connect a lead between terminal E25 and terminal 1 of section 3 of MEASURE SELECTIVE switch S3 or between equivalent points. Set the attenuator for 0 db loss. Adjust the signal generator to 110 kc ±3 cycles at .775 volt. Set the attenuator for a 42-db loss. Insert the TEST PANEL measure plug into the test jack assembly.

(3) Adjust capacitor C12 for a maximum indication on TEST PANEL meter M1; change the attenuator setting as necessary to keep the reading on scale. Remove the lead ((2) above) and the measure plug from the test jack assembly.

(4) For each position of the MEASURE SELECTIVE switch in the chart in (5) below, use the following procedure:

(*a*) Set the attenuator for a 0-db loss.

(*b*) Adjust the signal generator to the frequency shown in the table for that switch position.

(*c*) Adjust the signal generator output level to the voltage shown in the table.

(*d*) Adjust the attenuator to the loss indicated in the table.

(*e*) Insert the TEST PANEL measure plug into the test jack assembly.

(*f*) Adjust the capacitor indicated in

the table for the switch position used to obtain a maximum reading on TEST PANEL meter M1. It may be necessary to readjust the attenuator to keep the TEST PANEL meter reading on scale.

(5) Remove the measure plug from the test jack assembly.

MEASURE SELECTIVE switch position	Test signal frequency (cycles)	Signal generator output (volt)	Attenuator setting (db)	Adjust capacitor
CHECK GAIN	68 kc ±3	.775	40	C37
12KC	12 kc ±3	.775	42	C30, C31*
28KC	28 kc ±3	.775	42	C34
65KC	65 kc ±3	.775	32	C27
37KC	37 kc ±3	.775	32	C40
67KC	67 kc ±3	.775	42	C43
83KC	83 kc ±3	.775	42	C45
99KC	99 kc ±3	.775	42	C46
GRP PANEL 62KC	62 kc ±3	.775	30	C47

* Start with C30 and C31 in minimum capacity positions.

d. Selective Measurement IF Circuit, TEST PANEL. To adjust the selective measurement IF circuit, follow the procedures in *a* through *c* above, and then the procedures in (1) through (3) below.

(1) Set the MEASURE SELECTIVE switch to the CHECK GAIN position. Set the signal generator to 68 kc ±100 cycles at .775 volt; set the attenuator for a 40-db loss. Insert the measure plug into the test jack assembly and adjust the FINE TUNE control for a maximum reading on the TEST PANEL meter; change the attenuator setting as required to keep the meter reading as close to 0 db as possible. Operate the GAIN control to both its extreme clockwise and counterclockwise positions; note the meter readings. Then adjust the GAIN control for a meter reading midway between the readings noted. Remove the measure plug from the test jack assembly.

(2) Operate the MEASURE SELECTIVE and MEASURE NON-SELECTIVE switches to the GRP PANEL 62KC positions. Adjust the signal generator to 62 kc ±100 cycles at .775 volt. Set the attenuator for a 70-db loss. Insert the measure plug in the test jack assembly. Adjust the FINE TUNE control for a maximum meter reading. Adjust the AMP GAIN control of IF amplifier AR1 for a 0-db meter reading. Remove the measure plug from the test jack assembly.

(3) Set the MEASURE NON-SELECTIVE switch to the OFF position and the MEASURE SELECTIVE switch to the CHECK GAIN position. Adjust the signal generator to 68 kc ±100 cycles at .775 volt. Set the attenuator for a 46-db loss. Insert the measure plug into the test jack assembly. Adjust the FINE TUNE control for a maximum indication on the TEST PANEL meter. Remove the locking nut from the R44 control, and adjust R44 for a 0-db meter reading. Replace the locking nut on R44 and remove the measure plug from the test jack assembly.

e. Hf Oscillator, TEST PANEL. To adjust the hf oscillator, follow the procedures in *a* through *d* above, and then the procedures in (1) through (6) below.

(1) Set the switches or controls listed below to the positions indicated. Adjust capacitor C50 for a frequency of 68 kc ±10 cycles as measured with the frequency meter connected between terminal 6 of section 1 of the SEND switch and chassis ground.

Control	Position
HF	Midposition.
65 KC TR OR FAULT TEST.	Midposition.
65 KC REC	Midposition.
R38	Midposition.
SEND	CHECK GAIN CHECK HF.
HF FREQ	Midcapacity.

(2) Set the SEND switch to the 65 KC REC position. Adjust capacitor C59 for a frequency of 65 kc ±10 cycles as measured with the frequency meter.

(3) Operate the REP 3 pushbutton of the FAULT TEST switch, and adjust capacitor C57 for a frequency of 83kc ±10 cycles as measured with the frequency meter. Release the push button.

(4) Operate the REP 2 pushbutton of the FAULT TEST switch, and adjust capacitor C55 for a frequency of 91 kc ±10 cycles as measured with the frequency meter. Release the pushbutton.

(5) Operate the REP 1 pushbutton of the FAULT TEST switch, and adjust capacitor C53 for a frequency of 99 kc ±10 cycles as measured with the frequency meter. Release the pushbutton.

(6) Operate the MEASURE SELECTIVE switch to the OFF position, the MEASURE NON-SELECTIVE switch to the CHECK 1 KC CHECK HF position, and the SEND switch to the 65 KC TR OR FAULT TEST position.

(7) Connect terminals T and S of the test jack assembly to terminals K and W of the power test cable assembly (fig. 78).

(8) Insert the measure plug into the test jack assembly. Operate the 5 db pushbutton of the ATTENUATOR switch, and adjust the 65 KC TR OR FAULT TEST control for a 0-db meter reading. Release the pushbutton.

(9) Remove the locking nut from the R38 control. Operate the MEASURE NON-SELECTIVE switch to the FAULT TEST position, and, with the REP 2 pushbutton of the FAULT TEST switch operated, adjust the R38 control for a meter reading of —2.5 db. Replace the locking nut on R38.

CHAPTER 4
FINAL TESTING

Section I. GENERAL

168. Purpose of Final Testing

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

169. Test Equipment Required for Final Testing

In addition to the tools and test equipment listed in paragraph 77, the following items are required for final testing:

Item	Technical manual	Common name
Electron Tube Test Set TV-2/U	TM 11-2661	Tube test set
Electronic Multimeter TS-505/U or equal	TM 11-5511	Electronic multimeter
Oscilloscope OS-8A/U	TM 11-1214	Oscilloscope
Transmission Measuring Set TS-559/FT	TM 11-2094	Transmission measuring set
Variable Transformer TF-171/USM		Variable transformer

Section II. TELEPHONE MODEM TA-219/U

170. CHAN MODEM Transmitting Tests (fig. 129)

Follow the procedure given in *a* through *c* below to test each channel in the CHAN MODEM. Channel assemblies must be installed in the CHAN MODEM for testing.

a. Initial Procedure.

(1) Operate all switches on the CHAN MODEM to their normal positions.

(2) Interconnect the supply, transmission, and carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, and CHAN MODEM.

(3) Interconnect a 600-ohm resistor across terminals A and K of the transmission test cable assembly.

(4) Connect signal generator No. 2B, resistors R1 through R3, the attenuator, and transformer T109.

(5) Connect signal generator No. 1 across the terminals of the supply test cable assembly as indicated in the chart below. Adjust the signal generator to the output frequency indicated for the channel under test at an output level of .82 volt as measured with the voltmeter.

Channel assy under test	Signal generator No. 1 output freq (kc)	Terminals of supply test cable assembly
CHAN 1	8	C and M
CHAN 2	12	D and N
CHAN 3	16	E and P
CHAN 4	20	F and R

b. CHAN MODEM, Transmitting Direction.

(1) Interconnect signal generator No. 2B and associated components (*a*(3) above). Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109 and set the attenuator for a 0-db loss. Adjust the signal generator for an output frequency of

1 kc at an output level of —13.8 db measured across the 600-ohm resistor.

(2) Disconnect the 600-ohm resistor and connect terminals 3 and 6 of the transformer to the 2W 4WT binding posts on the channel under test.

(3) Operate the 4W–2W switch to the 2W position.

(4) Connect the voltmeter across terminals A and K of the transmission test cable assembly.

Note. The following procedure involves a circuit arrangement in which jumpering shorting of the resistors of the channel modulator output pad results in a decrease in the output voltage of that circuit. The procedure for adjusting the output of CHAN 1 of the CHAN MODEM is described in (5) below. The procedure used for adjusting the other three channel assemblies is the same.

(5) Jumper resistors R116 and R143 (fig. 2) in the order given in (*a*) through (*d*) below; note the output obtained for each condition. Select the arrangement that will produce an output power closest to an indication of —28.8 ±1 db on the voltmeter. After determining the correct strapping, remove the straps and replace with permanent straps.

(*a*) Neither R116 nor R143 is strapped.

(*b*) Only R116 is strapped.

(*c*) Only R143 is strapped.

(*d*) Both R116 and R143 are strapped.

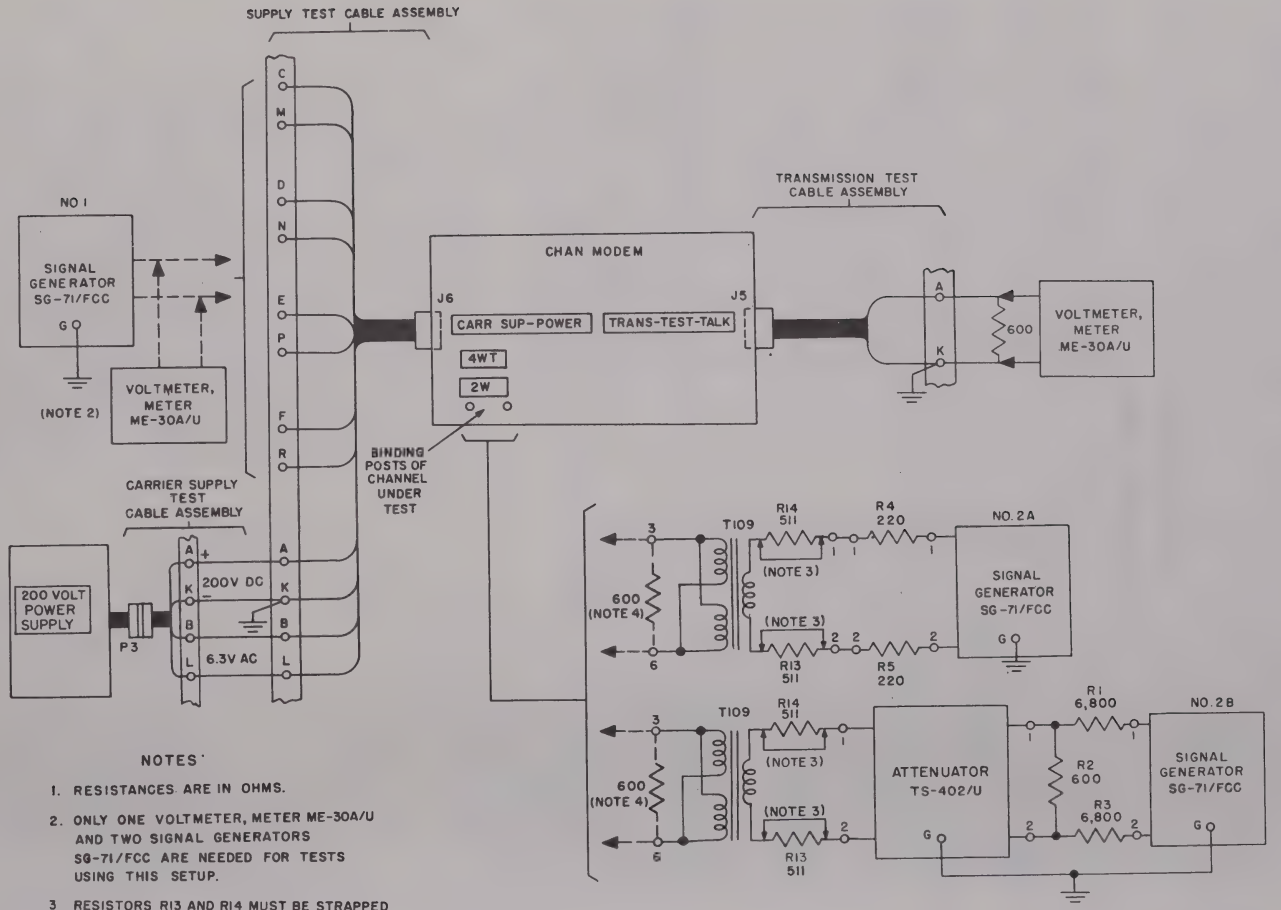
c. Transmitting Direction Overload Loss Test.

(1) Connect signal generator No. 2A and associated components (*a*(3) above). Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109.

(2) Adjust the signal generator for an output frequency of 1 kc at an output level of 14.7 db as measured across terminals 3 and 6 of transformer T109 with the voltmeter.

(3) Disconnect the 600-ohm resistor from the transformer and reconnect terminals 3 and 6 of the transformer to the 2W 4WT binding posts on the channel under test.

(4) Connect the voltmeter across termials A and K of the transmission test cable assembly. The voltmeter indication should not be more than 2 db higher than the indication received in *b*(5) above.



NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY ONE VOLTMETER, METER ME-30A/U AND TWO SIGNAL GENERATORS SG-71/FCC ARE NEEDED FOR TESTS USING THIS SETUP.
3. RESISTORS R13 AND R14 MUST BE STRAPPED OUT FOR THIS TEST SETUP.
4. CONNECT AS INDICATED IN FINAL TEST PROCEDURE

Figure 129. CHAN MODEM, final test setup, transmitting direction.

171. CHAN MODEM Receiving Tests
(fig. 130)

Follow the procedure given in *a* through *c* below to perform the receiving test on each of the channel assemblies in the CHAN MODEM. The channel assemblies must be installed in the CHAN MODEM to be tested.

a. Initial Procedure.

(1) Operate all switches on the CHAN MODEM to their normal positions.

(2) Interconnect the supply, transmission, carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, and CHAN MODEM.

(3) Interconnect signal generator No. 2, resistors R1 through R3, the attenuator, and transformer T109.

(4) Connect signal generator No. 1 to terminals of the supply test cable assembly as indicated in the chart below for the channel assembly being tested. Adjust the signal generator for the output frequency indicated for the channel under test. Using the voltmeter, adjust the signal generator for the output frequency indicated for the channel under test. Using the voltmeter, adjust the signal generator for an output level of .82 volt as measured across the terminals of the supply test cable assembly.

Channel assembly under test	Signal generator No. 1 output frequency (kc)	Supply test cable assembly terminal
1	8	C and M.
2	12	D and N.
3	16	E and P.
4	20	F and R.

b. Receiving Circuit Test.

(1) Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109. Adjust the attenuator for a 0-db loss; adjust the signal generator for an output frequency as indicated for the channel under test (chart below) at an output level of —3.8 db as measured across the 60-ohm resistor.

Channel assembly under test	Signal generator No. 2 output frequency (kc)	Output level (db)
CHAN 1	7	2
CHAN 2	11	2
CHAN 3	15	2
CHAN 4	19	1

(2) Connect terminals 3 and 6 of transformer T109 to terminals E and P of the transmission test cable assembly.

(3) Connect the voltmeter and a 600-ohm resistor across the 4WR binding posts on the channel assembly under test.

(4) Operate the 4W–2W switch to the 4W position on the channel assembly under test. Operate the GAIN control on the channel assembly to the extreme clockwise position.

(5) The voltmeter should indicate the output of the channel assembly under test as indicated in the *output level* column of the chart given in (1) above.

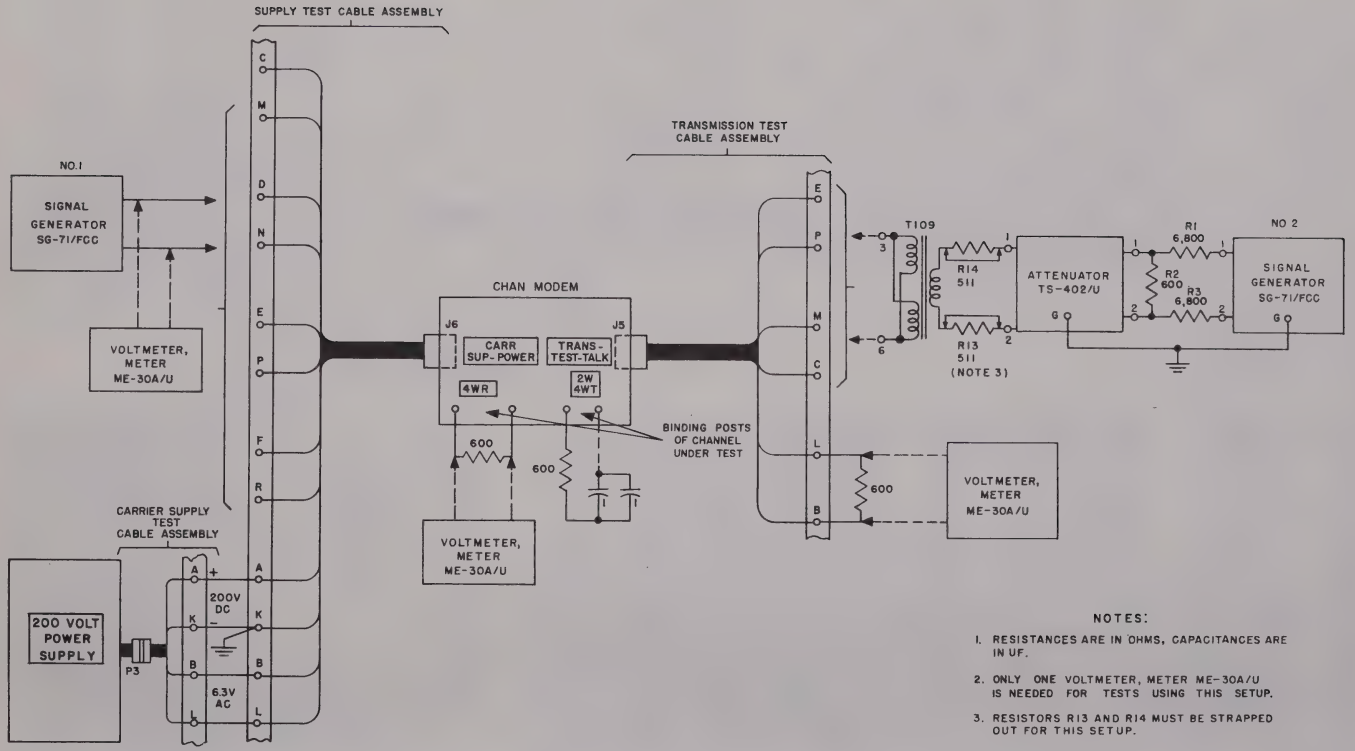
(6) Repeat the procedure given in (1) through (5) above using the frequencies listed in the chart below for each channel assembly. The voltmeter should indicate 1.4 ±2.4 db *less* than the output obtained in (5) above.

Channel assembly under test	Input frequency (cps)
1	7,675
1	4,550
2	11,675
2	8,550
3	15,675
3	12,550
4	19,675
4	16,550

(7) Using the test frequencies indicated in (1) above, adjust the channel GAIN control from the extreme counterclockwise position to the extreme clockwise position. The voltmeter indication should vary at least 20 db between these two positions on the GAIN control.

c. Hybrid Balance, Test.

(1) Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109.



T.O. 31M1-2TCC7-64

Figure 130. CHAN MODEM, final test setup, receiving direction.

(2) Arrange the attenuator for a 0-db loss; adjust signal generator No. 2 for an output frequency of 1 kc at an output level of —3.8 db measured across the 600-ohm resistor.

(3) Remove the 600-ohm resistor ((1) above) and connect terminals 3 and 6 of transformer T109 to terminals M and C of the transmission test cable assembly.

(4) Operate the 4W–2W switch to 2W; operate the TALK-MON switch to TALK; and operate the SEND-MEAS switch to SEND.

(5) Interconnect a 600-ohm resistor in series with two parallel 1-μf capacitors across the 2W 4WT binding posts.

(6) Connect the voltmeter and a 600-ohm resistor across terminals B and L of the transmission test cable assembly terminal board. The voltmeter should indicate a power level of —41 db or less.

Section III. TELEPHONE MODEM TA–227/U

172. SUBGROUP PANEL, Transmitting Tests

(fig. 56)

a. Initial Procedures.

(1) Interconnect the transmission, power, and carrier supply test cable assemblies, 135-ohm resistors, 200 VOLT POWER SUPPLY and the SUBGROUP PANEL.

(2) Connect signal generator No. 2, resistors R1 through R3, the attenuator, and transformer T108. Connect a 600-ohm resistor across terminals 1 and 3 of the transformer.

b. Transmitting Circuit Output Test.

(1) Connect signal generator No. 1 to terminals A and J of the transmission test cable assembly. Adjust the signal generator for an output frequency of 72 kc at an output level of .75 volt as measured with the voltmeter.

(2) Set the attenuator for a 0 db loss; adjust signal generator No. 2 for an output frequency of 11 kc at an output level of —3.8 db measured across terminals 1 and 3 of transformer T108 with the audio level meter.

(3) Connect a subgroup test cable assembly to CHAN MODEM 2 connector P2.

(4) Disconnect the 600-ohm resistor from transformer T108 and connect terminals 1 and 3 of the transformer to terminals A and K of the subgroup test cable assembly.

(5) Set the attenuator for a 35-db loss. Adjust the TR AMP GAIN control to the extreme clockwise position.

(6) Connect the voltmeter to terminals A and L of the power test cable assembly.

(7) Strap the output pads associated with subgroup channel 2 until the voltmeter indicates —48.8 ±.6 db.

Note. Two pads are provided—one for a 2-db loss, and the other adjustable by taps in approximately 1-db steps. The 2-db pad will usually be connected into the circuit of subgroup channel 1. The loss of the adjustable pad is increased by changing the taps in the direction from R47 to R43.

(8) Check the output at the following additional test points with the voltmeter; the output should be ±1 db of the reading obtained in (7) above.

(*a*) Terminals K and W of the power test cable assembly.

(*b*) 60–108 KC OUT binding posts.

(*c*) 60–108 KC OUT ALT binding posts

(*d*) 60–108 KC OUT jack.

Note. Use the test plug assembly (terminals T1 and R) to connect the voltmeter to the 60–108 KC OUT jack.

(9) Repeat the tests given in (1) through (7) above with signal generator No. 2 readjusted to provide an output frequency of 4.5 kc. The output signal should be within +1.8 and —2 db of the signal measured in (8) above.

(10) Perform the test given in (1) through (9) above, using the connection points, frequencies, and output levels indicated for signal generators No. 1 and 2 in the chart below. The output level should be the same as indicated in (7), (8), and (9) above.

Subgroup channel under test	Signal generator No. 1			Signal generator No. 2		
	Transmission test cable assembly connection	Frequency (kc)	Output level (volt)	Subgroup test cable assembly connection	Frequency (kc)	Output level (db)
1	C and L	56	.75	A and K (PL)	11	−3.8
3	D and E	88	.75	A and K (P3)	11	−3.8

c. Special Service Transmission Test.

(1) Connect signal generator No. 2 and associated components as described in *a*(2) above. Adjust signal generator No. 2 as described in *b*(2) above. Remove the 600-ohm resistor from terminals 1 and 3 of transformer T108. Connect terminals 1 and 3 to the SPECIAL SERVICE IN 2 binding posts.

(2) Connect signal generator No. 1 across terminals A and J of the transmission test cable assembly. Adjust the signal generator for an output frequency of 72 kc at an output level of .75 volt.

(3) Operate the TR AMP GAIN control to the extreme clockwise position and operate the SPECIAL SERVICE 2 switch to SPL SERV.

(4) Connect the voltmeter across terminals A and L of the power test cable assembly. The voltmeter should indicate −48.8 db ±.6 db.

(5) Perform the test given in (1) through (4) above for subgroup channels 1 and 3. Use the output frequencies, output levels and connection points for signal generators No. 1 and 2 as indicated in the chart below.

Subgroup channel under test	Signal generator No. 1			Signal generator No. 2		
	Transmission test cable assembly connection	Frequency (kc)	Output level (volt)	SPECIAL SERVICE IN binding posts	Frequency (kc)	Output level (db)
1	C and L	56	.75	1	11	−3.8
3	D and E	88	.75	3	11	−3.8

d. Transmitting Carrier Leak Test.

(1) Connect signal generator No. 1 terminals C and L of the transmission test cable assembly. Adjust the signal generator for an output frequency of 56 kc at an output of .75 volt.

(2) Connect the audio level meter across terminals A and L of the power test cable assembly.

(3) The audio level meter should indicate a maximum carrier leak of −80 db.

(4) Connect signal generator No. 1 to terminals A and J of the transmission test cable assembly; adjust the signal generator for an output frequency of 72 kc at an output of .75 volt. The audio level meter should indicate a maximum of −90 db.

(5) Connect signal generator No. 1 to terminals D and E of the transmission test cable assembly; adjust the signal generator for an output frequency of 88 kc at an output of .75 volt. The audio level meter should indicate a maximum of −89 db.

173. SUBGROUP PANEL, Final Test, Receiving Tests

(fig. 57)

a. Initial Procedures.

(1) Interconnect the transmission, power, and carrier supply test cable assemblies, 600-ohm resistors, SUBGROUP PANEL and 200 VOLT POWER SUPPLY.

(2) Connect signal generator No. 2, resistor R1 through R3, attenuator, and transformer T107.

b. Receiving Circuit Test.

(1) Connect the output of signal generator No. 1 across terminals A and J of the transmission test cable assem-

bly; adjust the signal generator for an output frequency of 72 kc at an output level of .75 volt.

(2) Connect the voltmeter and a 135-ohm resistor across terminals 1 and 2 of transformer T107. Set the attenuator for a 0-db loss; adjust signal generator No. 2 for an output frequency of 83 kc at an output level of —7.8 db as measured with the voltmeter. Disconnect the voltmeter and the 135-ohm resistor.

(3) Connect terminals 1 and 2 of transformer T107 to terminals H and R of the transmission test cable assembly.

(4) Adjust the DEM 2 GAIN control to the extreme clockwise position, and set the attenuator for a 5-db loss.

(5) Connect a subgroup test cable assembly to CHAN MODEM 2 connector P2.

(6) Connect the voltmeter and a 600-ohm resistor to terminals E and P of the subgroup test cable assembly with terminal P as ground. The voltmeter should indicate 5.2 db ±3 db.

(7) Readjust the DEM 2 GAIN control to the extreme counterclockwise position.

(8) The voltmeter indication should be not less than —4.8 db.

(9) Readjust the DEM 2 GAIN control to the extreme clockwise position.

(10) Readjust signal generator No. 2 (*b*(2) above) for an output frequency of 76.5 kc at an output level of —7.8 db.

(11) The voltmeter should indicate 5.2 db ±1.8 db.

(12) Connect the voltmeter and a 600-ohm resistor across the SPECIAL SERVICE OUT 2 binding posts. Operate the SPECIAL SERVICE 2 switch to SPL SERV. The voltmeter should indicate 5.2 db ±3 db.

(13) Connect the voltmeter to terminals T1 and R of the test plug assembly; insert the plug of the test plug assembly into the DEM OUT 2 jack. The voltmeter should indicate 5.2 db ±3 db.

(14) Disconnect signal generator No. 2. The voltmeter should indicate a maximum of —32.8 db.

(15) Perform the test given in (1) through (11) above using the connections, control settings, frequencies, and output levels given in the chart below for channel 1 of the SUBGROUP PANEL.

Test	Signal generator No. 1			Signal generator No. 2			DEM 1 GAIN control	Voltmeter	
	Transmission test cable assembly connection	Frequency (kc)	Output level (db)	Transmission test cable assembly connection	Frequency (kc)	Output level (db)		Subgroup test cable assembly connection	Indication (db)
1	C and L	56	.75	H and R	67	—7.8	Clockwise	E and P (P3)	6.7±3
2	C and L	56	.75	H and R	67	—7.8	Counter-clockwise.	E and P (P3)	—3.3
3	C and L	56	.75	H and R	60.5	—7.8	Clockwise	E and P (P3)	6.7±1.8

(16) Perform the test given in (12) and (13) above. Connect the voltmeter and resistor across the SPECIAL SERVICE OUT 1 binding posts. Operate the SPECIAL SERVICE 1 switch to SPL SERV, and insert the test plug assembly into the DEM OUT 1 jack. The voltmeter should indicate 6.7 ±3 db.

(17) Disconnect signal generator No. 2 from terminals H and R of the transmission test cable assembly. The voltmeter should indicate a maximum of —31.3 db.

(18) Perform the tests given in (1) through (11) above using the connections, control settings, frequencies, and output levels given in the chart below for channel 3 of the SUBGROUP PANEL.

Test	Signal generator No. 1			Signal generator No. 2			DEM 1 GAIN control	Voltmeter	
	Transmission test cable assembly connection	Frequency (kc)	Output level (db)	Transmission test cable assembly connection	Frequency (kc)	Output level (db)		Subgroup test cable assembly connection	Indication (db)
1	D and E	88	.75	H and R	99	−7.8	Clockwise	E and P (P1)	4.2±3
2	D and E	88	.75	H and R	99	−7.8	Counter-clockwise.	E and P (P1)	5.8 min.
3	D and E	88	.75	H and R	92.5	−7.8	Clockwise	E and P (P1)	4.2±1.8

(19) Perform the test given in (12) and (13) above. Connect the voltmeter and resistor across the SPECIAL SERVICE OUT 3 binding posts. Operate the SPECIAL SERVICE 3 switch to SPL SERV, and insert the test plug assembly in the DEM OUT 3 jack. The voltmeter should indicate 4.2 ±3 db.

(20) Disconnect signal generator No. 2 from terminals H and R of the transmission test cable assembly; the voltmeter should indicate a maximum of −32.8 db.

c. 60–108KC IN Test.

(1) Perform the procedures in *b*(1) and (2) above.

(2) Connect signal generator No. 2 and associated components to the 60–108-KC IN binding posts. Set the attenuator for a 5-db loss.

(3) Adjust the DEM GAIN 2 control to the extreme clockwise position.

(4) Connect the subgroup test cable assembly to connector P2. Connect the voltmeter to terminals E and P. The voltmeter indication should be 5.2 ±.5 db.

(5) Connect the signal generator to terminals T_1 and R of the test plug assembly. Insert the test plug assembly into the 60–108 KC IN jack. The voltmeter should indicate 5.2 ±.5 db.

Section IV. AMPLIFIER-PILOT REGULATOR AM–707/TCC–7

174. Transmission Circuit Tests

(fig. 131)

a. Initial Procedures.

(1) Interconnect the JUNCTION PANEL, GROUP PANEL, 200 VOLT POWER SUPPLY, resistors, and test cable assemblies.

(2) Interconnect signal generator No. 2, the resistors, attenuator, and transformer T107.

(3) Connect signal generator No. 1 across terminals H and R of the subgroup test cable assembly connected to connector P2 on the GROUP PANEL. Adjust the signal generator for an output frequency of 120 kc at an output level of .75 volt.

b. Carrier Transmission Circuit Transmitting Direction.

(1) Connect a 135-ohm resistor across terminals 1 and 2 of transformer T107. Set the attenuator for a 0-db loss. Adjust signal generator No. 2 for an output frequency of 60 kc at an output level of −7.8 db measured across the 135-ohm resistor. Remove the 135-ohm resistor from transformer T107.

(2) Connect terminals 1 and 2 of transformer T107 to terminals A and L of the carrier test cable assembly. Set the attenuator for a 42-db loss.

(3) Operate the CABLE REELS TO FIRST AN/TCC–11 TR switch to the 23 position.

(4) Connect the voltmeter and a 135-ohm resistor across terminals 1 and 2 of the junction panel test cable assembly; the voltmeter should indicate −7.8 ±2 db.

(5) Disconnect signal generator No. 2 and associated components and readjust the signal generator for an output frequency of 83 kc as explained

in (1) above. Repeat the test procedures given in (2) through (4) above. The voltmeter indication should be —7.8 ±2 db.

(6) Repeat the procedure given in (5) above, using an output frequency of 108 kc.

(7) Disconnect signal generator No. 2 and associated components and readjust for an output frequency of 83 kc at an output level of —7.8 db ((1) above). Connect the signal generator and associated components across terminals A and L of the carrier test cable assembly.

(8) Connect the voltmeter to terminals T_1 and R of the test plug assembly; insert the plug of the test plug assembly into the TR AMP OUT jack. The voltmeter should indicate —39.8 ±2 db.

(9) Connect signal generator No. 2 and associated components to the SPECIAL SERVICE 60–108KC IN binding posts. Set the attenuator for a 0-db loss; readjust the output of the signal generator for an output frequency of 83 kc at an output level of —7.8 db.

(10) Connect the voltmeter across the 135-ohm resistor connected across terminals 1 and 2 of the junction panel test cable assembly. The voltmeter should indicate —7.8 ±2 db.

(11) Connect signal generator No. 2 and associated components to the SPECIAL SERVICE 12–60 KC IN binding posts. Adjust the signal generator No. 2 for an output frequency of 28 kc at an output level of —7.8 db.

(12) Operate the SPECIAL SERVICE 12–60 KC switch to SPL SERV.

(13) Connect the voltmeter across the 135-ohm resistor connected to terminals 1 and 2 of the junction panel test cable assembly. The voltmeter should indicate —7.8 ±2 db.

(14) Connect signal generator No. 2 and associated components to terminals H and J of the carrier supply test cable assembly. Set the attenuator for a 35-db loss and adjust the signal generator for an output frequency of 68 kc at an output level of —7.8 db.

(15) Connect the voltmeter across the 135-ohm resistor connected across terminals 1 and 2 of the junction panel test cable assembly. The voltmeter should indicate —8.3 ±1.5 db.

c. Order Wire Transmission Circuit.

(1) Connect a 135-ohm resistor across terminals 1 and 2 of transformer T107; adjust the attenuator for 0-db loss and adjust signal generator No. 2 for an output frequency of 1 kc at an output level of —11.8 db as measured across the 135-ohm resistor.

(2) Remove the 135-ohm resistor and connect signal generator No. 2 to terminals 1 and 2 of the junction panel test cable assembly.

(3) Connect the voltmeter across the 600-ohm resistor connected across terminals L and M, with terminal M as ground, of the carrier test cable assembly terminal board (connected to plug P101). The voltmeter should indicate —6.7 ±1.5 db.

(4) Connect signal generator No. 2 and associated components across terminals 3 and 4 of the junction panel test cable assembly.

(5) Connect the voltmeter across the 600-ohm resistor that is connected to terminals F and S (with terminal S as ground) of the carrier test cable assembly. The voltmeter should indicate —10.1 db ±1.5 db.

d. Carrier Transmission Circuit, Receiving Direction.

(1) Connect a 135-ohm resistor across terminals 1 and 2 of transformer T107. Set the attenuator for a 0-db loss; adjust signal generator No. 2 for an output frequency of 68 kc at an output level of —7.8 db as measured across the 135-ohm resistor.

(2) Remove the 135-ohm resistor and connect the output of signal generator No. 2 and associated components to terminals 3 and 4 of the junction panel test cable assembly.

(3) Adjust the CABLE REELS TO FIRST AN/TCC–11 REC switch to

position 23; operate the BULGE ADJ 28 KC and SLOPE ADJ 12 KC controls to position 0; operate the REGULATOR switch to MAN.

(4) Connect a 10K resistor and 135-ohm resistor across terminals T_1 and R of the test plug assembly as shown in figure 131. Connect the voltmeter across the 135-ohm resistor and insert the plug of the test plug assembly into the REC IN jack; the voltmeter should indicate —46.8 ±2 db.

(5) Disconnect the 10K and 135-ohm resistors and connect the voltmeter across terminals T_1 and R of the test plug assembly.

(6) Adjust the FLAT ADJ 68 KC control to the extreme clockwise position and insert the plug of the test plug assembly into the REC AMP 1 OUT jack position. Readjust the attenuator for an indication of —37.8 db on the voltmeter. The attenuator should be set for a loss of 31 ±3 db.

(7) Adjust the FLAT ADJ 68 KC control to the extreme counterclockwise position. The voltmeter should indicate —57.8 db.

(8) Adjust the FLAT ADJ 68 KC control for an indication of —39.8 db on the voltmeter.

(9) Insert the plug of the test plug assembly into the REC AMP 2 OUT jack. Adjust the MAN REG OUTPUT control for an indication of —39.8 db on the voltmeter.

(10) Disconnect signal generator No. 2 and associated components from terminals 3 and 4 of the junction panel test cable assembly. Connect a 135-ohm resistor across terminals 1 and 2 of transformer T107. Set the attenuator for a 0-db loss and adjust the signal generator for an output frequency of 12 kc at an output level of —7.8 db as measured across the 135-ohm resistor. Remove the 135-ohm resistor.

(11) Connect signal generator No. 2 and associated components to terminals 3 and 4 of the junction panel test cable assembly.

(12) Insert the plug of the test plug assembly into the REC AMP 2 OUT jack. The voltmeter should indicate —46.5 ±3 db.

(13) Adjust signal generator No. 2 ((10) and (11) above) for an output frequency of 28 kc. The voltmeter should indicate —44.8 db with the plug of the test cable assembly inserted in the REC AMP 2 OUT jack.

(14) Adjust signal generator No. 2 ((10) and (11) above) for an output frequency of 60 kc. The voltmeter should indicate —40.8 ±2 db with the plug of the test plug assembly inserted in the REC AMP 2 OUT jack.

(15) Connect a 135-ohm resistor across terminals H and R of subgroup test cable assembly connected to plug P1. Adjust the DEM GAIN control to the extreme clockwise position. Adjust signal generator No. 2 for an output frequency of 12 kc ((10) above).

(16) Connect the voltmeter across the 135-ohm resistor ((15) above). The voltmeter should indicate —11.3 ±2.5 db.

(17) Readjust the signal generator for an output frequency of 28 kc ((10) above). The voltmeter indication should be 1.9 ±1.5 db greater than that in (16) above.

(18) Insert the plug of the test plug assembly (with the voltmeter across terminals T_1 and R) into the DEM OUT jack and then reconnect the voltmeter across the DEM OUT binding posts. The voltmeter indication should be the same as that given in (17) above.

(19) Repeat the tests given in (15) and (16) above with signal generator No. 2 readjusted for an output frequency of 60 kc. The voltmeter indication should be within 5.1 db of the indication in (15) above.

(20) Connect the 135-ohm resistor across terminals D and R of the carrier supply test cable assembly. Readjust signal generator No. 2 for an output frequency of 65 kc ((10) above) and connect the signal generator and as-

sociated components to terminals D and R of the carrier supply test cable assembly.

(21) Set the attenuator for a 4-db loss; connect the voltmeter across terminals T_1 and R of the test plug assembly terminal board. Insert the plug of the test plug assembly into the REC AMP 1 OUT jack. The voltmeter should indicate —40.1 ±2 db.

e. Carrier Transmission, Looped Circuit.

(1) Connect a 135-ohm resistor across terminals 1 and 2 of transformer T and adjust signal generator No. 2 for an output frequency of 68 kc at an output level of —7.8 db. Remove the 135-ohm resistor.

(2) Connect signal generator No. 2 and associated components across terminals H and J of the carrier supply test cable assembly. Strap terminals 1 and 3, and 2 and 4 of the junction panel test cable assembly.

(3) Operate the CABLE REELS TO FIRST AN/TCC–11 TR and the CABLE REELS TO FIRST AN/TCC–11 REC switches to position 11.

(4) Adjust the attenuator for a 35-db loss. Connect the voltmeter across terminals T_1 and R of the test plug assembly. Insert the plug of the test plug assembly into the TR AMP OUT jack; the voltmeter should indicate —39.8 ±2 db. If necessary, adjust the signal generator output control until a reading of —39.8 ±2 db is obtained.

(5) Reinsert the plug of the test plug assembly into the REC AMP 1 OUT jack. Adjust the FLAT ADJ 68 KC control for an indication of —39.8 ±2 db on the voltmeter.

(6) Insert the plug of the test plug assembly into the REC AMP 2 OUT jack. Operate the REGULATOR switch to AUTO and adjust the AUTO REG OUTPUT control to the extreme counterclockwise position. The voltmeter should indicate —48.3 ±2.5 db after the regulator circuit is stabilized.

(7) Adjust the AUTO REG OUTPUT control for an indication of —39.8 ±2 db on the voltmeter. Connect a *multimeter,* arranged to measure dc voltage, the REG VOLTS jacks on regulator and alarm unit Z6; the multimeter should indicate 3.5 ±.5 volts dc.

(8) Operate the ALARM TEST switch on regulator and alarm unit Z6 to the 2 LOW position. Operate the ALARM CUT OFF switch to NORMAL. Set the ADJ LOW control to the extreme counterclockwise position; then turn the control slowly clockwise until the LOW ALARM lamp lights and the audible alarm sounds. Release the ALARM TEST switch.

(9) Operate the ALARM CUT OFF switch to LOW. The audible alarm should be silenced. Operate the ALARM CUT OFF switch to NORMAL; the LOW ALARM lamp should go out and the audible alarm should sound. Reoperate the ALARM CUT OFF switch to LOW, the audible alarm should be silenced.

(10) Operate the ALARM TEST switch to the 1 HIGH position. Operate the ALARM CUT OFF switch to NORMAL. Set the ADJ HIGH control to the extreme counterclockwise position; then turn the control slowly until the HIGH ALARM lamp lights and the audible alarm sounds. Release the ALARM TEST switch.

(11) Operate the ALARM TEST switch to the 1 HIGH position; the audible alarm should be silenced. Operate the ALARM CUT OFF switch to NORMAL. The HIGH ALARM lamp should go out and the audible alarm should sound. Reoperate the ALARM CUT OFF switch to the NORMAL position. The audible alarm should be silenced.

(12) Connect a 10-ohm resistor across terminals F and P of the subgroup test cable assembly. Connect the voltmeter across the 10-ohm resistor.

The voltmeter should indicate —.3 ±3 db.

(13) Set the attenuator for a 30-db loss. Connect the voltmeter to terminals T_1 and R of the test plug assembly. Insert the plug of the test plug assembly into the REC AMP 2 OUT jack. The voltmeter should indicate —39.8 ±1.4 db. Set the attenuator for a 42-db loss; the voltmeter indication should increase 1.1 db.

(14) Set the attenuator for a 35-db loss. Operate the REGULATOR switch to MAN and adjust the MAN REG OUTPUT control for an indication of —39.8 ±2 db on the voltmeter.

(15) Connect a 135-ohm resistor and the voltmeter across terminals T_1 and R of the test plug assembly. Insert the plug of the test plug assembly into the TR 62 KC jack; the voltmeter should indicate —29.4 ±2 db. Insert the plug of the test plug assembly into the REC 62 KC jack, the voltmeter should indicate —25.6 ±2 db.

(16) Adjust signal generator No. 2 for an output frequency of 12 kc ((1) above). Connect the signal generator and associated components to the SPECIAL SERVICE 12–60 KC IN binding posts.

(17) Connect the voltmeter and a 135-ohm resistor across the SPECIAL SERVICE 12–60 KC OUT binding posts. Set the attenuator for a 0-db loss. Operate the 12–60 KC SPECIAL SERVICE switch to SPL SERV. The voltmeter should indicate —10 ±2 db.

(18) Remove the 135-ohm resistor from terminal T_1 and R of the test plug assembly and connect the voltmeter across the terminals. Insert the plug of the test plug assembly into the SPL SERV 12–60 KC IN jack; the voltmeter should indicate —1.8 ±1 db.

(19) Repeat the test procedure in (16) and (17) above using frequencies of 28 and 60 kc. The voltmeter should indicate 9.6 +2.5 db and 10.1 ±3 db respectively.

(20) Adjust signal generator No. 2 for an output frequency of 83 kc at an output level of 10 db as measured across a 135-ohm resistor connected across terminals 1 and 2 of transformer T107. Remove the 135-ohm resistor from terminals 1 and 2 of the transformer and connect the signal generator and associated components to the SPECIAL SERVICE 60–108 KC IN binding posts.

(21) Operate the 60–108 KC switch to SPL SERV. Set the attenuator for a 0-db loss. Insert the plug of the test plug assembly into the SPL SERV 60–108 KC IN jack; the voltmeter should indicate —12.8 db.

(22) Connect the voltmeter and a 135-ohm resistor across terminals T_1 and R of the test plug assembly. Adjust the DEM GAIN control to the extreme clockwise position. Insert the plug of the test plug assembly into the DEM OUT jack; the voltmeter should indicate —3.5 ±3 db.

(23) Connect the voltmeter and the 135-ohm resistor across the SPECIAL SERVICE 60–108 KC OUT binding posts. The voltmeter should indicate within ±.3 db of the reading obtained in (22) above. Adjust the DEM GAIN control to the extreme counterclockwise position; the voltmeter indication should be reduced by at least 10 db.

(24) Adjust signal generator No. 2 for an output frequency of 68 kc. Set the attenuator for a 35-db loss. Connect the voltmeter across terminals T_1 and R of the test plug assembly. Insert the plug of the test plug assembly into the REC IN jack.

(25) Set the CABLE REELS TO FIRST AN/TCC–11 TR switch to position 23 and set the CABLE REELS TO FIRST AN/TCC–11 REC switch to position 2. Operate the switches, one step at a time, until the CABLE REELS TO FIRST AN/TCC–11 TR switch is at position 2 and the CABLE REELS TO FIRST AN/TCC–11 REC switch is at position 23.

Check the voltmeter at each position of the switches. The voltmeter indications should not vary more than ±.5 db of each other at the switch position.

(26) Readjust signal generator No. 2 for an output frequency of 12 kc. Set the CABLE REELS TO FIRST AN/TCC–11 TR and the CABLE REELS TO FIRST AN/TCC–11 REC switches to positions 11. Set the SLOPE ADJ 12 KC control and the BULGE ADJ 28 KC control to the —5 position. Adjust the attenuator to obtain an indication of —51.8 ±.5 db on the voltmeter. Reset the SLOPE ADJ 12 KC control to the +5 position. The voltmeter indication should increase at least 12 db.

(27) Readjust signal generator No. 2 for an output frequency of 28 kc. Reset the SLOPE ADJ 12KC control to the —5 position. The voltmeter should indicate —51.8 ±.5 db. Reset the BULGE ADJ 28 KC control to the +5 position. The output signal strength should increase at least 6 db.

175. 12–68 Kc Amplifier Tests
(fig. 132)

a. Initial Procedure.

(1) Interconnect the modem and amplifier and carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, carrier supply test cable assembly, and the 12–68 kc amplifier.

(2) Interconnect the signal generator, resistors, attenuator, and transformer T108.

(3) Connect the resistors and capacitors to the modem and amplifier test cable assembly.

b. Power Distribution Test. Connect the multimeter across terminal 12 (ground) and the terminal indicated in the chart below on the modem and amplifier test cable assembly. The multimeter should indicate the voltages listed in the chart for each test.

Terminal	Dc voltages		
	Avg	Min	Max
20	16.2	14.7	17.7
8	18.5	17.0	20.0
13	18.8	17.6	20.1

Note. The measurements in the above table are made with no test signal input.

c. Gain Test Without Feedback Through 600-ohm Leg of Input Hybrid.

(1) Connect a 600-ohm resistor across terminals 1 and 3 of transformer T108. Set the attenuator for a 0-db loss and adjust the signal generator for an output frequency of 28 kc at an output level of —23.8 db as measured across the 600-ohm resistor. Remove the 600-ohm resistor.

(2) Connect the output of the signal generator and associated components to terminal 0 of the modem and amplifier test cable assembly and ground.

(3) Set the attenuator for a 63-db loss.

(4) Connect a ground to terminal E5 of the 12–68 kc amplifier.

(5) Connect the voltmeter between terminal 14 of the modem and amplifier test cable assembly and ground. The voltmeter should indicate —3.8 ±5 db.

(6) Adjust the signal generator for an output frequency of 12 kc as described in (1) above.

(7) The voltmeter should indicate a minimum of —11.8 db.

(8) Adjust the signal generator for an output frequency of 68 kc as described in (1) above.

(9) The voltmeter should indicate a minimum of —11.8 db.

d. Gain Test With Feedback Through 600-ohm Leg of Input Hybrid.

(1) Disconnect the ground from terminal E5 of the amplifier and readjust the attenuator for a 32-db loss.

(2) Repeat the test procedures given in *c*

Figure 131. GROUP PANEL and JUNCTION PANEL, final test setup.

(Contained in separate envelope)

above. The voltmeter should indicate the values shown in the chart below.

Signal generator frequency (kc)	Output signal level (db)
12	−3.3 ±2 db.
28	±1 db of the indication received for 12 kc.
68	+.3 ±1 db of the indication received for 12 kc. Record this indication.

(3) Set the attenuator for a 12-db loss; repeat the 68 kc test. The voltmeter indication should not vary more than ±1 db from the 68 kc indication recorded in (2) above.

(4) Connect the voltmeter to terminals 15 and 18 of the modem and amplifier test cable assembly with terminal 18 as ground. The voltmeter should indicate between 3.4 and 4.4 db.

(5) Remove the resistor-capacitor network connected between terminals 6 and 7 of the modem and amplifier test cable assembly.

(6) Set the attenuator for a 22-db loss. The voltmeter should indicate −3.3 ±1 db.

e. Gain Test With Feedback Through 120-ohm (Pilot) Leg of Input Hybrid.

(1) Connect a 135-ohm resistor across terminals 1 and 3 of transformer T108. Set the attenuator for a 0-db loss and adjust the signal generator for an output frequency of 68 kc at an output level of −7.8 db as measured across the 135-ohm resistor.

(2) Connect a 600-ohm resistor between terminal 0 of the modem and amplifier test cable assembly and ground. Connect the resistor-capacitor network between terminals 6 and 7 of the modem and amplifier test cable assembly as shown in figure 132.

(3) Disconnect the 135-ohm resistor between terminals 2 and 6 of the modem and amplifier test cable assembly and ground.

(4) Disconnect the 135-ohm resistor from terminals 1 and 3 of transformer T108 and connect the transformer to terminals 2 and 6 of the modem and amplifier test cable assembly. Set the attenuator for a 45-db loss.

(5) Connect the voltmeter to terminals 14 and 16 of the modem and amplifier test cable assembly. The voltmeter should indicate −.7 ±1.2 db.

f. Phase Margin Test.

(1) Operate the 200 VOLT POWER SUPPLY switch to the OFF position.

(2) Disconnect the signal generator and associated components from terminals 2 and 6 of the modem and amplifier test cable assembly. Disconnect the 600-ohm resistor from terminal 0 and ground of the modem and amplifier test cable assembly terminal board.

(3) Connect the voltmeter between the plate pin of tube V2 and ground.

(4) Operate the 200 VOLT POWER SUPPLY switch to the ON position. When a steady reading is obtained the voltmeter should indicate .1 volt or less.

176. Regulator and Alarm Unit Z6, Final Tests

(fig. 67)

a. Initial Procedure.

(1) Interconnect the modem and amplifier and carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, resistors, and regulator and alarm unit Z6.

(2) Connect the signal generator, resistors R1 through R3, attenuator, and transformer T108 together. (Do not connect the transformer to terminals 0 and 3 of the test cable assembly.)

(3) Operate all switches to their normal positions.

(4) Set the attenuator for a 0-db loss. Connect a 600-ohm resistor across terminals 1 and 3 of transformer T108. Adjust the signal generator for an output frequency of 68 kc at an output level of −7.8 db as measured across the 600-ohm resistor. Disconnect the 600-ohm resistor.

b. Regulating Function Test.

(1) Connect transformer T108 to terminals 0 and 3 of the modem and amplifier test cable assembly.

(2) Set the attenuator for a 2-db loss.

(3) Connect the multimeter to REG

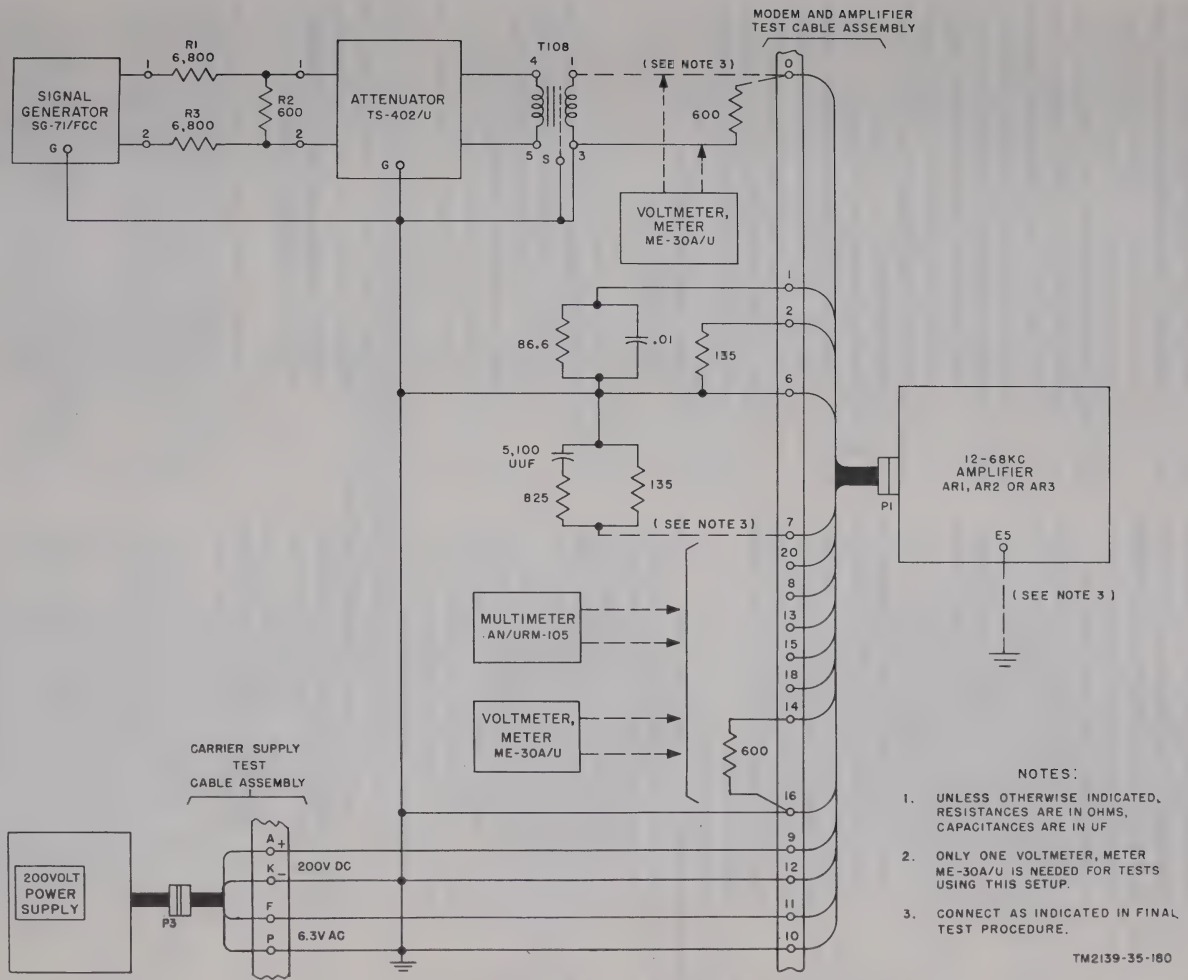


Figure 132. 12–68 kc amplifier (part of GROUP PANEL) final setup.

VOLTS jacks J1 and J2 and adjust the 20k variable resistor until the multimeter indicates 3.5 ±.5 volts dc.

(4) Connect the multimeter to terminals 14 and 12 of the modem and amplifier test cable assembly. The multimeter should indicate 65 ±20 volts dc.

(5) Connect the multimeter (arranged to measure current) in series with the 200-volt supply lead connected to terminal A of the carrier supply test cable assembly. The multimeter should indicate 61 ±10 ma.

(6) Set the attenuator for a 3-db loss. Connect the multimeter (arranged to measure voltage) to REG VOLTS jacks J1 and J2. The multimeter should indicate 6 volts minimum.

(7) Set the attenuator for a 1-db loss. The multimeter should indicate 2 volts maximum.

c. Alarm Function Test.

Note. Perform the adjustments described in (1) and (2) below with care. The adjustments are critical.

(1) Operate the ALARM TEST switch to the 1 HIGH position. Vary the ADJ HIGH control until high alarm relay K1 just releases. Measure the resistance across terminals 1 and 16, and 1 and 5 of the modem and amplifier test cable assembly with the multimeter. The multimeter should indicate 0-ohm for each measurement.

(2) Operate the ALARM TEST switch to the 2 LOW position. Vary the ADJ LOW control until low alarm relay K2 just releases. Measures the resistance across terminals 1 and 13, and 1 and 2 of the modem and amplifier test cable assembly. The multimeter should indicate 0-ohm for each measurement.

(3) Set the attenuator for a 4-db loss. Low alarm relay K2 should release and high alarm relay K1 should remain operated. Measure the resistance across terminals 1 and 2, 1 and 11, and 1 and 13 of the modem and amplifier test cable assembly. The multimeter should indicate 0-ohm for each measurement.

(4) Set the attenuator for a 3-db loss. Low alarm relay K2 should operate. Measure the resistance across terminals 1 and 13, and 1 and 2 of the modem and amplifier test cable assembly. The multimeter should indicate an infinite resistance for each measurement.

(5) Set the attenuator for 0-db loss. High alarm relay K1 should release, and low alarm relay K2 should remain operated. Measure the resistance across terminals 1 and 16, 1 and 5, and 1 and 8 of the modem and amplifier test cable assembly. The multimeter should indicate 0-ohm for each measurement.

(6) Set the attenuator for 3-db loss. High alarm relay K1 should operate. Measure the resistance across terminals 1 and 16 of the modem and amplifier test cable assembly. The multimeter should indicate an infinite resistance.

177. Modem and Amplifier AR4, Final Tests

(fig. 71)

a. Initial Procedures.

(1) Interconnect the modem and amplifier and carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, and modem and amplifier AR4.

(2) Connect terminals 6 and 9 of the modem and amplifier test cable assembly together.

(3) Connect a 200-ohm variable resistor across terminals 9 and 12 of the modem and amplifier test cable assembly and connect a 135-ohm resistor across terminals 15 and 18, and 14 and 17.

(4) Connect signal generator No. 1 to terminals 10 and 11 of the modem and amplifier test cable assembly. Adjust the signal generator for an output frequency of 120 kc at an output level of —2.5 db.

b. Transmitting Circuit Test.

(1) Connect signal generator No. 2A, resistors R1 through R3, attenuator and transformer T107 together. Connect a 135-ohm resistor across terminals 1 and 2 of transformer T107. Set the attenuator for a 0-db loss and adjust the signal generator for an output

frequency of 60 kc at an output level of —6.5 db as measured across the 135-ohm resistor with the audio level meter. Disconnect the 135-ohm resistor.

(2) Connect terminals 1 and 2 of transformer T107 to terminals 4 and 5 of the modem and amplifier test cable assembly.

(3) Connect a 600-ohm resistor across terminals 1 and 2 of the modem and amplifier test cable assembly.

(4) Set the attenuator for a 42-db loss. Connect the audio level meter across the 600-ohm resistor connected to terminals 1 and 2. Tune the audio level meter for 60 kc; it should indicate —47 ±1.5 db.

(5) Readjust signal generator No. 2A for an output frequency of 83 kc ((1) and (2) above). Readjust the audio level meter for 37 kc; it should indicate —47 ±1.5 db.

(6) Readjust signal generator No. 2A for an output frequency of 100 kc ((1) and (2) above). Tune the audio level meter for 20 kc; it should indicate —47 ±1.5 db.

c. Receiving Circuit Test.

(1) Connect a 600-ohm resistor across terminals 1 and 3 of transformer T108. Set the attenuator for a 0-db loss and adjust signal generator No. 2 for an output frequency of 37 kc at an output level of 3.8 db as measured across the 600-ohm resistor. Disconnect the 600-ohm resistor.

(2) Connect terminals 1 and 3 of transformer T108 across terminals 16 and 19 of the modem and amplifier test cable assembly terminal board.

(3) Adjust the 200-ohm variable resistor across terminals 9 and 12 for minimum resistance.

(4) Connect the voltmeter to terminals 14 and 17 of the modem and amplifier test cable assembly terminal board. The voltmeter should indicate —5.3 ±2 db. Record this value.

(5) Adjust the signal generator No. 2B for an output frequency of 60 kc ((1) and (2) above). The voltmeter indication should be within 1 db of the indication in (4) above.

(6) Adjust signal generator No. 2B for an output frequency of 12 kc ((1) and (2) above). The voltmeter indication should be within 1 db of the indication in (4) above.

Section V. TELEPHONE TEST SET TS–760/TCC–7 (PART OF RECEIVER-TRANSMITTER TEST SET GROUP OA–443/TCC–7)

178. High-Frequency Oscillator Circuit Tests
(fig. 78)

a. Initial Procedure.

(1) Interconnect the power, transmission, and carrier supply test cable assemblies, terminating resistors, 200 VOLT POWER SUPPLY, and TEST PANEL.

(2) Interconnect the signal generator, resistors R6 through R8, attenuator, transformer T107, 135-ohm resistor and test jack assembly.

b. SEND Lamp Test.

(1) The SEND lamp should light when the SEND switch is operated to 65 KC REC, and 65 KC TR OR FAULT TEST.

(2) The SEND lamp should go off when the SEND switch is operated to CHECK GAIN CHECK HF.

c. ATTENUATOR Switch Operation Test.

(1) Operate the MEASURE NON-SELECTIVE switch to CHECK 1 KC CHECK HF. Insert the measure cord plug into the test jack assembly connected to the signal source.

(2) Set the attenuator for a 46 db loss; adjust the signal generator for an output frequency of 68 kc at an output level of 0 db as indicated on the test panel meter.

(3) Operate and hold the 5 db push button of the ATTENUATOR switch and set the attenuator for a 41-db loss. The test panel meter should indicate 0 ±.7 db. Reset the attenuator for a loss of 46-db and release the 5 db push button.

(4) Operate and hold the 10 db push button of the ATTENUATOR switch and set the attenuator for a 36-db loss. The test panel meter should indicate 0 ±.7 db. Reset the attenuator for a 46-db loss and release the 10 db push button.

(5) Operate and hold the 20 db push button of the ATTENUATOR switch and set the attenuator for a 26-db loss. The test panel meter should indicate 0 db ±.7 db. Reset the attenuator for a 46-db loss and release the 20 db push button.

d. Hf Oscillator Frequencies, Test.

(1) Set the HF, 65 KC TR OR FAULT TEST, and 65 KC REC controls at approximately midpositions. Connect the frequency meter between terminal 6 of section 1 of the SEND switch and chassis ground.

(2) For each position of the SEND and FAULT TEST switches listed below, the frequency meter should indicate within the limits given in the *frequency* column.

SEND switch position	Push button of FAULT TEST switch operated	Frequency
CHECK GAIN CHECK HF.	None	68 kc ±100 cps.
65 KC REC	None	65 kc ±150 cps.
65 KC REC	REP 3	83 kc ±300 cps.
65 KC REC	REP 2	91 kc ±300 cps.
65 KC REC	REP 1	99 kc ±300 cps.

e. Hf Control Range Test.

(1) Operate the switches listed below to the indicated positions.

Switch	Position
MEASURE SELECTIVE	OFF.
MEASURE NONSELECTIVE.	CHECK 1 KC CHECK HF.
SEND	CHECK GAIN CHECK HF.

(2) Insert the TEST PANEL measure plug into the CHECK HF jack. Operate the HF control to its extreme clockwise position. The TEST PANEL meter reading should be +2.5 db or more. Operate the HF control to its extreme counterclockwise position. The meter reading should be −2.5 db or less.

(3) Readjust the HF control for a 0-db reading on the meter.

f. Check of TO TS–712/TCC–11 Connector J5.

(1) Connect the test jack assembly to terminals D and R of the transmission test cable assembly.

(2) Operate and hold the 20 db push button of the ATTENUATOR switch. Insert the TEST PANEL measure plug into the test jack assembly. The TEST PANEL meter should indicate +3 ±.8 db. Remove the measure plug from the test jack assembly and release the push button.

(3) Measure the resistance between terminals D and L and between D and A of the transmission test cable assembly with the multimeter. The resistance should be 680 ±68 ohms.

g. 65 KC TR OR FAULT TEST Control Range Test.

(1) Connect the test jack assembly across terminals K and W of the power test cable assembly. Operate the SEND switch to the 65 KC TR OR FAULT TEST position. Set the 65 KC TR OR FAULT TEST control to its extreme clockwise position. Operate and hold the 5db push button of the ATTENUATOR switch. Insert the measure

plug into the test jack assembly. The TEST PANEL meter reading should be +3 db or more.

(2) While holding the 5db push button operated, set the 65 KC TR OR FAULT TEST control to its extreme counterclockwise position. The TEST PANEL meter reading should be —3 db or less.

(3) While holding the 5db push button operated, adjust the 65 KC TR OR FAULT TEST control for a 0-db reading on the TEST PANEL meter. Release the 5db push button.

h. Fault Test Output Test.

(1) Operate the MEASURE NONSELECTIVE switch to the FAULT TEST position. Operate and hold the REP 2 push button. The TEST PANEL meter reading should be —2.5 ±.3 db. Release the push button.

(2) Operate and hold the REP 3 push button. The meter reading should be —2.5 ±1 db. Release the push button.

(3) Operate and hold the REP 1 push button. The meter reading should be —2.5 ±1 db. Release the push button.

i. 65 KC REC Control Range Test.

(1) Connect the test jack test cable assembly across terminals D and R of the power test cable assembly. Operate the MEASURE NONSELECTIVE switch to GRP DEM OUT. Operate the SEND switch to 65 KC REC. Set the 65 KC REC control to its maximum clockwise position. Insert the TEST PANEL measure plug into the test jack assembly. The TEST PANEL meter should read between +4.5 and +6.5 db.

(2) Check to see that the 65 KC REC control is capable of being adjusted for a reading of —5 db on the TEST PANEL meter. Remove the measure plug from the test jack assembly.

179. Test Oscillator, 1 Kc, Tests (fig. 78)

a. Initial Procedure. Prepare the TEST PANEL for testing as explained in paragraph 178*a*.

b. 1-Kc Oscillator Output Test.

(1) Operate the MEASURE NONSELECTIVE switch to the CHECK 1 KC CHECK HF position. Insert the TEST PANEL measure plug into the CHECK 1 KC jack. Set the 1 KC control to its maximum clockwise position. The TEST PANEL meter reading should be +2.5 db or more.

(2) Set the 1 KC control to its maximum counterclockwise position. The meter reading should be —3 db or less.

(3) Adjust the 1 KC control for a 0-db meter reading.

(4) Insert the measure plug in the CHANNEL OUT jack. The meter reading should be 0 db ±.5 db.

(5) Check for continuity between terminals P and F and between C and S of the power test cable assembly with the multimeter.

c. Oscillator Frequency Test.

(1) Connect the frequency meter across terminals P and C of the power test cable assembly.

(2) The frequency meter should indicate 1 kc ±20 cps.

180. Selector Measuring Circuit Tests (fig. 78)

a. Initial Procedure. Prepare the TEST PANEL for testing as explained in paragraph 178*a*.

b. Carrier Oscillator Output Test.

(1) Remove the bottom shield from the TEST PANEL chassis. Set the MEASURE SELECTIVE switch to OFF. Set the COARSE and FINE TUNE controls to their midpositions. Make no connection to the TEST PANEL measure cord.

(2) Calibrate the audio level meter (par. 79). Set its switches as shown in the chart below. Connect the audio level meter G binding post to chassis ground on the TEST PANEL and the unmarked binding post to terminal 2 of transformer T3. Tune the audio level meter for a maximum meter reading in the vicinity of 304 kc. The reading on the audio level meter should be between 0 ±4 db.

Audio level meter switch	Position
INJECTOR	REC.
METER	REC.
ATTENUATOR	0.
SELECTOR	VM–UNBAL 600 Ω BRG.

(3) Repeat the measurement in (2) above for each of the other positions of the MEASURE SELECTIVE switch. As an aid in tuning the audio level meter, the frequencies of the TEST PANEL carrier oscillator for the various MEASURE SELECTIVE switch positions are given in the chart below. The readings on the audio level meter, should be 0 ±4 db for all switch positions, and the difference between maximum and minimum readings, excluding the measurement in the off position should be less than .5 db.

MEASURE SELECTIVE switch position	Frequency (kc)
CHECK GAIN	262
12KC	206
28KC	222
68KC	262
65KC	259
37KC	231
67KC	261
83KC	277
99KC	293
GRP PANEL 62KC	256

(4) Remove the audio level meter connections and replace the bottom shield plate on the TEST PANEL chassis.

c. FINE TUNE Control Range Test.

(1) Operate the MEASURE NON-SELECTIVE switch to OFF; the MEASURE SELECTIVE switch to CHECK GAIN, and set the FINE TUNE control to the extreme clockwise position.

(2) Set the attenuator for a 46-db loss; adjust the signal generator for an output frequency of 68 kc at an output level of .775 volt as measured across terminals T and S of the test jack assembly.

(3) Insert the TEST PANEL measure plug into the test jack assembly connected to the test signal source.

(4) Adjust the COARSE TUNE control for a maximum meter indication.

(5) Set the FINE TUNE control to the extreme counterclockwise position.

(6) Adjust the signal generator for a maximum meter indication. Check the frequency of the signal generator with the frequency meter. The frequency should be between 70 and 71 kc.

(7) Readjust the signal generator for an output frequency of 68 kc.

(8) Adjust the FINE TUNE control to its midposition. Adjust the COARSE TUNE control for a maximum meter indication.

d. GAIN Control Range Test.

(1) Set the attenuator for a 47-db loss.

(2) Adjust the signal generator for an output frequency of 68 kc at an output level of .775 volt as measured across the test jack assembly.

(3) Insert the measure cord plug into the test jack assembly.

(4) Adjust the FINE TUNE control for a maximum meter indication.

(5) Adjust the GAIN control for a 0-db indication on the meter.

(6) Set the attenuator for a 45-db loss. Adjust the GAIN control for a 0-db indication on the meter.

Note. If a 0-db indication cannot be obtained on the meter, readjust AMP GAIN control R17 on the IF amplifier.

(7) Set the attenuator for a 46-db loss. Check to be sure that the FINE TUNE control is adjusted for maximum indication on the meter. Readjust the GAIN control for a 0-db indication on the meter.

e. Selective Circuit Sensitivity Test.

(1) Set the attenuator for a 0-db loss and adjust the signal generator as indicated in the *signal generator frequency* and *voltmeter reading* columns of the chart in (3) below.

(2) Insert the plug of the measure cord into the test jack assembly connected

to the signal source. Set the attenuator for the loss indicated in the *attenuator setting* column.

(3) Adjust the FINE TUNE control to obtain a maximum reading on the TEST PANEL meter for each position of the MEASURE SELECTIVE switch. The meter should be within the limits given in the *TEST PANEL meter reading* column.

MEASURE SELECTIVE switch position	Signal Generator frequency (kc±100 cps)	Voltmeter reading (ac volt)	Attenuator setting (db)	TEST PANEL meter reading (db)
CHECK GAIN	68	0.775	46	0
12KC	12	.731	48	0±.5
28KC	28	.731	48	0±.5
68KC	68	.731	38	0±.5
65KC	65	.731	38	0±.5
37KC	37	.731	38	0±.5
67KC	67	.731	48	0±.7
83KC	83	.731	48	0±.7
99KC	99	.731	48	0±.7
GRP PANEL 62KC*	62	.775	70	0±.9

* In this test, operate the MEASURE NONSELECTIVE switch to the GRP PANEL 62KC position.

181. Nonselective Measuring Circuit Test

(fig. 78)

a. Initial Procedure. Arrange the TEST PANEL for the following test as explained in paragraph 178*a*.

b. Test Procedures.

(1) Set the attenuator for a 0-db loss and adjust the signal generator as indicated in the *signal generator frequency* and *voltmeter reading* columns of the chart in (3) below.

(2) Insert the measure cord plug into the test jack assembly connected to the test signal source. Set the attenuator for the loss indicated in the *attenuator setting* column.

(3) The TEST PANEL meter indication should be within the limits given in the *TEST PANEL meter reading* column for each position of the MEASURE NON-SELECTIVE switch.

MEASURE NON-SELECTIVE switch position	Signal Generator frequency (kc±100 cps)	Voltmeter reading (ac volt)	Attenuator setting (db)	TEST PANEL meter reading (db)
CHECK 1 KC CHECK HF.	68	0.775	46	0±.1
CHANNEL OUT	1	.870	0	0±.5
SUB GRP MOD IN	7	.775	39	0±.5
SUB GRP MOD IN	19	.775	39	0±.5
GRP DEM OUT	68	.731	11	0±.5
SUB GRP DEM OUT	68	.775	0	0±.5
OW TR AMP OUT	1	.699	13	0±.5
OW REC AMP	1	.757	46	0±.5
CARR SUPPLY	1	.731	0	0±.5
CARR SUPPLY	68	.749	0	0±.5
CARR SUPPLY	120	.740	0	0±.7
FAULT TEST	83	.707	41	0±1.5
FAULT TEST	91	.707	41	0±1.5
FAULT TEST	99	.707	41	0±1.5

182. MEASURE Switch Operation and Meter Scale Accuracy Tests
(fig. 78)

a. Initial Procedure. Prepare the TEST PANEL for the following tests as explained in paragraph 178*a*.

b. MEASURE Switch Test.

(1) Operate the MEASURE switch to 200 VOLTS. Adjust the 200 VOLT POWER SUPPLY for a 0-db meter reading on the TEST PANEL meter. Measure the voltage between terminals V and J of the power test cable assembly with the multimeter. The reading should be 200 ±7 volts.

(2) Operate and leave the MEASURE switch in the 600 VOLTS position. No reading should be obtained on TEST PANEL meter.

(3) Operate the AC POWER switch to the OFF position. Connect terminal A to terminal V on the power test cable assembly. Operate the AC POWER switch to the ON position. The TEST PANEL meter reading should be 0 db. Remove the strap between terminals A and V.

c. Meter Scale Accuracy Test.

(1) Set the attenuator for a 46-db loss. Adjust the signal generator for an output frequency of 68 kc at an output level of .775 volt as measured across the test jack assembly.

(2) Set the attenuator to each of the values indicated in the *Attenuator loss* column of the chart below. Insert the measure cord plug into the test jack assembly. Check the TEST PANEL meter indication at each of the attenuator settings; the meter indication for each attenuator setting should be within the limits given in the *TEST PANEL meter reading* column of the chart below.

Attenuator loss (db)	TEST PANEL meter reading (db)
39	+7±.3
40	+6±.3
41	+5±.3
42	+4±.3
43	+3±.3
44	+2±.3
45	+1±.3
46	0
47	−1±.3
48	−2±.3
49	−3±.4
50	−4±.5
51	−5±.6
52	−6±.7
53	−7±.8

183. Flat and IF Amplifier Test
(fig. 86)

Note. The final test procedures for the two amplifier units are identical. Where test results or unit designations are different, parentheses are used in text to indicate IF amplifier AR1.

a. Initial Procedures (for Complete Test). If the amplifier is part of a complete TEST PANEL, use the procedure outlined in (1) through (4) below. If the amplifier is to be tested as a separate unit, use the procedure outlined in *b* below.

(1) Disconnect connector P2 from connector J1 of the amplifier and insert test plug connector P675 into connector J1.

(2) Connect the test cable assemblies, 200 VOLT POWER SUPPLY, TEST PANEL, and amplifier as shown in C, figure 86.

(3) Apply power to the TEST PANEL and operate the MEASURE switch to the TRANSMISSION position.

(4) Connect test signal source as shown in A, figure 86.

b. Initial Procedures (for Separate Test). If the amplifier to be tested is not part of a complete TEST PANEL and must be tested

separately, use the following procedure to prepare the amplifier for testing.

(1) Insert test plug connector P675 into connector J1 of the amplifier.
(2) Connect the amplifier, 200 VOLT POWER SUPPLY, measuring set, and test cable assembly as shown in B, figure 86.
(3) Apply power to the amplifier.
(4) Connect test signal source as shown in A, figure 86.

c. Range of GAIN Control R17 Test. Perform the appropriate initial procedure (*a* or *b* above) before proceeding to steps (1) through (9) below.

(1) Adjust the signal generator output frequency to 68 kc ±100 cps as read on the frequency meter.
(2) Set the attenuator for a 0-db loss.
(3) Adjust the signal generator output control for a reading of .775 volt on the voltmeter.
(4) Set the attenuator for a 49- (51-) db loss.
(5) Connect test lead B of the test plug assembly to terminal D of the plug connector P675. Connect the GND lead to chassis ground.
(6) Insert the test plug assembly into the test jack assembly.
(7) Remove the cap nut from GAIN (AMP GAIN) control R17 on the amplifier, and set R17 to its maximum clockwise position. The TEST PANEL meter (*a* above) or the measuring set meter (*b* above) should read +2.5 ±1.5 db (+3.5 ±1.5 db).
(8) Adjust GAIN (AMP GAIN) control R17 to its maximum counterclockwise position. The meter should read −3.5 ±1.5 db (−5.0 ±1.5 db).
(9) After making the tests above, adjust GAIN (AMP GAIN) control R17 for a 0-db reading on the meter. Replace the cap nut on GAIN control R17. Remove the test plug assembly from the test jack assembly.

d. Frequency Characteristic Test. Perform the appropriate initial procedure (*a* or *b* and *c* above) before proceeding with steps (1) and (2) below.

(1) Use the following procedure for tests at frequencies of 1, 12, and 68 kc. Connect the frequency meter across resistor R7 to check the frequency of the signal generator.
(*a*) Set the attenuator for a 0-db loss. Adjust the signal generator output control for a reading of .775 volt as indicated on the voltmeter.
(*b*) Set the attenuator for a 49- (51-) db loss.
(*c*) Insert the test plug assembly into the test jack assembly. Adjust the frequency of the signal generator for each test frequency within the limits given in the following chart.

Signal generator frequency	TEST PANEL or measuring set meter reading (db)
68 kc ±100 cps	0
1 kc ±20 cps	±.3 ±1
12 kc ±100 cps	0 ±1

(2) Use the following procedure for the test at 194 kc generator within the limits given in the chart in (5) below.
(*a*) Connect the audio level meter, along with the voltmeter, across the 135-ohm resistor.
(*b*) Arrange the switches of the audio level meter as follows:

Audio level meter switch	Position
INJECTOR	REC.
METER	REC.
ATTENUATOR	0 DB.
SELECTOR	VM–UNBAL 600 Ω BRG.

(*c*) Set the frequency of the signal generator to approximately 68 kc. Set the attenuator for 0-db loss. Adjust the signal generator output for a reading of .775 volt on the voltmeter.
(*d*) Adjust the frequency dial of the audio level meter for a maximum meter reading.
(*e*) Adjust the IF GAIN control of the audio level meter for a meter read-

ing of 0-db. Do not disturb this setting for the remainder of the test.

(*f*) Change the frequency of the signal generator to 194 kc ±100 cps as measured with the frequency meter.

(*g*) Adjust the frequency dial of the audio level meter for a maximum meter reading. Adjust the signal generator output control for a 0-db reading on the audio level meter.

(*h*) Set the attenuator for a 49- (51-) db loss.

(*i*) Insert the test plug assembly into the test jack assembly; the TEST PANEL or the measuring set meter should indicate 0 ±1 db.

Section VI. ORDER WIRE RECEIVER-TRANSMITTER RT–280/TCC–7 (PART OF RECEIVER-TRANSMITTER TEST SET GROUP OA–443/TCC–7)

184. Continuity Test of Switch S103

Perform the following test before proceeding with other final tests of the ORDER WIRE PANEL.

a. Remove the switch from its mounting in the panel. Be careful not to remove any of the leads or touch any part of the switch against the panel while making these tests.

b. Operate the switch to the position indicated in the *Switch S103 setting column in the chart below.* Connect the multimeter across the test points indicated at the top of each of the other six columns. The multimeter should indicate the resistance value indicated for each switch setting.

Switch S103 setting	Resistance measurements (ohms)					
	Term. 11, sect 3[b] to term. 12, sect 4	Term. 10, sect 4 to term. 12, sect 4	Term. 12, sect 2 to term. 11, sect 3	Term. 12, sect 1 to term. 11, sect 3	Term. 11, sect 4 to term. 10, sect 4	Term. 1, sect 1 to term. 2, sect 3
RADIO	1,100–1,300	[a]Open	Open	Open	Open	70–80
0–11	1,100–1,300	Open	Open	Open	Open	Open
12–34	2,100–2,400	0–0.2	4,700–5,500	500–650	Open	Open
35–57	3,700–4,300	0–0.2	4,700–5,500	800–950	Open	Open
58–80	5,800–6,600	0–0.2	9,400–10,600	410–550	Open	Open
81–103	8,500–9,600	0–0.2	15,000–18,000	240–300	Open	Open
104–126	12,000–14,200	0–0.2	15,000–18,000	500–650	Open	Open
127–149	Open	0–0.2	21,000–27,000	500–650	Open	Open
150–160	Open	0–0.2	30,000–40,000	390–500	Open	Open
150–160 (HOT).	Open	0–0.2	30,000–40,000	61–69	0–0.2	Open

[a] *Open* should correspond to a resistance reading greater than 5 megohms.
[b] Section 1 is the section nearest the knob end.

185. ORDER WIRE PANEL, Transmission Circuit Final Tests

The following procedures are used for testing all components of the ORDER WIRE PANEL transmission circuit except receiving and transmitting amplifiers AR101 and AR102.

a. Initial Procedures (fig. 133).

(1) Interconnect the power, and carrier supply test cable assemblies, resistors, 200 VOLT POWER SUPPLY, and ORDER WIRE PANEL.

(2) Interconnect signal generator B, resistors R1 through R3, attenuator, and transformer T109.

b. Lamp and Buzzer Test.

(1) Apply power to the ORDER WIRE PANEL. The CALL lamp should light and the buzzer in ringer-oscillator Y101 should sound as soon as the power is applied.

(2) The CALL lamp should go out and the buzzer should be silenced about 30 seconds after the power has been applied.

c. Load Test (fig. 133).

(1) Connect the handset to TB 101 on the ORDER WIRE PANEL. Measure the current delivered by the 200 and 10 volt sources of the 200 VOLT POWER SUPPLY with the conditions listed in the chart in (3) below.

(2) Connect the multimeter (arranged to measure current) in series with the lead connected to terminal T and then with the lead connected to terminal V of the power test cable assembly to measure the 10 volt and 200 volt sources respectively.

(3) Use either test 3 or 4 depending on the type handset being used. Clamp the handset in its storage position for test 3 or 4.

Test	Talk lever switch on telephone handset HS101	Dc supply (volts)	Current (ma)
1	Any position	200	37 ±5
2	Nonoperated	10	12.5 ±1
3	Operated (type TS–9F)	10	68 ±35
4	Operated (type H–60)	10	50 ±20

(4) Disconnect the telephone handset from TB101. Be sure to tag each lead.

d. Transmitting Circuit Output Test From 2W EXT Binding Posts (fig. 133).

(1) Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109. Adjust the attenuator for a 0-db loss; adjust signal generator B for an output frequency of 1 kc at an output level of 13.8 db as measured across the 600-ohm resistor.

(2) Disconnect the 600-ohm resistor from the transformer and connect the transformer to the 2W EXT binding posts.

(3) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to RADIO.

(4) Connect the voltmeter across terminals L and M of the power test cable assembly. The voltmeter should indicate 12.5 ±2 db.

(5) Connect the voltmeter across terminals T_1 and R on the test plug assembly and insert the test plug assembly into the TR AMP OUT jack. The voltmeter should not be more than .4 ±5 db of the indication received in (4) above.

(6) Adjust the TR GAIN control to the extreme counterclockwise position. Connect the voltmeter across terminals L and M of the power test cable assembly. The voltmeter indication should be —26.8 ±5 db.

(7) Adjust the TR GAIN control to the extreme clockwise position. Operate the SEND OW switch to ON. The voltmeter indication should be a maximum of —34.8 db.

(8) Disconnect transformer T109 from the 2W EXT binding posts. Adjust signal generator B for an output frequency of 300 cps at an output level of —13.8 db as measured across a 600-ohm resistor connected across terminals 3 and 6 of the transformer. Remove the 600-ohm resistor.

(9) Reconnect the transformer across the 2W EXT binding posts. The voltmeter should indicate not less than .7 ±2 db below the indication received in (4) above. Note the reading obtained.

(10) Readjust the signal generator for an output frequency of 1,700 cps as described in (8) above. Reconnect the transformer to the 2W EXT binding posts. The voltmeter indication should be within 1.5 db of the indication obtained in (4) above. Note the reading obtained.

(11) Readjust the signal generator for an output frequency of 1 kc as described in (8) above. Reconnect the transformer across the 2W EXT binding posts.

(12) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch from position 0–11 through position 150–160, one position at a time. At each switch position, the voltmeter should indicate within ±2 db of the indication obtained in (4) above.

(13) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 150–160 (HOT). The voltmeter should indicate not more than

1 ±2 db higher than the indication obtained in (4) above.

(14) Readjust the signal generator for an output frequency of 300 cps. Reconnect the transformer to the 2W EXT binding posts. Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 104–126. The voltmeter should not indicate more than 8.5 ± db more than the indication obtained in (4) above.

(15) Readjust the signal generator for an output frequency of 1,700 cps. Reconnect the transformer to the 2W EXT binding posts. The voltmeter indication should not indicate more than 1.2 ±2 db of the indication obtained in (4) above.

e. Transmitting Circuit Output Test Using Input From Telephone Handset (fig. 133).

(1) Interconnect signal generator C, resistors R1 through R3, the attenuator, transformer T101, and the 301-ohm resistor.

(2) Connect a 50-ohm resistor across terminals 1 and 4 of transformer T101. Set the attenuator for a 0-db loss; adjust signal generator C for an output frequency of 1 kc at an output level of —17.8 db as measured across terminals 1 and 4 of the transformer. Remove the 50-ohm resistor.

(3) Disconnect the 10-volt dc supply from terminals A and T of the power test cable assembly. Strap terminals A and T together.

(4) Connect terminals 1 and 4 of transformer T101 to terminals 2 and 3 of TR101 on the ORDER WIRE PANEL.

(5) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 to 0–11.

(6) Connect the voltmeter across terminals L and M of the power test cable assembly. The voltmeter should indicate a maximum of —17.8 db.

(7) Operate the ORDER WIRE switch to TALK. The voltmeter indication should be 4 ±2 db less than the indication obtained in *d*(4) above.

(8) Connect terminals 1 and 4 of transformer T101 to terminals 1 and 3 of TB101. The voltmeter indication should be 1.5 ±2 db less than the indication obtained in *d*(4) above.

(9) Operate the CHANNEL TALK switch to LINE and the ORDER WIRE switch to TALK. Connect the voltmeter across terminals C and P of the power test cable assembly. The voltmeter should indicate —22.3 ±1.5 db.

(10) Operate the CHANNEL TALK switch to TEST BD. Connect the voltmeter to terminals D and R of the power test cable assembly. The voltmeter indication should be —22.3 db ±1.5 db.

f. Transmitting Direction From Test Signal Connection (fig. 133).

(1) Interconnect signal generator, resistors R4 and R5, attenuator, and transformer T109.

(2) Connect a 10-ohm resistor across terminals 3 and 6 of T109. Adjust the attenuator for a 0-db loss; adjust the signal generator for an output frequency of 1 kc at an output level of —7.8 db as measured across the 10-ohm resistor.

(3) Connect terminals 3 and 6 of transformer T109 to terminals K and W of the power test cable assembly.

(4) Operate the CHANNEL TALK switch to TEST BD; ORDER WIRE switch to TALK; and the CABLE REELS TO NEXT AN/TCC–7 or AN/TCC–8 switch to RADIO.

(5) Connect the voltmeter to terminals L and M of the power test cable assembly. The voltmeter indication should be a maximum of —23.8 db.

(6) Operate the SEND OW switch to ON. The voltmeter should indicate 4 ±1.5 db higher than the indication obtained in *d*(4) above.

Figure 133. ORDER WIRE PANEL, final test setup, transmitting direction.

(Contained in separate envelope)

(7) Operate the ORDER WIRE switch to RING. The voltmeter should indicate 8.5 ±2 db less than the indication obtained in *d*(4) above.

g. Order Wire Channel, Receiving Direction Test (fig. 91).

(1) Interconnect the power, and carrier supply test cable assemblies, 301- and 600-ohm resistors, ORDER WIRE PANEL and 200 VOLT POWER SUPPLY.

(2) Interconnect signal generator A, resistors R1 through R3, the attenuator, and transformer T109.

(3) Connect the 1,300- and 301-ohm resistors in series across terminals 3 and 6 of transformer T109. Set the attenuator for a 0-db loss; adjust the signal generator for an output frequency of 1 kc at an output level of —25.8 db as measured across terminals 3 and 6 of transformer T109. Remove the 1,300- and 301-ohm resistors and connect terminals 3 and 6 of transformer T109 to terminals F and S of the power test cable assembly.

(4) Set the attenuator for a 15-db loss. Connect a 600-ohm resistor and the voltmeter across the 2W EXT binding posts. The voltmeter should indicate —7.8 with a tolerance of +2, or —3.5 db. Record the reading.

(5) Repeat the procedure in (3) above, except adjust the signal generator for 300 cps. The voltmeter should indicate within .5 ±1 db of the indication obtained in (4) above.

(6) Repeat the procedure in (3) above, except adjust the signal generator for 1,700 cps. The voltmeter should indicate within ±1 db of the indication obtained in (4) above.

(7) Readjust the signal generator to 1 kc (3) above. Connect the voltmeter across terminals T_1 and R of the test plug assembly. Insert the test plug into the REC AMP in jack. The voltmeter should indicate —21.3 ±1 db. Record this indication.

(8) Insert the test plug assembly into the REC AMP OUT jack. The voltmeter should indicate within ±1.5 to —2.7 db of the indication obtained in (7) above.

(9) Set the attenuator for a 5-db loss. Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to RADIO. Insert the test plug assembly into the REC AMP IN jack. The voltmeter should indicate within 10.5 ±2 db of the indication obtained in (7) above.

(10) Repeat the procedure in (3) above, except adjust the signal generator to 1,700 cps. Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 0–11 and adjust the REC GAIN control to the extreme counterclockwise position. The voltmeter should indicate not less than 2 ±5 db of the indication obtained in (7) above.

(11) Repeat the procedure in (3) above, except adjust the signal generator for 1,600 cps. Use the frequency meter to check the output frequency. Set the attenuator for a 15-db loss and then a 37-db loss. The CALL lamp should light and the buzzer should sound for each attenuator setting.

(12) Repeat the procedure in (3) above, except adjust the signal generator for 1 kc. Set the attenuator for a 15-db loss. Connect two series 121-ohm resistors across terminals 3 and 5 of TB101. Connect the voltmeter to terminals 3 and 5 of TB101, with terminal 3 ground. The voltmeter should indicate a maximum of —49.8 db.

(13) Set the attenuator for a 10-db loss. Operate the ORDER WIRE switch to TALK. The voltmeter should indicate —5.3 with a tolerance of +2, or —3.5 db. Record this reading. Disconnect the 121-ohm resistors from terminals 3 and 5 of TB101.

(14) Connect two 75-ohm resistors across terminals 3 and 4 of TB101. Connect the voltmeter to terminals 3 and 4 of TB101. The voltmeter should indicate not less than 7 ±2 db below the indication obtained in (13) above.

h. Receiving Direction from Message Channels Test (fig. 91).

(1) Interconnect the signal generator B, resistors R1 through R3, attenuator, and transformer T109.

(2) Connect a 600-ohm resistor and a 301-ohm resistor in parallel across terminals 3 and 6 of transformer T109. Set the attenuator for a 0-db loss; adjust the signal generator for an output frequency of 1 kc at an output level of —9.8 db as measured across terminals 3 and 6 of T109 with the voltmeter.

(3) Disconnect the 301-ohm resistor and connect terminals 3 and 6 of transformer T109 to terminals D and R of the power test cable assembly. Operate the CHANNEL TALK switch to LINE, and the ORDER WIRE switch to TALK.

(4) Connect two series-connected 121-ohm resistors across terminals 3 and 5 of TB101. Connect the voltmeter to terminals 3 and 5 of TB101 with terminal 3 as ground. The voltmeter should indicate —23.8 ±2 db.

(5) Connect signal generator B across terminals C and P of the power test cable assembly. Operate the CHANNEL TALK switch to TEST BD, and the ORDER WIRE switch to TALK. The voltmeter should indicate within ±.5 db of the indication obtained in (4) above.

(6) Disconnect the voltmeter and connect the telephone handset to TB101. A 1-kc tone should be heard in the handset.

186. Transmitting Amplifier AR101 Tests

(fig. 94).

a. Initial Procedure.

(1) Interconnect the carrier supply, and modem and amplifier test cable assemblies, 200 VOLT POWER SUPPLY, 1,300- and 301-ohm resistors, transmitting amplifier AR101, and 200 VOLT POWER SUPPLY.

(2) Interconnect the signal generator, resistors R1 through R3, attenuator, and transformer T109.

(3) Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109. Set the attenuator for 0-db loss and adjust the signal generator for an output frequency of 1 kc at an output level of —13.8 db as measured across the 600-ohm resistor. Disconnect the 600-ohm resistor.

b. Load Test. Connect the multimeter (arranged to measure current) in series with the lead connected to terminal 13 of the modem and amplifier test cable assembly to determine the total current being drawn by transmitting amplifier AR101. The multimeter should indicate 13.5 ±2 ma.

c. Gain Test.

(1) Connect terminals 3 and 6 of transformer T109 to terminals 2 and 0 of the modem and amplifier test cable assembly (terminal 0 is ground).

(2) Set the attenuator for a 39-db loss. Connect the voltmeter to terminals 17 and 19 of the modem and amplifier test cable assembly. The voltmeter should indicate —10.1 ±1.5 db.

(3) Repeat the procedure in *a*(3) and (1) and (2) above except adjust the signal generator for 300 cps. The voltmeter should indicate .4 db ±1 less than the indication obtained in (2) above.

(4) Repeat the procedure in *a*(3) and (1) and (2) above except adjust the signal generator for 2 kc. The voltmeter should indicate .3 ±1 db less than the indication obtained in (2) above.

187. Receiving Amplifier AR102 Tests

(fig. 97)

a. Initial Procedures.

(1) Interconnect the carrier supply, and modem and amplifier test cable assemblies, 200 VOLT POWER SUPPLY, 825-ohm resistor, and receiving amplifier AR102.

(2) Interconnect the signal generator, resistors R1 through R3, attenuator, and transformer T109.

(3) Connect a 301-ohm resistor and a 1,300-ohm resistor across terminals 3 and 6 of transformer T109. Set the attenuator for a 0-db loss. Adjust the signal generator for an out-

put frequency of 1 kc at an output level of —37.8 db as measured across terminals 3 and 6 of transformer T109. Disconnect the resistors from across terminals 3 and 6 of transformer T109.

b. Load Test. Connect the multimeter (arranged to measure current) in series with the lead connected to terminal 13 of the modem and amplifier test cable assembly to determine the total current being drawn by receiving amplifier AR102. The multimeter should indicate 6 ±1.5 ma.

c. Gain Test.

(1) Connect terminals 3 and 6 of transformer T109 across terminals 2 and 0 of the modem and amplifier test cable assembly with terminal 0 as ground.

(2) Set the attenuator for a 32-db loss. Connect the voltmeter across the 825-ohm resistor. The voltmeter should indicate —10.5 ±1 db. Note this reading.

(3) Readjust the signal generator (*a*(3) above) for an output frequency of 300 cps. Repeat the test given in (1) and (2) above. The voltmeter should indicate .1 ±1 db higher than the indication obtained in (2) above.

(4) Readjust the signal generator (*a*(3) above) for an output frequency of 2 kc. Repeat the test given in (1) and (2) above. The voltmeter should indicate .1 db ± db less than the indication obtained in (2) above.

188. Ringer Oscillator Y101 Tests
(fig. 100)

a. Initial Procedure.

(1) Interconnect the carrier supply and modem and amplifier test cable assemblies, 200 VOLT POWER SUPPLY, and ringer oscillator Y101.

(2) Interconnect the signal generator, resistors R1 through R3, attenuator, and transformer T109.

(3) Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109. Adjust the attenuator for a 0-db loss; adjust the signal generator for an output frequency of 1,600 cps at an output level of .31 volt as measured across the 600-ohm resistor. Remove the 600-ohm resistor.

b. Oscillator Frequency and Output Level Test.

Note. Allow the ringer oscillator to warm up at least 30 minutes before performing this test.

(1) Strap terminals 2 to 6 and 5 to 8 of the modem and amplifier test cable assembly terminal board. Connect a 600-ohm resistor across terminals 0 and 1 of the modem and amplifier test cable assembly.

(2) Connect the frequency meter across the 600-ohm resistor. The output frequency from the ringer-oscillator should be 1,600 ±4 cps. Strap capacitors C7, C8, and C9, and adjust capacitor C5 until the proper frequency is obtained.

(3) Connect the voltmeter across the 600-ohm resistor. The voltmeter should indicate .275 ±.03 volt.

(4) Disconnect the straps between terminals 2 and 6 and 5 and 8 of the modem and amplifier test cable assembly. Disconnect the 600-ohm resistor from terminals 0 and 1 of the test cable assembly.

c. Ringer Oscillator Y101 Sensitivity Test.

(1) Connect terminals 3 and 6 of transformer T109 to terminals 0 and 1 of the modem and amplifier test cable assembly.

(2) Set the attenuator for a 30-db loss. The buzzer should sound. Disconnect terminals 3 and 6 of transformer T109 from terminals 0 and 1 of the test cable assembly. The buzzer should be silenced.

(3) Set the attenuator for a 3-db loss and reconnect the transformer to terminals 0 and 1. The buzzer should sound. Disconnect the transformer from terminals 0 and 1; the buzzer should be silenced.

Note. The total current drawn by the ringer oscillator should be 18 ±4 ma.

d. Ringer Response Test.

(1) Set the attenuator for a 7-db loss. Connect terminals 3 and 6 of trans-

former T109 to terminals 0 and 1 of the modem and amplifier test cable assembly. After a short time the buzzer should sound.

(2) Disconnect the transformer from terminals 0 and 1; the buzzer should be silenced.

e. Guard Circuit Test.

(1) Connect a 600-ohm resistor across terminals 3 and 6 of transformer T109. Set the attenuator for a 0-db loss; adjust the signal generator for an output frequency of 300 cps at an output level of .14 volt as measured across the 600-ohm resistor.

(2) Disconnect the resistor and connect terminals 3 and 6 of transformer T109 to terminals 0 and 1 of the modem and amplifier test cable assembly. Connect the electronic multimeter between standoff E2 and chassis ground. The multimeter should indicate 9.5 ±4 volts dc.

(3) Repeat the procedure in (1) above, except adjust the signal generator for 1 kc. The electronic multimeter should indicate 7.5 ±1.5 volts dc.

(4) Repeat the procedure in (1) above, except adjust the signal generator for 3 kc. The electronic multimeter should indicate 10.5 ±2 volts dc.

Section VII. TELEPHONE CARRIER FREQUENCY SUPPLY TA-228/TCC-7

189. CARRIER SUPPLY PANEL

Output Tests
(fig. 103)

a. Initial Procedures.

(1) Interconnect the supply, transmission, and carrier supply test cable assemblies, 200 VOLT POWER SUPPLY, and CARRIER SUPPLY PANEL.

(2) Strap terminals P, C, M, and E of the supply test cable assembly together. Connect ground to terminal N and then strap terminals D, R, F, and K to terminal N of the supply test cable assembly. Connect the terminating resistors to the test cable assemblies.

b. Tuning Adjustments of 64-kc Oscillator and 64- to 4-kc Frequency Divider Circuits.

(1) Disconnect frequency stabilizer network Z1 from standoff terminals E61 and E62 (fig. 20) and replace it with a 100,000-ohm resistor.

(2) Connect the frequency meter across terminals T_1 and R of the test plug assembly (fig. 103) and insert the plug of the test plug assembly into the 64KC LOCAL jack.

(3) Adjust capacitors C49A and C49B to obtain a 64-kc ±100-cps indication on the frequency meter.

(4) Disconnect the 100,000-ohm resistor and reconnect frequency stabilizer network Z1. Disconnect capacitors C30 and C31 from standoff terminals E51 and E52 respectively. Connect the oscilloscope between terminal 1 of inductor L3 and ground; the wave shape on the oscilloscope should be a stable sine wave. Reconnect either capacitor C30 or C31, or both, for a maximum deflection on the oscilloscope.

Note. Maximum deflection may be obtained with neither capacitor C30 nor C31 reconnected.

(5) Allow a 20-minute warmup time for the frequency stabilizer network; remeasure the frequency at the 64KC LOCAL jack ((2) above). The output frequency should be 64 kc ±2 cps.

(6) Connect the oscilloscope across terminals 1 and 2 of transformer T3. Capacitor C10 may have either of two values: 300 μμf or 380 μμf. Select the value for C10 that results in the larger output of 32 kc.

(7) Connect the oscilloscope across terminals 1 and 2 of transformer T4. Capacitor C11 may have either of two values: 300 μμf or 390 μμf. Select the value for C11 that results in the larger output of 16 kc.

(8) Connect the oscilloscope across terminals 1 and 2 of transformer T6. Ca-

pacitor C13 may be used alone or in parallel with capacitor C50. Select the arrangement that results in the larger output of 8 kc. Disconnect the oscilloscope.

c. Channel Assemblies Carrier Output Adjustment Test. Connect the voltmeter across the terminals of one of the carrier supply test cable assemblies as indicated in the voltmeter connection column of the following chart. Select the value of the resistor indicated in the *resistor value* column which provides an output of .5 ±1.5 db as indicated on the voltmeter.

Voltmeter Connection	Resistor Designation	Resistor Value		
F and R	R78	3,000	3,900	4,700
E and P	R86	7,500	9,100	11K
D and N	R106	6,800	8,200	10K
C and M	R114	5,100	6,200	7,500

d. Subgroup and Group Panel Carrier Output Adjustment Test.

(1) Connect the voltmeter across terminals T_1 and R of the test plug assembly.

(2) Insert the plug of the test plug assembly into the jack listed in the *voltmeter connection* column of the following chart. Select a value for the resistor (fig. 20) listed in the *resistor value* column which provides an output of —.3 ±1.5 db indicated on the voltmeter.

Voltmeter connection (jack)	Resistor designation	Resistor Value				
56 KC	R123	2,400	3,000	3,900		
72 KC	R128	2,200	2,700	1,600*		
88 KC	R132	2,700	3,300	4,300	2K	
120 KC	R136	1,200	1,600	2K	680*	910*

* In panels bearing Order No. 14181-P-51 serial numbers 1 through 15, the 1,600-ohm value for R128 is 3,300 ohms; the 680- and 910-ohm values given for R136 should not be used.

(3) Connect the multimeter to terminals A and K of each of the carrier supply test cable assemblies. The multimeter should indicate 200 volts dc at each test cable assembly.

(4) Connect the multimeter across terminals B and L of each of the carrier supply test cable assemblies. The multimeter should indicate 6.3 volts ac at each test cable assembly.

e. Pilot and Test Frequencies Output Test.

(1) Connect the voltmeter across terminal E37 and ground.

(2) Operate the 12 & 28 KC switch to the ON position. The 12 & 28 KC lamp should light.

(3) Ground terminal 3 of filters FL4 and FL5. Adjust the 12 KC variable resistor to the extreme counterclockwise position. The voltmeter should indicate a maximum of —29 db.

(4) Readjust the 12 KC variable resistor to the extreme clockwise position. The voltmeter should indicate a minimum of —25 db.

(5) Disconnect the ground from terminal 3 of filters FL4 and FL5 and disconnect the voltmeter.

(6) Connect the audio level meter to terminals H and J of the supply test cable assembly. Adjust the audio level meter to measure a frequency of 28 kc. Adjust the 28 KC variable resistor to the extreme counterclockwise position. The audio level meter should indicate —54 db or less.

(7) Readjust the 28 KC variable resistor to the extreme clockwise position. The audio level meter should indicate at least —50 db.

(8) Operate the 12 & 28 KC switch to OFF. The 12 & 28 KC lamp should go out. Readjust the audio level meter to measure 68 kc. Adjust the 68-kc variable resistor to the extreme counterclockwise position. The audio level meter should indicate —44 db or less. Readjust the 68-kc variable resistor to the extreme clockwise po-

sition. The audio level meter should indicate at least 40 db.

190. CARRIER SUPPLY PANEL, Miscellaneous Tests
(fig. 103)

a. Initial Procedure. Prepare the CARRIER SUPPLY PANEL for testing as explained in paragraph 189*a*.

b. 68-kc and 120-kc Alarm Test.

(1) Connect terminal 1 of the frequency stabilizer network to ground. The 68 KC and 120 KC ALARM lamps should light. Connect the multimeter to terminals B and E of the supply test cable assembly. The multimeter should indicate 6.3 volts ac.

(2) Operate the 68 KC ALARM CUTOFF and the 120 KC ALARM CUTOFF switches. The multimeter should indicate zero voltage and the alarm lamps should remain lighted.

c. Test for Spurious Operation of Frequency Dividers.

(1) With terminal 1 of the frequency stabilizer still grounded, connect the voltmeter to terminals T_1 and R of the test plug assembly. Insert the plug of the test plug assembly into the DIV 2 jack.

(2) The voltmeter should indicate a maximum of .1 volt. Remove the plug from the jack and disconnect the ground from terminal 1 of the frequency stabilizer network.

d. Test Jacks Test. Insert the plug of the test plug assembly into the 4KC, 8KC, 12KC, 16KC, 20KC, 64KC LOCAL, DIV 1, and DIV 2 jacks. The voltmeter should indicate —.3 ±3 db at each jack.

e. Remote Operation Test.

(1) Connect the signal generator to terminals F and P of the transmission test cable assembly. Adjust the signal generator for an output frequency of 68 kc ±100 cps as measured with the frequency meter at an output level of —.3 db as measured with the voltmeter.

(2) Connect the voltmeter to terminals T_1 and R of the test plug assembly. Operate the CARR SYNC switch to REMOTE.

(3) Insert the plug of the test plug assembly into the SYNC jack and then the 64KC REM jack. The voltmeter should indicate —.3 ±3 db at each jack.

(4) Insert the plug of the test plug assembly into the 64KC LOCAL test jack. The voltmeter should indicate less than .2 volt. The 68 KC and 120 KC ALARM lamps should not be lighted.

Section VIII. POWER SUPPLY PP–827/U

191. Initial Procedures
(fig. 134)

The purpose of this pretest setup is to prepare the equipment for final test.

a. Interconnect the 200 VOLT POWER SUPPLY and the carrier supply test cable assembly.

b. Place the AC POWER switch to the ON position.

Caution: **Disconnect ac power from the power supply.**

c. Measure the resistance between the carrier supply test cable assembly terminals listed in the chart below and ground or between other points as indicated with the multimeter.

Test terminal	To	Resistance	Position of 115V–230V switch
B	R	Infinite.	
J	R	Infinite.	
P	R	Infinite.	
M	R	Infinite.	
A	R	Infinite.	
D	R	Infinite.	
R	R	Infinite.	
P2*	R	Infinite_____	115V.
P2*	R	Infinite_____	230V.
A	K	36K–44K.	

* Test from both terminals of input plug P2.

192. Voltage Requirements Test
(fig. 134)

a. Connect the power supply as shown. Operate the 115V–230V switch to the 115V position. Connect plug P2 to the 115-volt variable power source. Use variable transformer TF–171/USM. Connect the multimeter across the variable power source and adjust the transformer as indicated in the chart in *g* below. Operate the AC POWER switch to ON. The AC POWER lamp should light.

b. Refer to the appropriate notes in *g* below before performing each test.

c. Perform tests 1 through 5 (*g* below), using the *multimeter* bridged across terminals A and K of the carrier supply test cable assembly. Measure the output voltages as indicated in the chart.

d. Make tests 6 through 8, using the *multimeter* bridged across terminals D and H of the carrier supply test cable assembly. Measure the output voltages.

e. Repeat tests 1 through 4, using the *voltmeter* bridged across terminals A and K of the carrier supply test cable assembly. Measure the maximum ripple voltage.

f. Repeat tests 6 and 7, using the *voltmeter* bridged across terminals D and H of the carrier supply test cable assembly. Measure the maximum ripple voltage.

g. The tests for the 200 VOLT POWER SUPPLY are listed in the chart below.

Test No.	Resistance termination across terminals of carrier supply test cable assembly		See notes	Ac input (volts)	Voltage across terminals of carrier supply test cable assembly		Maximum ripple voltage across terminals of carrier supply test cable assembly	
	Terminals A and K (ohms)	Terminals D and H (ohms)			Terminals A and K (dc volts)	Terminals D and H (dc volts)	Terminals A and K (ac volts)	Terminals D and H (ac volts)
1	740	1,000, 2w	1, 2, 8, 10	115	200		.01	
2	740	1,000, 2w	3, 8, 10	97.5	197–200		.01	
3	800	1,000, 2w	3, 9, 10	115	200–202		.01	
4	800	1,000, 2w	1, 2, 9, 10	115	200		.01	
5	800	1,000, 2w	3, 9, 10	130	200–203		.02	
6	387	1,000, 2w	4, 11	115	190–210			
7	387	1,000, 2w	5, 10, 11	115	200	12 ±1		.03
8	387	1,000, 2w	5, 10, 11	115	200	9 ±1		.03
9	387	1,000, 2w	6, 11	115	200	9 ±1		
10	800	1,000, 2w	7, 9	115				
11	800	1,000, 2w	9, 12	230		12 ±1		

Notes.

1. Adjust the 200V ADJ control to obtain this voltage; the voltage increases when the control is turned clockwise.

2. The panel under test should be permitted to operate at least 5 minutes under the conditions of test No. 1 before proceeding with the subsequent tests. Do not interrupt the ac power during tests No. 1 through 4.

3. Do not readjust the 200V ADJ control when proceeding from test No. 1 through test No. 4.

4. Adjust the 200V ADJ control from maximum counterclockwise to maximum clockwise position. The readings obtained should be equal to, or greater than, the dc range indicated in the chart. After completing test No. 5, adjust the 200V ADJ control to an output of 200 volts dc across terminals A and K, as read on the multimeter. Tighten the locknut.

5. Measure the ripple voltage, with the voltmeter connected to terminals D and H of the carrier supply test cable assembly.

6. Measure the dc voltage across terminals M and N, P and F, B and L, and E and J of the carrier supply test cable assembly with the multimeter. The multimeter should read 7.2 ±1 volt.

7. Measure the ac voltage across outlets TO 600V POWER SUPPLY J2 and J3, and across 115 V CONVENIENCE OUTLETS J4 and J5. The multimeter should read 115 ±1 volt.

8. The 740-ohm resistance is formed by connecting two 1,500-ohm 25-watt variable resistors in parallel and adjusting them to obtain a resistance of 740 ohms.

9. The 800-ohm resistance is formed by connecting two 1,600-ohm 37-watt resistors in parallel.

10. Note the *average* value of ripple voltage. Ignore momentary peaks.

11. The 387-ohm resistance is formed by connecting a 1,000-ohm 55-watt resistor and a 630-ohm 87-watt resistor in parallel.

12. Before performing this test, set the AC POWER switch to OFF. Set the 115V–230V switch to 230V and adjust the ac input voltage to 230 volts. Set the AC POWER switch to ON and perform test No. 11. Measure the dc voltage across terminals M and N of the carrier supply test cable assembly with the multimeter. The multimeter should indicate 7.2 ±1 volt.

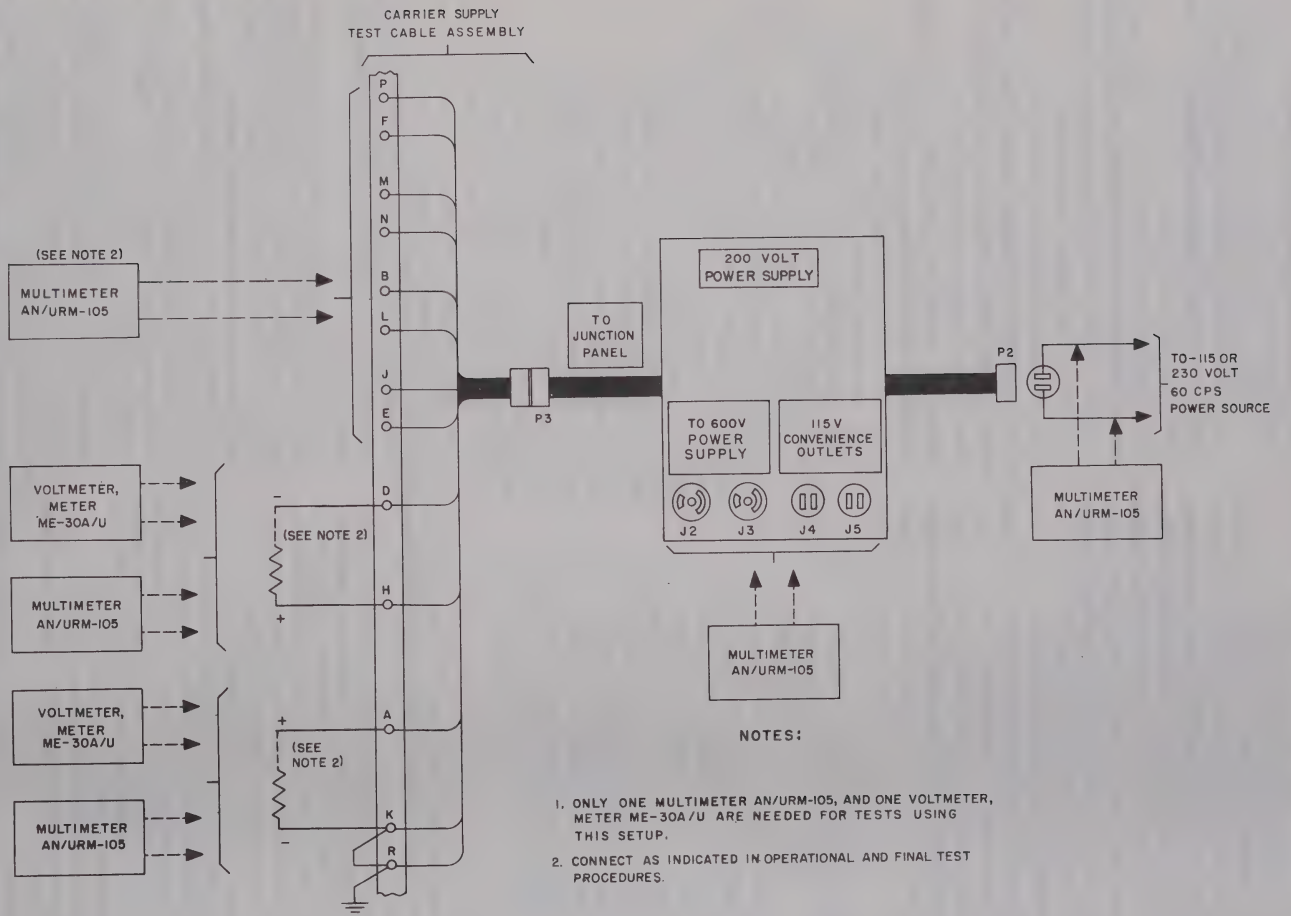


Figure 134. Power Supply PP-827/U, operational and final test setup.

193. Blower Operation Test
(fig. 134)

Note. Perform the following test with the power supply installed in its transit case.

a. Turn the power on and operate the power supply until the temperature within the panel is sufficient to cause thermostat S2 to close and cause the blower to operate. This usually takes about 20 minutes if the room temperature is about 60° F.

b. See that air is being forced *out* of the front panel grill.

Section IX. POWER SUPPLIES PP–826/U AND PP–826A/U

194. Power Supply PP–826/U Tests
(figs. 39 or 40 and 135)

a. Initial Procedure.

(1) Measure the resistances at the test points indicated in the chart below. Operate the AC POWER switch to ON and operate the 115V–230V switch to 115V.

***Caution:* Be sure the ac power has been disconnected from the power supply.**

Test points	Resistance (ohms)
Term. E on term. board 1 to grd	Infinite.
Term. F on term. board 1 to grd	Infinite.
Term. 1 on transformer T1 (main chassis) to grd.	Infinite.
Term. 11 on transformer T1 (low voltage rectifier and alarm unit Z1) to grd.	Infinite.
Term. 9 on transformer T1 (low voltage rectifier and alarm unit Z1) to grd.	Infinite.
Term. E on term. board 1 to term. 9 on transformer T1 (low voltage rectifier and alarm unit Z1)	Infinite.
Term. E on term. board 1 to term. 11 on transformer T1 (low voltage rectifier and alarm unit Z1).	Infinite.
Term. E on term. board 1 to term. 1 on transformer T1 (main chassis).	Infinite.
Term. B on term. board 1 to grd	2
Term. C on term. board 1 to grd	.2.
Term. D on term. board 1 to grd	450K, (+90K, −270K).
Term. A on term. board 1 to grd*	450K (+90K,* −270K).

* Operate the REPEATER switch to position 3.

(2) Measure the resistances between the test points on the REPEATER switch indicated in the chart below. Operate the REPEATER switch to the position indicated in the *REPEATER switch position* column. Connect the multimeter to the jacks indicated in the *test jacks* column. Operate the 600V ADJ control to the position indicated in the *600V ADJ position* column. The resistors checked in each test are listed in the *resistors measured* column and the normal indication are listed in the *resistance* column.

REPEATER switch position	Test jacks	600C ADJ position	Resistors measured	Resistance (ohms) ±20 percent
3	J1 to J3	Fully clockwise	R7	7,100
3	J3 to J4	Fully clockwise	R6, R12	2,000
3	J3 to J4	Fully counterclockwise	R6	500
2	J3 to J4	Fully counterclockwise	R6, R13	2,300
1	J3 to J4	Fully counterclockwise	R6, R13, R14	4,100
0	J3 to J4	Fully counterclockwise	R6, R13, R14, R15	5,700
TEST	J4 to ground	Fully counterclockwise	None	0

(3) Interconnect the 600 V power supply test cable assembly, RC network, and 600 VOLT POWER SUPPLY.

(4) Operate the AC POWER switch to OFF; operate the REPEATER switch to 3; and adjust the LOW-VOLT ALARM and LOAD CURRENT controls to the extreme counterclockwise position.

(5) Adjust the LOW-VOLT ALARM and

HIGH-VOLT ALARM controls to the extreme clockwise position. Adjust variable resistors R16 and R20 (low voltage rectifier and alarm unit Z1) to the extreme clockwise position.

(6) Connect power input plug P1 to the variable power source (use variable transformer TF–171/USM). Adjust the input to 115 volts.

(7) Connect the multimeter across terminals A and B of the 600 V power supply test cable assembly.

(8) Short one of the 1,800-ohm resistors. Adjust the variable resistor for a resistance reading of 4,000 ohms on the multimeter.

(9) Operate the AC POWER switch to ON. The CURRENT meter should indicate between 10 and 17 ma.

(10) Adjust variable resistor R16 slowly counterclockwise until relay K6 releases, causing relays K8, K9, and K1 to operate. The indication on the CURRENT meter should drop to zero and then rapidly build up to between 60 and 100 ma. Operate the AC POWER switch to OFF.

(11) Remove the short across the 1,800-ohm resistor.

b. Normal Output Voltage Test.

(1) Connect the multimeter across terminals A and B of the 600-volt power supply test cable assembly. Adjust the variable resistor for a resistance of 6,000 ohms on the multimeter. Disconnect the multimeter.

(2) Operate the AC POWER switch to the ON position. Adjust the variable transformer for an input of 115 volts.

(3) The LOAD ALARM lamp should light; operate the ALARM CUTOFF switch to the horizontal position. The alarm buzzer should sound. Operate the ALARM CUTOFF switch to the vertical position; the buzzer should be silenced. The CURRENT meter should indicate 80 ±15 ma within 8 seconds of the time the AC POWER switch is turned on. Recheck the line voltage ((2) above).

(4) Approximately 30 seconds after power is applied, adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter.

(5) Connect the multimeter across terminals A and B of the 600-volt power supply test cable assembly. Adjust the variable resistor for a meter indication of 600 volts. The LOAD ALARM lamp should go out.

(6) Connect the multimeter across terminals B and D of the 600V power supply test cable assembly. The multimeter should indicate 275 ±10 volts.

c. Output Ripple Voltage Test.

(1) Connect a 1-megohm resistor between the GND and unmarked terminals on the voltmeter. Connect a .5-μf capacitor between the unmarked terminal on the voltmeter and terminal A on the 600 V power supply test cable assembly. Connect the GND terminal of the voltmeter to terminal B of the 600 V power supply test cable assembly.

(2) The voltmeter should indicate a maximum ripple voltage of .2 volt.

d. Line Voltage Regulation Test.

(1) Adjust the input voltage to 115 volts. Note the indication on the CURRENT meter. Adjust the variable transformer to 132.5 volts. The indication on the CURRENT meter should not increase more than 1 ma. Check the ripple voltage (*c* above). The ripple voltage should be less than .2 volt.

(2) Adjust the variable transformer to 97.5 volts. The indication on the CURRENT meter should decrease not more than 1 ma. Check the ripple voltage (*c* above). The ripple voltage should be less than .2 volt.

(3) Readjust the variable transformer to 115 volts. Disconnect the voltmeter.

e. Low-Voltage Cutoff Range and Requirements Test.

(1) Connect the multimeter to terminals A and B of the 600 V power supply test cable assembly. Adjust the variable resistor until the output voltage cuts off. The multimeter should indicate between 450 and 510 volts at the time cutoff occurs. The LOAD

ALARM and LOW VOLTAGE lamps should light and the buzzer should sound.

Note. If cutoff cannot be reached with the variable resistor adjusted to provide approximately 450 volts indication on the multimeter, adjust the LOW-VOLT ALARM control until cutoff occurs between 450 and 510 volts.

(2) Operate the AC POWER switch to OFF. Adjust the variable resistor R677 to provide an indication of 6,000 ohms on the multimeter. Arrange the multimeter to measure dc volts. Operate the AC POWER switch to ON. Press the RESTORE switch momentarily; dc power should be restored. The LOAD ALARM and LOW VOLTAGE lamps should go out and the buzzer should be silenced.

(3) Adjust the variable resistor to provide an indication of approximately 680 volts. Adjust the LOW-VOLT ALARM to the extreme clockwise position. Adjust the variable resistor until cutoff occurs. The multimeter indication should be a minimum of 570 volts.

(4) Adjust the LOW-VOLT ALARM control to the extreme counterclockwise position. Repeat the procedure in (2) above.

(5) Adjust the variable resistor for an indication of 532 volts on the multimeter. Adjust the LOW-VOLT ALARM control until cutoff occurs. This is the normal position for the LOW-VOLT ALARM control and the control should remain at this setting. More than one trial may be required to obtain the proper setting.

(6) Adjust the variable resistor until cutoff occurs. Cutoff should occur between 530 and 535 volts. The LOAD ALARM and LOW VOLTAGE lamps should light and the buzzer should sound. Readjust the power supply for normal operation ((2) above).

f. High-Voltage Cutoff Range and Requirements Test.

(1) Connect the multimeter to terminals A and B of the 600 V power supply test cable assembly. Increase the output voltage by adjusting the variable resistor until the cutoff occurs. The LOAD ALARM and HIGH VOLTAGE lamps should light. Cutoff should occur at 750 volts or above.

Note. If cutoff does not occur at 750 volts, adjust the 600V ADJ control until cutoff occurs.

(2) Operate the AC POWER switch to OFF. Adjust the variable resistor for an indication of 6,000 ohms on the multimeter. Adjust the 600V ADJ control to the extreme counterclockwise position. Arrange the multimeter to measure dc volts. Operate the AC POWER switch to ON, and operate the RESTORE switch momentarily. Dc power should be restored immediately and the LOAD ALARM and HIGH VOLTAGE lamps should go out; the buzzer should be silenced.

(3) Adjust the variable resistor for an output voltage of approximately 570 volts. Adjust the HIGH-VOLTAGE ALARM control to the extreme clockwise position. Slowly increase the output voltage by adjusting the variable resistor. Cutoff should occur at 660 volts or less.

(4) Adjust the HIGH VOLTAGE ALARM control fully counterclockwise. Repeat the procedure in (2) above.

(5) Adjust the variable resistor for an indication of 672 volts on the multimeter. Adjust the HIGH VOLTAGE ALARM control until cutoff occurs. More than one trial may be required to obtain the proper setting. Tighten the locknut on the control.

(6) Increase the output voltage by adjusting the variable resistor until cutoff occurs (between 670 and 675 volts). The HIGH VOLTAGE and LOAD ALARM lamps should light and the buzzer should sound. Readjust the HIGH VOLTAGE ALARM control, if necessary ((5) above).

(7) Restore normal operation ((2) above).

g. Low-Voltage Alarm Operation Below 530 Volts.

(1) Connect the multimeter across terminals A and B of the 600 V power supply test cable assembly. Adjust the 600V ADJ control for an indication of 600 volts dc on the multimeter.

(2) Adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter.

(3) Adjust the variable resistor for an output voltage of 510 volts as indicated on the multimeter. While reducing the voltage to 510 volts, a low-voltage cutoff will occur. The LOW VOLTAGE and LOAD ALARM lamps should light and the buzzer should sound.

(4) Operate the RESTORE switch; the dc output voltage will be restored. Continue the adjustment of the variable resistor ((3) above). The starting time delay will provide time to complete this adjustment.

(5) The LOAD ALARM lamp should go out and dc should be restored to the line after the 20-second time delay; low-voltage cutoff should occur.

(6) Operate the RESTORE switch; the dc output voltage will be restored. Adjust the variable resistor for an output voltage of 600 volts as indicated on the multimeter.

h. Load Current Range Test.

(1) Connect the multimeter across terminals A and B of the 600 V power supply test cable assembly.

(2) Adjust the LOAD CURRENT control from the extreme clockwise position to the extreme counterclockwise position. Adjust the variable resistor for a voltage indication of between 535 and 670 volts while the LOAD CURRENT control is being adjusted to prevent cutoff from occurring.

(3) The LOAD CURRENT control range should be 90 to 115 ma. Adjust the LOAD CURRENT control for a CURRENT meter indication of 100 ma; adjust the variable resistor for an output voltage of 600 volts.

(4) Hand-tighten the locknut on the LOAD CURRENT control.

i. Load Detection Circuits and Requirements Test.

(1) Connect the multimeter across terminals A and B of the 600V power supply test cable assembly. Adjust the variable resistor for an output voltage of 480 volts.

Notes.

1. Below 530 volts, a low-voltage cutoff should occur. Operate the RESTORE switch and continue to adjust for 480 volts.

2. After the 20-second starting time delay, another low-voltage cutoff should occur.

(2) Operate the AC POWER switch to OFF. Adjust variable resistor R16 (inside low voltage rectifier and alarm unit Z1) to the extreme clockwise position.

(3) Operate the AC POWER switch to ON. Dc power should not come on and the CURRENT meter should indicate between 8 and 15 ma.

(4) Adjust variable resistor R16 counterclockwise until relay K6 releases. The CURRENT meter indication should drop to zero and then increase to 100 ma. Quickly adjust the variable resistors for an output voltage of 400 volts as indicated on the multimeter. Low-voltage cutoff should not occur if the adjustment is completed within 20 seconds.

(5) Operate the AC POWER switch to OFF and then to ON. The dc output should not come on and the LOAD ALARM lamp should remain lighted.

(6) Hand-tighten the locknut on resistor R16. Recheck the position of R16 by slowly adjusting the variable resistor until normal dc output is restored. When the CURRENT meter indicates 100 ma, the multimeter should indicate 480 $\pm$10 volts. If necessary, readjust resistor R16 to obtain these values.

(7) Operate the AC POWER switch to OFF and adjust the 600 V ADJ control to the extreme counterclockwise position. Adjust the variable resistor for a resistance of 4,000 ohms. Ar-

range the multimeter to measure dc voltage. Operate the AC POWER switch to ON; dc power should not come on but the CURRENT meter should indicate about 10 ma. Adjust the variable resistor until dc power just comes on. The CURRENT meter indication should drop to 0 ma and rapidly rise to 100 ma. The output voltage as read on the multimeter should be 480 ±10 volts. Repeat the procedures in (1) through (6) above if the requirements are not met.

j. Low Line Voltage Cutoff Protection Adjustments and Requirements Test.

(1) Adjust the input voltage of the ac source to 115 volts. Connect the multimeter to terminals A and B of the 600 V power supply test cable assembly. Adjust the 600-V ADJ control for an indication of 600 volts on the multimeter. Adjust the LOAD CURRENT control for an indication of 100 ma on the CURRENT meter.

(2) Adjust the input voltage of the ac source to 93 volts with the variable transformer. Adjust resistor R20 (inside low voltage rectifier and alarm unit Z1) slowly counterclockwise until relay K9 releases. The buzzer should sound and the LOAD ALARM lamp should light. The dc output should decrease and the power supply should cycle on and off but should not cut off. Hand tighten the locknut on resistor R20.

(3) Increase the input voltage of the ac source to 97 volts. The power supply should stop cycling and the CURRENT meter should indicate 100 ma. Readjust resistor R20 if the power supply continues to recycle.

(4) Adjust the input voltage to between 60 and 70 volts; cutoff should occur. Readjust the input voltage to 115 volts; dc output should be restored automatically. Interrupt the input voltage for 2 seconds; normal operation should restore automatically. If the requirements are not met, repeat the procedures in (1) through (3) above.

k. Blower Operational Test.

(1) After all previous final tests have been completed on the power supply, install the power supply in its carrying case.

(2) Operate the AC POWER switch to ON and operate the power supply until the temperature within the panel is sufficient to close thermostat S2, and operate the blower. This usually takes about 20 minutes if the room temperature is about 60° F.

(3) See that the blower forces air *out* of the front panel grill.

195. Power Supply PP–826A/U Tests (figs. 35 and 135)

a. Initial Procedures.

(1) Measure the resistance at the test points indicated in paragraph 194*a* (1).

(2) Check the resistance between the contacts of the REPEATER switch as indicated in paragraph 194*a*(2).

(3) Interconnect the 600 V power supply test cable assembly, the RC network, and the 600 VOLT POWER SUPPLY.

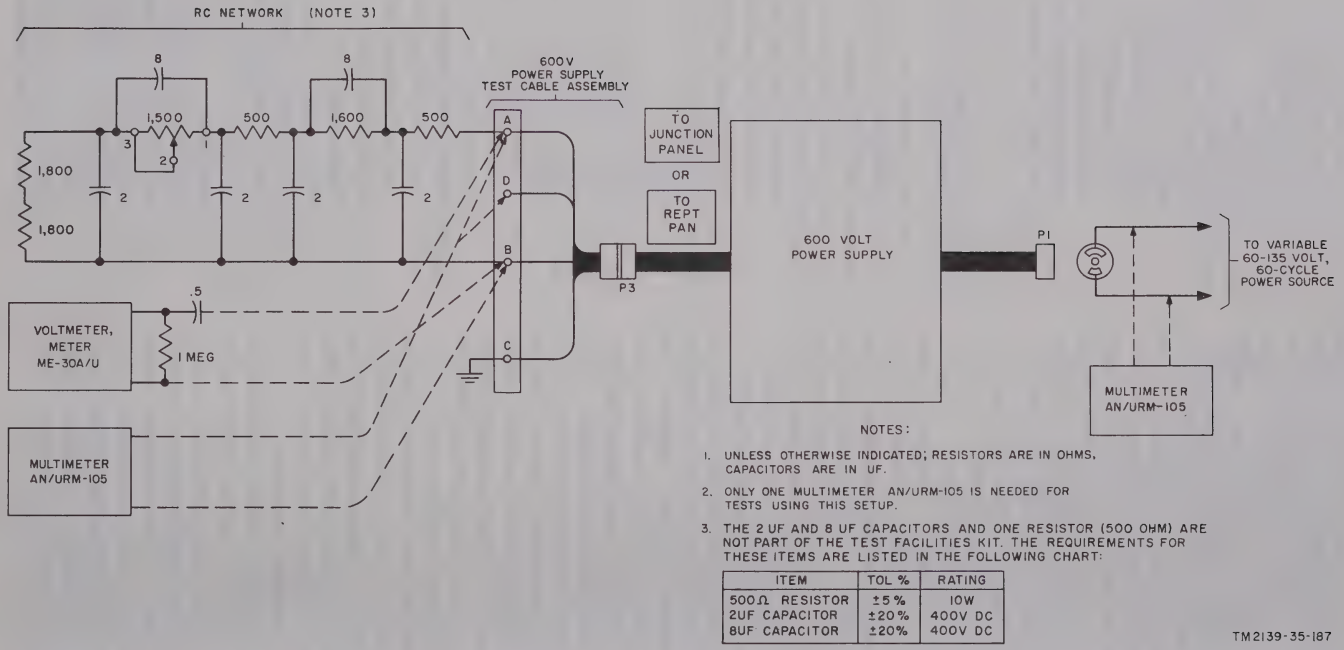
(4) Operate the AC POWER switch to OFF; operate the 115V–230V switch to 115V; and operate the REPEATER switch to position 3.

(5) Adjust the 600-V ADJ and the LOAD CURRENT controls to the extreme counterclockwise positions.

(6) Disconnect resistor R32 (on low voltage rectifier and alarm unit Z2) from standoff terminal E22.

(7) Adjust the LOW-VOLT ALARM and HIGH-VOLT ALARM controls to their extreme counterclockwise positions; adjust variable resistor R16 (on low voltage rectifier and alarm unit Z2) to the extreme clockwise position.

(8) Connect the multimeter across terminals A and B of the 600 V power supply test cable assembly. Short both 1,800-ohm resistors of the RC network (fig. 135) and adjust variable resistor for an indication of 3,000 ohms on the multimeter.



NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF.
2. ONLY ONE MULTIMETER AN/URM-105 IS NEEDED FOR TESTS USING THIS SETUP.
3. THE 2 UF AND 8 UF CAPACITORS AND ONE RESISTOR (500 OHM) ARE NOT PART OF THE TEST FACILITIES KIT. THE REQUIREMENTS FOR THESE ITEMS ARE LISTED IN THE FOLLOWING CHART:

ITEM	TOL %	RATING
500Ω RESISTOR	±5%	10W
2UF CAPACITOR	±20%	400V DC
8UF CAPACITOR	±20%	400V DC

TM2139-35-187

Figure 135. Power Supply PP-826(*)/U, final test setup.

(9) Connect the power supply to the variable power source (use variable transformer TF–171/USM). Adjust the transformer for 115 volts.

(10) Disconnect the multimeter from terminals A and B and operate the AC POWER switch to ON. The CURRENT meter should indicate between 16 and 23 ma. Adjust resistor R16 slowly counterclockwise until relay K6 releases and relay K1 operates. The CURRENT meter indication should drop to zero and then rapidly increase to approximately 90 ma. Tighten the locknut on resistor R16.

(11) Operate the AC POWER switch to OFF and reconnect resistor R32 to standoff E22. Remove the short across the 1,800-ohm resistor.

b. Safeguard Against Starting into Open Line Test.

(1) Disconnect the 1,800-ohm resistors from the RC network.

(2) Adjust the input voltage for 132.5 volts. Operate the AC POWER switch to ON. The LOAD ALARM lamp should light and the buzzer should sound after about 1 second. Operate the ALARM CUTOFF switch to silence the buzzer.

(3) Operate and hold the RESTORE switch until the LOAD ALARM lamp is extinguished and the buzzer sounds. Release the switch and operate the ALARM CUTOFF switch to silence the buzzer. After about 1 second the LOAD ALARM lamp should light and the buzzer should sound.

(4) Operate the AC POWER switch to OFF. Adjust the input voltage to 115 volts; discharge all capacitors in the RC network and reconnect the 1,800-ohm resistors.

c. Safeguard Against Starting into Low Resistance Test.

(1) Short the 2 μf capacitor at the junction of the 1,500-ohm variable resistor and the 500-ohm resistor of the RC network. Operate the AC POWER switch to ON.

(2) The LOAD ALARM and LOW VOLTAGE lamps should light and the buzzer should sound. After about 1 second, the LOW VOLTAGE lamp should go out and the LOAD ALARM lamp should remain lighted and the buzzer should continue to sound. Silence the buzzer by operating the ALARM CUTOFF switch.

(3) Repeat the procedures given in *b*(3) above to see that the correct indications are obtained. Disconnect the short from the 2 μf capacitor ((1) above).

d. Normal Operating Condition Test.

(1) Connect the multimeter across terminals A and B of the 600 V test cable assembly. Adjust the variable resistor of the RC network for a reading of 6,000 ohms on the multimeter. Disconnect the multimeter.

(2) Short the 2 μf capacitor at the junction of the 1,500-ohm variable resistor and the 500-ohm resistor.

(3) Operate the AC POWER switch to ON. The LOAD ALARM lamp should light and the buzzer should sound. Operate the ALARM CUTOFF switch to silence the buzzer. The CURRENT meter indication should increase to 80 ±15 ma within 8 seconds. If necessary, adjust the line voltage to 115 volts.

(4) Approximately 30 seconds after the AC POWER switch is set to the ON position, adjust the LOAD CURRENT control clockwise until the CURRENT meter indicates exactly 100 ma. Arrange the multimeter to measure dc voltage. Connect the multimeter to terminals A and B on the 600 V power supply test cable assembly. Adjust the variable resistor to obtain a reading of 600 volts dc on the multimeter. The LOAD ALARM lamp should extinguish.

(5) Connect the multimeter across terminals D and B of the 600 V power supply test cable assembly. The multimeter should indicate 275 ±10 volts dc.

(6) Operate the AC POWER switch to OFF and disconnect the short from

the terminals of the 2 μf capacitor ((2) above).

e. Starting into Low Resistance with High Ac Input.

(1) Connect a short across the 2 μf capacitor at the junction of the 1,500-ohm variable resistor and the 1,800-ohm resistor. Connect the multimeter across terminals A and B of the 600 V test cable assembly.

(2) Adjust the variable resistor of the RC network for a reading of 3,000 ohms on the multimeter. Disconnect the multimeter.

(3) Adjust the ac input voltage to 132.5 volts with the variable transformer and set the AC POWER switch to ON. The LOAD ALARM and the LOW VOLTAGE lamps should light and the buzzer should sound. The indication on the CURRENT meter should rise to approximately 100 ma after about 10 seconds but the lamps should remain lighted and the buzzer should continue to sound.

(4) After approximately 30 seconds, operate and hold the RESTORE switch. The indication on the CURRENT meter should decrease to approximately 15 ma. The LOAD ALARM and LOW VOLTAGE lamps should extinguish, and the buzzer should be silenced.

(5) Release the RESTORE switch. The CURRENT meter indication should drop to zero and immediately start increasing toward 100 ma, the LOAD ALARM and LOW VOLTAGE lamps should light, and the buzzer should sound.

(6) Operate the AC POWER switch to OFF. Disconnect the short from the terminals of the 2 μf capacitor ((1) above).

(7) Connect the multimeter, arranged as an ohmmeter, to terminals A and B of the 600 V test cable assembly. Adjust the variable resistor for a reading of 6,000 ohms.

f. Low-Voltage Alarm Range and Requirements Test.

(1) Arrange the multimeter to measure dc voltage. Connect the multimeter to terminals A and B of the 600 V test cable assembly.

(2) Adjust the variable resistor to decrease the voltage to 530 volts dc.

(3) Slowly rotate the LOW-VOLT ALARM control clockwise until the LOW VOLTAGE and LOAD ALARM lamps light and the buzzer sounds. Hand-tighten the locknut on the control.

(4) Adjust the variable resistor to increase the voltage to 600 volts dc. After approximately 30 seconds, the lamps should be extinguished and the buzzer should stop sounding.

g. High-Voltage Cutoff Range and Requirements Test.

(1) Connect the multimeter to terminals A and B of the 600 V test cable assembly. Increase the output voltage with the variable resistor of the RC network to 672 volts dc.

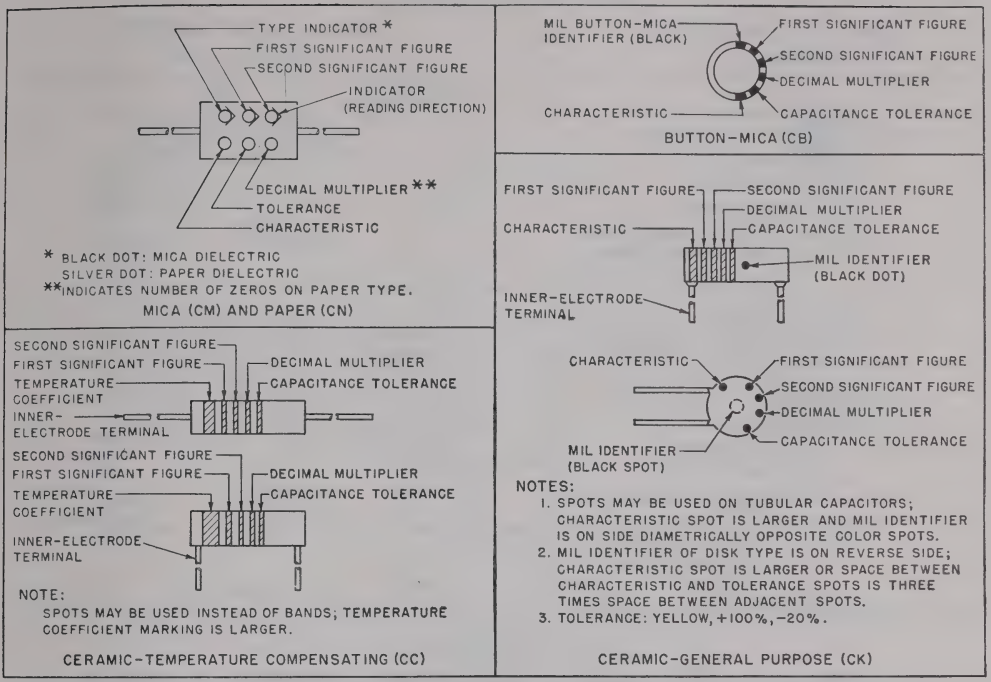
(2) Adjust the HIGH-VOLT ALARM control for cutoff. This adjustment may drift slightly, depending on the warmup time allowed for tube V6 and associated relay K3 circuits; therefore, more than one trial may be required to obtain the required setting. When the setting becomes stable, hand-tighten the locknut on the HIGH-VOLT ALARM Control.

(3) Check the high-voltage cutoff requirements by adjusting the variable resistor to increase the output voltage. Cutoff should occur between 670 and 675 volts. The HIGH VOLTAGE and LOAD ALARM lamps should light, and the buzzer should sound.

(4) Operate and release the RESTORE switch. The power supply should start (CURRENT meter indication increases toward 100 ma and the LOAD ALARM and LOW VOLTAGE lamps light). Quickly adjust the variable resistor to decrease the voltage indicated on the multimeter to 600 volts. After approximately 30 seconds, the lamps should be extinguished and the buzzer should stop sounding.

Note. If cutoff occurs before the voltage is reduced to 600 volts, repeat the procedure in (4) above.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
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			

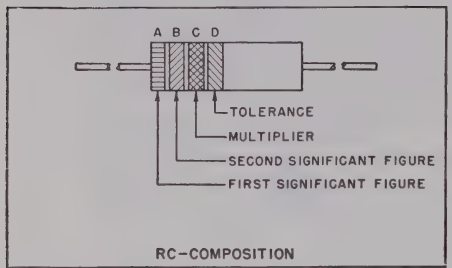
1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

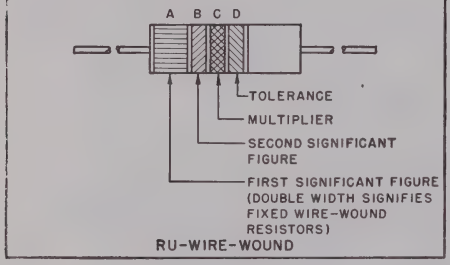
Figure 136. MIL-STD capacitor color code marking.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS
(INSULATED)

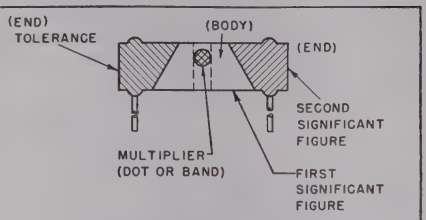


RC-COMPOSITION

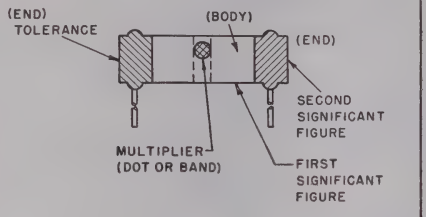


RW-WIRE-WOUND

RADIAL-LEAD RESISTORS
(UNINSULATED)



RZ-COMPOSITION



RZ-COMPOSITION

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-RI

Figure 137. MIL-STD resistor color code marking.

Figure 138. Telephone Modem TA–219/U, wiring diagram.

Figure 139. CHAN 1 (part of Telephone Modem TA–219/U), wiring diagram.

Figure 140. CHAN 2 (part of Telephone Modem TA–219/U), wiring diagram.

Figure 141. CHAN 3 (part of Telephone Modem TA–219/U), wiring diagram.

Figure 142. CHAN 4 (part of Telephone Modem TA–219/U), wiring diagram.

Figure 143. Telephone Modem TA–227/U, wiring diagram.

Figure 143—Continued.

Figure 144. GROUP PANEL (part of Amplifier-Pilot Regulator AM–707/TCC–7), wiring diagram.

Figure 144—Continued.

Figure 145. 12-68 kc amplifier (AR1, AR2, or AR3) (part of GROUP PANEL), wiring diagram.

Figure 146. Regulator and alarm unit Z6 (part of GROUP PANEL), wiring diagram.

Figure 147. Modem and amplifier AR4 (part of GROUP PANEL), wiring diagram.

Figure 148. JUNCTION PANEL (part of Amplifier-Pilot Regulator AM–707/TCC–7), wiring diagram.

Figure 149. JUNCTION PANEL (part of Amplifier-Pilot Regulator AM–707/TCC–7) with modified ground bus, wiring diagram.

Figure 150. Telephone Carrier Frequency Supply TA–228/TCC–7, wiring diagram.

Figure 150—Continued.

Figure 151. Receiver-Transmitter Order Wire RT–230/TCC–7, (part of Receiver-Transmitter Test Set Group OA–443/TCC–7), wiring diagram.

Figure 151—Continued.

(Contained in separate envelope)

Figure 152. Transmitting Amplifier AR101 (part of ORDER WIRE PANEL), wiring diagram.

Figure 153. Receiving amplifier AR102 (part of ORDER WIRE PANEL), wiring diagram.

Figure 154. Ringer-oscillator Y101 (part of ORDER WIRE PANEL), wiring diagram.

Figure 155. Telephone Test Set TA-760/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), wiring diagram.

Figure 155—Continued.

Figure 156. IF amplifier AR1 (part of TEST PANEL), wiring diagram.

Figure 157. Flat amplifier AR2 (part of TEST PANEL), wiring diagram.

Figure 158. Power Supply PP-827/U (200 VOLT POWER SUPPLY), wiring diagram.

Figure 159. Power Supply PP-826/U (600 VOLT POWER SUPPLY), wiring diagram (original units).

Figure 160. Low-Voltage rectifier and alarm unit Z1 (part of Power Supply PP-826/U), wiring diagram (original units).

Figure 161. Power Supply PP-826/U (600 VOLT POWER SUPPLY), wiring diagram (revised units).

Figure 162. Low-Voltage rectifier and alarm unit Z1 (part of Power Supply PP-826/U), wiring diagram (revised units).

Figure 163. Power Supply PP-826/U bearing Order No. 14181-Phila-51, serial numbers 1,170 through 2,964, and Power Supply PP-826A/U, wiring diagram.

Figure 164. Low-Voltage rectifier and alarm unit Z2 (part of Power Supply PP-826A/U), wiring diagram.

(Contained in separate envelope)

APPENDIX
REFERENCES

Following is a list of references applicable and available to the field and depot repairman of Telephone Terminal AN/TCC-7.

TB SIG 328	Telephone Carrier System Test Facilities Kit MK-155/TCC.
TM 11-381	Cable Assembly CX-1065/G, Telephone Cable Assemblies CX-1606/G and CX-1512/U and Telephone Loading Coil Assembly CV-260/G.
TM 11-687	Radio Set AN/TRC-24, Radio Terminal Set AN/TRC-35, and Radio Relay Set AN/TRC-36.
TM 11-900	Power Units PE-75-C, -D, -J, -K, -P, -S, -T, -U, -W, -AA, -AB, -AC, and -AE.
TM 11-900A	Power Unit PE-75-AF.
TM 11-1214	Instruction Book for Oscilloscope OS-8A/U.
TM 11-2044	Attenuator TS-402/U and TS-402A/U.
TM 11-2094	Transmission Measuring Set TS-559/FT.
TM 11-2139-10	Telephone Terminal AN/TCC-7, Operator's manual.
TM 11-2139-20	Telephone Terminal AN/TCC-7, Organizational Maintenance.
TM 11-2140-10	Telephone Repeater AN/TCC-8 and Telephone Repeater AN/TCC-21, Operator's Manual.
TM 11-2140-20	Telephone Repeater AN/TCC-8 and Telephone Repeater AN/TCC-21, Organizational Maintenance.
TM 11-2140-35	Telephone Repeater AN/TCC-8 and Telephone Repeater AN/TCC-21, Field and Depot Maintenance.
TM 11-2143	Telephone Test Set TS-712/TCC-11.
TM 11-2148	Telephone Repeater AN/TCC-11.
TM 11-2150	Telephone Carrier Systems Using Telephone Terminal AN/TCC-7, Telephone Repeater AN/TCC-8 (AN/TCC-21), Telephone Repeater AN/TCC-11, and Telephone Test Set TS-712/TCC-11.
TM 11-2151	Audio Level Meter ME-71A/FCC and ME-71B/FCC.
TM 11-2661	Electron Tube Test Set TV-2/U.
TM 11-5057	Frequency Meter AN/USM-26.
TM 11-5083	Electron Tube Test Set TV-7/U, TV-7A/U, and TV-7B/U.
TM 11-5088	Signal Generators SG-71/FCC and SG-71A/FCC.
TM 11-5132	Electric Voltmeter ME-30B/U and Voltmeter, Meter ME-30A/U.
TM 11-5511	Electronic Multimeter TS-505/U.

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Receiving amplifier AR102	144	207
Ringer-oscillator Y101	147	213
Transmitting amplifier AR101	142	206
Theory:		
Auxiliary connections	29	44
Block diagram analysis	26	39
Receiving amplifier AR101	28*b*	43
Receiving circuit	28	42
Ringer-oscillator Y101	30	45
Transmitting amplifier	27*e*	41
Transmitting circuit	27	40
Transmitting amplifier AR101:		
Final tests	186	304
Operational tests	141	206

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Theory	27*e*	41
Troubleshooting charts	139	199
Troubleshooting data	136	194
Power Supplies PP–826/U and PP–826A/U. (*See* 600 VOLT POWER SUPPLY.)		
Power Supply PP–827/U. (*See* 200 VOLT POWER SUPPLY.)		
Receiver-Transmitter Order Wire RT–280/TCC–7. (*See* ORDER WIRE PANEL.)		
Receiving amplifier AR102:		
Final tests	187	304
Operational tests	143	207
Signal substitution test	144	207
Theory	28*b*	43
Regulator and alarm unit Z6:		
Final tests	176	290
Operational tests	105	139
Signal substitution chart	107	142
Theory:		
Block diagram analysis	13	20
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Troubleshooting chart	106	141
Relay tests	164	270
Replacement and removal of parts	167	272
Ringer-oscillator Y101:		
Final tests	188	305
Operational tests	145	209
Signal substitution tests	147	213
Theory	30	45
Troubleshooting chart	146	210
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600 VOLT POWER SUPPLY:		
Dc resistance of transformers and coils	162*a*	263
Final tests:		
PP–826/U	194	311
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Operational tests:		
PP–826/U	159	244
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Theory:		
PP–826/U:		
General	62	71
Low-voltage rectifier and alarm unit Z1. (*See* Low-voltage rectifier and alarm unit Z1.)		
PP–826A/U:		
Block diagram analysis	42	59
Current regulator circuit	46	61
General	41	59
High voltage rectifier circuit	44	60
Input power circuits	43	60
Low-voltage rectifier and alarm unit Z2. (*See* Low-voltage rectifier and alarm unit Z2.)		
Reference-voltage rectifier circuit	45	60
Regulating action	47	61
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Troubleshooting chart	161	247
Troubleshooting data	158	244
SUBGROUP PANEL:		
Dc resistance of transformers and coils	96	117

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Final tests:		
Receiving	173	283
Transmitting	172	281
Miscellaneous continuity tests	93	104
Operational tests:		
Receiving circuit	92	103
Transmitting circuit	91	102
Signal substitution charts	95	108
Theory:		
Block diagram analysis	7	8
Schematic analysis:		
Receiving circuit	9	9
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Troubleshooting data	90	102
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Telephone Carrier Frequency Supply TA–228/TCC–7. (*See* CARRIER SUPPLY PANEL.)		
Telephone Modem TA–219/U. (*See* Channel assemblies.)		
Telephone Modem TA–227/U. (*See* SUBGROUP PANEL.)		
Telephone Test Set TA–760/TCC–7. (*See* TEST PANEL.)		
Test equipment and tools:		
Final testing	77, 169	88, 276
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Test Facilities Kit MK–155/TCC, telephone carrier system	78	88
Test frequencies, channel assemblies	81	91
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Alinement procedures	167	272
Dc resistance of transformers and coils	135	194
Final tests:		
Flat amplifier AR2	183	298
Hf oscillator circuit	178	293
IF amplifier AR1	183	298
MEASURE switch operation	182*a*	298
Meter scale accuracy	182*a*	298
Nonselective measuring circuit	181	297
Selective measuring circuit	180	295
Test oscillator, 1-kc	179	295
Operational test connections	120	162
Signal substitution tests:		
Detector and carrier oscillator	127	186
Flat amplifier AR2	133	192
Hf oscillator	132	192
IF amplifier AR1	134	193
IF circuit	130	190
Modulator	129	189
One-kc oscillator test	131	191
Selective measurements of detector input circuit	128	188
Setup	125	185
Theory:		
Amplifier-detector circuit:		
Block diagram analysis	32*e*	48
Schematic analysis	37	52
ATTENUATOR switch S2	33*b*	49
Block diagram analysis	32	47
Carrier oscillator	36*a*	50
Flat amplifier AR2	37*a*	52
General	31	47
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Input circuit:		
Block diagram analysis	32*a*	47
Schematic analysis	33	49

TEST PANEL—Continued	Paragraphs	Page
Modulator-amplifier circuit:		
Block diagram analysis	32*d*	48
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Nonselective control circuit:		
Block diagram analysis	32*b*	47
Schematic analysis	34	49
Selective control circuit:		
Block diagram analysis	32*c*	47
Schematic analysis	35	49
Test oscillators (hf and 1-kc):		
Block diagram analysis	32*f*	48
Schematic analysis	38	54
Troubleshooting chart	122	162
Troubleshooting data	119	161
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Transmitting amplifier AR101:		
Final test	186	304
Operational test	141	206
Theory	27*e*	41
Troubleshooting:		
General instructions	75	87
Procedures	76	87
Troubleshooting charts:		
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GROUP PANEL	101	122
IF amplifier AR1	121, 124	162, 183
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ORDER WIRE PANEL	139	199
Power Supplies PP–826/U and PP–826A/U	161	247
Regulator and alarm unit Z6	106	141
Ringer-oscillator Y101	146	210
SUBGROUP PANEL	94	105
TEST PANEL	122	162
200 VOLT POWER SUPPLY	156	235
Troubleshooting data:		
CARRIER SUPPLY PANEL	149	215
CHAN MODEM	80	91
GROUP PANEL	97	118
JUNCTION PANEL	112	154
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Power Supplies PP–826/U and PP–826A/U	158	233
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Final tests	175	289
Operational tests	103	137
Signal substitution chart	104	138
Theory	11*e*	13
200 VOLT POWER SUPPLY:		
Dc resistance of transformers and coils	157	243
Final tests:		
Blower operation	193	311
Initial procedures	191	308
Voltage requirements	192	309
Operational tests	155	233
Theory:		
Block diagram analysis	39	55
Schematic analysis	40	56
Troubleshooting chart	156	235
Troubleshooting data	154	233

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Section II. FOURTH ECHELON TESTS OF POWER SUPPLY PP–827/U (200 VOLT POWER SUPPLY)

167.6. Tests of 200 VOLT POWER SUPPLY

(fig. 128.2)

a. Test Equipment and Material.

ME–30B/U Power switch: ON DB VOLTS: .03 VOLTS		128.2, and note ME–30B/U average meter indication. Ignore momentary peak indications. *b.* Disconnect hookup wire of ME–30B/U from terminal A (D, fig. 128.2) and reconnect to terminal H; disconnect hookup wire from terminal K and reconnect to terminal D. Note ME–30B/U meter indication. Ignore momentary peak indications. *c.* Operate push-to-talk switch on ORDER WIRE PANEL handset and note ME–30B/U meter indication. Ignore momentary peak indications. *d.* Release push-to-talk switch on handset. *e.* Observe blower operation. *f.* Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF and ON-OFF switch on CN–16A/U to OFF. Disconnect test setup (A and D, fig. 128.2). Remove 200 VOLT POWER SUPPLY being tested from AN/TCC–7 and substitute original 200 VOLT POWER SUPPLY in its place. Reconnect 200 VOLT POWER SUPPLY in AN/TCC–7 to JUNCTION PANEL.	*b.* 0.03 volt ac maximum. *c.* Same indication as obtained in *b* above. *d.* None. *e.* Blower is operating, forcing air *out* through front grill. *f.* None.

Section II. FOURTH ECHELON TESTS OF POWER SUPPLY PP–827/U (200 VOLT POWER SUPPLY)

167.6. Tests of 200 VOLT POWER SUPPLY

(fig. 128.2)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Terminal, Telephone AN/TCC–7	5805–503–1228	TM 11–2139–10
Electronic Multimeter TS–505(*)/U [a]	6625–243–0562	TM 11–6625–239–12
Voltmeter, Meter ME–30(*)/U [b]	6625–669–0742	TM 11–6625–320–12
Variable Power Transformer CN–16(*)/U [c]	5950–235–2086	
Telephone Carrier System Test Facilities Kit MK–155/TCC	6625–603–9523	TB SIG 328
Hookup wire (approx 4 ft) [d]	6145–160–5300	

[a] Indicates Electronic Multimeter TS–505A/U or TS–505B/U, or Multimeter TS–505C/U or TS–505D/U. (Electronic Multimeter TS–505 A/U is used in the test procedures (*d* below).)
[b] Indicates Voltmeter, Meter ME–30A/U, or Voltmeter, Electronic ME–30B/U or ME–30C/U. (Voltmeter,Electronic ME–30B/U is used in the test procedures (*d* below).)
[c] Indicates Variable Power Transformer CN–16A/U or CN–16B/U. (Variable Power Transformer CN–16A/U is used in the test procedures (*d* below).)
[d] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Interconnect, test, and calibrate an AN/TCC–7 (pars. 167.3*d* and 167.22*b* and *c*). After the AN/TCC–7 has been calibrated, do not change switch settings and control adjustments.

(2) On the 200 VOLT POWER SUPPLY to be tested and the one in the AN/TCC–7, operate the AC POWER switches to OFF. Substitute the 200 VOLT POWER SUPPLY to be tested for the one in the AN/TCC–7. Connect the equipment as shown in A, figure 128.2.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*AN/TCC–7* Switches and controls: unchanged from settings used in calibration procedures (par. 167.22). *CN–16A/U* Control: fully counterclockwise ON-OFF: ON *TS–505A/U* FUNCTION: A.C. RANGE: 250V–RX1M	*200 VOLT POWER SUPPLY* AC POWER: ON 115V–230V (internal): 115V 200V ADJ: fully counterclockwise.	*Ac input circuits* *a.* Note indication of green AC POWER lamp on 200 VOLT POWER SUPPLY. *b.* Rotate control on CN–16A/U clockwise until TS–505A/U meter indicates 115 volts ac. *Note.* Wait until AN/TCC–7 alarms stop sounding before proceeding. Operate any ALARM CUTOFF switch necessary to silence any alarms still sounding. Allow AN/TCC–7 about 5 minutes to warm up. *c.* Operate 115V–230V switch on 200 VOLT POWER SUPPLY to 230V position. Note TS–505A/U meter indication. *d.* Operate 115V–230V switch to 115V position. Remove test leads of TS–505A/U from 115V CONVENIENCE OUTLETS (A, fig. 128.2) and reconnect to terminals of next 115V CONVENIENCE OUTLETS and to terminals of each of TO 600V POWER SUPPLY outlets, in turn. Note TS–505A/U meter indication for each outlet measurement. *e.* Remove test leads of TS–505A/U from terminals of TO 600V POWER SUPPLY outlet.	*a.* AC POWER lamp lights. *b.* 115 volts ac. *c.* 0 volt. *d.* 115 volts ac. *e.* None.
2	Unchanged except: *TS–505A/U* FUNCTION: +D.C. RANGE: 250V–RX1M	Unchanged.	*200–volts dc output* *a.* Connect TS–505A/U as shown in B, figure 128.2. Note TS–505A/U meter indication. *b.* Rotate 200V ADJ control on 200 VOLT POWER SUPPLY fully clockwise and note TS–505A/U meter indication. *c.* Rotate 200V ADJ control until TS–505A/U meter indicates 200 volts dc. Note indication. *d.* Disconnect test leads of TS–505A/U from terminals A and K (B, fig. 128.2). Operate FUNCTION switch on TS–505A/U to A.C. Reconnect TS–505A/U as shown in A, figure 128.2. *e.* Rotate CN–16A/U control until TS–505A/U meter indicates 97 volts ac. *f.* Disconnect test leads of TS–505A/U from terminals of 115V CONVENIENCE OUTLETS (A, fig. 128.2). Operate FUNCTION switch on TS–505A/U to +D.C. and reconnect TS–505A/U as shown in B, figure 128.2. Note TS–505A/U meter indication. *g.* Repeat procedures given in *d* above. Rotate CN–16A/U control until TS–505A/U meter indicates 130 volts ac. *h.* Repeat procedures given in *f* above. *i.* Repeat procedures given in *d* above. Rotate CN–16A/U control until TS–505A/U meter indicates 115 volts ac. *j.* Repeat procedures given in *f* above except do not note TS–505A/U meter indication. *k.* Operate 115V–230V switch on 200 VOLT POWER SUPPLY to 230V. Note TS–505/U meter indication. *l.* Operate 115V–230V switch to 115V. Wait until alarms stop sounding. Disconnect test leads of TS–505A/U from terminals A and K (B, fig. 128.2).	*a.* Not more than 190 volts dc and not less than 140 volts dc ±10. *b.* Not less than 210 volts dc and not more than 260 volts dc ±10. *c.* 200 volts dc. *d.* None. *e.* None. *f.* Between 197 and 200 volts dc. *g.* None. *h.* Between 200 and 203 volts dc. *i.* None. *j.* None. *k.* 70 volts dc ±5. *l.* None.
3	Unchanged except: *TS–505A/U* FUNCTION: +D.C. RANGE: 25V–RX1000	Unchanged.	*–10 volts dc output* *a.* Connect COMMON test lead of TS–505A/U to terminal D (B, fig. 128.2) and D.C. test lead to terminal H. Note TS–505A/U meter indication. *b.* Operate push-to-talk switch on ORDER WIRE PANEL handset and note TS–505A/U meter indication. *c.* Release push-to-talk switch. Operate 115V–230V switch on 200 VOLT POWER SUPPLY to 230V and note TS–505A/U meter indication. *d.* Operate 115V–230V switch to 115V. Disconnect test leads of TS–505A/U from terminals D and H (B, fig. 128.2).	*a.* 11 volts dc ±1. *b.* 8 volts dc ±1. *c.* 4 volts dc ±0.5. *d.* None.
4	Unchanged except: *TS–505A/U* FUNCTION: A.C.	Unchanged.	*Filament voltages output* *a.* Connect TS–505A/U as shown on C, figure 128.2 and note TS–505A/U meter indication. *b.* Disconnect test leads of TS–505A/U from terminals B and L (C, fig. 128.2), and reconnect to terminals E and J, F and P, and M and N, in turn (C, fig. 128.2). Note TS–505A/U meter indication at each connection. *c.* Connect test leads of TS–505A/U to terminals M and N. Operate 115V–230V switch on 200 VOLT POWER SUPPLY to 230V. Note TS–505A/U meter indication. *d.* Operate 115V–230V switch to 115V. Disconnect test leads of TS–505A/U from terminals M and N (C, fig. 128.2).	*a.* 6.2 volts ac ±0.2. *b.* Same as *a* above. *c.* 3 volts ac ±0.2. *d.* None.
5	Unchanged. *ME–30B/U* Power switch: ON DB VOLTS: .03 VOLTS	Unchanged.	*Ac output ripple voltages and blower operation* *a.* Connect ME–30B/U as shown in D, figure 128.2, and note ME–30B/U average meter indication. Ignore momentary peak indications. *b.* Disconnect hookup wire of ME–30B/U from terminal A (D, fig. 128.2) and reconnect to terminal H; disconnect hookup wire from terminal K and reconnect to terminal D. Note ME–30B/U meter indication. Ignore momentary peak indications. *c.* Operate push-to-talk switch on ORDER WIRE PANEL handset and note ME–30B/U meter indication. Ignore momentary peak indications. *d.* Release push-to-talk switch on handset. *e.* Observe blower operation. *f.* Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF and ON-OFF switch on CN–16A/U to OFF. Disconnect test setup (A and D, fig. 128.2). Remove 200 VOLT POWER SUPPLY being tested from AN/TCC–7 and substitute original 200 VOLT POWER SUPPLY in its place. Reconnect 200 VOLT POWER SUPPLY in AN/TCC–7 to JUNCTION PANEL.	*a.* 0.01 volt ac maximum. *b.* 0.03 volt ac maximum. *c.* Same indication as obtained in *b* above. *d.* None. *e.* Blower is operating, forcing air *out* through front grill. *f.* None.

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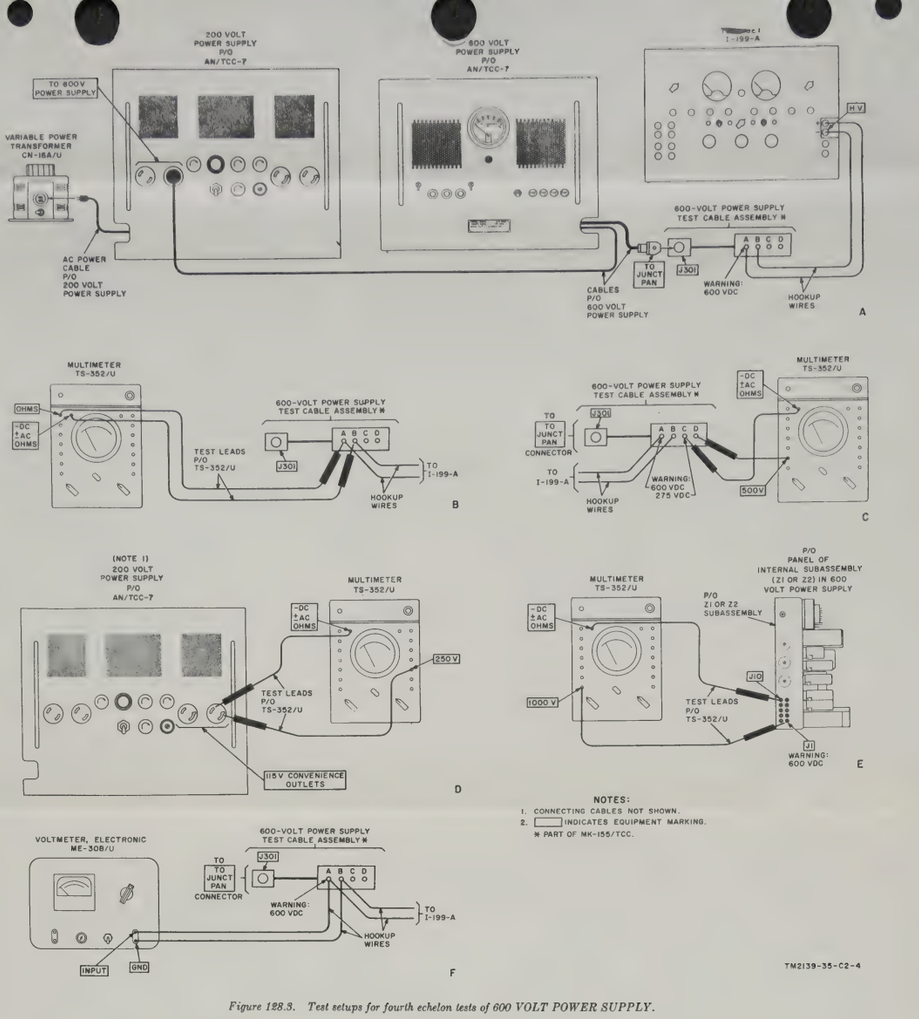


Figure 128.3. Test setups for fourth echelon tests of 600 VOLT POWER SUPPLY.

Section III. FOURTH ECHELON TESTS OF POWER SUPPLIES PP-826/U AND PP-826A/U (600 VOLT POWER SUPPLY)

167.8. Tests of 600 VOLT POWER SUPPLY

(fig. 128.3)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Power Supply PP-827/U (part of Telephone Terminal AN/TCC-7)	5865-500-4436	TM 11-2139-10
Test Set I-199-(*) [a]	6625-242-1065	TM 11-2604
Multimeter TS-352(*)/U [b]	6625-242-5023	TM 11-5527
Voltmeter, Electronic ME-30(*)/U [c]	6625-669-0742	TM 11-6625-329-12
Variable Power Transformer CN-16A/U	5005-235-2086	
Telephone Carrier System Test Facilities kit MK-155/TCC	6625-603-9523	TB SIG 328
Hookup wire (approx 8 ft) [d]	6145-160-5300	

[a] Test Set I-199-(*) indicates Test Set I-199 or I-199-A. (Test Set I-199-A is used in the test procedures (*c* below).)
[b] Multimeter TS-352(*)/U indicates Multimeter TS-352/U, TS-352A/U, or TS-352B/U. (Multimeter TS-352/U is used in the test procedures (*c* below).)
[c] Voltmeter, Electronic ME-30(*)/U indicates Voltmeter, Electronic ME-30B/U or ME-30C/U, or Voltmeter, Meter ME-30A/U. (Voltmeter, Electronic ME-30B/U is used in the test procedures *c* below).)
[d] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Operate the AC POWER switches on the PP-827/U (200 VOLT POWER SUPPLY) and the 600 VOLT POWER SUPPLY to OFF and the ON-OFF switch on the CN-16A/U to OFF.

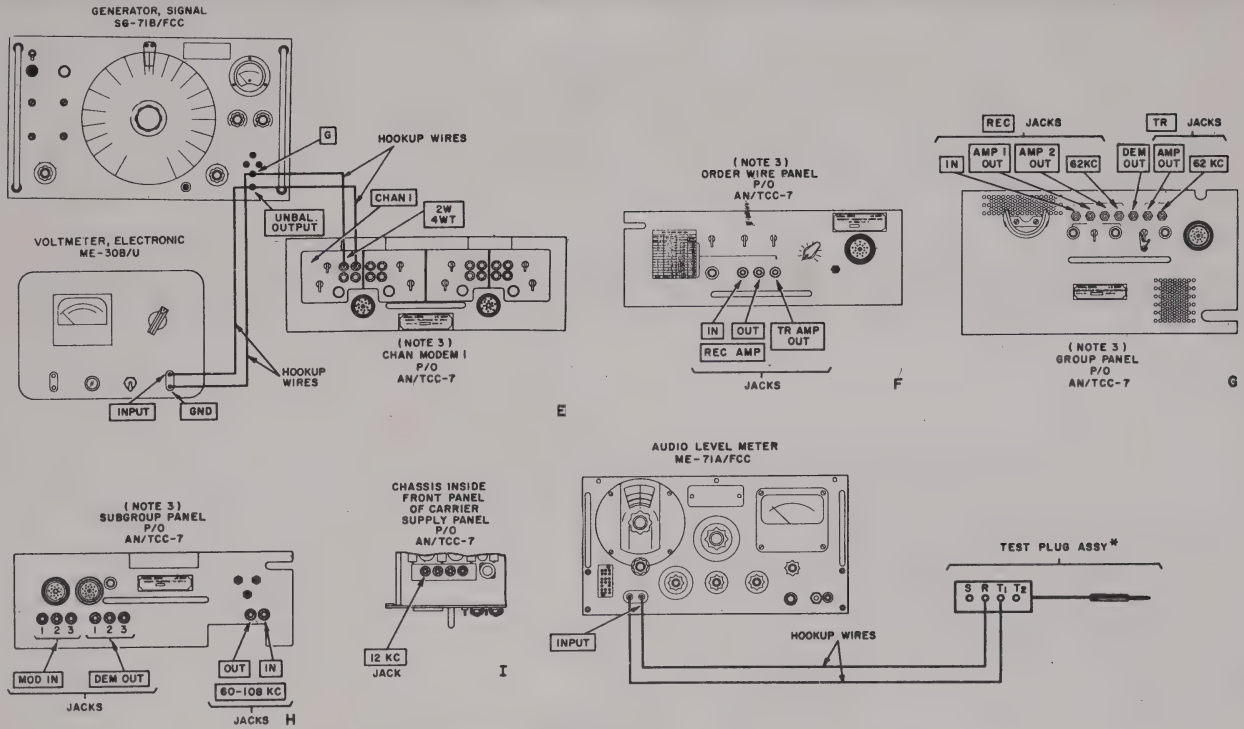
(2) Connect the equipment as shown in A and B, figure 128.3. Connect the ac power cable of the CN-16A/U (not shown) to the ac power source.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*200 VOLT POWER SUPPLY* AC POWER: OFF *CN-16A/U* Control: fully counterclockwise ON-OFF: OFF *TS-352/U* FUNCTION: OHMS Range switch: RX100 *I-199-A* H.V. LOAD COARSE ADJ.: third position from full clockwise position	*600 VOLT POWER SUPPLY* AC POWER: OFF REPEATER (internal): 3 600 V ADJ: fully counterclockwise LOAD CURRENT (internal): fully counterclockwise LOW-VOLT ALARM (internal): fully counterclockwise HIGH-VOLT ALARM (internal): fully counterclockwise 115V–230V: 115V	*Normal output* *a.* Disconnect the TO JUNCT PAN connection of 600 VOLT POWER SUPPLY from connector J301 (A, fig. 128.3). Adjust H.V. LOAD FINE ADJ. control on I-199-A to obtain 6,000-ohm indication on meter of TS—352/U. Reconnect TO JUNCT PAN connector of 600 VOLT POWER SUPPLY to connector J301. *b.* Disconnect test leads of TS-352/U from terminals of 600-volt power supply test cable assembly (B, fig. 128.3) and reconnect as shown in D, figure 128.3. Operate FUNCTION switch of TS-352/U to AC VOLTS. *c.* Operate ON-OFF switch of CN–16A/U to ON. Adjust control of CN–16A/U to obtain 115 volts ac indication on meter of TS–352/U. *d.* Operate AC POWER switch on 600 VOLT POWER SUPPLY to ON and observe CURRENT meter indication for approximately 8 seconds. *e.* Note indications of buzzer and alarm lamps on 600 VOLT POWER SUPPLY. *f.* Approximately 20 seconds after ac power is applied (*d* above), adjust LOAD CURRENT control on 600 VOLT POWER SUPPLY until CURRENT meter indicates 100 ma. Note meter indication. *g.* Note buzzer and alarm lamp indications. *h.* Adjust H.V. LOAD FINE ADJ. control on I–199–A until OUTPUT meter indicates 600 volts dc. *i.* If necessary, readjust control of CN–16A/U to obtain 115 volts ac indication on meter of TS–352/U. *j.* Operate OUTPUT switch on I–199–A to MA. Press 600 MA–120 MA OUTPUT switch and note OUTPUT meter indication. Release 600 MA–120 MA OUTPUT switch, and note indication. *k.* Disconnect test leads of TS–352/U from 200 VOLT POWER SUPPLY (D, fig. 128.3). Operate FUNCTION switch to 200000/VDC DIRECT. Connect test leads as shown in C, figure 128.3, and note TS–352/U meter indication. *l.* Disconnect test leads of TS–352/U from terminals of 600-volt power supply test cable assembly (C, fig. 128.3).	*a.* None. *b.* None. *c.* None. *d.* 80 ma ±15 within approximately 8 seconds. *e.* Buzzer sounds and LOAD ALARM lamp lights On PP–826A/U, LOW VOLTAGE lamp also lights *f.* 100 ma. *g.* Buzzer is silenced and LOAD ALARM lamp is extinguished. On PP–826A/U, LOW VOLTAGE lamp is also extinguished. *h.* None. *i.* None. *j.* 100 ma ±2. *k.* 275 volts dc ±10. *l* None.
2	Unchanged	Unchanged	*Low-output voltage* *a.* Rotate H. V. LOAD FINE ADJ. control on I–199–A until OUTPUT meter indicates 530 volts dc. Note 600 VOLT POWER SUPPLY indications. *b.* Rotate LOW-VOLT ALARM control on 600 VOLT POWER SUPPLY clockwise until de power cutoff occurs on PP–826/U or until LOAD ALARM and LOW VOLTAGE lamps on PP–826A/U are lighted. Tighten locknut on control. Note indications. *c.* On PP–826/U, operate RESTORE switch on 600 VOLT POWER SUPPLY momentarily and release. *d.* Rotate H.V. LOAD FINE ADJ. control on I–199–A until OUTPUT meter indicates 600 volts dc.	*a.* LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent. *b.* LOAD ALARM and LOW VOLTAGE lamps light and buzzer sounds. On PP–826/U, CURRENT meter indicates 0 ma; on PP–826A/U CURRENT meter indicates 100 ma. *c.* CURRENT meter indication rises to 100 ma. *d.* In approximately 20 seconds, LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent.
3	Unchanged.	Unchanged.	*High-output voltage* *a.* Rotate H.V. LOAD FINE ADJ. control until OUTPUT meter indicates 670 volts dc. Note 600 VOLT POWER SUPPLY indications. *b.* Rotate HIGH-VOLT ALARM control clockwise until cutoff occurs. Tighten locknut on control. *c.* Operate RESTORE switch on 600 VOLT POWER SUPPLY momentarily and release. When CURRENT meter on 600 VOLT POWER SUPPLY stabilizes at 100 ma, rotate H.V LOAD FINE ADJ. control on I–199–A to obtain 600-volt indication on OUTPUT meter of I–199–A. Note 600 VOLT POWER SUPPLY indications.	*a.* CURRENT meter indicates 100 ma; no alarm lamps light and buzzer is silent. *b.* LOAD ALARM and HIGH VOLTAGE lamps light and buzzer sounds. CURRENT meter indicates 0 ma. *c.* In approximately 20 seconds, LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent. CURRENT meter indicates 100 ma.
4	Unchanged.	Unchanged.	*LOAD CURRENT control range* *a.* (See note below.) Slowly rotate LOAD CURRENT control on 600 VOLT POWER SUPPLY fully counterclockwise and *simultaneously* rotate H.V. LOAD FINE ADJ. control on I–199–A to maintain approximately 600 volts indication on OUTPUT meter. Note CURRENT meter indication. *Note.* If cutoff occurs during adjustment momentarily operate and release RESTORE switch on 600 VOLT POWER SUPPLY, wait for CURRENT meter indication to stabilize, and then continue simultaneous rotation of controls. *b.* Slowly rotate LOAD CURRENT control fully clockwise and *simultaneously* rotate H.V LOAD FINE ADJ. control to maintain approximately 600 volts indication on OUTPUT meter. Note CURRENT meter indication. (See note in *a* above.)	*a.* 85 ma ±5. *b* 120 ma ±5.

			g. Note buzzer and alarm lamp indications.	*g.* Buzzer is silenced and LOW VOLTAGE ALARM lamp is extinguished. On PP-826A/U, LOW VOLTAGE lamp is also extinguished
			h. Adjust H.V. LOAD FINE ADJ. control on I–199–A until OUTPUT meter indicates 600 volts dc.	*h.* None.
			i. If necessary, readjust control of CN–16A/U to obtain 115 volts ac indication on meter of TS–352/U.	*i.* None.
			j. Operate OUTPUT switch on I–199–A to MA. Press 600 MA–120 MA OUTPUT switch and note OUTPUT meter indication. Release 600 MA–120 MA OUTPUT switch, and note indication.	*j.* 100 ma ±2
			k. Disconnect test leads of TS–352/U from 200 VOLT POWER SUPPLY (D, fig. 128.3). Operate FUNCTION switch to 2000Ω/VDC DIRECT. Connect test leads as shown in C, figure 128.3, and note TS–352/U meter indication.	*k.* 275 volts dc ±10.
			l. Disconnect test leads of TS–352/U from terminals of 600-volt power supply test cable assembly (C, fig. 128.3).	*l.* None.
2	Unchanged	Unchanged	*Low-output voltage.*	
			a. Rotate H. V. LOAD FINE ADJ. control on I–199–A until OUTPUT meter indicates 530 volts dc. Note 600 VOLT POWER SUPPLY indications.	*a.* LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent.
			b. Rotate LOW-VOLT ALARM control on 600 VOLT POWER SUPPLY clockwise until de power cutoff occurs on PP–826/U or until LOAD ALARM and LOW VOLTAGE lamps on PP–826A/U are lighted. Tighten locknut on control. Note indications.	*b.* LOAD ALARM and LOW VOLTAGE lamps light and buzzer sounds. On PP–826/U, CURRENT meter indicates 0 ma; on PP–826A/U CURRENT meter indicates 100 ma.
			c. On PP–826/U, operate RESTORE switch on 600 VOLT POWER SUPPLY momentarily and release.	*c.* CURRENT meter indication rises to 100 ma.
			d. Rotate H.V. LOAD FINE ADJ. control on I–199–A until OUTPUT meter indicates 600 volts dc.	*d.* In approximately 20 seconds, LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent.
3	Unchanged.	Unchanged	*High-output voltage*	
			a. Rotate H.V. LOAD FINE ADJ. control until OUTPUT meter indicates 670 volts dc. Note 600 VOLT POWER SUPPLY indications.	*a.* CURRENT meter indicates 100 ma; no alarm lamps light and buzzer is silent.
			b. Rotate HIGH-VOLT ALARM control clockwise until cutoff occurs. Tighten locknut on control.	*b.* LOAD ALARM and HIGH VOLTAGE lamps light and buzzer sounds; CURRENT meter indicates 0 ma.
			c. Operate RESTORE switch on 600 VOLT POWER SUPPLY momentarily and release. When CURRENT meter on 600 VOLT POWER SUPPLY stabilizes at 100 ma, rotate H.V. LOAD FINE ADJ. control on I–199–A to obtain 600-volt indication on OUTPUT meter of I–199–A. Note 600 VOLT POWER SUPPLY indications.	*c.* In approximately 20 seconds, LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent. CURRENT meter indicates 100 ma.
4	Unchanged.	Unchanged.	*LOAD CURRENT control range*	
			a. (See note below.) Slowly rotate LOAD CURRENT control on 600 VOLT POWER SUPPLY fully counterclockwise and *simultaneously* rotate H.V. LOAD FINE ADJ. control on I–199–A to maintain approximately 600 volts indication on OUTPUT meter. Note CURRENT meter indication. *Note.* If cutoff occurs during adjustment, momentarily operate and release RESTORE switch on 600 VOLT POWER SUPPLY, wait for CURRENT meter indication to stabilize, and then continue simultaneous rotation of controls.	*a.* 85 ma ±5.
			b. Slowly rotate LOAD CURRENT control fully clockwise and *simultaneously* rotate H.V. LOAD FINE ADJ. control to maintain approximately 600 volts indication on OUTPUT meter. Note CURRENT meter indication. (See note in a above.)	*b.* 120 ma ±5.
			c. Rotate LOAD CURRENT control counterclockwise to obtain 100-ma indication on CURRENT meter and *simultaneously* rotate H.V. LOAD FINE ADJ. control to maintain 600 volts dc on OUTPUT meter.	*c.* None.
5	Unchanged.	Unchanged.	*600 V ADJ control range*	
			a. Connect TS–352/U as shown in E, figure 128.3.	*a.* None.
			b. Rotate 600 V ADJ control on 600 VOLT POWER SUPPLY fully counterclockwise and note meter indication of TS–352/U. Rotate 600 V ADJ control fully clockwise and note meter indication. Note voltage *difference* between first and second reading. *Note.* If power cutoff occurs before obtaining high-voltage indication, operate RESTORE switch momentarily and release. Continue rotation of 600 V ADJ control clockwise during warmup period to obtain high-voltage indication.	*b.* 110 volts dc ±10.
			c. Rotate 600 V ADJ control counterclockwise until meter of TS–352/U indicates 600 volts dc. Remove test leads of TS–352/U from pin jacks J1 and J10 (E, fig. 128.3).	*c.* None.
6	Unchanged except: *ME–30B/U* ON-OFF: ON DB VOLTS: .03 VOLTS	Unchanged.	*Ac line and ripple voltages, PP–826/U*	
			a. Connect TS–352/U as shown in D, figure 128.3, and ME–30B/U as shown in F.	*a.* None.
			b. Note ME–30B/U meter indication.	*b.* 0.02 volt ac maximum.
			c. Rotate control on CN–16A/U to reduce voltage indication on meter of TS–352/U to 100 volts ac, and note 600 VOLT POWER SUPPLY indications.	*c.* CURRENT meter indicates 100 ma; no alarms are obtained.
			d. Note ME–30B/U meter indication.	*d.* Same as obtained in *b* above.
			e. Rotate control on CN–16A/U to reduce voltage indication on meter of TS–352/U to 90 volts ac.	*e.* LOAD ALARM lamp cycles on and off and, simultaneously, CURRENT meter cycles between 0 and 100 ma.
			f. Rotate control or CU–16A/U to reduce voltage indication on meter of TS–352/U to 65 volts ac.	*f.* LOAD ALARM lamp lights and CURRENT meter indicates 0 ma.
			g. Operate AC POWER switch on 600 VOLT POWER SUPPLY to OFF, and then to ON.	*g.* Same as *f* above.
			h. Rotate control on CN–16A/U to obtain 115 volts ac indication on meter of TS–352/U. Operate AC POWER switch to ON. Wait until LOAD ALARM lamp is extinguished (20 seconds, approx).	*h.* None.
			i. Rotate control on CN–16A/U clockwise to obtain 130 volts ac indication on meter of TS–352/U, and note 600 VOLT POWER SUPPLY indication.	*i.* CURRENT meter indicates 100 ma ±2.
			j. Note ME–30B/U meter indication.	*j.* Same as obtained in *b* above.
			k. Rotate control on CN–16A/U counterclockwise to obtain 115-volt ac indication on meter of TS–352/U.	*k.* None.
7	Unchanged except: *ME–30B/U* ON-OFF: ON DB VOLTS: .03 VOLTS	Unchanged.	*Ac line and ripple voltages, PP–826A/U*	
			a. Connect TS–352/U as shown in D, figure 128.3, and ME–30B/U as shown in F.	*a.* None.
			b. Note ME–30B/U meter indication.	*b.* 0.02 volt ac maximum.
			c. Rotate CN–16A/U to reduce voltage indication on meter of TS–352/U to 90 volts ac. Note 600 VOLT POWER SUPPLY indication.	*c.* CURRENT meter indicates 100 ma.
			d. Note ME–30B/U meter indication.	*d.* Same as obtained in *b* above.
			e. Operate AC POWER switch on 600 VOLT POWER SUPPLY to OFF for 3 seconds; and then operate to ON.	*e.* In 2 or 3 seconds, CURRENT meter indicates 100 ma; LOAD CURRENT and LOW VOLTAGE lamps light. In 20 seconds (approx), lamps are extinguished.
			f. Slowly rotate control on CN–16A/U counterclockwise until LOAD ALARM and LOW VOLTAGE lamps light. Note TS–352/U and 600 VOLT POWER SUPPLY indications.	*f.* At 80 volts ac ±5, LOAD ALARM and LOW VOLTAGE lamps light.
			g. Operate ON-OFF switch on 600 VOLT POWER SUPPLY to OFF for 3 seconds, and then operate to ON.	*g.* CURRENT meter indicates 0 ma and LOAD ALARM lamp lights.
			h. Rotate control on CN–16A/U to obtain 115 volts ac indication on meter of TS–352/U. Operate AC POWER switch to OFF, and then to ON. Wait until LOAD ALARM and LOW VOLTAGE lamps are extinguished (20 seconds, approx).	*h.* None.
			i. Rotate control on CN–16A/U clockwise to obtain 120 volts ac indication on meter of TS–352/U.	*i.* CURRENT meter indicates 100 ma +2.
			j. Note ME–30D/U meter indication.	*j.* Same as obtained in *b* above.
			k. Rotate control on CN–16A/U counterclockwise to obtain 115 volts ac indication on meter of TS–352/U. Disconnect TS–352/U and ME–30B/U from test setup.	*k.* None.
8	Unchanged except: *TS–352/U* FUNCTION: OHMS	Unchanged except: AC POWER: OFF	*Low output voltage, PP–826/U*	
			a. Disconnect connector TO JUNCTION PAN from connector J301 (A, fig. 128.3). Connect TS–352/U as shown in B, figure 128.3. Rotate H.V. LOAD FINE ADJ. control on I–199–A to obtain 4,000-ohm indication on meter of TS–352/U. Disconnect TS–352/U test leads from terminals A and B.	*a.* None.
			b. Operate AC POWER switch to ON.	*b.* CURRENT meter indicates 10 ma ±2 and LOAD ALARM lamp lights.
			c. Operate AC POWER switch to OFF. Reconnect connector TO JUNCTION PAN to connector J301 (A, fig. 128.3).	*c.* None.
			d. Operate AC POWER switch to ON.	*d.* Same as obtained in *b* above.
			e. Rotate H.V. LOAD FINE ADJ. control on I–199–A slowly counterclockwise until dc power comes on.	*e.* LOAD ALARM lamp lights and CURRENT meter indication slowly rises to 100 ma. OUTPUT meter on I–199–A indicates 480 volts dc ±10. After approximately 20 seconds, LOAD ALARM lamp extinguishes. Immediately cutoff occurs; CURRENT meter indicates 0 ma and LOAD ALARM lamp lights.
			f. Operate RESTORE switch on 600 VOLT POWER SUPPLY momentarily and release. While voltage indication of OUTPUT meter on I–199–A is increasing, rotate H.V. LOAD FINE ADJ. control until OUTPUT meter indicates 600 volts dc. After 20 seconds (approx), LOAD ALARM lamp is extinguished.	*f.* None.
9	Unchanged except: *TS–352/U* FUNCTION: OHMS	Unchanged except: AC POWER: OFF	*Low output voltage, PP–826A/U*	
			a. Perform operations given in step No. 8a except obtain 2,000-ohm indication on meter of TS–352/U.	*a.* None.
			b. Operate AC POWER switch to ON.	*b.* CURRENT meter indicates 0 ma and LOAD ALARM lamp lights.
			c. Operate AC POWER switch to OFF. Reconnect connector TO JUNCTION PAN to connector J301 (A, fig. 128.3).	*c.* None.
			d. Operate AC POWER switch to ON.	*d.* Same as *b* above.
			e. Rotate H.V. LOAD FINE ADJ. control on I–199–A to increase voltage, operate RESTORE switch on 600 VOLT POWER SUPPLY momentarily and release. Rotate H.V. LOAD FINE ADJ. control until OUTPUT meter indicates 600 volts dc. After 20 seconds (approx), LOAD ALARM lamp is extinguished and CURRENT meter indicates 100 ma.	*e.* None.
10	Unchanged except: *TS–352/U* FUNCTION 2000Ω/VDC DIRECT	Unchanged.	*REPEATER switch positions and blower operation*	
			a. Connect TS–352/U as shown in E, figure 128.3.	*a.* None.
			b. *Simultaneously*, rotate REPEATER switch on 600 VOLT POWER SUPPLY to position 2 and H.V. LOAD COARSE ADJ. control on I–199–A one position to right. *Note.* If cutoff occurs, operate RESTORE switch momentarily and release. Power will be restored.	*b.* CURRENT meter indicates 100 ma and no alarms are obtained. OUTPUT meter of I–199–A indicates 420 volts dc ±20. TS–352/U meter indicates 600 volts dc ±10.
			c. *Simultaneously*, rotate REPEATER switch to position 1 and adjust H.V. LOAD FINE ADJ. until OUTPUT meter indicates 240 volts dc.	*c.* CURRENT meter indicates 100 ma and TS–352/U meter indicates 600 volts dc ±10. No alarms are obtained.
			d. Rotate REPEATER switch to position 0. Connect jumper wire across terminals A and B of 600-volt power supply test cable assembly (A, fig. 128.3).	*d.* None.
			e. Operate RESTORE switch momentarily and release. Adjust 600 V ADJ. control until meter of TS–352/U indicates 600 volts dc.	*e.* CURRENT meter indicates 100 ma and no alarms are obtained.
			f. Operate REPEATER switch to TEST position.	*f.* Same as *e* above.
			g. Observe blower operation.	*g.* Blower is operating, forcing air out through front grill.
			h. Operate AC POWER switch on 600 VOLT POWER SUPPLY to OFF and ON-OFF switch on CN–16A/U to OFF. Disconnect all equipment connections.	*h.* None.

T.O. 31Y7-2FOOF-64



NOTES:

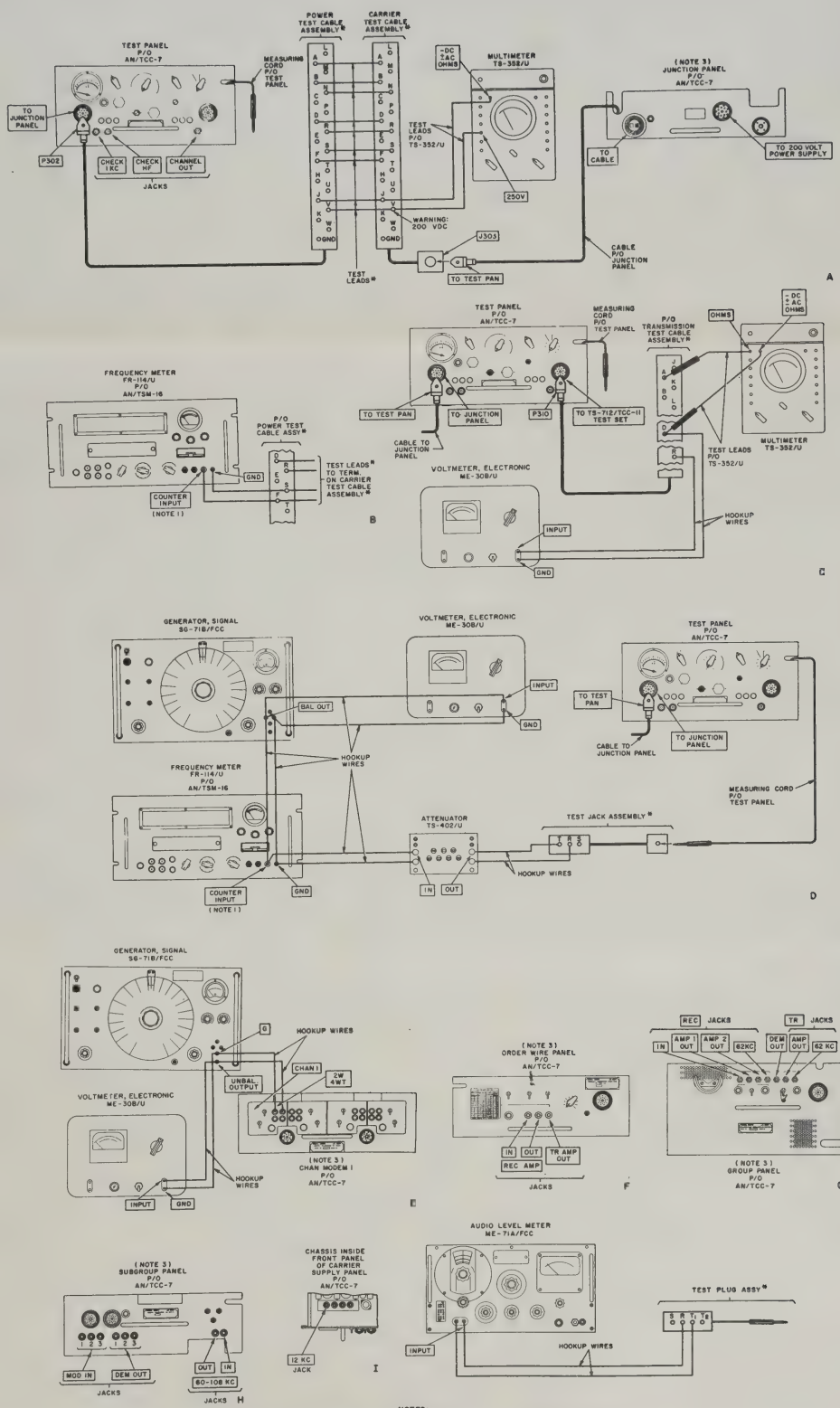
1. HOOKUP WIRE IS ATTACHED TO ADAPTER CONNECTOR UG-641/U (P/O AN/TSM-16) WHICH IS ATTACHED TO THE COUNTER INPUT RECEPTACLE.
2. ▭ INDICATES EQUIPMENT MARKING.
3. ALL CONNECTING CABLES OF PANEL NOT SHOWN.

* PART OF MK-155/TCC.

TM2139-35-C2-5

Figure 128.4 Test setups for fourth echelon tests of TEST PANEL.

Section IV. FOURTH ECHELON TESTS OF TELEPHONE TEST SET TS-760/TCC-7 (TEST PANEL)



NOTES:

1. HOOKUP WIRE IS ATTACHED TO ADAPTER CONNECTOR UG-641/U (P/O AN/TSM-16) WHICH IS ATTACHED TO THE [COUNTER INPUT] RECEPTACLE.
2. [ ] INDICATES EQUIPMENT MARKING.
3. ALL CONNECTING CABLES OF PANEL NOT SHOWN.

* PART OF MK-155/TCC.

TM2139-35-C2-8

Figure 128.4 Test setups for fourth echelon tests of TEST PANEL.

167.10. Tests of TEST PANEL

(fig. 128.4)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Terminal, Telephone AN/TCC-7	5805-503-1228	TM 11-2139-10
Generator, Signal SG-71(*)/FCC [a]	6625-669-0255	TM 11-5088
Audio Level Meter ME-71(*)/FCC [b]	6625-545-7949	TM 11-2151
Frequency Meter AN/TSM-16 (includes Frequency Meter FR-114/U)	6625-542-1666	TM 11-6625-218-12
Voltmeter, Meter ME-30(*)/U [c]	6625-669-0742	TM 11-6625-320-12
Multimeter TS-352(*)/U [d]	6625-242-5023	TM 11-5527
Attenuator TS-402(*)/U [e]	5905-230-5149	TM 11-2044
Telephone Carrier System Test Facilities Kit MK-155/TCC	6625-603-9523	TB SIG 328
Hookup wire (approx 20 ft) [f]	6145-160-5300	

[a] Indicates Generator, Signal SG-71/FCC, SG-71A/FCC, or SG-71B/FCC. (Generator, Signal SG-71B/FCC is used in the test procedures (c below).)
[b] Indicates Audio Level Meter ME-71/FCC, ME-71A/FCC, or ME-71B/FCC. (Audio Level Meter ME-71A/FCC is used in the test procedures (c below).)
[c] Indicates Voltmeter, Meter ME-30A/U, Voltmeter, Electronic ME-30B/U, or ME-30C/U. (Voltmeter, Electronic ME-30B/U is used in the test procedures (c below).)
[d] Indicates Multimeter TS-352/U, TS-352A/U, or TS-352B/U. (Multimeter TS-352/U is used in the test procedures (c below).)
[e] Indicates Attenuator TS-402/U, or TS-402A/U. (Attenuator TS-402/U is used in the test procedures (c below).)
[f] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Interconnect, test, and calibrate an AN/TCC-7 (pars. 167.3*d* and 167.22*b* and *c*). After the AN/TCC-7 has been calibrated, do not change switch settings and control adjustments.
(2) Calibrate the ME-71A/FCC (par. 167.3*c*).
(3) Operate the AC POWER switch of the 200 VOLT POWER SUPPLY to OFF. Substitute the TEST PANEL to be tested for the TEST PANEL in the AN/TCC-7 and connect the equipment as shown in A, figure 128.4.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*CARRIER SUPPLY PANEL* CARR SYNC: LOCAL *200 VOLT POWER SUPPLY* AC POWER: ON Other panels and controls of AN/TCC-7: unchanged from settings used in calibration procedures (par. 167.22). *TS-352/U* FUNCTION: 20000Ω/VDC DIRECT.	*TEST PANEL* MEASURE: 200 VOLTS MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: OFF SEND: CHECK GAIN CHECK HF	*200-volt measurement* *a.* Adjust 200V ADJ control on 200 VOLT POWER SUPPLY to obtain 0-db indication on TEST PANEL meter. *b.* Note TS-352/U meter indication.	*a.* 0 db. *b.* 200 volts dc ± 10.
2	Unchanged. *600 VOLT POWER SUPPLY* REPEATER (internal): TEST AC POWER: ON	Unchanged except: MEASURE: 600 VOLTS	*600-volt measurement* *a.* Disconnect test lead of TS-352/U from terminal V of carrier test cable assembly (A, fig. 128.4), and reconnect to terminal A. Wait until equipment alarms stop sounding (approximately 20 to 30 seconds). *b.* Adjust 600V ADJ control on 600 VOLT POWER SUPPLY to obtain 0-db indication on TEST PANEL meter. *c.* Note TS-352/U meter indication. *d.* Disconnect TS-352/U test leads from test setup (A, fig. 128.4). Operate AC POWER switch on 600 VOLT POWER SUPPLY to OFF.	*a.* None. *b.* 0 db. *c.* 200 volts dc ±10. *d.* None.
3	Unchanged. *FR-114/U* POWER-STANDBY-OFF: POWER (POWER and XTAL OVEN ON LAMPS light; begin adjustments when XTAL OVEN ON lamp starts cycling.) TIME-SECONDS: 1 FUNCTION: FREQ. COUNT AUTO-MANUAL: AUTO DISPLAY TIME: 5 SENSITIVITY: Adjust until INPUT LEVEL meter indicates in left end of green area. TRIGGER VOLTAGE: clockwise from full counterclockwise position until numerical counters start to count; note position. Continue clockwise until counting stops; note position. Set to position between two noted positions. SENSITIVITY: adjust until INPUT LEVEL meter needle indicates in center of green area.	Unchanged except: MEASURE: TRANSMISSION MEASURE NONSELECTIVE: CHECK 1 KC CHECK HF.	*1-kc circuit* *a.* Connect FR-114/U as shown in B, figure 128.4 and adjust as in *Test equipment control settings* column. *b.* Record FR-114/U frequency count. *c.* Insert TEST PANEL measuring cord plug into CHECK 1 KC jack (A, fig. 128.4). *d.* Rotate 1 KC control (internal) on TEST PANEL fully clockwise. *e.* Rotate CHECK 1 KC control fully counterclockwise. *f.* Adjust CHECK 1 KC control to obtain 0-db indication on TEST PANEL meter. *g.* Disconnect hookup wires of the FR-114/U from terminals S and F (B, fig. 128.4).	*a.* None. *b.* 1,000 cps ±20. *c.* None. *d.* +2.5 db or more. *e.* −2.5 db or less. *f.* None. *g.* None.
4	Unchanged.	Unchanged except: SEND: 65 KC REC HF: fully clockwise 65 KC REC: fully clockwise.	*65 kc and fault test frequencies* *a.* Record SEND lamp indication on TEST PANEL. *b.* Connect GND hookup wire from FR-114/U to terminal R and counter INPUT hookup wire to terminal D (B, fig. 128.4). *c.* Adjust SENSITIVITY control on FR-114/U to obtain INPUT LEVEL meter needle indication in center of green area. Note frequency count. *d.* Depress REP 1 pushbutton on TEST PANEL and note FR-114/U frequency count. Release pushbutton. *e.* Depress REP 2 pushbutton and note FR-114/U frequency count. Release pushbutton. *f.* Depress REP 3 pushbutton and note FR-114/U frequency count. Release pushbutton. *g.* Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF and disconnect power and carrier test cable assemblies and FR-114/U in test setup shown in A and B, figure 128.4. Reconnect connector TO TEST PAN on cable from JUNCTION PANEL (A, fig. 128.4) to TO JUNCTION PANEL receptacle on TEST PANEL (D, fig. 128.4). Operate AC POWER switch on 200 VOLT POWER SUPPLY to ON and wait until alarms are silenced.	*a.* SEND lamp lights. *b.* None. *c.* 65,000 cps ±150. *d.* 99,000 cps ±150 *e.* 91,000 cps ±150. *f.* 83,000 cps ±150. *g.* None.
5	Unchanged. *TS-402/U* Keys 40, 3, and 2 aligned with white line parallel to short dimension of panel (45 db). *ME-30B/U* ON-OFF: ON DB VOLTS: 0 DB *SG-71B/FCC* Power switch: ON MOD BAL.-BAL-UNBAL.: BAL. RANGE: X1000 Tuning dial: Adjust to obtain 68,000-cps frequency count on FR-114/U. COARSE AMPLITUDE: Adjust to obtain 0-db indication on ME-30B/U meter. *FR-114/U* Same as step No. 3.	Unchanged except: SEND: CHECK GAIN CHECK HF	*Meter calibration* *a.* Connect equipment as shown in D, figure 128.4. Adjust equipment as in *Test equipment control settings* column. *b.* Note TEST PANEL meter indication. *c.* Operate key 2 on TS-402/U to align white line parallel with long dimension of panel (43 db). *d.* Operate key 3 on TS-402/U to align white line parallel with long dimension of panel (40 db). *e.* Operate ATTENUATOR 5db pushbutton on TEST PANEL and note TEST PANEL meter indication. Release pushbutton. *f.* Operate key 40 on TS-402/U to align white line parallel with long dimension of panel (0 db), and operate keys 20, 10, 5, and 3 to align white line parallel with short dimension of panel (38 db). *g.* Hold ATTENUATOR 10db pushbutton on TEST PANEL operated and operate key 3 on TS-302/U to align white line parallel with long dimension on panel (35 db). Note TEST PANEL meter indication. Release pushbutton. *h.* Hold ATTENUATOR 20db pushbutton on TEST PANEL operated and operate key 10 on TS-402/U to align white line parallel with long dimension of panel (25 db). Note TEST PANEL meter indication. Release pushbutton. *i.* Operate keys 20 and 10 on TS-402/U to align white line with long dimension of panel, and operate keys 40 and 3 to align white line with short dimension of panel (48 db). *j.* Operate keys 5 and 3 on TS-402/U to align white line with long dimension on panel, and operate key 10 to align white line with short dimension of panel (50 db). *k.* Operate key 2 on TS-402/U to align white line with short dimension on panel (52 db). *l.* Disconnect measuring cord plug from test jack assembly (D, fig. 128.4).	*a.* None. *b.* 0 db ±0.5. *c.* +2 db ±0.5. *d.* +5 db ±0.5. *e.* 0 db ±0.5. *f.* +7 db ±0.5. *g.* 0 db ±0.5. *h.* 0 db ±0.5. *i.* −3 db ±0.5. *j.* −5 db ±0.5. *k.* −7 db ±0.5. *l.* None.
6	Unchanged.	Unchanged.	*65-kc oscillator output level* *a.* Insert TEST PANEL measuring cord plug into CHECK HF jack on TEST PANEL (A, fig. 128.4). *b.* Rotate HF control on TEST PANEL fully counterclockwise. *c.* Rotate HF control on TEST PANEL clockwise until meter indicates 0 db.	*a.* +2.5 db or higher. *b.* −2.5 db or less. *c.* 0 db.

7	Unchanged.	Unchanged except: MEASURE SELECTIVE: CHECK GAIN. MEASURE NONSELECTIVE: OFF	*65-kc gain adjustment* *a.* Adjust FINE TUNE control on TEST PANEL to center of range. Adjust COARSE TUNE for peak indication on meter. Readjust FINE TUNE TO check for peak meter indication. *b.* Adjust GAIN control on TEST PANEL to center of range. Adjust AMP GAIN control (internal control on if. amplifier AR1 subassembly at rear center of TEST PANEL chassis) to obtain 0-db meter indication. *c.* Rotate GAIN control fully clockwise. *d.* Rotate GAIN control fully counterclockwise. *e.* Rotate GAIN control clockwise until meter indicates 0 db.	*a.* Peak indication obtained. *b.* 0 db. *c.* Between +1 and +1.5 db. *d.* Between −1.5 and −1 db. *e.* 0 db.
8	Unchanged except: *ORDER WIRE PANEL* CABLE REELS TO NEXT AN/TCC-7 or AN/TCC-8: 0–11. SEND OW: ON	Unchanged except: MEASURE NONSELECTIVE: OW TR AMP OUT. MEASURE SELECTIVE: OFF	*Order wire transmission* Insert TEST PANEL measuring cord plug into TR AMP OUT jack on ORDER WIRE PANEL (F, fig. 128.4).	+2.5 db ±0.5.
9	Unchanged.	Unchanged except: MEASURE NONSELECTIVE: OW REC AMP.	*Order wire reception* *a.* Insert TEST PANEL measuring cord plug into REC AMP OUT jack on ORDER WIRE PANEL (F, fig. 128.4). *b.* Operate SEND OW switch on ORDER WIRE PANEL to vertical position.	*a.* 0 db ±0.5. *b.* None.
10	Unchanged.	Unchanged except: MEASURE SELECTIVE: 68KC MEASURE NONSELECTIVE: OFF	*68-kc transmission* *a.* Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). *b.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	*a.* None. *b.* 0 db ±0.5.
11	Unchanged except: *CHAN MODEM 1, 2, and 3* SEND-MEAS switch of each CHAN 2: SEND.	Unchanged except: MEASURE NONSELECTIVE: SUB GRP MOD IN MEASURE SELECTIVE: OFF	*SUBGROUP PANEL input* *a.* Insert TEST PANEL measuring cord plug into MOD IN 1 jack on SUBGROUP PANEL (H, fig. 128.4). *b.* Insert measuring cord plug into MOD IN 2 jack on SUBGROUP PANEL, and note TEST PANEL meter indication. *c.* Insert measuring cord plug into MOD IN 3 jack on SUBGROUP PANEL, and note TEST PANEL meter indication.	*a.* 0 db±3. *b.* 0 db ±3. *c.* 0 db ±3.
12	Unchanged.	Unchanged except: MEASURE SELECTIVE: 07KC MEASURE NONSELECTIVE: OFF	*Transmission Modulation* *a.* Insert TEST PANEL measuring cord plug into 60–108 KC OUT jack on SUBGROUP PANEL (H, fig. 128.4). *b.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	*a.* None. *b.* 0 db ±2.
13	Unchanged.	Unchanged except: MEASURE SELECTIVE: 83KC	*83-kc transmission* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	0 db ±2.
14	Unchanged.	Unchanged except: MEASURE SELECTIVE: 99KC	*99-kc transmission* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	0 db ±1.
15	Unchanged.	Unchanged except: MEASURE SELECTIVE: 37KC	*37-kc transmission* *a.* Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). *b.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *c.* Operate SEND-MEAS switches on CHAN 2 of CHAN MODEM 1, 2, and 3 to vertical position.	*a.* None. *b.* 0 db ±0.5. *c.* None.
16	Unchanged except: *CARRIER SUPPLY PANEL* 12 & 28 KC: ON (12 & 28 KC lamp lights).	Unchanged except: MEASURE SELECTIVE: 12KC	*12-kc transmission* *a.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *b.* Insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack on GROUP PANEL (G, fig. 128.4).	*a.* 0 db ±0.5. *b.* 0 db ±0.5.
17	Unchanged.	Unchanged except: MEASURE SELECTIVE: 28KC	*28-kc transmission* *a.* Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). *b.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *c.* Insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack on GROUP PANEL (G, fig. 128.4). *d.* Operate 12 & 28 KC switch on CARRIER SUPPLY PANEL to vertical position.	*a.* None. *b.* 0 db ±0.5. *c.* 0 db ±0.5. *d.* None.
18	Unchanged except: *CHAN MODEM 2* SEND-MEAS switch of CHAN 2: SEND	Unchanged except: MEASURE NONSELECTIVE: GRP DEM OUT MEASURE SELECTIVE: OFF	*GROUP PANEL demodulator output* Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (G, fig. 128,4).	0 db ±0.5.
19	Unchanged except: *CHAN MODEM 1, 2, and 3* SEND-MEAS switch of CHAN 2: SEND	Unchanged except: MEASURE NONSELECTIVE: SUB GRP DEM OUT	*SUBGROUP PANEL output* *a.* Insert TEST PANEL measuring cord plug into DEM OUT 1 jack on SUBGROUP PANEL (H, fig. 128.4). *b.* Insert TEST PANEL measuring cord plug into DEM OUT 2 jack on SUBGROUP PANEL. *c.* Insert TEST PANEL measuring cord plug into DEM OUT 3 jack on SUBGROUP PANEL. *d.* Operate SEND-MEAS switches of CHAN 2 on CHAN MODEM 1, 2, and 3 to vertical position.	*a.* 0 db ±0.5. *b.* 0 db ±0.5. *c.* 0 db ±0.5. *d.* None.
20	Unchanged.	Unchanged except: MEASURE NONSELECTIVE: FAULT TEST SEND: 65KC TR OR FAULT TEST.	*Fault test level measurement* *a.* Note SEND lamp indication. *b.* Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). *c.* Press FAULT TEST-REP 1 pushbutton on TEST PANEL and note meter indication. Release pushbutton. *d.* Press FAULT TEST-REP 2 pushbutton and note meter indication. Release pushbutton. *e.* Press FAULT TEST-REP 3 pushbutton and note meter indication. Release pushbutton.	*a.* SEND lamp lights. *b.* None. *c.* 0 db ±1. *d.* 0 db ±1. *e.* 0 db ±1.
21	Unchanged. *ME-71A/FCC* AUD. GAIN: midposition INJECTOR: REC METER: REC SELECTOR: VM-BAL 135Ω BRG ATTENUATOR DB: −20 Tuning dial: 65	Unchanged except: MEASURE SELECTIVE: 65KC MEASURE NONSELECTIVE: OFF 65 KC TR OR FAULT TEST (internal): fully clockwise.	*65-kc transmission* *a.* Connect equipment as shown in J, figure 128.4. Insert plug of test plug assembly into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). *b.* Adjust tuning dial on ME-71A/FCC to obtain peak indication on DECIBELS meter at 65 kc. Wait for indication to stabilize. *c.* Operate ATTENUATOR DB switch on ME-71A/FCC to −30. Rotate 65 KC TR OR FAULT TEST control on TEST PANEL fully counterclockwise. Wait for meter indication of DECIBELS meter or ME-71A/FCC to stabilize. *d.* Rotate 65 KC TR OR FAULT TEST control to obtain −30 db indication on DECIBELS meter of ME-71A/FCC. Wait for meter indication to stabilize. *e.* Remove test plug assembly plug (J, fig. 128.4) from GROUP PANEL. Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL. *f.* Adjust FINE TUNE control on TEST PANEL to obtain peak meter indication. *g.* Adjust 65KC TR OR FAULT TEST control on TEST PANEL until meter indicates 0 db. *h.* Remove TEST PANEL measuring cord plug	*a.* None. *b.* −23 db ±1. *c.* −32 db ±1. *d.* None. *e.* None. *f.* 0 db ±1.5. *g.* 0 db. *h.* None.

			f. Insert TRANSMISSION MEAS TUNE test plug assembly into jack on SUBGROUP PANEL, and note TEST PANEL meter indication.	
12	Unchanged.	Unchanged except: MEASURE SELECTIVE: 67KC MEASURE NONSELECTIVE: OFF	*Transmission Modulation* a. Insert TEST PANEL measuring cord plug into 60–108 KC OUT jack on SUBGROUP PANEL (H, fig. 128.4). b. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	a. None. b. 0 db ±2.
13	Unchanged.	Unchanged except: MEASURE SELECTIVE: 83KC	*83-kc transmission* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	0 db ±2.
14	Unchanged.	Unchanged except: MEASURE SELECTIVE: 99KC	*99-kc transmission* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	0 db ±1
15	Unchanged.	Unchanged except: MEASURE SELECTIVE: 37KC	*37-kc transmission* a. Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). b. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. c. Operate SEND-MEAS switches on CHAN 2 of CHAN MODEM 1, 2, and 3 to vertical position.	a. None. b. 0 db ±0.5. c. None.
16	Unchanged except: *CARRIER SUPPLY PANEL* 12 & 28 KC: ON (12 & 28 KC lamp lights).	Unchanged except: MEASURE SELECTIVE: 12KC	*12-kc transmission* a. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. b. Insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack on GROUP PANEL (G, fig. 128.4).	a. 0 db ±0.5. b. 0 db ±0.5.
17	Unchanged.	Unchanged except: MEASURE SELECTIVE: 28KC	*28-kc transmission* a. Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). b. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. c. Insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack on GROUP PANEL (G, fig. 128.4). d. Operate 12 & 28 KC switch on CARRIER SUPPLY PANEL to vertical position.	a. None. b. 0 db ±0.5. c. 0 db ±0.5. d. None.
18	Unchanged except: *CHAN MODEM 2* SEND-MEAS switch of CHAN 2: SEND	Unchanged except: MEASURE NONSELECTIVE: GRP DEM OUT MEASURE SELECTIVE: OFF	*GROUP PANEL demodulator output* Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (G, fig. 128,4).	0 db ±0.5.
19	Unchanged except: *CHAN MODEM 1, 2, and 3* SEND-MEAS switch of CHAN 2: SEND	Unchanged except: MEASURE NONSELECTIVE: SUB GRP DEM OUT	*SUBGROUP PANEL output* a. Insert TEST PANEL measuring cord plug into DEM OUT 1 jack on SUBGROUP PANEL (H, fig. 128.4). b. Insert TEST PANEL measuring cord plug into DEM OUT 2 jack on SUBGROUP PANEL. c. Insert TEST PANEL measuring cord plug into DEM OUT 3 jack on SUBGROUP PANEL. d. Operate SEND-MEAS switches of CHAN 2 on CHAN MODEM 1, 2, and 3 to vertical position.	a. 0 db ±0.5. b. 0 db ±0.5. c. 0 db ±0.5. d. None.
20	Unchanged.	Unchanged except: MEASURE NONSELECTIVE: FAULT TEST SEND: 65KC TR OR FAULT TEST.	*Fault test level measurement* a. Note SEND lamp indication. b. Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). c. Press FAULT TEST-REP 1 pushbutton on TEST PANEL and note meter indication. Release pushbutton. d. Press FAULT TEST-REP 2 pushbutton and note meter indication. Release pushbutton. e. Press FAULT TEST-REP 3 pushbutton and note meter indication. Release pushbutton.	a. SEND lamp lights. b. None. c. 0 db ±1. d. 0 db ±1. e. 0 db ±1.
21	Unchanged. *ME-71A/FCC* AUD. GAIN: midposition INJECTOR: REC METER: REC SELECTOR: VM-BAL 135Ω BRG ATTENUATOR DB: −20 Tuning dial: 65	Unchanged except: MEASURE SELECTIVE: 65KC MEASURE NONSELECTIVE: OFF 65 KC TR OR FAULT TEST (internal): fully clockwise.	*65-kc transmission* a. Connect equipment as shown in J, figure 128.4. Insert plug of test plug assembly into TR AMP OUT jack on GROUP PANEL (G, fig. 128.4). b. Adjust tuning dial on ME–71A/FCC to obtain peak indication on DECIBELS meter at 65 kc. Wait for indication to stabilize. c. Operate ATTENUATOR DB switch on ME–71A/FCC to −30. Rotate 65 KC TR OR FAULT TEST control on TEST PANEL fully counterclockwise. Wait for meter indication of DECIBELS meter or ME–71A/FCC to stabilize. d. Rotate 65 KC TR OR FAULT TEST control to obtain −30 db indication on DECIBELS meter of ME–71A/FCC. Wait for meter indication to stabilize. e. Remove test plug assembly plug (J, fig. 128.4) from GROUP PANEL. Insert TEST PANEL measuring cord plug into TR AMP OUT jack on GROUP PANEL. f. Adjust FINE TUNE control on TEST PANEL to obtain peak meter indication. g. Adjust 65KC TR OR FAULT TEST control on TEST PANEL until meter indicates 0 db. h. Remove TEST PANEL measuring cord plug from GROUP PANEL.	a. None. b. −23 db ±1. c. −32 db ±1. d. None. e. None. f. 0 db ±1.5. g. 0 db. h. None.
22	Unchanged except: *ME-71A/FCC* ATTENUATOR DB: −20	Unchanged except: SEND: 65 KC REC 65 KC REC: fully clockwise.	*65-kc reception* a. Record indication of SEND lamp on TEST PANEL. b. Insert test plug assembly plug into REC AMP 2 OUT jack on GROUP PANEL (G, fig. 128.4). Wait for indication of DECIBELS meter on ME–71A/FCC to stabilize. c. Operate ATTENUATOR DB switch on ME–71A/FCC to −50. Rotate 65 KC REC control on TEST PANEL fully counterclockwise. Wait for DECIBELS meter indication to stabilize. d. Operate ATTENUATOR DB switch on ME–71A/FCC to −30. Rotate 65 KC REC control on TEST PANEL until DECIBELS meter indicates −30. e. Remove test plug assembly plug (J, fig. 128.4) from GROUP PANEL. f. Insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack on GROUP PANEL (G, fig. 128.4). Record TEST PANEL meter indication. g. Adjust 65 KC REC control on TEST PANEL until meter indicates 0 db.	a. SEND lamp lights. b. −25 db ±1. c. −60 db ±5. d. None. e. None. f. 0 db ±1.5. g. 0 db.
23	Unchanged.	Unchanged except: MEASURE SELECTIVE: GRP PANEL 52 KC. MEASURE NONSELECTIVE: GRP PANEL 62 KC. SEND: 65 KC TR OR FAULT TEST.	*62-kc transmission* a. Insert TEST PANEL measuring cord plug into TR 62 KC jack on GROUP PANEL (G, fig. 128.4). b. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	a. None. b. No meter indication, or peak indication is at left of −5 db.
24	Unchanged.	Unchanged except: SEND: 65 KC REC	*62-kc reception* a. Insert TEST PANEL measuring cord plug into REC KC jack on GROUP PANEL (G, fig. 128.4). b. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	a. None. b. No meter indication, or peak indication is at left of −5 db.
25	Unchanged.	Unchanged except: MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: CARR. SUPPLY. SEND: CHECK GAIN CHECK HF.	*Carrier supply circuit* Insert TEST PANEL measuring cord plug into 12 KC jack on CARRIER SUPPLY PANEL (I, fig. 128.4).	0 db ±3.
26	Unchanged except: *CHAN MODEM 1* SEND-MEAS switch of CHAN 1: MEAS *ME-30B/U* DB VOLTS: 0 DB ON-OFF: ON *SG-71B/FCC* Power switch: ON MOD BAL.-BAL.-UNBAL.: UNBAL. Range: X10 Tuning dial: 100 FINE AMPLITUDE: Midposition. COARSE AMPLITUDE: rotate to obtain −3-dbm indication on ME-30B/U meter.	Unchanged except: MEASURE NONSELECTIVE: CHANNEL OUT.	*CHAN MODEM output* a. Connect equipment as shown in E, figure 128.4, and adjust output as given in *Test equipment control settings* column. b. Insert TEST PANEL measuring cord plug into CHANNEL OUT jack on TEST PANEL (A, fig. 128.4). c. Adjust GAIN control of CHAN 1 on CHAN MODEM 1 until TEST PANEL meter indicates 0 db. d. Disconnect test equipment for CHAN MODEM 1 (E, fig. 128.4).	a. None b. None. c. 0 db. d. None.
27	Unchanged except: *TS-352/U* FUNCTION: OHMS Range: RX100 *ME-30B/U* DB VOLTS: −20 DB	Unchanged except: MEASURE NONSELECTIVE: OFF.	*TO TS-712/TCC-11 TEST SET connector measurements* a. Touch test leads of TS-352/U together and adjust OHMS ZERO ADJ control until meter needle indicates 0 ohm. Connect equipment as shown in C, figure 128.4. b. Note ME-30B/U meter indication c. Note TS-352/U meter indication d. Disconnect test lead of TS-352/U from terminal A of transmission test cable assembly, and reconnect to terminal L (C, fig. 128.4). Note TS-352/U meter indication. e. Disconnect transmission test cable assembly from TEST PANEL (C, fig. 128.4) Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF. Remove TEST PANEL from AN/TCC-7 and substitute original TEST PANEL in its place.	a. None. b. −22 db ±2 c. 680 ohms ±10 percent. d. Same as obtained in c above e. None

Section V. FOURTH ECHELON TESTS OF TELEPHONE CARRIER FREQUENCY SUPPLY TA–228/TCC–7 (CARRIER SUPPLY PANEL)

167.12. Tests of CARRIER SUPPLY PANEL

(fig. 128.5)

a. Test Equipment and Material

			e. Remove TEST PANEL measuring cord plug from TR AMP OUT jack on GROUP PANEL.	e. None.
			Alarm circuits	
7	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: OFF	Unchanged except: 12 & 28 KC: vertical	a. Remove tube V16 (A, fig. 128.5).	a. 120KC ALARM lamp on CARRIER SUPPLY PANEL lights and buzzer in GROUP PANEL sounds.
			b. Operate 120KC ALARM CUTOFF switch on CARRIER SUPPLY PANEL to right.	b. 120KC ALARM lamp remains lighted and buzzer is silenced.
			c. Replace tube V16.	c. 120KC ALARM lamp is extinguished and buzzer sounds.
			d. Operate 120KC ALARM CUTOFF switch to vertical position.	d. Buzzer is silenced.
			e. Remove tube V6 (A, fig. 128.5).	e. 68KC ALARM and 120KC ALARM lamps light and buzzer sounds.
			f. Replace tube V6.	f. 68KC ALARM and 120KC ALARM lamps are extinguished and buzzer silenced.
			g. Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF. Remove CARRIER SUPPLY PANEL from AN/TCC–7 and replace original CARRIER SUPPLY PANEL in AN/TCC–7.	g. None.

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Section V. FOURTH ECHELON TESTS OF TELEPHONE CARRIER FREQUENCY SUPPLY TA–228/TCC–7 (CARRIER SUPPLY PANEL)

167.12. Tests of CARRIER SUPPLY PANEL

(fig. 128.5)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Terminal, Telephone AN/TCC–7	5805–503–1228	TM 11–2139–10
Frequency Meter AN/TSM–16 (includes Frequency Meter FR–114/U)	6625–542–1666	TM 11–6625–218–12
Telephone Carrier System Test Facilities Kit MX–155/TCC	6625–603–9523	TB SIG 328
Hookup wire (approx 6 ft) [a]	6145–160–5300	

[a] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

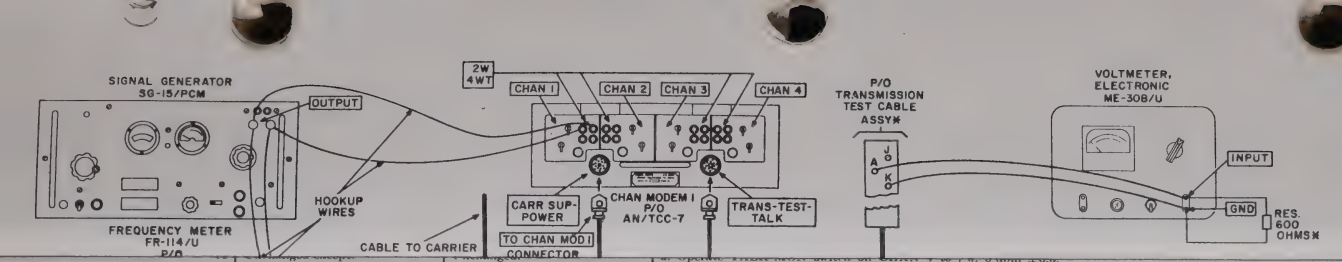
(1) Interconnect, test, and calibrate an AN/TCC–7 (pars. 167.3*d* and 167.22*b* and *c*). After the AN/TCC–7 has been calibrated, do not change switch settings and control adjustments.

(2) Operate the AC POWER switch of the 200 VOLT POWER SUPPLY to OFF. Substitute the CARRIER SUPPLY PANEL to be tested for the CARRIER SUPPLY PANEL in the AN/TCC–7.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*SUBGROUP PANEL* SPECIAL SERVICE: CHAN MODEM *GROUP PANEL* 12–60 KC: REGULAR 60–108 KC: REGULAR *TEST PANEL* MEASURE: TRANSMISSION MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: CARRIER SUPPLY SEND: CHECK GAIN CHECK HF *200 VOLT POWER SUPPLY* AC POWER: ON Other panels and controls of AN/TCC–7: Unchanged from settings used in calibration procedures (par. 167.22).	*CARRIER SUPPLY PANEL* CARR SYNC: LOCAL 12 & 28 KC: OFF (vertical) 120 KC ALARM CUTOFF: vertical 68 KC ALARM CUTOFF: vertical	*Divider circuits* Insert TEST PANEL measuring cord plug (C, fig. 128.5) into each of following jacks (internal), in turn, on CARRIER SUPPLY PANEL (A, fig. 128.5). (1) 64KC LOCAL (2) DIV 1 (3) DIV 2 (4) 4KC (5) 8KC (6) 16KC (7) 20KC (8) 12KC (9) 56KC (10) 72KC (11) 88KC (12) 120KC	0 db ±3 at each jack connection.
2	Unchanged.	Unchanged except: CARR SYNC: REMOTE	*Remote pilot operation* *a.* Insert TEST PANEL measuring cord plug (C, fig. 128.5) into each of following jacks, in turn, on CARRIER SUPPLY PANEL (A, fig. 128.5). (1) 4KC (2) SYNC. (3) 64KC REM *b.* Insert TEST PANEL measuring cord plug into 64KC LOCAL jack (A, fig. 128.5).	*a.* 0 db ±3 at each jack connection. *b.* No indication.
3	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: OFF *FR–114/U* POWER-STANDBY-OFF: POWER (Begin adjustments when XTAL OVEN ON lamp cycles on and off.) TIME-SECONDS: 1 FUNCTION: FREQ. COUNT AUTO-MANUAL: AUTO DISPLAY TIME: 5 SENSITIVITY: adjust until INPUT LEVEL meter needle indicates at left end of green area. TRIGGER VOLTAGE: rotate clockwise from full counterclockwise until numerical indicators start to count; note control position. Continue clockwise until counting stops; note control position. Set midway between two noted positions. SENSITIVITY: adjust until INPUT LEVEL meter needle indicates in center of green area.	Unchanged except: CARR SYNC: LOCAL	*Frequency check* *a.* Connect equipment as shown in B, figure 128.6. Insert plug of test jack assembly into 64KC LOCAL jack on CARRIER SUPPLY PANEL (A, fig. 128.6) and adjust FR–114/U as given in *Test equipment control settings* column. Note FR–114/U frequency count. *b.* Insert plug of test jack assembly into 4KC jack on CARRIER SUPPLY PANEL (A, fig. 128.5) and adjust SENSITIVITY control of FR–114/U until meter needle indicates in green portion on meter scale. Note FR–114/U frequency count. *c.* Remove plug of test plug assembly from 4KC jack.	*a.* 64,000 cps ±2. *b.* 4,000 cps ±1. *c.* None.
4	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 68-KC	Unchanged.	*68-kc circuit* *a.* Insert TEST PANEL measuring cord plug (C, fig. 128.5) into TR AMP OUT jack on GROUP PANEL (D, fig. 128.5). Adjust FINE TUNE control on TEST PANEL to obtain peak meter indication. *b.* Rotate 68KC control on CARRIER SUPPLY PANEL (internal) fully counterclockwise. *Note.* Operate ALARM CUTOFF switch on GROUP PANEL as necessary to silence buzzer alarm. *c.* Rotate 68KC control fully clockwise. *d.* Adjust 68KC control to obtain 0-db indication on TEST PANEL METER.	*a.* None. *b.* −2 db or less. *c.* +2 db or more. *d.* None.
5	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 12-KC	Unchanged except: 12 & 28 KC: ON	*12-kc circuit* *a.* Note 12 & 28 KC lamp indication. *b.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *c.* Rotate 12KC control on CARRIER SUPPLY PANEL fully counterclockwise. *d.* Rotate 12KC control fully clockwise. *e.* Adjust 12KC control to obtain 0-db indication on TEST PANEL meter.	*a.* 12 & 28 KC lamp lights. *b.* None. *c.* −3 db or less. *d.* +3 db or more *e.* None.
6	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 28-KC.	Unchanged.	*28-kc circuit* *a.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *b.* Rotate 28 KC control on CARRIER SUPPLY PANEL fully counterclockwise. *c.* Rotate 28KC control fully clockwise. *d.* Rotate 28KC control to obtain 0-db indication on TEST PANEL meter. *e.* Remove TEST PANEL measuring cord plug from TR AMP OUT jack on GROUP PANEL.	*a.* None. *b.* −2 db or less. *c.* +2 db or more. *d.* None. *e.* None.
7	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: OFF	Unchanged except: 12 & 28 KC: vertical	*Alarm circuits* *a.* Remove tube V16 (A, fig. 128.5). *b.* Operate 120KC ALARM CUTOFF switch on CARRIER SUPPLY PANEL to right. *c.* Replace tube V16. *d.* Operate 120KC ALARM CUTOFF switch to vertical position. *e.* Remove tube V6 (A, fig. 128.5). *f.* Replace tube V6. *g.* Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF. Remove CARRIER SUPPLY PANEL from AN/TCC–7 and replace original CARRIER SUPPLY PANEL in AN/TCC–7.	*a.* 120KC ALARM lamp on CARRIER SUPPLY PANEL lights and buzzer in GROUP PANEL sounds. *b.* 120KC ALARM lamp remains lighted and buzzer is silenced. *c.* 120KC ALARM lamp is extinguished and buzzer sounds. *d.* Buzzer is silenced. *e.* 68KC ALARM and 120KC ALARM lamps light and buzzer sounds. *f.* 68KC ALARM and 120KC ALARM lamps are extinguished and buzzer silenced. *g.* None.

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	SG-15/PCM FREQUENCY: rotate until FR-114/U counts 19,000 cps. *ME-22/PCM* DBM: 0 on SCALE B		TALK and note ME-22/RCM db meter indication. *b.* Operate DBM switch on ME-22/PCM to −20 on SCALE B. Operate TALK-MON switch on CHAN 4 to MON and note ME-22/PCM db meter indication. Release TALK-MON switch.	*b.* −21 dbm ±1.
17	Unchanged except: *SG-15/PCM* FREQUENCY: 1 kc FINE DBM: rotate until OUTPUT LEVEL meter indicates −4 dbm. *ME-22/PCM* DBM: −30 on SCALE B	Unchanged except: 2W-4W (on CHAN 1, CHAN 2, CHAN 3, and CHAN 4): 2W.	*Hybrid balance, channel 1, CHAN MODEM 1* *a.* Connect equipment as shown in D, figure 128.6. *b.* Operate SEND-MEAS switch on CHAN 1 to SEND, and TALK-MON switch on CHAN 1 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Operate switches (*b* above) to vertical position.	*a.* None. *b.* None. *c.* −40 dbm or less. *d.* None.
18	Unchanged.	Unchanged.	*Hybrid balance, channel 2, CHAN MODEM 1* *a.* Disconnect 600-ohm resistor and 1-μf capacitors from CHAN 1 and reconnect to 2W-4WT binding posts on CHAN 2 (D, fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 2 to SEND, and TALK-MON switch on CHAN 2 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Operate switches (*b* above) vertical position.	*a.* None. *b.* None. *c.* −40 db or less. *d.* None.
19	Unchanged.	Unchanged.	*Hybrid balance, channel 3, CHAN MODEM 1* *a.* Disconnect 600-ohm resistor and 1μf capacitors from CHAN 2 and reconnect to 2W-4WT binding posts on CHAN 3 (D, fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 3 to SEND, and TALK-MON switch on CHAN 3 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Operate switches (*b* above) to vertical position.	*a.* None. *b.* None. *c.* −40 dbm or less.
20	Unchanged.	Unchanged.	*Hybrid balance, channel 4, CHAN MODEM 1* *a.* Disconnect 600-ohm resistor and 1μf capacitors from CHAN 3 and reconnect to 2W-4WT binding posts on CHAN 4 (D, fig. 128.6). *b.* Operate SEND-MEAS switch to CHAN 4 to SEND, and TALK-MON switch to CHAN 4 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Remove test equipment connections (D, fig. 128.6). Remove CHAN MODEM 1 (being tested) from AN/TCC-7 and substitute original CHAN MODEM 1 in AN/TCC-7. Reconnect AN/TCC-7 cables to CHAN MODEM 1.	*a.* None. *b.* None. *c.* −40 dbm or less. *d.* None.

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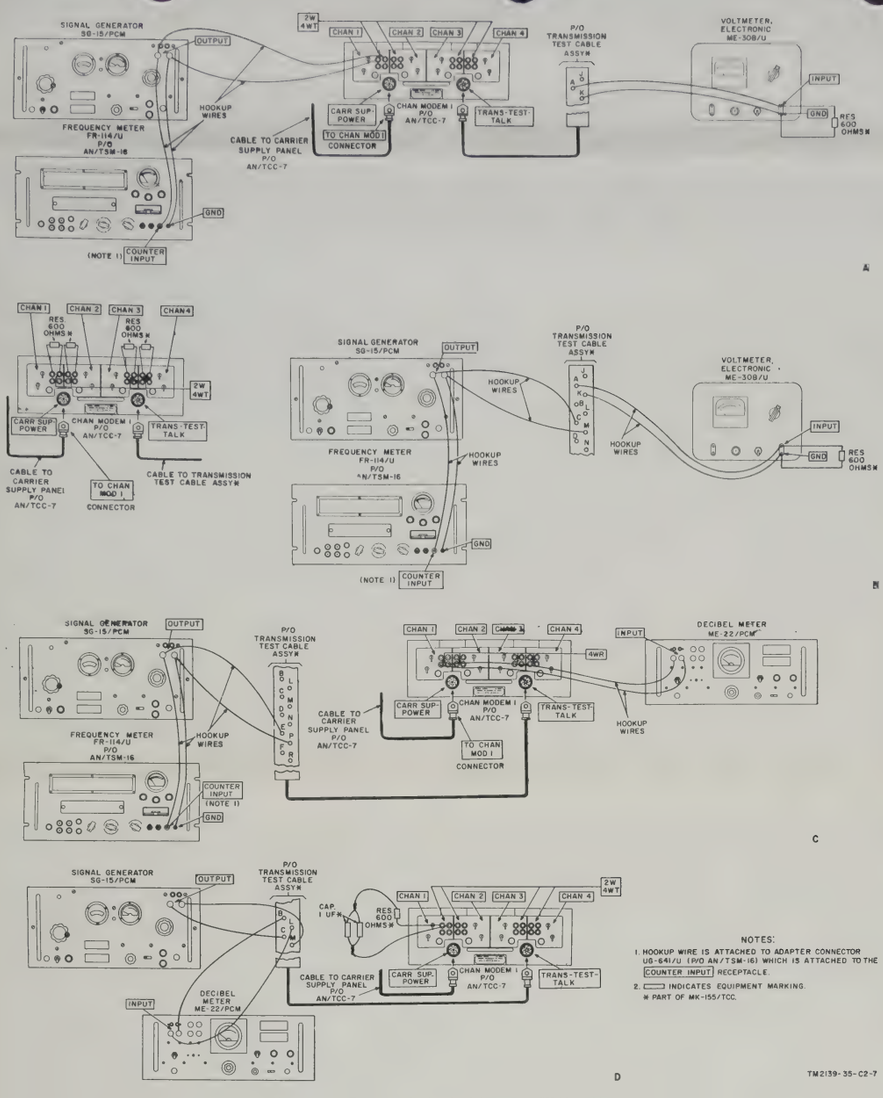


Figure 128.6. Test setups for fourth echelon tests of CHAN MODEM.

Section VI. FOURTH ECHELON TESTS OF MODEM, TELEPHONE TA–219/U (CHAN MODEM)

167.14. Tests of CHAN MODEM

(fig. 128.6)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Terminal, Telephone AN/TCC-7	5805-503-1228	TM 11-2139-10
Signal Generator SG-15(*)/PCM [a]	6625-229-1087	TM 11-2096
Decibel Meter ME-22(*)/PCM [b]	6625-498-3469	TM 11-2096
Frequency Meter AN/TSM-16 (includes Frequency Meter FR-114/U)	6625-543-1666	TM 11-6625-218-12
Voltmeter, Meter ME-30(*)/U [c]	6625-669-6742	TM 11-6625-320-12
Telephone Carrier System Test Facilities Kit MK-155/TCC	6625-603-9523	TB SIG 328
Hookup wire (approx 16 ft) [d]	6145-160-5300	

[a] Indicates Signal Generator SG-15/PCM or SG-15A/PCM. (Signal Generator SG-15/PCM is used in the test procedures (*c* below).)
[b] Indicates Decibel Meter ME-22/PCM or ME-22A/PCM. (Decibel Meter ME-22/PCM is used in the test procedures (*c* below).)
[c] Indicates Voltmeter, Meter ME-30A/U, or Voltmeter, Electronic ME-30B/U or ME-30C/U. (Voltmeter, Electronic ME-30B/U is used in the test procedures (*c* below).)
[d] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Interconnect, test, and calibrate an AN/TCC–7 (pars. 167.3*d* and 167.22*b* and *c*). After the AN/TCC–7 has been calibrated do not change switch settings or control adjustments.
(2) Calibrate the SG–15/PCM and ME–22/PCM (par. 167.3*a* and *b*).
(3) Operate the AC POWER switch on the 200 VOLT POWER SUPPLY to OFF. Substitute the CHAN MODEM to be tested for CHAN MODEM 1 in the AN/TCC–7. Connect the equipment as shown in A, figure 128.6.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*SUBGROUP PANEL* SPECIAL SERVICE: CHAN MODEM *GROUP PANEL* 12-60 KC: REGULAR 60-108 KC (external): REGULAR *CARRIER SUPPLY PANEL* CARRIER SYNC: LOCAL *TEST PANEL* MEASURE: TRANSMISSION MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: OFF *200 VOLT POWER SUPPLY* AC POWER: ON Other panels and controls of AN/TCC-7: Unchanged from settings used in calibration procedures (par. 176.22). *ME-30B/U* Power: ON (up). DB VOLTS: −40 DB. *SG-15/PCM* ON-OFF: ON. COARSE DBM: −10. FREQUENCY: rotate until FR-114/U counts 1,000 cps. FINE DBM: rotate until OUTPUT LEVEL meter indicates 0 (−10 dbm). *FR-114/U* POWER-STANDBY-OFF: POWER. (Begin adjustments when XTAL OVEN ON lamp cycles on and off.) TIME-SECONDS: 1 FUNCTION: FREQ COUNT AUTO-MANUAL: AUTO DISPLAY TIME: 5 SENSITIVITY: meter needle at left in green area. TRIGGER VOLTAGE: clockwise from full counterclockwise until numerical indicators start to count; note control position. Continue clockwise until counting stops, note control position. Set midway between two positions. Reset SENSITIVITY control until INPUT LEVEL meter indicates in center of green area.	*CHAN MODEM 1* (*under test*) (*CHAN 1, CHAN 2, CHAN 3, and CHAN 4*) TALK-MON: vertical SEND-MEAS: vertical 2W-4W (internal): 4W	*Transmitting branch loss, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Note ME-30B/U meter indication. *b.* Disconnect hookup wires of SG-15/PCM from CHAN 1 (A, fig. 128.6) and reconnect to 2W 4WT binding posts on CHAN 2, CHAN 3, and CHAN 4, in turn, and note ME-30B/U meter indication for each channel connection. *c.* Disconnect hookup wires of SG-15/PCM from binding posts of CHAN 4 and reconnect to 2W 4WT binding posts on CHAN 1 (fig. 128.6).	*a.* −45.5 dbm ±1. *b.* Same as *a* above. *c.* None.
2	Unchanged except: *ME-30B/U* DB VOLTS: −30 DB *SG-15/PCM* COARSE DBM: +10 FINE DBM: rotate until OUTPUT LEVEL meter indicates +5 (+15 dbm).	Unchanged.	*Transmitting branch overload loss, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Note ME-30B/U meter indication. *b.* Disconnect hookup wires from CHAN 1 (A, fig. 128.6) and reconnect to 2W 4WT binding posts on CHAN 2, CHAN 3, and CHAN 4, in turn, and note ME-30B/U meter indication for each channel connection. *c.* Disconnect hookup wires from binding posts on CHAN 4, and reconnect to 2W 4WT binding posts on CHAN 1 (A, fig. 128.6).	*a.* −27 dbm ±2. *b.* Same as *a* above. *c.* None.
3	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 1,000 cps. DBM FINE: rotate until OUTPUT LEVEL meter indicates 0 (−10 dbm). *ME-30B/U* DB VOLTS: −40 DB	Unchanged.	*Transmitting branch, order wire circuit, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Connect equipment as shown in B, figure 128.6. *b.* Operate TALK-MON switch on CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to TALK and record ME-30B/U meter indication as each TALK-MON switch is operated; operate TALK-MON switch to vertical position after each measurement is obtained.	*a.* None. *b.* −45 dbm ±2.
4	Unchanged.	Unchanged.	*Transmitting branch, test frequency circuit, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Disconnect hookup wires of SG-15/PCM from terminals C and M, and reconnect to terminals D and N (B, fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND position and record ME-30B/U meter indication as each switch is operated. Operate SEND-MEAS switch to vertical position after each measurement is obtained. *c.* Disconnect hookup wires of ME-30B/U from terminals A and K (B, fig. 128.6).	*a.* None. *b.* −45 dbm ±2. *c.* None.
5	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 7,000 cups. COURSE DBM: 0	Unchanged except: *CHAN 1* GAIN: fully clockwise 2W 4W: 4W	*Receiving branch, channel 1, GAIN control adjustment, CHAN MODEM 1* *a.* Connect equipment as shown in C, figure 128.6 and adjust equipment controls as given in *Test equipment control settings* column. *b.* Record ME-22/PCM db meter indication. *c.* Operate GAIN control on GAIN 1 fully counter-	*a.* None. *b.* Between +3 and +8 dbm *c.* At least 20 db less than indication

	(begin adjustments when XTAL OVEN ON lamp cycles on and off.) TIME-SECONDS: 1 FUNCTION: FREQ COUNT AUTO-MANUAL: AUTO DISPLAY TIME: 5 SENSITIVITY: meter needle at left in green area. TRIGGER VOLTAGE: clockwise from full counterclockwise until numerical indicators start to count; note control position. Continue clockwise until counting stops; note control position. Set control between two positions. Reset SENSITIVITY control until INPUT LEVEL meter indicates in center of green area.			
2	Unchanged except: *ME-30B/U* DB VOLTS: −30 DB *SG-15/PCM* COARSE DBM: +10 FINE DBM: rotate until OUTPUT LEVEL meter indicates +5 (+15 dbm).	Unchanged	*Transmitting branch overload loss, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Note ME-30B/U meter indication. *b.* Disconnect hookup wires from CHAN 1 (A, fig. 128.6) and reconnect to 2W 4WT binding posts on CHAN 2, CHAN 3, and CHAN 4, in turn, and note ME-30B/U meter indication for each channel connection. *c.* Disconnect hookup wires from binding posts on CHAN 4, and reconnect to 2W 4WT binding posts on CHAN 1 (A, fig. 128.6).	*a.* −27 dbm ±2. *b.* Same as *a* above. *c.* None.
3	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 1,000 cps. DBM FINE: rotate until OUTPUT LEVEL meter indicates 0 (−10 dbm). *ME-30B/U* DB VOLTS: −40 DB	Unchanged.	*Transmitting branch, order wire circuit, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Connect equipment as shown in B, figure 128.6. *b.* Operate TALK-MON switch on CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to TALK and record ME-30B/U meter indication as each TALK-MON switch is operated; operate TALK-MON switch to vertical position after each measurement is obtained.	*a.* None. *b.* −45 dbm ±2.
4	Unchanged.	Unchanged.	*Transmitting branch, test frequency circuit, channels 1, 2, 3, and 4, CHAN MODEM 1* *a.* Disconnect hookup wires of SG-15/PCM from terminals C and M, and reconnect to terminals D and N (B, fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND position and record ME-30B/U meter indication as each switch is operated. Operate SEND-MEAS switch to vertical position after each measurement is obtained. *c.* Disconnect hookup wires of ME-30B/U from terminals A and K (B, fig. 128.6).	*a.* None. *b.* −45 dbm ±2. *c.* None.
5	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 7,000 cups. COURSE DBM: 0 FINE DBM: rotate until OUTPUT LEVEL meter indicates −4 dbm. *ME-22/PCM* ON-OFF: ON INPUT IMPEDANCE: 600 OHM. DBM: 0 on SCALE A.	Unchanged except: *CHAN 1* GAIN: fully clockwise 2W–4W; 4W	*Receiving branch, channel 1, GAIN control adjustment, CHAN MODEM 1* *a.* Connect equipment as shown in C, figure 128.6 and adjust equipment controls as given in *Test equipment control settings* column. *b.* Record ME-22/PCM db meter indication. *c.* Operate GAIN control on GAIN 1 fully counterclockwise. Operate DBM switch on ME-22/PCM to −10 or −20 on SCALE B to obtain meter indication in center of meter scale. Note ME-22/PCM db meter indication. *d.* Operate DBM switch on ME-22/PCM to 0 on SCALE B. *e.* Adjust GAIN control on CHAN 1 until ME-22/PCM db meter indicates 0 on SCALE B.	*a.* None. *b.* Between +3 and +8 dbm. *c.* At least 20 db less than indication obtained in *b* above. *d.* None. *e.* 0 dbm.
6	Unchanged except: *ME-22/PCM* DB VOLTS: 0 on SCALE A. *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 11,000 cps.	Unchanged except: *CHAN 2* 2W–4W: 4W GAIN: fully clockwise.	*Receiving branch, channel 2, GAIN control adjustment, CHAN MODEM 1* *a.* Disconnect hookup wires of ME-22/PCM from CHAN 1 and reconnect to 4WR binding posts on CHAN 2 (C, fig. 128.6). Adjust equipment controls. *b.* Note ME-22/PCM db meter indication. *c.* Operate GAIN control on CHAN 2 fully counterclockwise. Operate DBM switch on ME-22/PCM to −10 or −20 on SCALE B to obtain meter indication in center of meter scale and note ME-22/PCM db meter indication. *d.* Operate DBM switch on ME-22/PCM to 0 on SCALE B. *e.* Adjust GAIN control on CHAN 2 until ME-22/PCM db meter indicates 0 on SCALE B.	*a.* None. *b.* Between +3 and +8 dbm. *c.* At least 20 db less than indication obtained in *b* above. *d.* None. *e.* 0 dbm.
7	Unchanged except: *ME-22/PCM* DBM: 0 on SCALE A. *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 15,000 cps.	Unchanged except: *CHAN 3* 2W–4W: 4W GAIN: fully clockwise.	*Receiving branch, channel 3, GAIN control adjustment, CHAN MODEM 1* *a.* Disconnect hookup wires of ME-22/PCM from CHAN 2, and reconnect to 4WR binding posts on CHAN 3 (C, fig. 128.6). Adjust equipment controls. *b.* Note ME-22/PCM db meter indication. *c.* Operate GAIN control on CHAN 3 fully counterclockwise. Operate DBM switch on ME-22/PCM to −10 or −20 on SCALE B to obtain meter indication in center of meter scale and note ME-22/PCM db meter indication. *d.* Operate DBM switch on ME-22/PCM to 0 on SCALE B. *e.* Adjust GAIN control on CHAN 3 until ME-22/PCM db meter indicates 0 on SCALE B.	*a.* None. *b.* Between +3 and +8 dbm. *c.* At least 20 db less than indication obtained in *b* above. *d.* None. *e.* 0 dbm.
8	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 19,000 cps.	Unchanged except: *CHAN 4* 2W–4W: 4W. GAIN: fully clockwise.	*Receiving branch, channel 4, GAIN control adjustment, CHAN MODEM 1* *a.* Disconnect hookup wires from CHAN 3 and reconnect to 4WR binding posts on CHAN 4 (C, fig. 128.6). Adjust equipment controls. *b.* Note ME-22/PCM db meter indication. *c.* Operate GAIN control on CHAN 4 fully counterclockwise. Operate DBM switch on ME-22/PCM to −10 or −20 on SCALE B to obtain meter indication in center of meter scale and note ME-22/PCM db meter indication. *d.* Operate DBM switch on ME-22/PCM to 0 on SCALE B. *e.* Adjust GAIN control on CHAN 4 until ME-22/PCM db meter indicates 0 on SCALE B.	*a.* None. *b.* Between +3 and +8 dbm. *c.* At least 20 db less than indication obtained in *b* above. *d.* None. *e.* 0 dbm.
9	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 7,000 cps.	Unchanged.	*Receiving branch, channel 1, test frequency circuit, CHAN MODEM 1* *a.* Disconnect hookup wires of ME-22/PCM from CHAN 4, and reconnect to terminals R and F on transmission test cable assembly (C, fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 1 to MEAS, and note ME-22/PCM db meter indication. Release SEND-MEAS switch.	*a.* None. *b.* 6 dbm ±0.5.
10	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 11,000 cps.	Unchanged.	*Receiving branch, channel 2, test frequency circuit, CHAN MODEM 1* Operate SEND-MEAS switch on CHAN 2, to MEAS, and note ME-22/PCM db meter indication. Release SEND-MEAS switch.	0 dbm ±0.5.
11	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 15,000 cps.	Unchanged.	*Receiving branch, channel 3, test frequency circuit, CHAN MODEM 1* Operate SEND-MEAS switch on CHAN 3 to MEAS, and note ME-22/PCM db meter indication. Release SEND-MEAS switch.	0 dbm ±0.5.
12	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 19,000 cps.	Unchanged.	*Receiving branch, channel 4, test frequency circuit, CHAN MODEM 1* Operate SEND-MEAS switch on CHAN 4 to MEAS and note ME-22/PCM db meter indication. Release SEND-MEAS switch.	0 dbm ±0.5.
13	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 7,000 cps.	Unchanged.	*Receiving branch, channel 1, order wire circuit, CHAN MODEM 1* *a.* Disconnect hookup wires of ME-22/PCM from terminals F and R, and reconnect to terminals B and L (C, fig. 128.6). *b.* Operate TALK-MON switch on CHAN 1 to TALK and note ME-22/PCM db meter indication. *c.* Operate DBM switch on ME-22/PCM to −20 on SCALE B. Operate TALK-MON switch on CHAN 1 to MON and note ME-22/PCM db meter indication. Release TALK-MON switch.	*a.* None. *b.* 0 dbm ±0.5. *c.* −21 dbm ±1.
14	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 11,000 cps. *ME-22/PCM* DBM: 0 on SCALE B.	Unchanged.	*Receiving branch, channel 2, order wire circuit, CHAN MODEM 1* *a.* Operate TALK-MON switch on CHAN 2 to TALK, and note ME-22/PCM db meter indication. *b.* Operate DBM switch on ME-22/PCM to −20 on SCALE B. Operate TALK-MON switch on CHAN 2 to MON, and note ME-22/PCM db meter indication. Release TALK-MON switch.	*a.* 0 dbm ±0.5. *b.* −21 dbm ±1.
15	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 15,000 cps. *ME-22/PCM* DBM: 0 on SCALE B	Unchanged.	*Receiving branch, channel 3, order wire circuit, CHAN MODEM 1* *a.* Operate TALK-MON switch on CHAN 3 to TALK and note ME-22/PCM db meter indication. *b.* Operate DBM switch on ME-22/PCM to −20 on SCALE B. Operate TALK-MON switch on CHAN 3 to MON, and note ME-22/PCM db meter indication. Release TALK-MON switch.	*a.* 0 dbm ±0.5. *b.* −21 dbm ±1.
16	Unchanged except: *SG-15/PCM* FREQUENCY: rotate until FR-114/U counts 19,000 cps. *ME-22/PCM* DBM: 0 on SCALE B	Unchanged	*Receiving branch, channel 4, order wire circuit, CHAN MODEM 1* *a.* Operate TALK-MON switch on CHAN 4 to TALK and note ME-22/PCM db meter indication. *b.* Operate DBM switch on ME-22/PCM to −20 on SCALE B. Operate TALK-MON switch on CHAN 4 to MON and note ME-22/PCM db meter indication. Release TALK-MON switch.	*a.* 0 dbm ±0.5 *b.* −21 dbm ±1
17	Unchanged except: *SG-15/PCM* FREQUENCY: 1 kc FINE DBM: rotate until OUTPUT LEVEL meter indicates −4 dbm. *ME-22/PCM* DBM: −30 on SCALE B	Unchanged except: 2W–4W (on CHAN 1, CHAN 2, CHAN 3, and CHAN 4): 2W.	*Hybrid balance, channel 1, CHAN MODEM 1* *a.* Connect equipment as shown in D, figure 128.6. *b.* Operate SEND-MEAS switch on CHAN 1 to SEND, and TALK-MON switch on CHAN 1 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Operate switches (*b* above) to vertical position.	*a.* None. *b.* None. *c.* −40 dbm or less. *d.* None.
18	Unchanged.	Unchanged.	*Hybrid balance, channel 2, CHAN MODEM 1* *a.* Disconnect 600-ohm resistor and 1-μf capacitors from CHAN 1 and reconnect to 2W–4WT binding posts on CHAN 2 (1), fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 2 to SEND, and TALK-MON switch on CHAN 2 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Operate switches (*b* above) vertical position.	*a.* None. *b.* None. *c.* −40 db or less. *d.* None.
19	Unchanged	Unchanged.	*Hybrid balance, channel 3, CHAN MODEM 1* *a.* Disconnect 600-ohm resistor and 1μf capacitors from CHAN 2 and reconnect to 2W–4WT binding posts on CHAN 3 (1), fig. 128.6). *b.* Operate SEND-MEAS switch on CHAN 3 to SEND, and TALK-MON switch on CHAN 3 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Operate switches (*b* above) to vertical position	*a.* None. *b.* None *c.* −40 dbm or less.
20	Unchanged	Unchanged	*Hybrid balance, channel 4, CHAN MODEM 1* *a.* Disconnect 600-ohm resistor and 1μf capacitors from CHAN 3 and reconnect to 2W–4WT binding posts on CHAN 4 (1), fig. 128.6). *b.* Operate SEND-MEAS switch to CHAN 4 to SEND, and TALK-MON switch to CHAN 4 to TALK. *c.* Note ME-22/PCM db meter indication. *d.* Remove test equipment connections (D, fig. 128.6). Remove CHAN MODEM 1 (being tested) from AN/TCC-7 and substitute original CHAN MODEM 1 in AN/TCC-7. Reconnect AN/TCC-7 cables to CHAN MODEM 1.	*a.* None. *b.* None. *c.* −40 dbm or less. *d.* None.

T.O. 31W1-2RC07-64

167.16. Tests of SUBGROUP PANEL

(fig. 128.7)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Terminal, Telephone AN/TCC–7	5805–503–1224	TM 11–2139–10
Signal Generator SG–15(*)/PCM [a]	6625–229–1087	TM 11–2096
Decibel Meter ME–22(*)/PCM [b]	6625–498–3469	TM 11–2096
Telephone Carrier System Test Facilities Kit MK–155/TCC	6625–603–9523	TB SIG 328
Hookup wire (approx 9 ft) [c]	6145–160–5300	

[a] Indicates Signal Generator SG–15/PCM or SG–15A/PCM. (Signal Generator SG–15/PCM is used in the test procedures (*c* below).)
[b] Indicates Decibel Meter ME–22/PCM or ME–22A/PCM. (Decibel Meter ME–22/PCM is used in the test procedures (*c* below).)
[c] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Interconnect, test, and calibrate an AN/TCC–7 (pars. 167.3*d* and 167.22*b* and *c*). After the AN/TCC–7 has been calibrated, do not change switch settings or control adjustments.
(2) Operate the AC POWER switch of the 200 VOLT POWER SUPPLY to OFF. Substitute the SUBGROUP PANEL to be tested for the SUBGROUP PANEL in the AN/TCC–7. Connect the substituted SUBGROUP PANEL to the AN/TCC–7.
(3) Calibrate the SG–15/PCM and the ME–22/PCM (par. 167.3*a* and *b*).

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*GROUP PANEL* 12–60KC: REGULAR 60–108KC (internal): REGULAR *CARRIER SUPPLY PANEL* CARRIER SYNC: LOCAL *TEST PANEL* MEASURE: TRANSMISSION MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: SUB GRP MOD IN *CHAN MODEMs 1, 2, and 3* SEND-MEAS switch on each CHAN 2: SEND *200 VOLT POWER SUPPLY* AC POWER: ON Other panels and controls of AN/TCC–7: unchanged from settings used in preliminary calibration procedures (par. 167.22).	*SUBGROUP PANEL* SPECIAL SERVICE 1, 2, and 3: CHAN MODEM TR AMP GAIN: fully clockwise	*Transmitting circuit input* *a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7), in turn, into MOD IN 1, MOD IN 2, and MOD IN 3 jacks on SUBGROUP PANEL (D, fig. 128.7). Note TEST PANEL meter indication for each jack circuit tested. *b.* Operate SEND-MEAS switch on each CHAN 2 to vertical position.	*a.* 0 db ±3. *b.* None.
2	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 83-KC MEASURE NONSELECTIVE: OFF *CHAN MODEM 2* SEND-MEAS switch of CHAN 2: SEND	Unchanged:	*83-kc transmission* *a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into 60–108 KC OUT jack on SUBGROUP PANEL (D, fig. 128.7). Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate TR AMP GAIN control (internal) on SUBGROUP PANEL to counterclockwise position. Note TEST PANEL meter indication. *c.* Operate TR AMP GAIN control on SUBGROUP PANEL to obtain 0-db indication on TEST PANEL meter. *d.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into jack assembly of adapter cord (A, fig. 128.7) and connect probes of adapter cord to 60–108 KC OUT and 60–108 KC OUT ALT binding posts, in turn, on SUBGROUP PANEL (E, fig. 128.7). Note TEST PANEL meter indication for each connection. *e.* Disconnect TEST PANEL measuring cord plug from jack assembly of adapter cord. Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* +2 db ±1. *b.* 6 db ±1 less than indication obtained in *a* above. *c.* 0 db. *d.* 0 db ±1. *e.* None.
3	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 67KC. *CHAN MODEM 1* SEND-MEAS switch of CHAN 2: SEND	Unchanged.	*67-kc transmission* *a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into 60–108 KC OUT jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *c.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position.	*a.* None. *b.* 0 db ±2. *c.* None.
4	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 99KC. *CHAN MODEM 3* SEND-MEAS switch of CHAN 2: SEND	Unchanged.	*99-kc transmission* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 3 to vertical position.	*a.* 0 db ±2. *b.* None.
5	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 37KC. *CHAN MODEM 2* SEND-MEAS switch of CHAN 2: SEND.	Unchanged.	*37-kc transmission* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into TR AMP OUT jack on GROUP PANEL (C, fig. 128.7). Adjust FINE TUNE control on TEST PANEL for peak indication on meter. Adjust TR AMP GAIN control on SUBGROUP PANEL until TEST PANEL meter indicates 0 db.	0 db.
6	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: GRP DEM OUT. MEASURE SELECTIVE: OFF.	Unchanged.	*Receiving circuit, input check* *a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM OUT jack on GROUP PANEL (C, fig. 128.7). Adjust DEM GAIN control on GROUP PANEL to obtain 0-db indication on TEST PANEL meter. *b.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into 60–108 KC IN jack on SUBGROUP PANEL (D, fig. 128.7). Note TEST PANEL meter indication. *c.* Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.7). Touch 60–108 KC IN binding posts on SUBGROUP PANEL (E, fig. 128.7) with probes of adapter cord and note TEST PANEL indication. *d.* Disconnect TEST PANEL measuring cord plug from jack assembly of adapter cord. Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* None. *b.* 0 db. *c.* 0 db. *d.* None.
7	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: SUB GRP DEM OUT. *CHAN MODEM 1* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*Receiving circuit, output of SUBGROUP PANEL to CHAN MODEM 1* *a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM OUT 1 jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Rotate DEM 1 GAIN control on SUBGROUP PANEL fully clockwise and note TEST PANEL meter indication. *c.* Rotate DEM 1 GAIN control fully counterclockwise and note TEST PANEL meter indication. *d.* Rotate DEM 1 GAIN control until TEST PANEL meter indicates 0 db. *e.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position.	*a.* None. *b.* Not less than +4 db. *c.* At least 9 db less than indication obtained in *b* above. *d.* 0 db. *e.* None.
8	Unchanged except: *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*Receiving circuit, output of SUBGROUP PANEL to CHAN MODEM 2* *a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM 2 OUT jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Rotate DEM 2 GAIN control on SUBGROUP PANEL fully clockwise and note TEST PANEL meter indication.	*a.* None. *b.* Not less than +4 db.

			67-kc transmission	
3	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 67KC. *CHAN MODEM 1* SEND-MEAS switch of CHAN 2: SEND	Unchanged.	*a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into 60–108 KC OUT jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *c.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position.	*a.* None. *b.* 0 db ±2. *c.* None.
			99-kc transmission	
4	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 99KC. *CHAN MODEM 3* SEND-MEAS switch of CHAN 2: SEND	Unchanged.	*a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 3 to vertical position.	*a.* 0 db ±2. *b.* None.
			37-kc transmission	
5	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 37KC. *CHAN MODEM 2* SEND-MEAS switch of CHAN 2: SEND.	Unchanged.	Insert TEST PANEL measuring cord plug (B, fig. 128.7) into TR AMP OUT jack on GROUP PANEL (C, fig. 128.7). Adjust FINE TUNE control on TEST PANEL for peak indication on meter. Adjust TR AMP GAIN control on SUBGROUP PANEL until TEST PANEL meter indicates 0 db.	0 db.
			Receiving circuit, input check	
6	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: GRP DEM OUT. MEASURE SELECTIVE: OFF.	Unchanged.	*a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM OUT jack on GROUP PANEL (C, fig. 128.7). Adjust DEM GAIN control on GROUP PANEL to obtain 0-db indication on TEST PANEL meter. *b.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into 60–108 KC IN jack on SUBGROUP PANEL (D, fig. 128.7). Note TEST PANEL meter indication. *c.* Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.7). Touch 60–108 KC IN binding posts on SUBGROUP PANEL (E, fig. 128.7) with probes of adapter cord and note TEST PANEL indication. *d.* Disconnect TEST PANEL measuring cord plug from jack assembly of adapter cord. Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* None. *b.* 0 db. *c.* 0 db. *d.* None.
			Receiving circuit, output of SUBGROUP PANEL to CHAN MODEM 1	
7	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: SUB GRP DEM OUT. *CHAN MODEM 1* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM OUT 1 jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Rotate DEM 1 GAIN control on SUBGROUP PANEL fully clockwise and note TEST PANEL meter indication. *c.* Rotate DEM 1 GAIN control fully counterclockwise and note TEST PANEL meter indication. *d.* Rotate DEM 1 GAIN control until TEST PANEL meter indicates 0 db. *e.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position.	*a.* None. *b.* Not less than +4 db. *c.* At least 9 db less than indication obtained in *b* above. *d.* 0 db. *e.* None.
			Receiving circuit, output of SUBGROUP PANEL to CHAN MODEM 2	
8	Unchanged except: *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM 2 OUT jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Rotate DEM 2 GAIN control on SUBGROUP PANEL fully clockwise and note TEST PANEL meter indication. *c.* Rotate DEM 2 GAIN control fully counterclockwise and note TEST PANEL meter indication. *d.* Rotate DEM 2 GAIN control until TEST PANEL meter indicates 0 db. *e.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* None. *b.* Not less than +4 db. *c.* At least 9 db less than indication obtained in *b* above. *d.* 0 db. *e.* None.
			Receiving circuit, output of SUBGROUP PANEL to CHAN MODEM 3	
9	Unchanged except: *CHAN MODEM 3* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into DEM 3 OUT jack on SUBGROUP PANEL (D, fig. 128.7). *b.* Rotate DEM 3 GAIN control on SUBGROUP PANEL fully clockwise and note TEST PANEL meter indication. *c.* Rotate DEM 3 GAIN control fully counterclockwise and note TEST PANEL meter indication. *d.* Rotate DEM 3 GAIN control until TEST PANEL meter indicates 0 db. *e.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 3 to vertical position.	*a.* None. *b.* Not less than +4 db. *c.* At least 9 db less than indication obtained in *b* above. *d.* 0 db. *e.* None.
			Receiving circuit, output of SUBGROUP PANEL through CHAN MODEM 1	
10	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: CHANNEL OUT. *CHAN MODEM 1* SEND-MEAS switch on CHAN 2: SEND. 2W–4W: 4W	Unchanged.	*a.* Insert TEST PANEL measuring cord plug (B, fig. 128.7) into jack assembly of adapter cord (A, fig. 128.7). Touch probes of adapter cord to 4WR binding posts on CHAN 2 on CHAN MODEM 1. *b.* Adjust GAIN control on CHAN 2 of CHAN MODEM 1 until TEST PANEL meter indicates 0 db. *c.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position.	*a.* None. *b.* 0 db. *c.* None.
			Receiving circuit, output of SUBGROUP PANEL through CHAN MODEM 2	
11	Unchanged except: *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND. 2W–4W: 4W	Unchanged.	*a.* Touch probes of adapter cord to 4WR binding posts on CHAN 2 of CHAN MODEM 2. Adjust GAIN control on CHAN 2 of CHAN MODEM 2 until TEST PANEL meter indicates 0 db. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* 0 db. *b.* None.
			Receiving circuit, output of SUBGROUP PANEL through CHAN MODEM 3	
12	Unchanged except: *CHAN MODEM 3* SEND-MEAS switch on CHAN 2: SEND. 2W–4W: 4W	Unchanged.	*a.* Touch probes of adapter cord to 4WR binding posts on CHAN 2 of CHAN MODEM 3. Adjust GAIN control on CHAN 2 of CHAN MODEM 3 until TEST PANEL meter indicates 0 db. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 3 to vertical position.	*a.* 0 db. *b.* None.
			Special service circuit, channel 1 of SUBGROUP PANEL	
13	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: OFF. *SG–15/PCM* ON-OFF: ON FREQUENCY: 10 kilocycles. COARSE DEM: 0 FINE DBM: 0 on OUTPUT LEVEL meter (0 dbm). *ME–22/PCM* ON-OFF: ON INPUT IMPEDANCE: 600 OHM. DBM: 0 on SCALE B.	Unchanged except: SPECIAL SERVICE 1: SPL SERV.	*a.* Connect equipment as shown (E, fig. 128.7). *b.* Note SPL SERV lamp indication. *c.* Note ME–22/PCM db meter indication.	*a.* None. *b.* SPL SERV lamp is lighted. *c.* 0 dbm ±1.
			Special service circuit, channel 2 of SUBGROUP PANEL	
14	Unchanged.	Unchanged except: SPECIAL SERVICE 1: CHAN MODEM SPECIAL SERVICE 2: SPL SERV	*a.* Disconnect hookup wires of SG–15/PCM from SPECIAL SERVICE 1 IN binding posts and reconnect to SPECIAL SERVICE 2 IN binding posts (E, fig. 128.7). Disconnect hookup wires of ME–22/PCM from SPECIAL SERVICE 1 OUT binding posts and reconnect to SPECIAL SERVICE 2 OUT binding posts. *b.* Note SPL SERV lamp indication. *c.* Note ME–22/PCM db meter indication.	*a.* None. *b.* SPL SERV lamp is lighted. *c.* 0 dbm ±1.
			Special service circuit, channel 3 of SUBGROUP PANEL	
15	Unchanged.	Unchanged except: SPECIAL SERVICE 2: CHAN MODEM. SPECIAL SERVICE 3: SPL SERV.	*a.* Disconnect hookup wires of SG–15/PCM from SPECIAL SERVICE 2 IN binding posts and reconnect to SPECIAL SERVICE 3 IN binding posts (E, fig. 128.7). Disconnect hookup wires of ME–22/PCM from SPECIAL SERVICE 2 OUT binding posts and reconnect to SPECIAL SERVICE 3 OUT binding posts. *b.* Note SPL SERV lamp indication. *c.* Note ME–22/PCM db meter indication. *d.* Operate SPECIAL SERVICE 3 switch on SUBGROUP PANEL to CHAN MODEM. *e.* Disconnect hookup wires of SG–15/PCM and ME–22/PCM from binding posts of SUBGROUP PANEL (E, fig. 128.7). Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF. Disconnect and remove SUBGROUP PANEL being tested from AN/TCC–7 and replace original SUBGROUP-PANEL in AN/TCC–7	*a.* None. *b.* SPL SERV lamp is lighted. *c.* 0 dbm ±1. *d.* None. *e.* None.

7.18. Te[illegible]ROUP PANEL

(fig. 1[illegible]

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Telephone Terminal AN/TCC-7	5805-228-1228	TM 11-2139-10
Generator, Signal SG-71(*)/FCC [a]	6625-669-0255	TM 11-5088
Voltmeter, Meter ME-30(*)/U [b]	6625-669-0742	TM 11-6625-320-12
Attenuator TS-402(*)/U [c]	5905-230-5149	TM 11-2044
Telephone Carrier System Test Facilities Kit MK-155/TCC	6625-603-9523	TB SIG 328
Adapter cord (part of AN/TCC-7)		
Hookup wire (approx 9 ft) [d]		

	to 0dbm = 0 db indication on ME-30B/U meter.		*f.* Remove measuring cord plug from adapter cord jack assembly (A, fig. 128.8).	*f.* None.
15	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: SPL SERV 60-108KC IN. *TS-402/U* Align all keys with white line parallel to long dimension of panel (0 db). *SG-71B/FCC* COARSE AMPLITUDE: fully counterclockwise.	Unchanged except: 60-108KC (internal): SPL SERV.	*60-108 kc, special service* *a.* Note SPL SERV lamp indication on GROUP PANEL. *b.* Disconnect hookup wires of T102 from MOD IN binding posts on GROUP PANEL (F, fig. 128.8) and reconnect to SPECIAL SERVICE 60-108KC IN binding posts. *c.* Insert TEST PANEL measuring cord plug into SPL SERV 60-108KC IN jack (internal) (F, fig. 128.8) on GROUP PANEL. *d.* Rotate COARSE AMPLITUDE control on SG-71B/FCC clockwise *until* TEST PANEL *meter indicates −4 db.* *e.* Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (D, fig. 128.8). *f.* Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.8). Touch probes of adapter cord to SPECIAL SERVICE 60-108KC OUT binding posts (F, fig. 128.8).	*a.* SPL SERV lamp is lighted. *b.* None. *c.* None. *d.* −4 db. *e.* 0 db ±1. *f.* Same as obtained in *e* above, ±1.
16	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: GRP SPL SERV 12-60 KC IN. *SG-71B/FCC* Tuning dial: 50 COARSE AMPLITUDE: fully counterclockwise.	Unchanged except: 60-108KC (internal): REGULAR 12-60KC: SPL SERV	*12-60 kc, special service* *a.* Note SPL SERV lamp indication on GROUP PANEL. *b.* Disconnect hookup wires of T102 from SPECIAL SERVICE 60-108KC IN binding posts and reconnect to SPECIAL SERVICE 12-60KC IN binding posts (F, fig. 128.8). *c.* Insert TEST PANEL measuring cord plug into SPL SERV 12-60KC IN jack on GROUP PANEL (F, fig. 128.8). *d.* Rotate COARSE AMPLITUDE control on SG-71B/FCC *until* TEST PANEL *meter indicates 0 db.* *e.* Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (D, fig. 128.8). *f.* Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.8). Touch probes of adapter cord to SPECIAL SERVICE 12-60KC OUT binding posts (F, fig. 128.8). *g.* Operate AC POWER switch to 200 VOLT POWER SUPPLY to OFF. Disconnect test setup (E and F, fig. 128.8). Remove GROUP PANEL from AN/TCC-7 and replace original GROUP PANEL in AN/TCC-7.	*a.* SPL SERV lamp is lighted. *b.* None. *c.* None. *d.* 0 db. *e.* 0 db ±1. *f.* 0 db ±1. *g.* None.

T.O. 31W1-2RCC7-64

167.18. Te[illegible]ROUP PANEL

(fig. 1[illegible])

a. Test Equipment and Material.

Nomenclature	Federal stock No	Technical publication
Telephone Terminal AN/TCC-7	5805-228-1228	TM 11-2139 10
Generator, Signal SG-71(*)/FCC [a]	6625-669-0255	TM 11-5088
Voltmeter, Meter ME-30(*)/U [b]	6625-669-0742	TM 11-6625-320-12
Attenuator TS-402(*)/U [c]	5905-230-5419	TM 11-2014
Telephone Carrier System Test Facilities Kit MK-135/TCC	6625-669-9523	TB SIG 328
Adapter cord (part of AN/TCC-7)		
Hookup wire (approx 9 ft) [d]	6145-160-5300	

[a] Generator, Signal SG-71(*)/FCC designates Generator, Signal SG-71/FCC, SG-71A/FCC, or SG-71B/FCC (Generator, Signal SG-71B/FCC is used in the test procedures (*c* below).)
[b] Voltmeter, Meter ME-30(*)/U designates Voltmeter, Meter ME-30A/U, or Voltmeter, Electronic ME-30B/U or ME-30C/U. (Voltmeter, Electronic ME-30B/U is used in the test procedures (*c* below).)
[c] Attenuator TS-402(*)/U designates Attenuator TS-402/U or TS-402A/U. (Attenuator TS-402/U is used in the test procedures (*c* below).)
[d] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Test interconnect, and calibrate an AN/TCC-7 (pars. 167.3*d* and 167.22*b* and *c*). After the AN/TCC-7 has been calibrated, do not change switch settings and control adjustments.

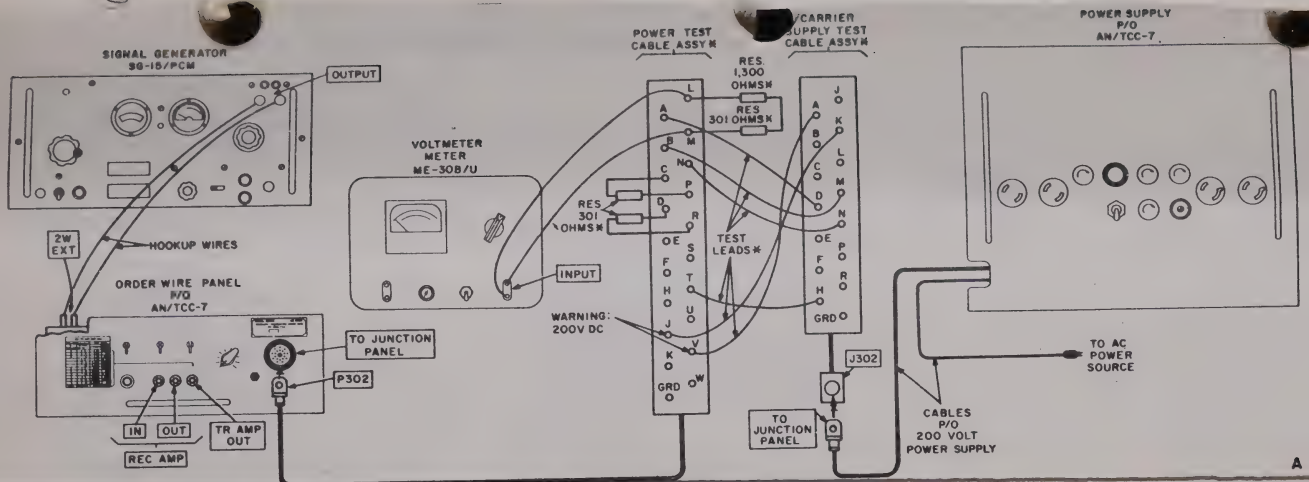
(2) Operate the AC POWER switch of the 200 VOLT POWER SUPPLY to OFF. Substitute the GROUP PANEL to be tested for the GROUP PANEL in the AN/TCC-7. Connect the substituted GROUP PANEL to the AN/TCC-7.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*SUBGROUP PANEL* SPECIAL SERVICE 1, SERVICE 2, and SPECIAL SERVICE 3 (internal): CHAN MODEM *CARRIER SUPPLY PANEL* CARRIER SYNC: LOCAL *200 VOLT POWER SUPPLY* AC POWER: ON *TEST PANEL* MEASURE: TRANSMISSION MEASURE SELECTIVE: 68KC MEASURE NONSELECTIVE: OFF SEND: CHECK GAIN CHECK HF. Other panels and controls of AN/TCC-7: unchanged from settings used in calibration procedures (par. 167.22).	*GROUP PANEL* TR CABLE REELS TO FIRST AN/TCC-11: 11 REC CABLE REELS TO FIRST AN/TCC-11: 11 SLOPE ADJ 12KC (internal): 0 BULGE ADJ 28KC (internal): 0 REGULATOR (internal): MAN 60-108KC (internal): REGULAR 12-60KC: REGULAR FLAT ADJ 68KC: set to same position as that in removed GROUP PANEL ALARM CUTOFF: NORMAL If buzzer is sounding, operate to position that stops buzzing.	*68-kc transmission* *a.* Insert TEST PANEL measuring cord plug (C, fig. 128.8) into TR AMP OUT jack on GROUP PANEL (D, fig. 128.8). *b.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	*a.* None. *b.* 0 db.
2	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 37KC *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*37-kc transmission* *a.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* 0 db. *b.* None.
3	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 68KC	Unchanged.	*62-kc transmission and jack circuit* *a.* Insert TEST PANEL measuring cord plug into TR 62KC jack on GROUP PANEL (D, fig. 128.8). *b.* Adjust FINE TUNE control on TEST PANEL *to obtain 0-db* indication on TEST PANEL meter. *Note.* This procedure tests TR 62KC *jack circuit.* *c.* Operate MEASURE SELECTIVE switch on TEST PANEL to GRP PAN 62KC, MEASURE NONSELECTIVE to GRP PAN 62KC, and SEND switch to 65KC TR OR FAULT TEST. *d.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	*a.* None. *b.* 0 db. *c.* None. *d.* No indication, or indication is to left of −5 db.
4	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 68-KC MEASURE NONSELECTIVE: OFF SEND: CHECK GAIN CHECK HF	Unchanged.	*68-kc reception* *a.* Insert TEST PANEL measuring cord plug into REC IN jack on GROUP PANEL (D, fig. 128.8). *b.* Rotate FINE TUNE control on TEST PANEL to obtain peak indication on meter. If indication is past +7 db, operate ATTENUATOR 5db pushbutton on TEST PANEL and adjust FINE TUNE control for peak meter indication.	*a.* None. *b.* +8 db ±1.
5	Unchanged.	Unchanged except: TR CABLE REELS TO FIRST AN/TCC-11 (internal): 2 REC CABLE REELS TO FIRST AN/TCC-11 (internal): 23	*TR and REC CABLE REELS TO FIRST AN/TCC-11 switches function* *a.* Adjust FINE TUNE control on TEST PANEL *to obtain 0-db meter indication.* *b.* Operate TR CABLE REELS TO FIRST AN/TCC-11 to 5 and REC CABLE REELS TO FIRST AN/TCC-11 to 20. *c.* Operate TR CABLE REELS TO FIRST AN/TCC-11 clockwise to each position, in turn, and simultaneously operate REC CABLE REELS TO FIRST AN/TCC-11 counterclockwise one position for each position of TR CABLE REELS TO FIRST AN/TCC-11 switch. (Sum of numerals of both switches will be 25.) Note TEST PANEL meter indication obtained for each paired switch operation. *d.* Operate TR CABLE REELS TO FIRST AN/TCC-11 and REC CABLE REELS to FIRST AN/TCC-11 switches to 11.	*a.* 0 db. *b.* 0 db ±0.5. *c.* 0 db ±0.5. *d.* None.
6	Unchanged except: *ME-30B/U* DB VOLTS: −20 DB	Unchanged except: FLAT ADJ 68KC: fully clockwise. *Note.* Operate ALARM CUTOFF switch as necessary to silence alarm buzzer.	*68-kc reception, flat gain adjustment* *a.* Connect equipment as shown in G, figure 128.8. Insert plug of test plug assembly into REC AMP 1 OUT jack On GROUP PANEL (D, fig. 128.8). Note ME-30B/U meter indication. *b.* Operate FLAT ADJ 68KC control on GROUP PANEL fully counterclockwise. Operate DB VOLTS switch on ME-30B/U to −50 DB and note meter indication. *c.* Remove plug of test plug assembly from GROUP PANEL. Operate FLAT ADJ 68KC control to position 4. *d.* Insert TEST PANEL measuring cord plug into REC AMP 1 OUT jack on GROUP PANEL (D, fig. 128.8). Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *e.* Adjust FLAT ADJ 68KC control to obtain 0-db indication on TEST PANEL meter.	*a.* −27 db ±2. *b.* −54 db ±2. *c.* None. *d.* None. *e.* 0 db; obtained with control setting between 2 and 6.
7	Unchanged.	Unchanged.	*68-kc reception and alarm adjustments* *a.* Insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack on GROUP PANEL (D, fig. 128.8). Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *b.* Depress ATTENUATOR 10db pushbutton on TEST PANEL and rotate MAN REG OUTPUT control (internal) on GROUP PANEL fully clockwise; note TEST PANEL meter indication. Release 10db pushbutton. *c.* Rotate MAN REG OUTPUT control fully counterclockwise, and note TEST PANEL meter indication. *d.* Adjust MAN REG OUTPUT control to obtain 0-db indication on TEST PANEL meter. *e.* Operate ADJ LOW and ADJ HIGH controls (internal) on GROUP PANEL fully counterclockwise. *f.* Operate ALARM TEST switch (internal) on GROUP PANEL to 1 HIGH and adjust ADJ HIGH control *slowly* clockwise until alarm sounds. *g.* Release ALARM TEST switch. *h.* Operate ALARM TEST switch to 2 LOW and adjust ADJ LOW control *slowly* clockwise until alarm first sounds. *i.* Release ALARM TEST switch. *j.* Operate REGULATOR switch (internal) on GROUP PANEL to AUTO, and adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter. *k.* Adjust AUTO REG OUTPUT control (internal) on GROUP PANEL until TEST PANEL meter indication stabilizes at 0 db. *l.* Remove TEST PANEL measuring cord plug from REC AMP 2 OUT jack. *m.* Insert plug of test plug assembly (G, fig. 128.8) into REC AMP 2 OUT jack on GROUP PANEL (D, fig. 128.8). Operate DB VOLTS switch on ME-30B/U to −30 DB and note ME-30B/U meter indication *Note.* Immediately go to *n* above. Do not adjust any controls obtained in *n* below. *n.* Rotate AUTO REG OUTPUT control fully counterclockwise. Operate DB VOLTS switch on ME-30B/U to −40 DB and note meter indication after meter stabilizes (approx 1 minute) Note the *difference* between this meter indication and that obtained in *m* above. *o.* Disconnect plug of test plug assembly from REC AMP 2 OUT jack and insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack. Readjust AUTO REG OUTPUT control until TEST PANEL meter indication stabilizes at 0 db and no alarm indications exist. *p.* Operate REC CABLE REELS TO FIRST AN/TCC-11 switch on GROUP PANEL to 5 *q.* Operate ALARM CUTOFF switch on GROUP PANEL to LOW ALARM. *r.* Operate ALARM CUTOFF switch to NORMAL and record buzzer indication. *s.* Operate REC CABLE REELS TO FIRST AN/TCC-11 switch to 17. *t.* Operate ALARM CUTOFF switch to HIGH ALARM. *u.* Operate ALARM CUTOFF switch to NORMAL. *v.* Operate REC CABLE REELS TO FIRST AN/TCC-11 to 11. Wait until TEST PANEL meter stabilizes (approx 1 min) and note indications.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* Buzzer sounds and HIGH ALARM lamp lights. *g.* Buzzer stops sounding and HIGH ALARM lamp is extinguished. *h.* Buzzer sounds and LOW ALARM lamp lights *i.* Buzzer stops sounding and LOW ALARM lamp is extinguished *j.* None. *k* 0 db. (No high- or low-alarm indications should occur.) *l.* None. *m.* None. *n.* 9 db ±1. *o.* None. *p.* Alarm buzzer sounds and LOW ALARM lamp lights. *q.* On GROUP PANEL, alarm buzzer stops sounding and LOW ALARM lamp is lighted. TEST PANEL meter needle slowly returns toward 0 db. At 0 db ±0.5 indication, LOW ALARM lamp is extinguished and buzzer sounds. *r.* Buzzer is silenced. *s.* Alarm buzzer sounds and HIGH ALARM lamp lights. *t.* On GROUP PANEL, alarm buzzer stops sounding and HIGH ALARM lamp is lighted. TEST PANEL meter needle slowly returns toward 0 db. At 0 db ±0.5 indication, HIGH ALARM lamp is extinguished and buzzer sounds. *u.* Buzzer is silenced. *v.* TEST PANEL meter indicates 0 db ±0.5; GROUP PANEL buzzer is silenced and LOW ALARM lamp is extinguished.
8	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 12KC *CARRIER SUPPLY PANEL*	Unchanged.	*SLOPE ADJ 12KC control adjustment* *a.* Adjust FINE TUNE control on TEST PANEL for 0-db indication on meter. *b.* Rotate SLOPE ADJ 12 KC control (internal) on GROUP PANEL *counterclockwise* from 0, one position at a time. Note TEST PANEL meter	*a.* None. *b.* 1.25-db decrease from one position to next position.

			k. Adjust AUTO REG OUTPUT control (internal) on GROUP PANEL until TEST PANEL meter indication stabilizes at 0 db.	*k.* 0 db. (No high- or low-alarm indications should occur.)
			l. Remove TEST PANEL measuring cord plug from REC AMP 2 OUT jack.	*l.* None.
			m. Insert plug of test plug assembly (G, fig. 128.8) into REC AMP 2 OUT jack on GROUP PANEL (D, fig. 128.8). Operate DB VOLTS switch on ME–30B/U to −30 DB and note ME–30B/U meter indication. *Note.* Indication is to be compared with indication obtained in *n* below.	*m.* None.
			n. Rotate AUTO REG OUTPUT control fully counterclockwise. Operate DB VOLTS switch on ME–30B/U to −40 DB and note meter indication after meter stabilizes (approx 1 minute). Note the *difference* between this meter indication and that obtained in *m* above.	*n.* 9 db ±1.
			o. Disconnect plug of test plug assembly from REC AMP 2 OUT jack and insert TEST PANEL measuring cord plug into REC AMP 2 OUT jack. Readjust AUTO REG OUTPUT control until TEST PANEL meter indication stabilizes at 0 db and no alarm indications exist.	*o.* None.
			p. Operate REC CABLE REELS TO FIRST AN/TCC–11 switch on GROUP PANEL to 5.	*p.* Alarm buzzer sounds and LOW ALARM lamp lights.
			q. Operate ALARM CUTOFF switch on GROUP PANEL to LOW ALARM.	*q.* On GROUP PANEL, alarm buzzer stops sounding and LOW ALARM lamp is lighted. TEST PANEL meter needle slowly returns toward 0 db. At 0 db ±0.5 indication, LOW ALARM lamp is extinguished and buzzer sounds.
			r. Operate ALARM CUTOFF switch to NORMAL and record buzzer indication.	*r.* Buzzer is silenced.
			s. Operate REC CABLE REELS TO FIRST AN/TCC–11 switch to 17.	*s.* Alarm buzzer sounds and HIGH ALARM lamp lights.
			t. Operate ALARM CUTOFF switch to HIGH ALARM.	*t.* On GROUP PANEL, alarm buzzer stops sounding and HIGH ALARM lamp is lighted. TEST PANEL meter needle slowly returns toward 0 db. At 0 db ±0.5 indication, HIGH ALARM lamp is extinguished and buzzer sounds.
			u. Operate ALARM CUTOFF switch to NORMAL.	*u.* Buzzer is silenced.
			v. Operate REC CABLE REELS TO FIRST AN/TCC–11 to 11. Wait until TEST PANEL meter stabilizes (approx 1 min) and note indications.	*v.* TEST PANEL meter indicates 0 db ±0.5; GROUP PANEL buzzer is silenced and LOW ALARM lamp is extinguished.
8	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 12KC *CARRIER SUPPLY PANEL* 12 & 28 KC: ON (12 & 28 KC lamp lights).	Unchanged.	*SLOPE ADJ 12KC control adjustment* *a.* Adjust FINE TUNE control on TEST PANEL for 0-db indication on meter.	*a.* None.
			b. Rotate SLOPE ADJ 12 KC control (internal) on GROUP PANEL *counterclockwise* from 0, one position at a time. Note TEST PANEL meter indication for each position and note *db difference* between each adjacent position.	*b.* 1.25-db decrease from one position to next position.
			c. Note TEST PANEL meter indication when SLOPE ADJ 12 KC control is at −5 position. *Note.* Indication is to be compared with indication obtained in *f* below.	*c.* None.
			d. Rotate SLOPE ADJ 12KC control to 0.	*d.* None.
			e. Rotate SLOPE ADJ 12KC control *clockwise*, one position at a time, and note TEST PANEL meter indication for each position. Note *db difference* between each adjacent switch position.	*e.* 1.25-db increase from one position to next position.
			f. Note TEST PANEL meter indication when SLOPE ADJ 12 KC control is at +5 position.	*f.* None.
			g. Compute db difference between meter indications obtained in *e* and *f* above.	*g.* Not less than 12 db nor more than 14 db.
			h. Rotate SLOPE ADJ 12KC control counterclockwise to 0.	*h.* None.
9	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 28 KC	Unchanged.	*BULGE ADJ 28KC control adjustment* *a.* Adjust FINE TUNE control on TEST PANEL to obtain peak meter indication.	*a.* None.
			b. Rotate BULGE ADJ 28KC control (internal) *on* GROUP PANEL *counterclockwise* from 0, one position at a time. Note TEST PANEL meter indication for each position and note *db difference* between each adjacent position.	*b.* 0.75-db decrease from one position to next position.
			c. Note TEST PANEL meter indication when BULGE ADJ 28KC control is at −5 position. *Note.* Indication is to be compared with indication obtained in *f* below.	*c.* None.
			d. Rotate BULGE ADJ 28KC control to 0.	*d.* None.
			e. Rotate BULGE ADJ 28KC control *clockwise*, one position at a time, and note TEST PANEL meter indication for each position. Note *db difference* between each adjacent position.	*e.* 0.75-db increase from one position to next position.
			f. Note TEST PANEL meter indication when BULGE ADJ 28KC control is at +5 position.	*f.* None.
			g. Compute db difference between meter indications obtained in *c* and *f* above.	*g.* Not less than 6 db nor more than 8 db.
			h. Rotate BULGE ADJ 28KC control counterclockwise to 0.	*h.* None.
			i. Operate 12 & 28 KC switch on TEST PANEL to OFF.	*i.* None.
10	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 65KC SEND: 65KC REC (SEND lamp lights)	Unchanged.	*65-kc reception* *a.* Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	*a.* None.
			b. Adjust 65 KC REC control on TEST PANEL to obtain 0-db indication on meter.	*b.* 0 db.
11	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 68KC SEND: CHECK GAIN CHECK HF	Unchanged.	*62-kc reception and jack circuit* *a.* Insert TEST PANEL measuring cord plug into REC 62KC jack on GROUP PANEL (D, fig. 128.8).	*a.* None.
			b. Adjust FINE TUNE control on TEST PANEL to obtain 0-db indication on TEST PANEL meter. *Note.* This procedure tests REC 62KC jack circuit.	*b.* 0 db.
			c. Operate MEASURE SELECTIVE switch on TEST PANEL to GRP PAN 62KC. MEASURE NONSELECTIVE switch to GRP PAN 62KC, and SEND switch to 65KC REC	*c.* None.
			d. Adjust FINE TUNE control on TEST PANEL to obtain peak indication on meter.	*d.* No indication, or indication is to left of −5 db.
12	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: GRP DEM OUT. SEND: CHECK GAIN CHECK HF *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	Unchanged.	*Demodulation adjustment* *a.* Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (D, fig. 128.8).	*a.* None.
			b. Rotate DEM GAIN control on GROUP PANEL fully counterclockwise.	*b.* −4 db ±1.
			c. Depress ATTENUATOR 5db pushbutton on TEST PANEL and rotate DEM GAIN control fully clockwise.	*c.* +8 db ±1.
			d. Release ATTENUATOR 5db pushbutton and rotate DEM GAIN control counterclockwise until TEST PANEL meter indicates 0 db.	*d.* 0 db.
			e. Insert TEST PANEL measuring cord plug into 60–108 KC IN jack SUBGROUP PANEL (F, fig. 128.8).	*e.* 0 db.
			f. Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*f.* None.
13	Unchanged except: *CARRIER SUPPLY PANEL* CARRIER SYNC: REMOTE *TEST PANEL* MEASURE NONSELECTIVE: CARR SUPPLY. MEASURE SELECTIVE: OFF	Unchanged.	*Remote 65-kc reception* *a.* Insert TEST PANEL measuring cord plug into SYNC jack (internal) on CARRIER SUPPLY PANEL (B, fig. 128.8).	*a.* 0 db ±3.
			b. Operate CARRIER SYNC switch on CARRIER SUPPLY PANEL to LOCAL.	*b.* None.
14	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: GRP DEM OUT. *TS–402/U* Align white line on all keys parallel with long dimension on panel (0 db). *ME–30B/U* DB VOLTS: 0 DB *SG–71B/FCC* Power switch: ON MOD BAL.–BAL.–UNBAL: BAL. RANGE: X1000 Tuning dial: 80 COARSE AMPLITUDE: adjust to obtain −6 db indication on ME–30B/U meter.	Unchanged.	*External equipment circuits* *a.* Connect equipment as shown in E, figure 128.8 and adjust as given in *Test equipment control settings* column.	*a.* None.
			b. Operate 20, 10, and 5 keys on TS–402/U to align white line with short dimension on panel (35 db). Disconnect 135-ohm resistor and ME–30B/U from T102. (E, fig. 128.8), and connect equipment as shown in *F*, figure 128.8.	*b.* None.
			c. Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (D, fig. 128.8).	*c.* 0 db ±1.
			d. Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.8).	*d.* None.
			e. Connect probes of adapter cord to DEM OUT and DEM OUT ALT bindling posts (F, fig. 128.8), in turn , and note TEST PANEL meter indication for each connection.	*e.* Same as obtained in *c* above.
			f. Remove measuring cord plug from adapter cord jack assembly (A, fig. 128.8)	*f.* None
15	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: SPL SERV 60–108KC IN. *TS–402/U* Align all keys with white line parallel to long dimension of panel (0 db). *SG–71B/FCC* COARSE AMPLITUDE: fully counterclockwise.	Unchanged except: 60–108KC (internal): SPL SERV.	*60–108 kc. special service* *a.* Note SPL SERV lamp indication on GROUP PANEL.	*a.* SPL SERV lamp is lighted.
			b. Disconnect hookup wires of T102 from MOD IN binding posts on GROUP PANEL (F, fig. 128.8) and reconnect to SPECIAL SERVICE 60–108KC IN binding posts.	*b.* None.
			c. Insert TEST PANEL measuring cord plug into SPL SERV 60–108KC IN jack (internal) (F, fig. 128.8) on GROUP PANEL.	*c.* None.
			d. Rotate COARSE AMPLITUDE control on SG–71B/FCC clockwise *until* TEST PANEL *meter indicates −4 db.*	*d.* −4 db.
			e. Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (D, fig. 128.8.	*e.* 0 db ±1.
			f. Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.8). Touch probes of adapter cord to SPECIAL SERVICE 60–108KC OUT binding posts (F, fig. 128.8).	*f.* Same as obtained in *e* above, ±1.
16	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: GRP SPL SERV 12–60 KC IN. *SG–71B/FCC* Tuning dial: 50 COARSE AMPLITUDE: fully counterclockwise.	Unchanged except: 60–108KC (internal): REGULAR 12–60KC: SPL SERV	*12–60 kc. special service* *a.* Note SPL SERV lamp indication on GROUP PANEL.	*a.* SPL SERV lamp is lighted.
			b. Disconnect hookup wires of T102 from SPECIAL SERVICE 60–108KC IN binding posts and reconnect to SPECIAL SERVICE 12–60KC IN binding posts (F, fig. 128.8).	*b.* None.
			c. Insert TEST PANEL measuring cord plug into SPL SERV 12–60KC IN jack on GROUP PANEL (F, fig. 128.8).	*c.* None.
			d. Rotate COARSE AMPLITUDE control on SG–71B/FCC *until* TEST PANEL *meter indicates 0 db.*	*d.* 0 db.
			e. Insert TEST PANEL measuring cord plug into DEM OUT jack on GROUP PANEL (D, fig. 128.8).	*e.* 0 db ±1.
			f. Insert TEST PANEL measuring cord plug into jack assembly of adapter cord (A, fig. 128.8). Touch probes of adapter cord to SPECIAL SERVICE 12–60KC OUT binding posts (F, fig. 128.8).	*f.* 0 db ±1.
			g. Operate AC POWER switch to 200 VOLT POWER SUPPLY to OFF. Disconnect test setup (E and F, fig. 128.8). Remove GROUP PANEL from AN/TCC–7 and replace original GROUP PANEL in AN–TCC–7.	*g.* None.

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			Note ME-30B/U meter indication. *c.* Rotate REC GAIN control fully clockwise.	*c.* None.
11	Unchanged except: *SG-15/PCM* COARSE DBM: −40 FINE DBM: adjust to obtain −4 indication on OUTPUT LEVEL meter (−44 db) *ME-30B/U* DB VOLTS: −10 DB	Unchanged except: ORDER WIRE: TALK	*Receiving branch, handset receiving circuit* *a.* Label and remove handset cable wires connected to terminals 3 and 4 *or* 3 and 5 of terminal board TB101 (J, fig. 128.9). Connect equipment as shown in J, figure 128.9. *b.* Note ME-30B/U meter indication. *c.* Disconnect hookup wire of ME-30B/U from terminal 5 and reconnect to terminal 4 of TB101 (J, fig. 128.9). Note ME-30B/U meter indication. *d.* Disconnect test setup (J, fig. 128.9). Reconnect handset cable wires to original terminals. *e.* Listen for test tone in ORDER WIRE PANEL handset receiver.	*a.* None. *b.* −12 db ±3. *c.* 7 db ±1 less than indication obtained in *b* above. *d.* None *e.* Tone is heard in handset receiver.
12	Unchanged.	Unchanged except: ORDER WIRE: TALK CHANNEL TALK: TEST BD	*Receiving branch, channel circuits reception* *a.* Connect ME-30B/U as shown in H, figure 128.9 *b.* Note ME-30B/U meter indication. *c.* Disconnect hookup wires of ME-30B/U from terminals C and P, and reconnect to terminals D and R (H, fig. 128.9). Operate CHANNEL TALK switch on ORDER WIRE PANEL to LINE: *d.* Note ME-30B/U meter indications. *e.* Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF. Disconnect test connections.	*a.* None. *b.* −12 db ±2. *c.* None. *d.* Same as obtained in *b* above. *e.* None.

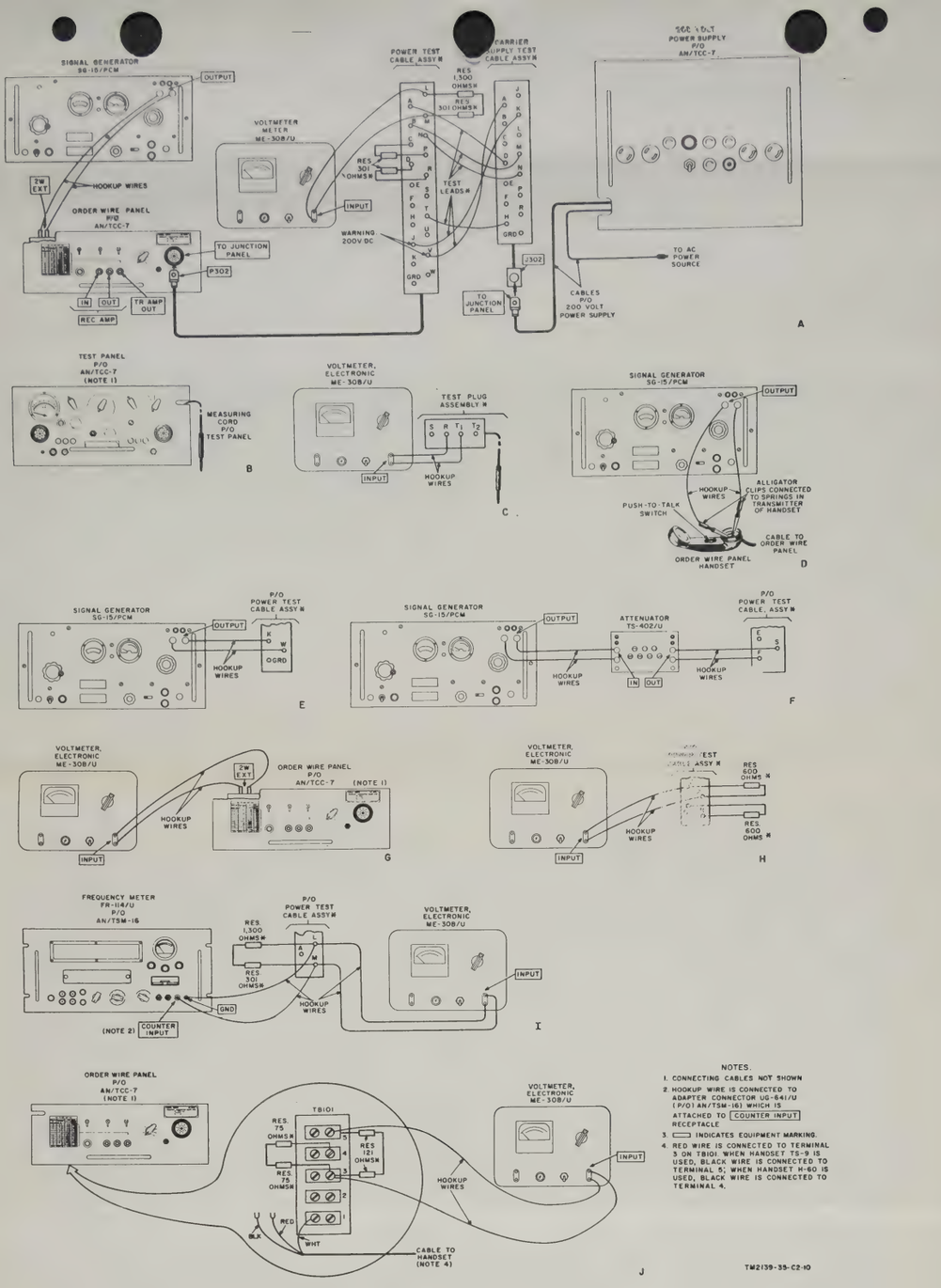


Figure 128.9. Test setups for fourth echelon tests of ORDER WIRE PANEL.

Section IX. FOURTH ECHELON TESTS OF RECEIVER-TRANSMITTER ORDER WIRE RT-280/TCC-7 (ORDER WIRE PANEL)

167.20. Tests of ORDER WIRE PANEL

(fig. 128.9)

a. Test Equipment and Material.

Nomenclature	Federal stock No.	Technical publication
Power Supply PP-827/U (200 VOLT POWER SUPPLY) (part of AN/TCC-7)	5805-500-4436	TM 11-2139-10
Signal Generator SG-15(*)/PCM [a]	6625-229-4087	TM 11-2096
Voltmeter, Electronic ME-30(*)/U [b]	6625-669-0742	TM 11-6625-320-12
Frequency Meter AN/TSM-16	6625-542-1666	TM 11-6625-218-12
Attenuator TS-402(*)/U [c]	5905-230-5149	TM 11-2044
Telephone Carrier System Test Facilities Kit MK-155/TCC	6625-603-9523	TB SIG 328
Hookup wire (approx 8 ft) [d]	6145-160-5300	

[a] Signal Generator SG-15(*)/PCM designates Signal Generator SG-15/PCM or SG-15A/PCM. (Signal Generator SG-15/PCM is used in the test procedures (*c* below).)
[b] Voltmeter, Electronic ME-30(*)/U designates Voltmeter, Electronic ME-30B/U or ME-30C/U, or Voltmeter, Meter ME-30A/U. (Voltmeter, Electronic ME-30B/U is used in the test procedures (*c* below).)
[c] Attenuator TS-402(*)/U designates Attenuator TS-402/U or TS-402A/U. (Attenuator TS-402/U is used in the test procedures (*c* below).)
[d] Any hookup wire #16 to #20 AWG may be used.

b. Test Connections and Conditions.

(1) Operate the AC POWER switch on the 200 VOLT POWER SUPPLY to OFF.

(2) Connect the equipment as shown in A, figure 128.9.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*200 VOLT POWER SUPPLY* AC POWER: ON *SG-15/PCM* ON-OFF: ON FREQUENCY: 1,000 cps COARSE DBM: −10 FINE DBM: adjust for −4 dbm indication on OUTPUT LEVEL meter (−14 db). *ME-30B/U* ON-OFF: ON DB VOLTS: +10 DB	*ORDER WIRE PANEL* CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8: RADIO SEND OW: vertical ORDER WIRE: vertical CHANNEL TALK: LINE TR GAIN (internal): fully clockwise. REC GAIN: fully counterclockwise.	*Transmitting branch, signal transmission* *a.* Note ME-30B/U meter indication. *b.* Disconnect hookup wires of ME-30B/U from test setup (A, fig. 128.9) and reconnect as shown in C, figure 128.9. *c.* Insert plug of test plug assembly (C, fig. 128.9) into TR AMP OUT jack on ORDER WIRE PANEL (A, fig. 128.9). Record ME-30B/U meter indication. *d.* Remove plug of test plug assembly from TR AMP OUT jack. Disconnect hookup wires of ME-30B/U from test plug assembly (C, fig. 128.9) and reconnect to terminals L and M (A, fig. 128.9). *e.* Operate TR GAIN control on ORDER WIRE PANEL fully counterclockwise. Operate DB VOLTS switch on ME-30B/U to −20 DB.	*a.* +12.5 db ±2. *b.* None. *c.* Within 0.5 db of indication obtained in *a* above. *d.* None. *e.* −27 db ±2.
2	Unchanged except: *SG-15/PCM* FREQUENCY: 300 cps *ME-30B/U* DB VOLTS: +10 DB	Unchanged except: TR GAIN: fully clockwise.	*Transmitting branch, bandpass filter characteristics* *a.* Note ME-30B/U meter indication. *b.* Rotate FREQUENCY dial on SG-15/PCM to 1,700 cps and note ME-30B/U meter indication.	*a.* Within 1 db of indication obtained in step No. 1*a*. *b.* Same as obtained in *a* above
3	Unchanged except: *SG-15/PCM* FREQUENCY: 1,000 cps	Unchanged.	*Transmitting branch, switch operation and bandpass filter frequency characteristics* *a.* Operate CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8 switch on ORDER WIRE PANEL clockwise to each position in turn, note ME-30B/U meter indication at each switch position. *b.* Operate CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8 switch to 104-126. *c.* Rotate FREQUENCY dial on SG-15/PCM counterclockwise to 300 cps. Note ME-30B/U meter indication. *d.* Rotate FREQUENCY dial clockwise to 1,700 cps. Note ME-30B/U meter indication. *e.* Disconnect hookup wires of SG-15/PCM from ORDER WIRE PANEL (Q, fig. 128.9).	*a.* Within 1 db of indication obtained in step No. 1*a*. In 150-160 (HOT) position, 1.5 db ±0.5 higher than average indication. *b.* None. *c.* 11 db ±1 less than indication obtained in *a* above. *d.* Within 2 db of indication obtained in *a* above. *e.* None
4	Unchanged except: *ME-30B/U* DB VOLTS: ±10 DB *SG-15/PCM* FREQUENCY: 1,000 cps COARSE DBM: −10 Fine DBM: adjust to obtain +5-db indication on OUTPUT LEVEL meter (−5 db)	Unchanged except: CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8: RADIO ORDER WIRE: TALK	*Transmitting branch, handset transmission circuit* *a.* Disconnect test leads from terminals A and D and between T and H of power and carrier test cable assemblies (A, fig. 128.9). Connect a test lead (strap) between terminals A and T of power test cable assembly. *b.* Remove transmitter cover and capsule from handset, and clip hookup wires of SG-15/PCM to springs in handset transmitter (D, fig. 128.9). *c.* Operate handset push-to-talk switch (D, fig. 128.9) and note meter indication. Release handset push-to-talk switch.	*a.* None. *b.* None *c.* For Handset H-60(*), 7 db ±1 less than indication obtained in step No. 1*a*. For Handset TS-9(*), 1.5 db ±2 less than indication obtained in step No. 1*a*. *Note.* H-60(*) and TS-9(*) indicate all models of each handset.

	FREQUENCY: 1,000 cps COARSE DBM: −10 FINE DBM: adjust for −4 dbm indication on OUTPUT LEVEL meter (−14 db). *ME–30B/U* ON-OFF: ON DB VOLTS: +10 DB	SEND OW: vertical ORDER WIRE: vertical CHANNEL TALK: LINE TR GAIN (internal): fully clockwise. REC GAIN: fully counterclockwise.	*c.* Insert plug of test plug assembly (C, fig. 128.9) into TR AMP OUT jack on ORDER WIRE PANEL (A, fig. 128.9). Record ME–30B/U meter indication. *d.* Remove plug of test plug assembly from TR AMP OUT jack. Disconnect hookup wires of ME–30B/U from test plug assembly (C, fig. 128.9) and reconnect to terminals L and M (A, fig. 128.9). *e.* Operate TR GAIN control on ORDER WIRE PANEL fully counterclockwise. Operate DB VOLTS switch on ME–30B/U to −20 DB.	*c.* Within 0.5 db of indication obtained in *a* above. *d.* None. *e.* −27 db ±2.
2	Unchanged except: *SG–15/PCM* FREQUENCY: 300 cps *ME–30B/U* DB VOLTS: +10 DB	Unchanged except: TR GAIN: fully clockwise.	*Transmitting branch, bandpass filter characteristics* *a.* Note ME–30B/U meter indication. *b.* Rotate FREQUENCY dial on SG–15/PCM to 1,700 cps and note ME–30B/U meter indication.	*a.* Within 1 db of indication obtained in step No. 1*a*. *b.* Same as obtained in *a* above.
3	Unchanged except: *SG–15/PCM* FREQUENCY: 1,000 cps.	Unchanged.	*Transmitting branch, switch operation and bandpass filter frequency characteristics* *a.* Operate CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch on ORDER WIRE PANEL clockwise to each position in turn, note ME–30B/U meter indication at each switch position. *b.* Operate CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 104–126. *c.* Rotate FREQUENCY dial on SG–15/PCM counterclockwise to 300 cps. Note ME–30B/U meter indication. *d.* Rotate FREQUENCY dial clockwise to 1,700 cps. Note ME–30B/U meter indication. *e.* Disconnect hookup wires of SG–15/PCM from ORDER WIRE PANEL (Q, fig. 128.9).	*a.* Within 1 db of indication obtained in step No. 1*a*. In 150–160 (HOT) position, 1.5 db ±0.5 higher than average indication. *b.* None. *c.* 11 db ±1 less than indication obtained in *a* above. *d.* Within 2 db of indication obtained in *a* above. *e.* None.
4	Unchanged except: *ME–30B/U* DB VOLTS: ±10 DB *SG–15/PCM* FREQUENCY: 1,000 cps COARSE DBM: −10 Fine DBM: adjust to obtain +5-db indication on OUTPUT LEVEL meter (−5 db)	Unchanged expect: CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8: RADIO ORDER WIRE: TALK	*Transmitting branch, handset transmission circuit* *a.* Disconnect test leads from terminals A and D and between T and H of power and carrier test cable assemblies (A, fig. 128.9). Connect a test lead (strap) between terminals A and T of power test cable assembly. *b.* Remove transmitter cover and capsule from handset, and clip hookup wires of SG–15/PCM to springs in handset transmitter (D, fig. 128.9). *c.* Operate handset push-to-talk switch (D, fig. 128.9) and note meter indication. Release handset push-to-talk switch. *d.* Disconnect hookup wires of ME–30B/U from terminals L and M (A, fig. 128.9), and reconnect to terminals C and P (H, fig. 128.9). *e.* Operate DB VOLTS switch on ME–30B/U to −20 DB. Operate push-to-talk switch on handset (D, fig. 128.9) and note meter indication. Release push-to-talk switch. *f.* Disconnect hookup wires of ME–30B/U from terminals C and P, reconnect to terminals D and R (H, fig. 128.9). *g.* Operate CHANNEL TALK switch on ORDER WIRE PANEL to TEST BD. Operate push-to-talk switch on handset (D, fig. 128.9) and note ME–30B/U meter indication. Release push-to-talk switch. *h.* Operate CHANNEL TALK switch on ORDER WIRE PANEL to LINE. *i.* Disconnect alligator clips on hookup wires of SG–15/PCM from handset (D, fig. 128.9). Replace transmitter capsule and cover on handset. Disconnect test lead (strap) from terminals A and T of power test cable assembly, and reconnect test leads between terminals A and D and between terminals T and H of power and carrier supply test cable assemblies (A, fig. 128.9). *j.* Operate push-to-talk switch on handset (D, fig. 128.9) and speak in normal voice into handset transmitter. Observe for ME–30B/U meter indication and sidetone in handset receiver; release push-to-talk switch.	*a.* None. *b.* None. *c.* For Handset H–60(*), 7 db ±1 less than indication obtained in step No. 1*a*. For Handset TS–9(*), 1.5 db ±2 less than indication obtained in step No. 1*a*. *Note:* H–60(*) and TS–9(*) indicate all models of each handset. *d.* None. *e.* −22 db ±1.5. *f.* None. *g.* Same as obtained in *e* above. *h.* None. *i.* None. *j.* ME–30B/U meter needle fluctuates with speech variations. Sidetone heard in handset receiver.
5	Unchanged except: *SG–15/PCM* COARSE DBM: −10 FINE DBM: adjust to obtain 0-db indication on OUTPUT LEVEL meter (−10 db). *ME–30B/U* DB VOLTS: +20 DB *FR–114/U* POWER-STANDBY-OFF: POWER (Begin adjustments when XTAL OVEN ON lamp cycles on and off.) TIME-SECONDS: 1 FUNCTION: FREQ. COUNT AUTO-MANUAL: AUTO DISPLAY TIME: 5 SENSITIVITY: meter needle at left end of green area. TRIGGER VOLTAGE: clockwise from full counterclockwise until numerical indicators start to count; note control position. Continue clockwise until counting stops; note control position. Set to midway between two positions.	Unchanged except: CHANNEL TALK: LINE ORDER WIRE: vertical	*Transmitting branch, test and ringing frequencies transmission* *a.* Connect SG–15/PCM as shown in E, figure 128.9, and FR–114/U as shown in I, figure 128.9. Adjust FR–114/U as given in *Test equipment control settings* column. *b.* Operate SEND OW switch on ORDER WIRE PANEL to ON and note ME–30B/U meter indication. *c.* Operate SEND OW switch to vertical position. Operate DB VOLTS switch on ME–30B/U to +30 DB. *d.* Operate ORDER WIRE switch on ORDER WIRE PANEL to RING; and note indications of ME–30B/U meter and ORDER WIRE PANEL. *e.* Operate ORDER WIRE switch to RING and adjust SENSITIVITY control of FR–114/U to count frequency. Release ORDER WIRE switch and note FR–114/U frequency count. *f.* Disconnect hookup wires of FR–114/U and ME–30B/U from terminals L and M (I, fig. 128.9); disconnect hookup wires of SG–15/PCM from terminals K and W (E, fig. 128.9).	*a.* None. *b.* 4 db ±2 higher than indication obtained in step No. 1*a*. *c.* None. *d.* ME–30B/U indicates +27 db ±1. On ORDER WIRE PANEL, CALL lamp lights and buzzer sounds. *e.* 1,600 cps ±4. *f.* None.
6	Unchanged except: *SG–15/PCM* FREQUENCY: 1,000 cps COARSE DBM: −40 FINE DBM: adjust to obtain −4-db indication on OUTPUT LEVEL meter (−44 db). *ME–30B/U* DB VOLTS: 0 DB	Unchanged except: CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8: 0–11. REC GAIN: fully clockwise.	*Receiving branch, bandpass filter frequency characteristics* *a.* Connect equipment as shown in F and G, figure 128.9. *b.* Note ME–30B/U meter indication. *c.* Rotate FREQUENCY dial on SG–15/PCM counterclockwise to 300 cps. Note ME–30B/U meter indication. *d.* Rotate FREQUENCY dial on SG–15/PCM clockwise to 1,700 cps. Note ME–30B/U meter indications. *Note.* Disregard CALL lamp and buzzer indications.	*a.* None. *b.* −8 dbm ±3. *c.* Within 1 db of indication obtained in *b* above. *d.* Within 1 db of indication obtained in *b* above.
7	Unchanged except: *SG–15/PCM* COARSE DBM: −30 *ME–30B/U* DB VOLTS: −10 DB	Unchanged except: CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8: RADIO.	*Receiving branch, switch in RADIO position* *a.* Note ME–30B/U meter indication. *b.* Disconnect hookup wires of ME–30B/U from ORDER WIRE PANEL (G, fig. 128.9).	*a.* −15 db ±3. *b.* None.
8	Unchanged except: *SG–15/PCM* FREQUENCY: 1,600 cps COARSE DBM: −40 FINE DBM: adjust to obtain 0 indication on OUTPUT LEVEL meter (−40 db).	Unchanged except: CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8: 0–11.	*Receiving branch, ringing signal reception* *a.* Note ORDER WIRE PANEL indications. *b.* Operate keys 20 and 3 on TS–402/U to align white line parallel with short dimension of panel (−23 db).	*a.* Call lamp lights and buzzer sounds. *b.* Same as *a* above.
9	Unchanged except: *SG–15/PCM* FREQUENCY: 1,000 cps COARSE DBM: −30 FINE DBM: adjust to obtain +1 indication on OUTPUT LEVEL meter (−29 db). *TS–402/U* Operate all keys to align white line with long dimension of panel (0 db). *ME–30B/U* DB VOLTS: −20 DB	Unchanged.	*Receiving branch, receiving jack circuits* *a.* Connect ME–30B/U to test plug assembly (C, fig. 128.9). Insert plug of test plug assembly into REC AMP IN jack on ORDER WIRE PANEL (A, fig. 128.9). *b.* Note ME–30B/U meter indication. *c.* Insert plug of test plug assembly into REC AMP OUT jack (A, fig. 128.9) and note ME–30B/U meter indication.	*a.* None. *b.* −26 db ±1. *c.* Within 2 db of indication obtained in *b* above.
10	Unchanged except: *SG–15/PCM* COARSE DBM: 0 *ME–30B/U* DB VOLTS: 0 DB	Unchanged.	*Receiving branch, REC GAIN control range* *a.* Insert plug of test plug assembly (C, fig. 128.9) into REC AMP IN jack on ORDER WIRE PANEL (A, fig. 128.9). Adjust FINE DBM control on SG–15/PCM to obtain 0-db indication of meter of ME–30B/U. *b.* Operate DB VOLTS switch on ME–30B/U to −30 DB. Rotate REC GAIN control on ORDER WIRE PANEL fully counterclockwise. Note ME–30B/U meter indication. *c.* Rotate REC GAIN control fully clockwise.	*a.* None. *b.* −38 db ±3 (range of switch is 38 db ±3). *c.* None.
11	Unchanged except: *SG–15/PCM* COARSE DBM: −40 FINE DBM: adjust to obtain −4 indication on OUTPUT LEVEL meter (−44 db) *ME–30B/U* DB VOLTS: −10 DB	Unchanged except: ORDER WIRE: TALK	*Receiving branch, handset receiving circuit* *a.* Label and remove handset cable wires connected to terminals 3 and 4 or 3 and 5 of terminal board TB101 (J, fig. 128.9). Connect equipment as shown in J, figure 128.9. *b.* Note ME–30B/U meter indication. *c.* Disconnect hookup wire of ME–30B/U from terminal 5 and reconnect to terminal 4 of TB101 (J, fig. 128.9). Note ME–30B/U meter indication. *d.* Disconnect test setup (J, fig. 128.9). Reconnect handset cable wires to original terminals. *e.* Listen for test tone in ORDER WIRE PANEL handset receiver.	*a.* None. *b.* −12 db ±3. *c.* 7 db ±1 less than indication obtained in *b* above. *d.* None *e.* Tone is heard in handset receiver.
12	Unchanged.	Unchanged except: ORDER WIRE: TALK CHANNEL TALK: TEST BD	*Receiving branch, channel circuits reception* *a.* Connect ME–30B/U as shown in H, figure 128.9 *b.* Note ME–30B/U meter indication. *c.* Disconnect hookup wires of ME–30B/U from terminals C and P, and reconnect to terminals D and R (H, fig. 128.9). Operate CHANNEL TALK switch on ORDER WIRE PANEL to LINE. *d.* Note ME–30B/U meter indications. *e.* Operate AC POWER switch on 200 VOLT POWER SUPPLY to OFF. Disconnect test connections.	*a.* None. *b.* −12 db ±2. *c.* None. *d.* Same as obtained in *b* above. *e.* None.

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167.22. Tests of AN/TCC-7

a. Testing Each Panel and Chassis Assembly of AN/TCC-7.

(1) Remove and test each panel and chassis assembly of the AN/TCC-7, in turn. The following chart lists the paragraphs that contain the fourth echelon testing procedures for each panel and chassis assembly of the AN/TCC-7.

	Panel of AN/TCC-7				Test according to procedures given in paragraph
200 VOLT POWER SUPPLY					167.6
27	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: CHANNEL OUT. *CHAN MODEM 1* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: SEND). *CHAN MODEM 2 and 3* SEND-MEAS switch on each CHAN 2: vertical.	Not used.		*CHAN MODEM 1 signal reception* *a.* Insert TEST PANEL measuring cord plug into jack of adapter cord (part of AN/TCC-7; stowed in storage drawer above CARRIER SUPPLY PANEL). *b.* Touch probes of adapter cord to 4WR binding posts of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, of CHAN MODEM 1. As each binding post pair is touched, adjust GAIN control of same CHAN until meter indicates 0 db. Note indication for each CHAN adjustment.	*a.* None. *b.* 0 db.
28	Unchanged except: *CHAN MODEM 1* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: vertical. *CHAN MODEM 2* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: SEND.	Not used.		*CHAN MODEM 2 signal reception* Touch probes of adapter cord to 4WR binding posts of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, of CHAN MODEM 2. As each binding post pair is touched, adjust GAIN control of same CHAN until meter indicates 0 db. Note indication for each CHAN adjustment.	0 db.
29	Unchanged except: *CHAN MODEM 2* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: vertical. *CHAN MODEM 3* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: SEND.	Not used.		*CHAN MODEM 3 signal reception* *a.* Touch probes of adapter cord to 4WR binding posts of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, of CHAN MODEM 3. As each binding post pair is touched, adjust GAIN control of same CHAN until meter indicates 0 db. Note indication for each CHAN adjustment. *b.* Remove TEST PANEL measuring cord plug from adapter cord.	*a.* 0 db. *b.* None.
30	Unchanged except: *CHAN MODEM 3* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: vertical. *TEST PANEL* MEASURE NONSELECTIVE: OW REC *ORDER WIRE PANEL* SEND OW: ON ORDER WIRE: TALK	ORDER WIRE PANEL.	REC AMP OUT.	*Order wire signal reception* *a.* Adjust REC GAIN control on ORDER WIRE PANEL until meter indicates 0 db. *b.* Listen for 1,000 cps tone in receiver of ORDER WIRE PANEL handset. *c.* Operate SEND OW switch on ORDER WIRE PANEL to vertical position. *d.* Operate press-to-talk switch on handset and talk. Note sidetone and meter indications. *e.* Operate ORDER WIRE switch on ORDER WIRE PANEL to RING and note CALL lamp and meter indications. *f.* Release ORDER WIRE switch.	*a.* 0 db. *b.* 1,000-cps tone is heard. *c.* None. *d.* Sidetone is heard and meter needle fluctuates with speech variations. *e.* CALL lamp lights and meter needle fluctuates. *f.* None.
31				*Voice communication tests* Perform procedures given in *c* below.	

T.O. 31W1-2MC7-4

167.22. Tests of AN/TCC-7

a. Testing Each Panel and Chassis Assembly of AN/TCC-7.

(1) Remove and test each panel and chassis assembly of the AN/TCC-7, in turn. The following chart lists the paragraphs that contain the fourth echelon testing procedures for each panel and chassis assembly of the AN/TCC-7.

Panel of AN/TCC-7	Test according to procedures given in paragraph
200 VOLT POWER SUPPLY	167.6
600 VOLT POWER SUPPLY	167.8
TEST PANEL	167.10
CARRIER SUPPLY PANEL	167.12
CHAN MODEM 1, CHAN MODEM 2, and CHAN MODEM 3	167.14
SUBGROUP PANEL	167.16
GROUP PANEL	167.18
ORDER WIRE PANEL	167.20

(2) After all panel and chassis assemblies of the AN/TCC-7 have been tested ((1) above) and found to meet the required performance standards, proceed to test the AN/TCC-7 as a complete terminal (*b* and *c* below).

b. Testing AN/TCC-7 Signal Circuits. Prepare a chart similar to that given in paragraph 167.23*a*. Use it to record the actual test indications obtained during the tests.

(1) *Material required.* The equipment required is the junction panel test cable assembly (part of Telephone Carrier System Test Facilities Kit MK-155/TCC (Federal stock No. 6625-603-9523) (TB SIG 328)).

(2) *Test connections and conditions.*

(*a*) On the 200 VOLT POWER SUPPLY and the 600 VOLT POWER SUPPLY panels, operate the AC POWER switches to OFF and the 115V-230V switches to the position corresponding to the ac power source.

(*b*) Refer to figure 128.10 and connect the cables of the AN/TCC-7 to the proper panels.

Warning: **When the AC POWER switch of the 600 VOLT POWER SUPPLY is operated to ON, voltages as high as 600 volts dc may be present in the junction panel test cable assembly (fig. 128.10).**

(*c*) Operate all switches on the front panels of the AN/TCC-7 to the vertical position. Operate the internal switches and control to the positions given in the following chart. Do not change the switch positions unless instructed during the test procedures ((3) below).

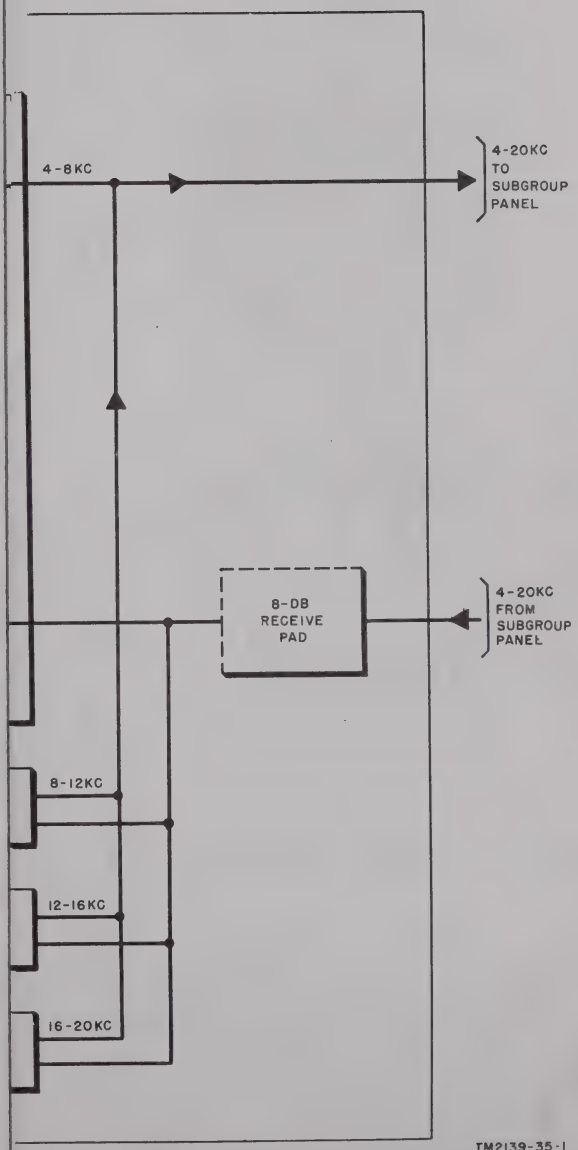
Panel	Switch or control (internal)	Position
GROUP PANEL	TR CABLE REELS TO FIRST AN/TCC-11	11
	REC CABLE REELS TO FIRST AN/TCC-11	11
	60-108 KC	REGULAR
	REGULAR	MAN
SUBGROUP PANEL	SPECIAL SERVICE 1	CHAN MODEM
	SPECIAL SERVICE 2	CHAN MODEM
	SPECIAL SERVICE 3	CHAN MODEM
CHAN MODEM 1 (CHAN 1, CHAN 2, CHAN 3, and CHAN 4)	2W-4W	4W
CHAN MODEM 2 (CHAN 1, CHAN 2, CHAN 3, and CHAN 4)	2W-4W	4W
CHAN MODEM 3 (CHAN 1, CHAN 2, CHAN 3, and CHAN 4)	2W-4W	4W
ORDER WIRE PANEL	TR GAIN	Fully counterclockwise
600 VOLT POWER SUPPLY	REPEATER	TEST

(3) *Procedure.* Perform the tests given in the following chart in sequence; do not vary the sequence. For each step in the test, perform the operations given in the *Panel and control settings* and *TEST PANEL measuring cord plug connection* columns; then perform each specific test procedure given in the *Test procedures* column and verify the results against the indications given in the *Performance standards* column.

Step No.	Panel and control settings	TEST PANEL measuring cord plug connection: Panel	TEST PANEL measuring cord plug connection: Jack	Test procedures	Performance standards
1	*TEST PANEL* MEASURE: 200 VOLTS *600 VOLT POWER SUPPLY* ON-OFF: ON Other switches and controls: unchanged from settings given in (2) above.	Not used.	Not used.	*a.* Note AC POWER lamp indication on 200 VOLT POWER SUPPLY. *b.* During first 20 to 30 seconds, note alarm lamps and buzzer indications. *c.* After 20 to 30 seconds, note alarm lamps and buzzer indications. *d.* Adjust 200V ADJ control on 200 VOLT POWER SUPPLY to obtain 0-db meter indication.	*a.* AC POWER lamp lights. *b.* On ORDER WIRE PANEL, CALL lamp lights and buzzer sounds. On GROUP PANEL, HIGH ALARM and LOW ALARM lamps light. On CARRIER SUPPLY PANEL, 68KC ALARM and 120KC ALARM lamps light and buzzer sounds. *c.* On ORDER WIRE PANEL, CALL lamp is extinguished and buzzer is silent. On GROUP PANEL, HIGH ALARM and LOW ALARM lamps are extinguished. On CARRIER SUPPLY PANEL, 68KC ALARM and 120KC ALARM lamps are extinguished and buzzer is silent *d.* 0 db.
2	Unchanged except: *TEST PANEL* MEASURE: 600 VOLTS *600 VOLT POWER SUPPLY* LOW-VOLT ALARM: counterclockwise HIGH-VOLT ALARM: counterclockwise LOAD CURRENT: counterclockwise ON-OFF: ON	Not used.	Not used.	*600 VOLT POWER SUPPLY* *a.* Note AC POWER lamp indication. *b.* Note meter and alarm indications. *c.* Adjust LOAD CURRENT control until CURRENT meter indicates 100 ma. *d.* Adjust 600V ADJ control until TEST PANEL meter indicates 0 db.	*a.* AC POWER lamp lights. *b.* Buzzer sounds. LOAD ALARM lamp lights (also LOW VOLTAGE lamp on PP-826A/U lights). CURRENT meter momentarily indicates approximately 8 to 12 ma; indication drops to 0 ma, then slowly rises to 85 ma ±5. In approximately 20 seconds after ac power is applied, LOAD ALARM lamp (and LOW VOLTAGE lamp on PP-826A/U) is extinguished; buzzer is silent as soon as lamp is extinguished. *c.* 100 ma. *d.* 0 db.
3	Unchanged except: MEASURE: TRANSMISSION MEASURE NONSELECTIVE: CARR. SUPPLY			*CARRIER SUPPLY PANEL signal jack measurements* Insert TEST PANEL measuring cord plug into following jacks (internal), in turn, and note meter indication for each jack connection: 64 KC LOCAL DIV 1 DIV 2 4 KC 8 KC 12 KC 16 KC 20 KC 56 KC 72 KC 88 KC 120 KC	0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3 0 db ±3
4	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: CHECK 1 KC CHECK HF	TEST PANEL	CHECK 1 KC	*1-kc and hf measurements* *a.* Adjust 1 KC control (internal) on TEST PANEL until meter indicates 0 db. *b.* Insert TEST PANEL measuring cord plug into CHECK HF jack on TEST PANEL. *c.* Adjust HF control on TEST PANEL until meter indicates 0 db.	*a.* 0 db. *b.* None. *c.* 0 db.
5	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: OFF MEASURE SELECTIVE: CHECK GAIN FINE TUNE: midposition	TEST PANEL	CHECK HF	*Hf test signal adjustment* *a.* Adjust COARSE TUNE control on TEST PANEL to obtain peak meter indication. *b.* Adjust FINE TUNE control for peak meter indication. *c.* Adjust GAIN control on TEST PANEL until meter indicates 0 db. If unable to reach 0 db indication, proceed as follows: *d.* Adjust GAIN control to midposition. *e.* Adjust AMP GAIN control on AR1 (in rear center of TEST PANEL chassis) to obtain as near 0-db meter indication as possible. *f.* Adjust GAIN control until meter indicates 0 db.	*a.* Near 0 db. *b.* None. *c.* 0 db. *d.* None. *e.* Near 0 db. *f.* 0 db.
6	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 68KC	GROUP PANEL	TR AMP OUT	*68-kc transmission measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust 68 KC control (internal) on CARRIER SUPPLY PANEL until meter indicates 0 db.	*a.* None. *b.* 0 db.
7	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 12KC *CARRIER SUPPLY PANEL* 12 & 28 KC: ON	GROUP PANEL	TR AMP OUT	*12-kc and 28-kc transmission measurement* *a.* Note 12 & 28 KC lamp indication on CARRIER SUPPLY PANEL. *b.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *c.* Adjust 12 KC control on CARRIER SUPPLY PANEL until meter indicates 0 db. *d.* Operate MEASURE SELECTIVE switch on TEST PANEL to 28KC. Adjust FINE TUNE control on TEST PANEL for peak meter indication. *e.* Adjust 28 KC control on CARRIER SUPPLY PANEL until meter indicates 0 db. *f.* Operate 12 & 28 KC switch on CARRIER SUPPLY PANEL to vertical position.	*a.* 12 & 28 KC lamp lights. *b.* None. *c.* 0 db. *d.* None. *e.* 0 db. *f.* None.
8	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: SUB GRP MOD IN	SUBGROUP PANEL	MOD IN 1	*CHAN MODEM 1 signal transmission* On CHAN MODEM 1, operate SEND-MEAS switch of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND, and note meter indication. Operate SEND-MEAS switch to vertical position after each measurement.	0 db ±3.
9	Unchanged.	SUBGROUP PANEL	MOD IN 2	*CHAN MODEM 2 signal transmission* On CHAN MODEM 2, operate SEND-MEAS switch of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND, and note meter indication. Operate SEND-MEAS switch to vertical position after each measurement.	0 db ±3.
10	Unchanged.	SUBGROUP PANEL	MOD IN 3	*CHAN MODEM 3 signal transmission* On CHAN MODEM 3, operate SEND-MEAS SWITCH of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND, and note meter indication. Operate SEND-MEAS switch to vertical position after each measurement.	0 db ±3
11	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: OFF. MEASURE SELECTIVE 67KC *CHAN MODEM 1* SEND-MEAS switch on CHAN 2: SEND.	SUBGROUP PANEL	60-108 KC OUT	*67-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position	*a.* Peak indication at 0 db ±2. *b.* None.
12	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 83KC *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	SUBGROUP PANEL	60-108 KC OUT	*83-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position	*a.* Peak indication at 0 db ±2. *b.* None.
13	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 99KC *CHAN MODEM 3* SEND-MEAS switch on CHAN 2: SEND.	SUBGROUP PANEL	60-108 KC OUT	*99-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 3 to vertical position.	*a.* Peak indication at 0 db ±2. *b.* None.
14	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 37KC *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	GROUP PANEL	TR AMP OUT	*37-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust TR AMP GAIN control (internal) on SUBGROUP PANEL until meter indicates 0 db. *c.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position	*a.* None. *b.* 0 db.
15	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 65KC SEND: 65 KC TR OR FAULT TEST.	GROUP PANEL	TR AMP OUT	*65-kc signal transmission measurement* *a.* Note SEND lamp indication on TEST PANEL. *b.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *c.* Adjust 65 KC TR OR FAULT TEST control (internal) on TEST PANEL until meter indicates 0 db.	*a.* SEND lamp lights. *b.* None. *c.* 0 db.
16	Unchanged except: *TEST PANEL*	GROUP PANEL	TR AMP OUT	*Fault test frequencies measurement* *a.* Press FAULT TEST REP 1 pushbutton on TEST PANEL and note meter indication.	*a.* 0 db ±1

	MEASURE NONSELECTIVE: SUB GRP MOD IN			meter indication. Operate SEND-MEAS switch to vertical position after each measurement.	
9	Unchanged.	SUBGROUP PANEL	MOD IN 2	*CHAN MODEM 2 signal transmission* On CHAN MODEM 2, operate SEND-MEAS switch of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND, and note meter indication. Operate SEND-MEAS switch to vertical position after each measurement.	0 db ±3.
10	Unchanged.	SUBGROUP PANEL.	MOD IN 3	*CHAN MODEM 3 signal transmission* On CHAN MODEM 3, operate SEND-MEAS SWITCH of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, to SEND, and note meter indication. Operate SEND-MEAS switch to vertical position after each measurement.	0 db ±3.
11	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: OFF. MEASURE SELECTIVE 67KC *CHAN MODEM 1* SEND-MEAS switch on CHAN 2: SEND.	SUBGROUP PANEL.	60-108 KC OUT	*67-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 1 to vertical position.	*a.* Peak indication at 0 db ±2. *b.* None.
12	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 83KC *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	SUBGROUP PANEL.	60-108 KC OUT	*83-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* Peak indication at 0 db ±2. *b.* None.
13	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 99KC *CHAN MODEM 3* SEND-MEAS switch on CHAN 2: SEND.	SUBGROUP PANEL.	60-108 KC OUT	*99-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 3 to vertical position.	*a.* Peak indication at 0 db ±2. *b.* None.
14	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 37KC *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	GROUP PANEL	TR AMP OUT	*37-kc signal measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust TR AMP GAIN control (internal) on SUBGROUP PANEL until meter indicates 0 db. *c.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* None. *b.* 0 db.
15	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 65KC SEND: 65 KC TR OR FAULT TEST.	GROUP PANEL	TR AMP OUT	*65-kc signal transmission measurement* *a.* Note SEND lamp indication on TEST PANEL. *b.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *c.* Adjust 65 KC TR OR FAULT TEST control (internal) on TEST PANEL until meter indicates 0 db.	*a.* SEND lamp lights. *b.* None. *c.* 0 db.
16	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: FAULT TEST.	GROUP PANEL	TR AMP OUT	*Fault test frequencies measurement* *a.* Press FAULT TEST REP 1 pushbutton on TEST PANEL and note meter indication. Release pushbutton after measurement. *b.* Press FAULT TEST REP 2 pushbutton on TEST PANEL and note meter indication. Release pushbutton after measurement. *c.* Press FAULT TEST REP 3 pushbutton on TEST PANEL and note meter indication. Release pushbutton after measurement.	*a.* 0 db ±1. *b.* 0 db ±1. *c.* 0 db ±1.
17	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: GRP PANEL 62 KC. MEASURE SELECTIVE: GRP PANEL 62 KC.	GROUP PANEL	TR 62 KC	*62-kc signal transmission measurement* Adjust FINE TUNE control on TEST PANEL for peak meter indication.	No meter indication, or meter needle peaks to left of −5 db.
18	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: OW TR AMP OUT. MEASURE SELECTIVE: OFF SEND: CHECK GAIN CHECK HF. *ORDER WIRE PANEL* SEND OW: ON.	ORDER WIRE PANEL.	TR AMP OUT	*Order wire signal transmission* *a.* Adjust TR GAIN control (internal) on ORDER WIRE PANEL until meter indicates +2.5 db *b.* Operate SEND OW switch on ORDER WIRE PANEL to vertical position.	*a.* +2.5 db. *b.* None.
19	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 68KC MEASURE NONSELECTIVE: OFF.	GROUP PANEL	REC AMP 1 OUT.	*68-kc reception measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust FLAT ADJ 68KC control (internal) on GROUP PANEL until meter indication stabilizes at 0 db. Note control setting and meter indication.	*a.* None *b.* FLAT ADJ 68KC control setting is between +2 and +6; meter indication is 0 db.
20	Unchanged.	GROUP PANEL	REC AMP 2 OUT.	*Manual regulation adjustments* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust MAN REG OUTPUT control (internal) on GROUP PANEL until meter indicates 0 db.	*a.* None. *b.* 0 db.
21	Unchanged except: *GROUP PANEL* REGULATOR: AUTO ADJ HIGH (internal screwdriver control): counterclockwise. ADJ LOW (internal screwdriver control): counterclockwise.	GROUP PANEL	REC AMP 2 OUT.	*Automatic regulation adjustments* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust AUTO REG OUTPUT control (internal) on GROUP PANEL until meter stabilizes at 0 db. *c.* Operate and hold ALARM TEST switch (internal) on GROUP PANEL to 1 HIGH position and rotate ADJ HIGH control (adjacent to ALARM TEST switch) clockwise until HIGH ALARM lamp lights and buzzer sounds. *d.* Release ALARM TEST switch and note indications. *e.* Operate and hold ALARM TEST switch to 2 LOW position and rotate ADJ LOW control (adjacent to ALARM TEST switch) clockwise until ALARM lamp lights and buzzer sounds. *f.* Release ALARM TEST switch and note indications.	*a.* None. *b.* 0 db. *c.* HIGH ALARM lamp lights and buzzer sounds. *d.* HIGH ALARM lamp is extinguished and buzzer is silent. *e.* LOW ALARM lamp lights and buzzer sounds. *f.* LOW ALARM lamp is extinguished and buzzer is silent.
22	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 12-KC. *CARRIER SUPPLY PANEL* 12 & 28 KC: ON	GROUP PANEL	REC AMP 2 OUT.	*12-kc and 28-kc reception measurement* *a.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *b.* Adjust SLOPE ADJ 12 KC control (internal) on GROUP PANEL to obtain as near 0-db meter indication as possible. Note SLOPE ADJ 12KC control setting and meter indication. *c.* Operate MEASURE SELECTIVE switch on TEST PANEL to 28KC. Adjust FINE TUNE control on TEST PANEL for peak meter indication. *d.* Adjust BULGE ADJ 28KC control (internal) on GROUP PANEL to obtain as near 0-db meter indication as possible. Note BULGE ADJ 28KC control setting and meter indication. *e.* Operate 12 & 28 KC switch on CARRIER SUPPLY PANEL to vertical position.	*a.* None. *b.* SLOPE ADJ 12KC control setting is −1, 0, or +1. Meter indication is 0 db ±2. *c.* None. *d.* BULGE ADJ 28KC control setting is −1, 0, or +1. Meter indication is 0 db ±2. *e.* None.
23	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: 65-KC. SEND: 65 KC REC	GROUP PANEL	REC AMP 2 OUT.	*65-kc reception measurement* *a.* Note SEND lamp indication on TEST PANEL. *b.* Adjust FINE TUNE control on TEST PANEL for peak meter indication. *c.* Adjust 65 KC REC control on TEST PANEL until meter indicates 0 db.	*a.* SEND lamp lights. *b.* None. *c.* 0 db.
24	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: GRP PANEL 62 KC. MEASURE NONSELECTIVE: GRP PANEL 62 KC.	GROUP PANEL	REC 62 KC	*62-kc reception measurement* Adjust FINE TUNE control on TEST PANEL for peak meter indication.	No meter indication, or meter needle peaks to left of −5 db.
25	Unchanged except: *TEST PANEL* MEASURE SELECTIVE: OFF MEASURE NONSELECTIVE: GRP DEM OUT. SEND: CHECK GAIN CHECK HF *CHAN MODEM 2* SEND-MEAS switch on CHAN 2: SEND.	GROUP PANEL	DEM OUT	*GROUP PANEL signal reception* *a.* Adjust DEM GAIN control (internal) on GROUP PANEL until meter indicates 0 db. *b.* Operate SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to vertical position.	*a.* 0 db. *b.* None.
26	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: SUB GRP DEM OUT. *CHAN MODEM 1, 2, and 3* SEND-MEAS switch on each CHAN 2: SEND.	SUBGROUP PANEL.	DEM OUT 1	*SUBGROUP PANEL signal reception* *a.* Adjust DEM 1 GAIN control on SUBGROUP PANEL until meter indicates 0 db. *b.* Insert TEST PANEL measuring cord plug into DEM 2 OUT jack on SUBGROUP PANEL. Adjust DEM 2 GAIN control until meter indicates 0 db. *c.* Insert TEST PANEL measuring cord plug into DEM 3 OUT jack on SUBGROUP PANEL. Adjust DEM 3 GAIN control until meter indicates 0 db.	*a.* 0 db. *b.* 0 db. *c.* 0 db.
27	Unchanged except: *TEST PANEL* MEASURE NONSELECTIVE: CHANNEL OUT. *CHAN MODEM 1* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: SEND). *CHAN MODEM 2 and 3* SEND-MEAS switch on each CHAN 2: vertical.	Not used.		*CHAN MODEM 1 signal reception* *a.* Insert TEST PANEL measuring cord plug into jack of adapter cord (part of AN/TUC-2 stowed in storage drawer above CARRIER SUPPLY PANEL). *b.* Touch probes of adapter cord to 4WR binding posts of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, of CHAN MODEM 1. As each binding post pair is touched, adjust GAIN control of same CHAN until meter indicates 0 db. Note indication for each CHAN adjustment.	*a.* None *b.* 0 db
28	Unchanged except: *CHAN MODEM 1* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: vertical. *CHAN MODEM 2* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: SEND.	Not used.		*CHAN MODEM 2 signal reception* Touch probes of adapter cord to 4WR binding posts of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, of CHAN MODEM 2. As each binding post pair is touched, adjust GAIN control of same CHAN until meter indicates 0 db. Note indication for each CHAN adjustment.	0 db
29	Unchanged except: *CHAN MODEM 2* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: vertical. *CHAN MODEM 3* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: SEND.	Not used.		*CHAN MODEM 3 signal reception* *a.* Touch probes of adapter cord to 4WR binding posts of CHAN 1, CHAN 2, CHAN 3, and CHAN 4, in turn, of CHAN MODEM 3. As each binding post pair is touched, adjust GAIN control of same CHAN until meter indicates 0 db. Note indication for each CHAN adjustment. *b.* Remove TEST PANEL measuring cord plug from adapter cord.	*a.* 0 db. *b.* None.
30	Unchanged except: *CHAN MODEM 3* SEND-MEAS switches on CHAN 1, CHAN 2, CHAN 3, and CHAN 4: vertical. *TEST PANEL* MEASURE NONSELECTIVE: OW REC *ORDER WIRE PANEL* SEND OW: ON ORDER WIRE: TALK	ORDER WIRE PANEL.	REC AMP OUT.	*Order wire signal reception* *a.* Adjust REC GAIN control on ORDER WIRE PANEL until meter indicates 0 db. *b.* Listen for 1,000-cps tone in receiver of ORDER WIRE PANEL handset. *c.* Operate SEND OW switch on ORDER WIRE PANEL to vertical position. *d.* Operate press-to-talk switch on handset and talk. Note sidetone and meter indications. *e.* Operate ORDER WIRE switch on ORDER WIRE PANEL to RING and note CALL lamp and meter indications. *f.* Release ORDER WIRE switch.	*a.* 0 db. *b.* 1,000-cps tone is heard *c.* None. *d.* Sidetone is heard and meter needle fluctuates with speech variations. *e.* CALL lamp lights and meter needle fluctuates. *f.* None.
31				*Voice communication tests* Perform procedures given in *c* below.	

TO 31-1-2307-4


4-8KC
4-20KC
TO
SUBGROUP
PANEL
8-DB
RECEIVE
PAD
4-20KC
FROM
SUBGROUP
PANEL
8-12KC
12-16KC
16-20KC
TM2139-35-1

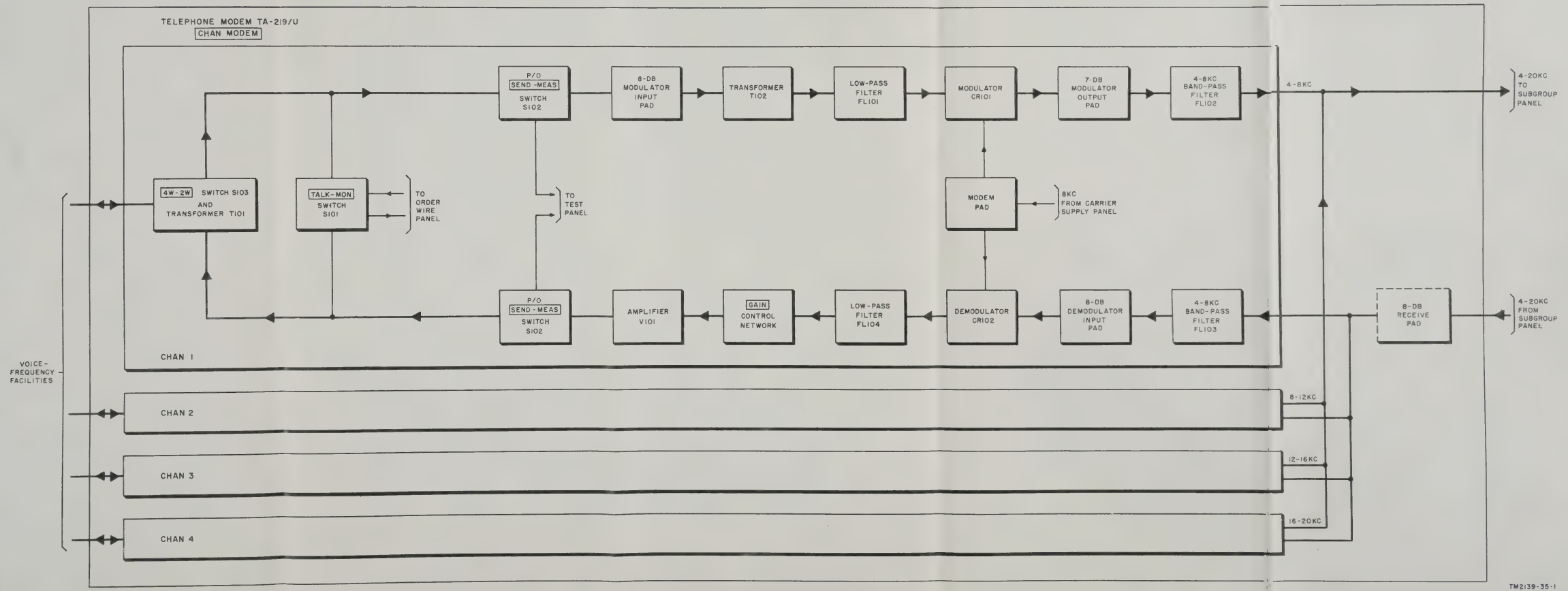
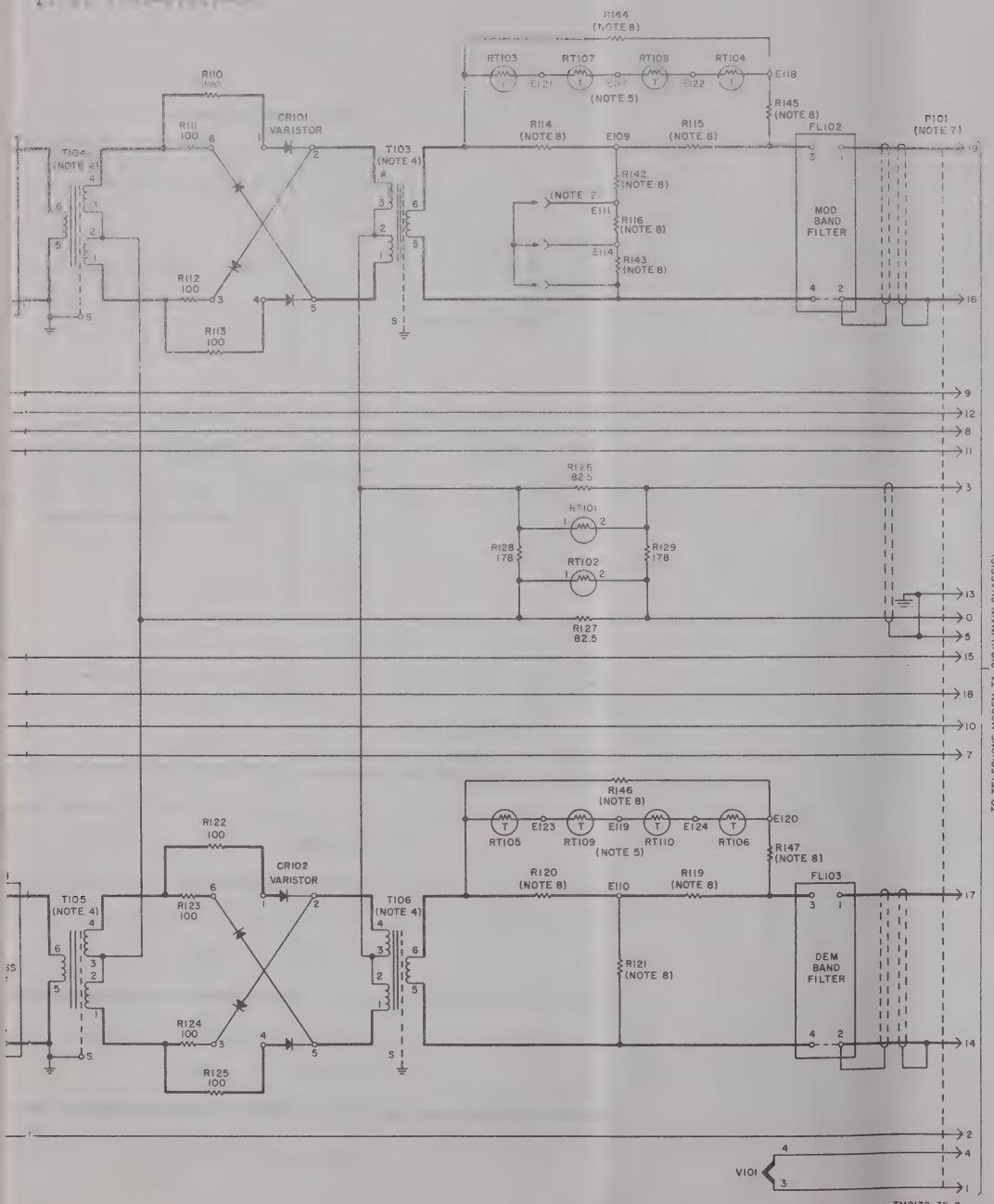
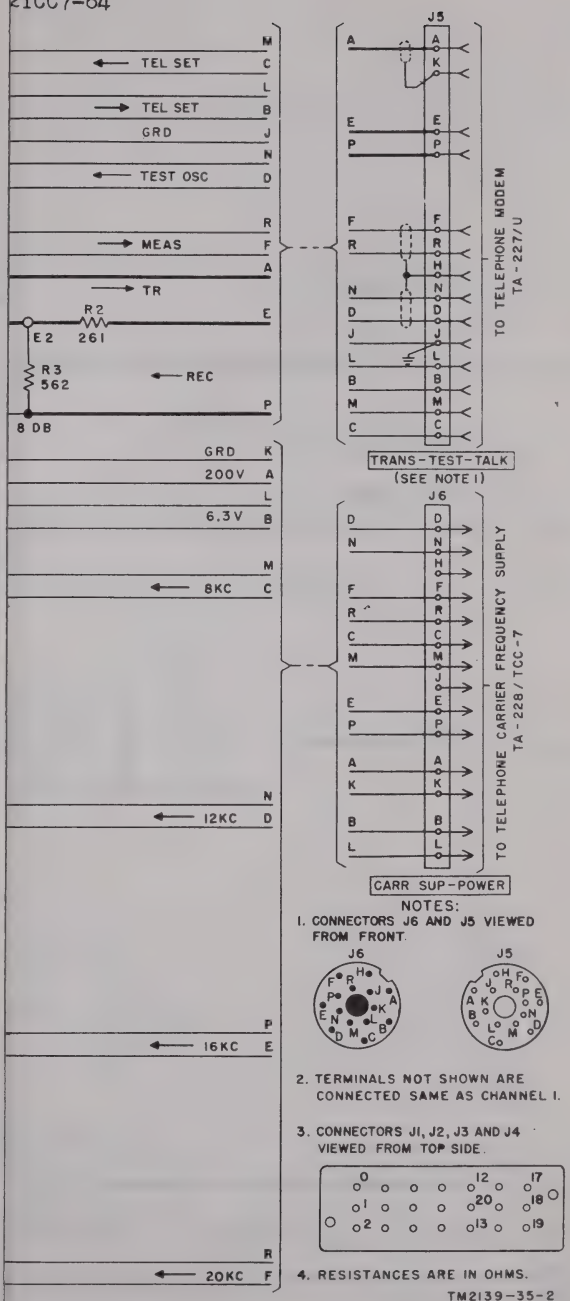


Figure 1.

Figure 1. Telephone Modem TA-219/U, block diagram.


R144
(NOTE 8)
RT103
RT107
RT108
RT104
E118
E121
E122
(NOTE 5)
R145
(NOTE 8)
FL102
P101
(NOTE 7)
R110
R111
100
CR101
VARISTOR
T104
(NOTE 4)
T103
(NOTE 4)
R114
(NOTE 8)
E109
R115
(NOTE 8)
R142
(NOTE 8)
(NOTE 2)
E111
R116
(NOTE 8)
E114
R143
(NOTE 8)
MOD
BAND
FILTER
R112
100
R113
100
S
16
9
12
8
11
R126
82.5
3
RT101
R128
178
RT102
R129
178
R127
82.5
13
0
5
15
18
10
7
R146
(NOTE 8)
RT105
E123
RT109
E119
RT110
E124
RT106
E120
R147
(NOTE 8)
(NOTE 5)
R122
100
CR102
VARISTOR
R120
(NOTE 8)
E110
R119
(NOTE 8)
FL103
17
T105
(NOTE 4)
R123
100
T106
(NOTE 4)
R121
(NOTE 8)
DEM
BAND
FILTER
R124
100
R125
100
14
2
V101
4
4
3
1
TO TELEPHONE MODEM TA-219/U (MAIN CHASSIS)
TM2139-35-3



am of main chassis.

NOTES

REFERENCE SYMBOLS ARE SHOWN FOR CHAN 1.

2 UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.

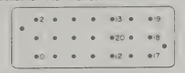
3 UPON REPLACEMENT OF ASSOCIATED CIRCUIT ELEMENTS, STRAP THESE RESISTORS FOR PROPER CHANNEL OUTPUT.

4 T103, T104, T105, T106 (5-6)600Z, (1-2)(3-4)12KΩ.

5 THERMISTORS RT107 THROUGH RT110 AND TERMINAL LUGS E121 THROUGH E124 ARE USED ON CHAN 1 ONLY.

6 CONTACT NUMBERS ON SWITCHES S101, S102, AND S103 ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

7 CONNECTOR P101 MATES WITH CONNECTOR J1 ON MAIN CHASSIS OF TELEPHONE MODEM TA-219/U. CONNECTOR P101 VIEWED FROM PIN SIDE.



8 RESISTOR VALUES FOR EACH CHANNEL ARE LISTED BELOW.

RESISTOR	CHAN 1	CHAN 2	CHAN 3	CHAN 4
R4	270	604	604	604
R5	270	604	604	604
R6	392	58	158	261
R9	270	604	604	604
R20	270	604	604	604
R2	845	392	392	392
R42	698	332	332	487
R43	562	261	261	562
R44	180	845	845	845
R45	301	140	140	140
R46	2K	953	953	953
R47	576	267	267	267

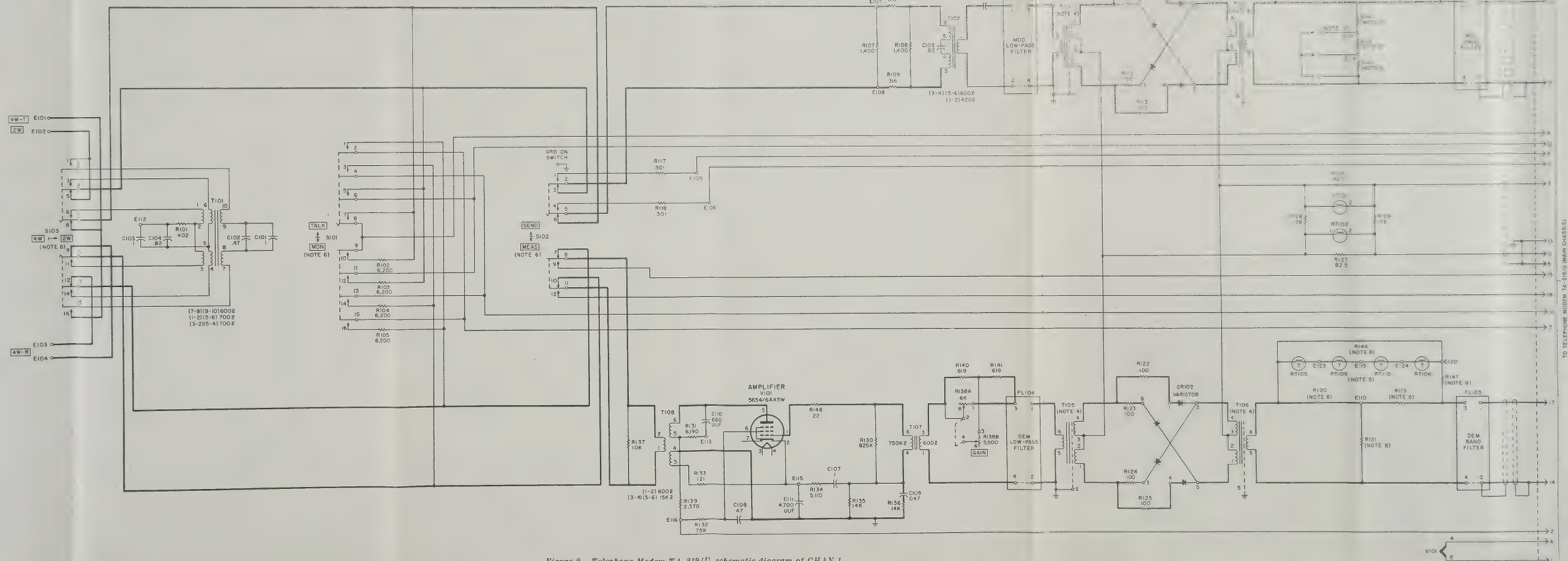


Figure 2. Telephone Modem TA-219/U, schematic diagram of CHAN 1.

Figure 2.

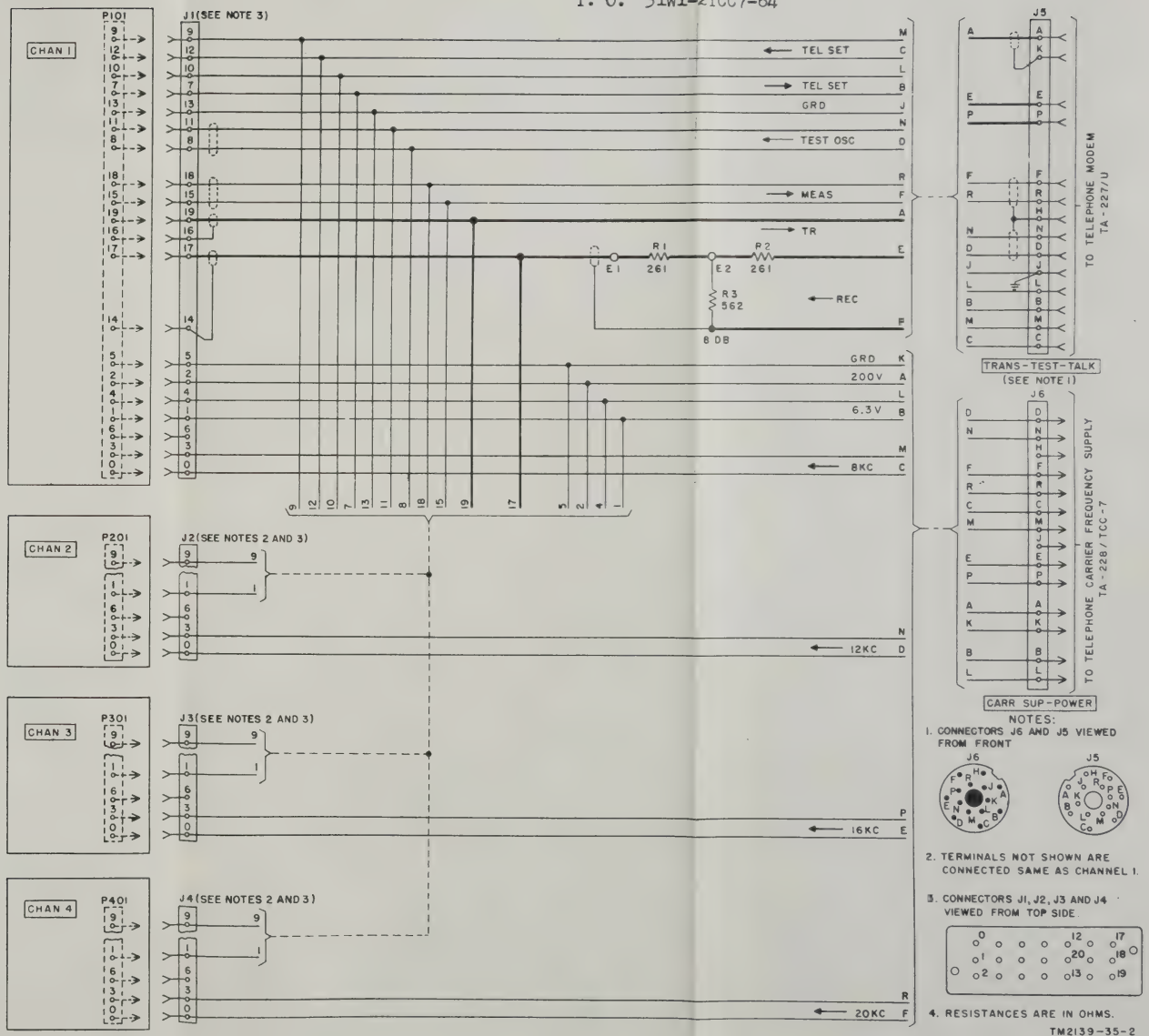
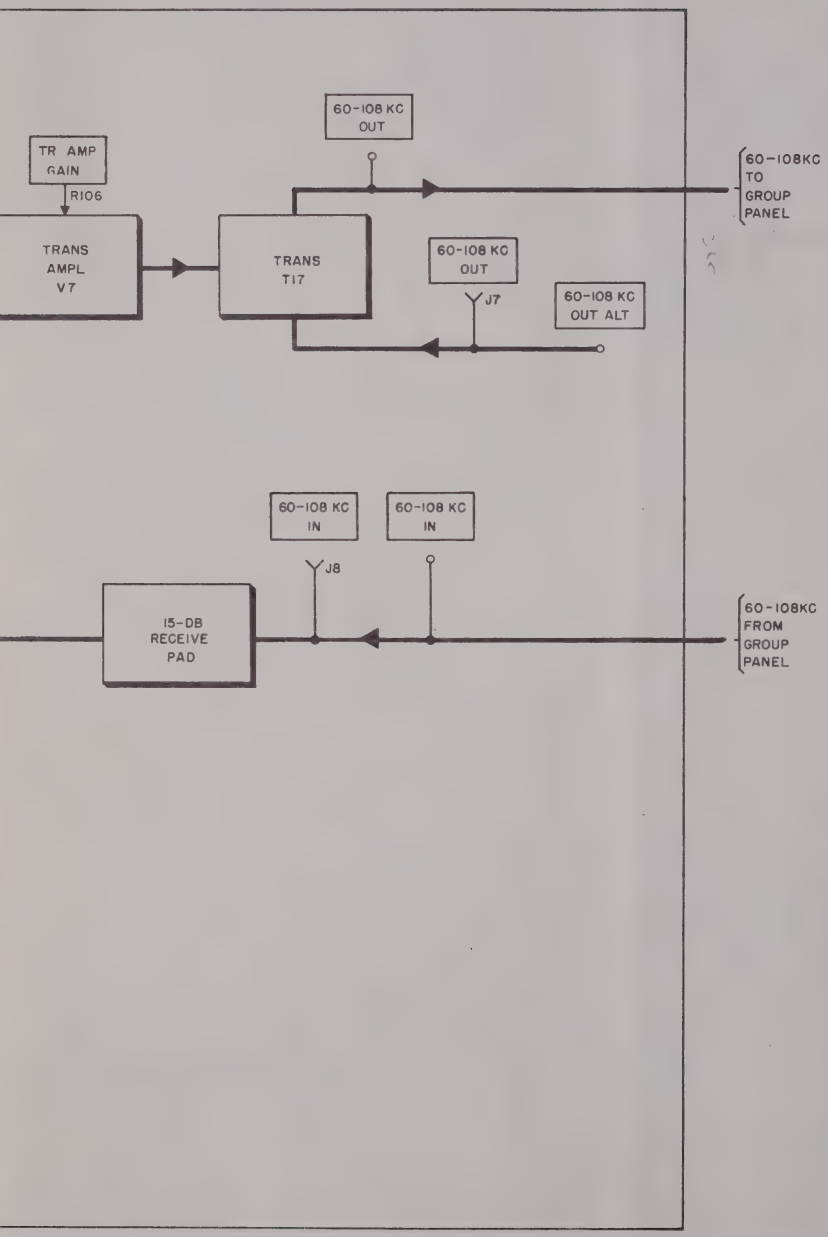
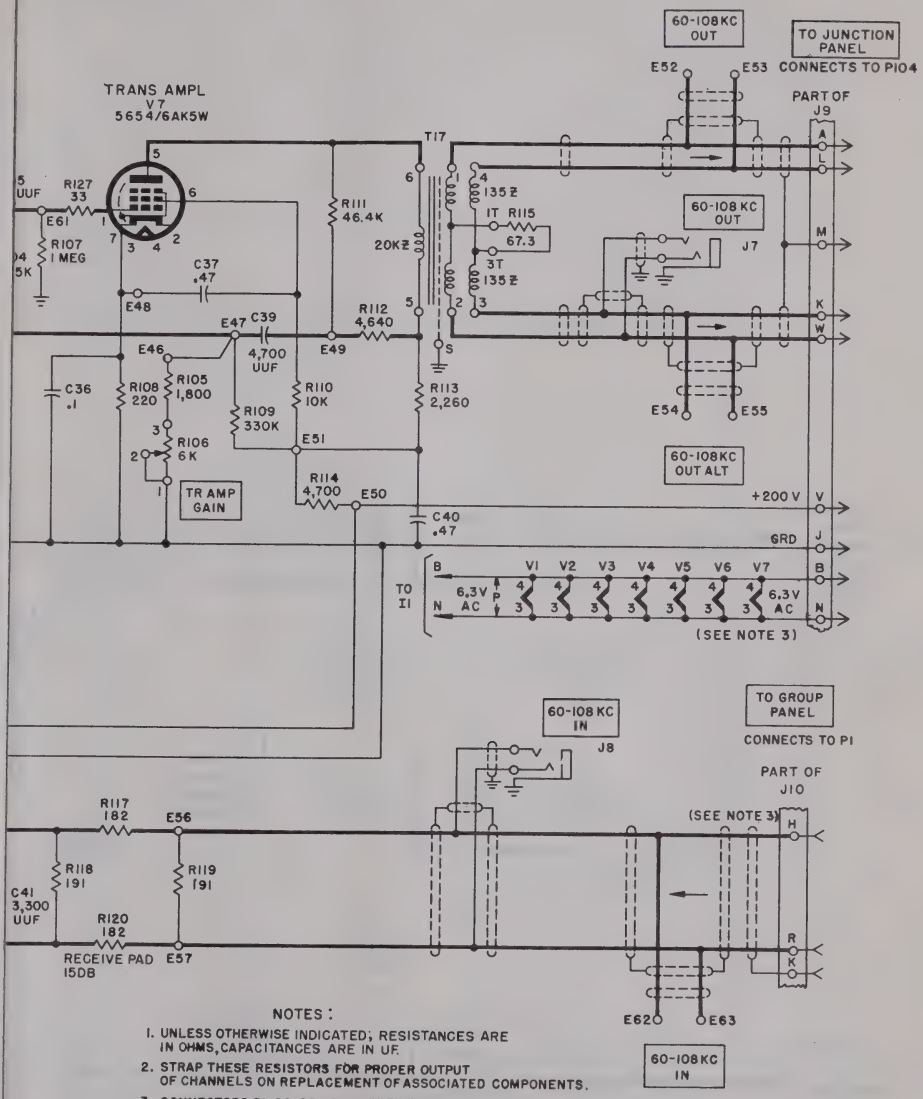


Figure 3.

Figure 3. Telephone Modem TA-219/U, schematic diagram of main chassis.

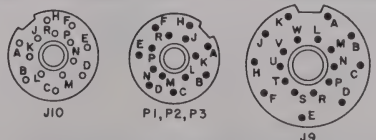

60-108 KC
OUT
TR AMP
GAIN
R106
60-108KC
TO
GROUP
PANEL
TRANS
AMPL
V7
TRANS
T17
60-108 KC
OUT
J7
60-108 KC
OUT ALT
60-108 KC
IN
60-108 KC
IN
J8
15-DB
RECEIVE
PAD
60-108KC
FROM
GROUP
PANEL

TM2139-35-9



NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
2. STRAP THESE RESISTORS FOR PROPER OUTPUT OF CHANNELS ON REPLACEMENT OF ASSOCIATED COMPONENTS.
3. CONNECTORS P1, P2, P3, J9, J10, VIEWED FROM PIN SIDE.



4. SWITCH CONTACT NUMBERS HAVE BEEN ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

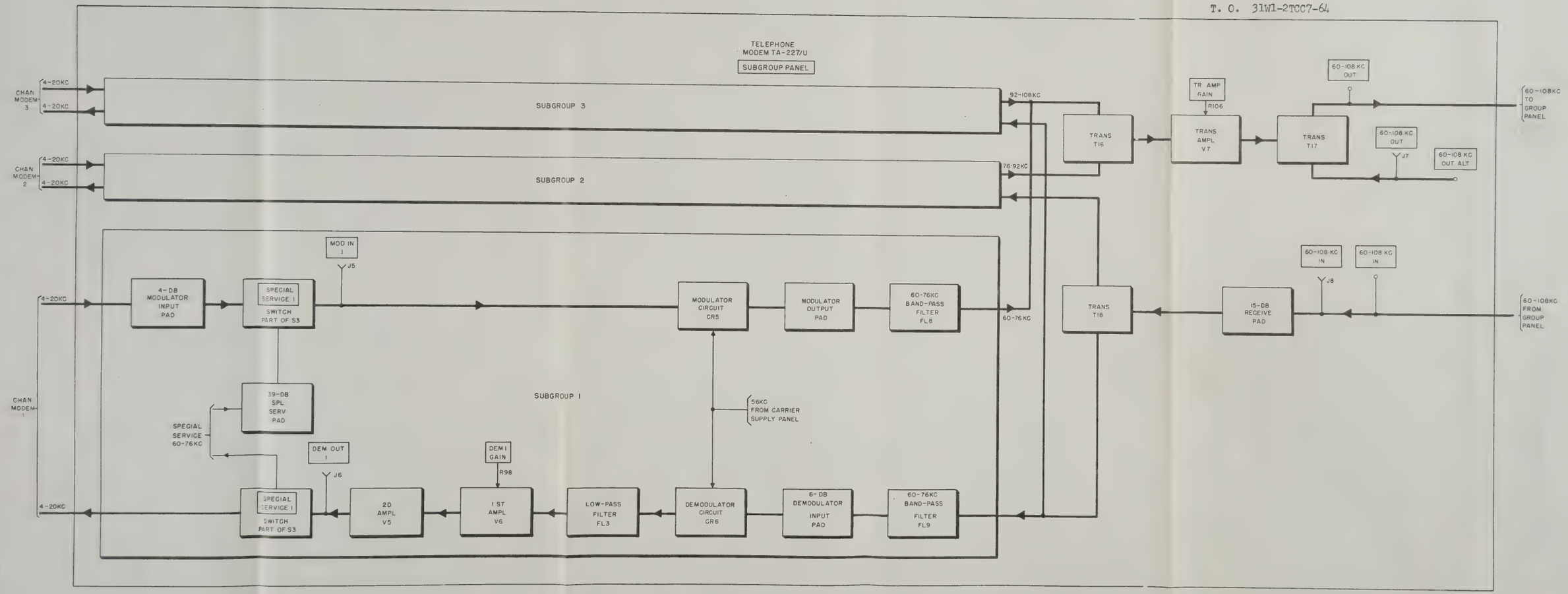


Figure 4.

Figure 4. Telephone Modem TA-227/U, block diagram.

TM2139-35-9

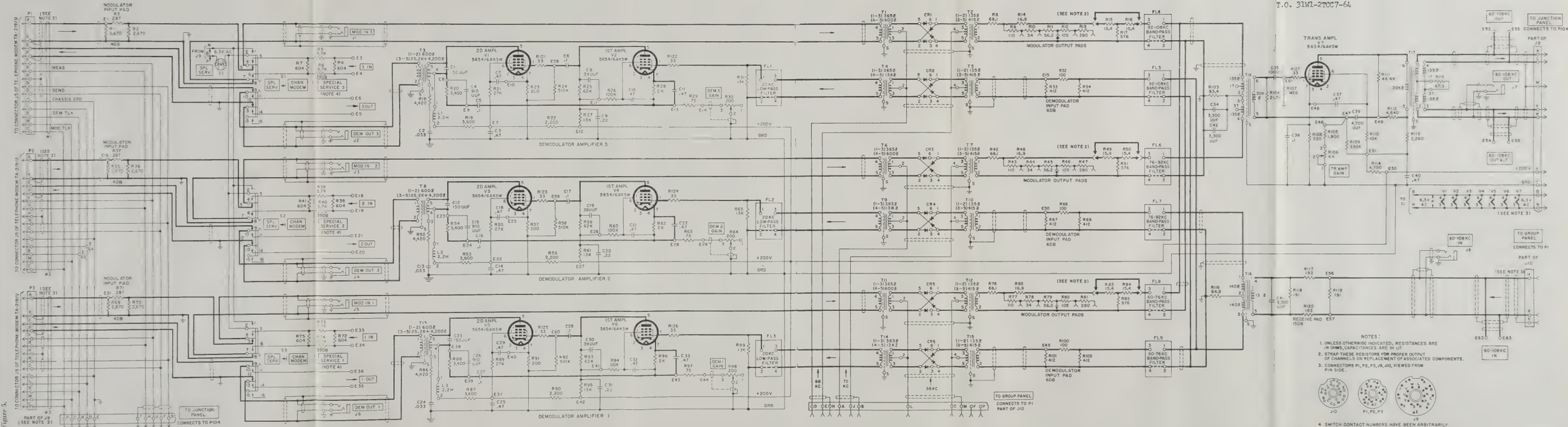


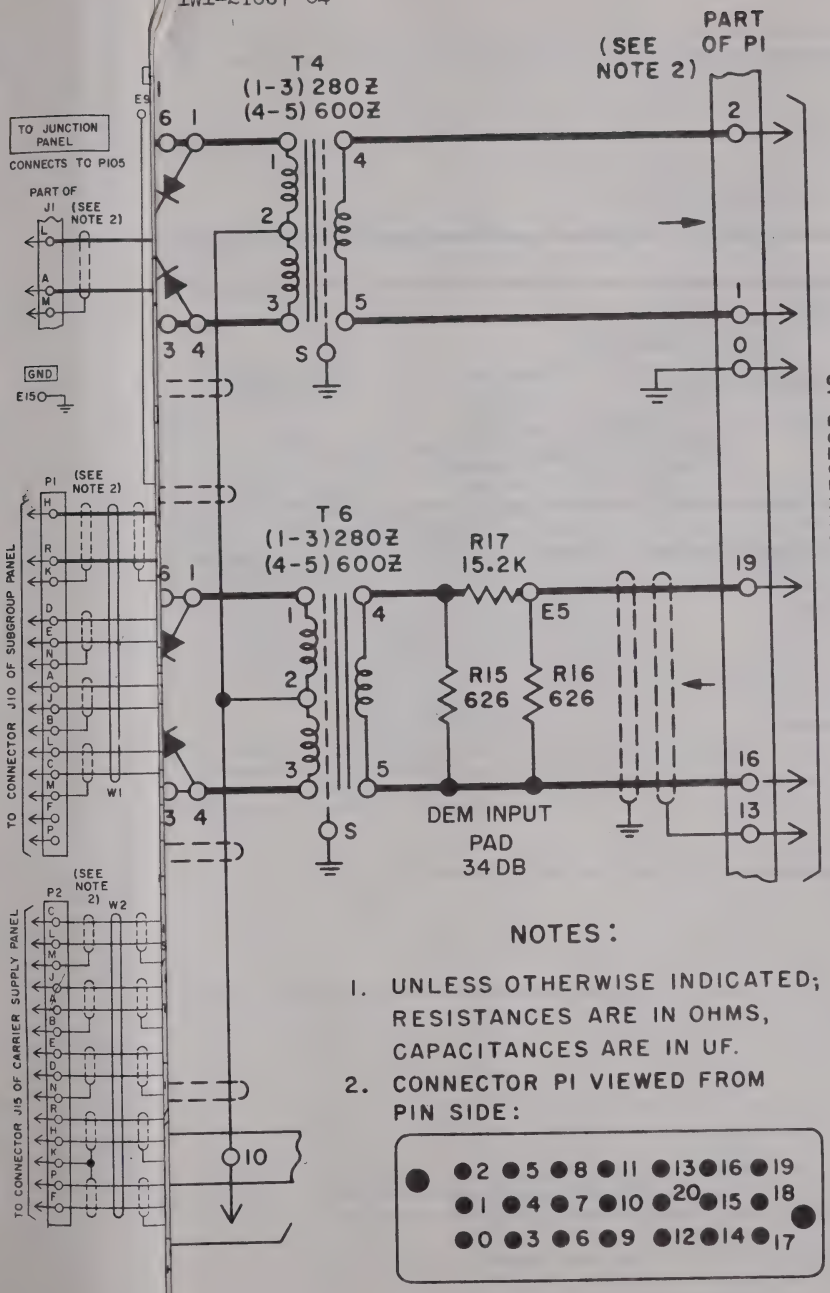
Figure 5. Telephone Modem TA-227/U, schematic diagram.

TM2139-35-10

12-60KC TO JUNCTION PANEL

12-60KC FROM JUNCTION PANEL

TM2139-35-13



NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
2. CONNECTOR PI VIEWED FROM PIN SIDE:

TM2139-35-17

Figure 7.

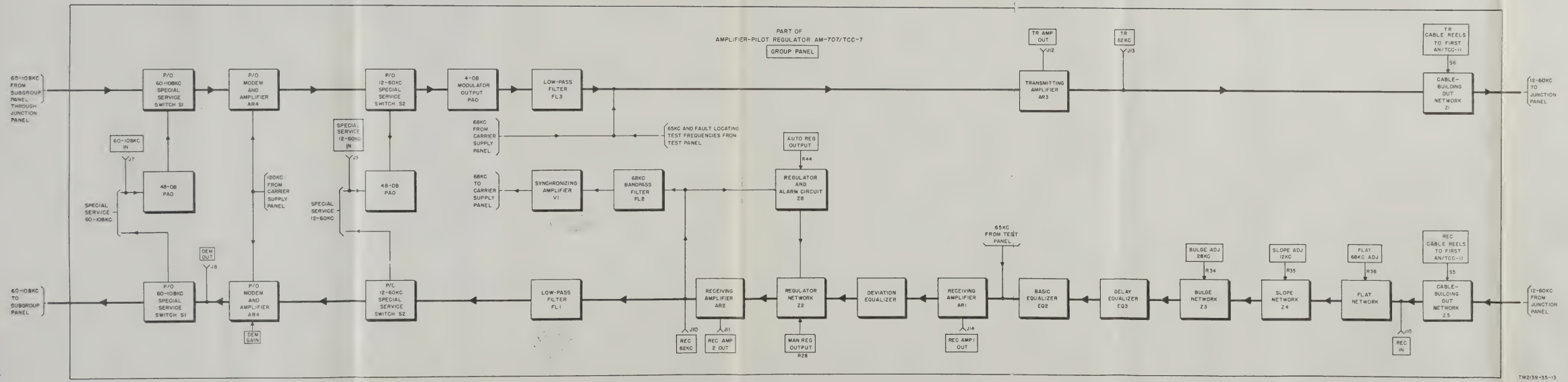


Figure 6.

Figure 6. Amplifier-Pilot Regulator AM-707/TCC-7, block diagram.

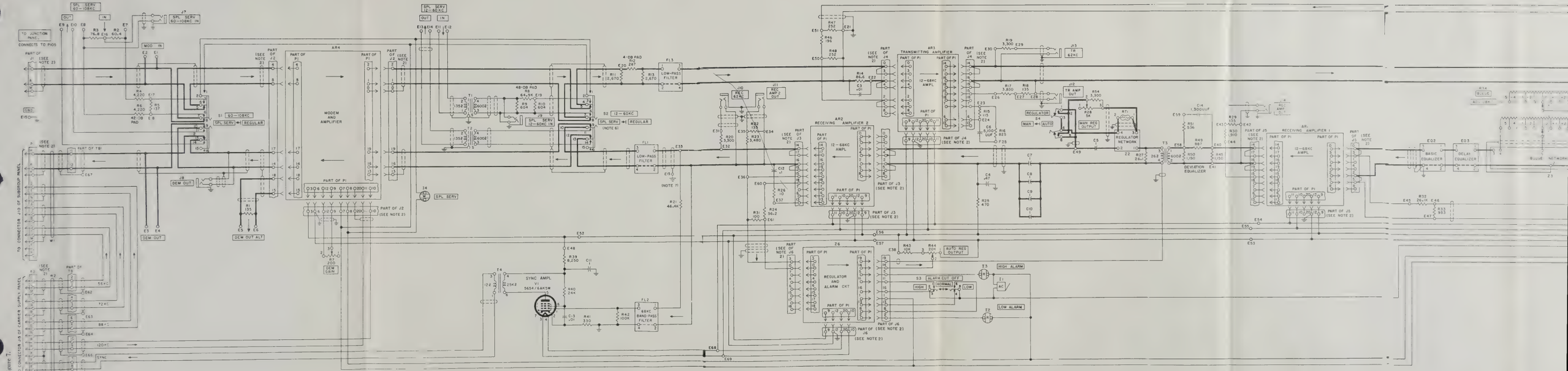


Figure 7. Amplifier-pilot Regulator AM-707/TCC-7, schematic diagram.

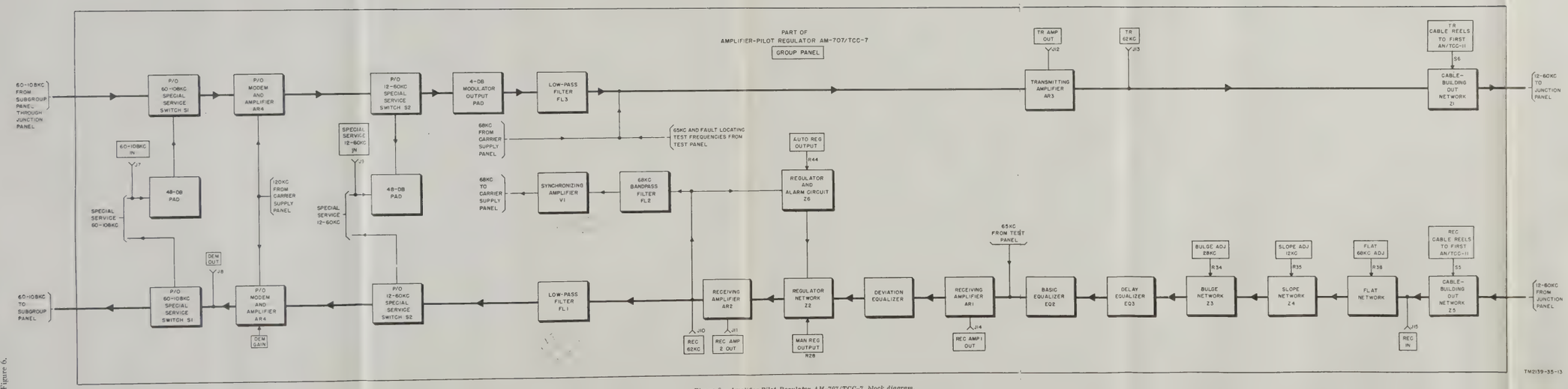


Figure 6. *Amplifier-Pilot Regulator AM-707/TCC-7, block diagram.*

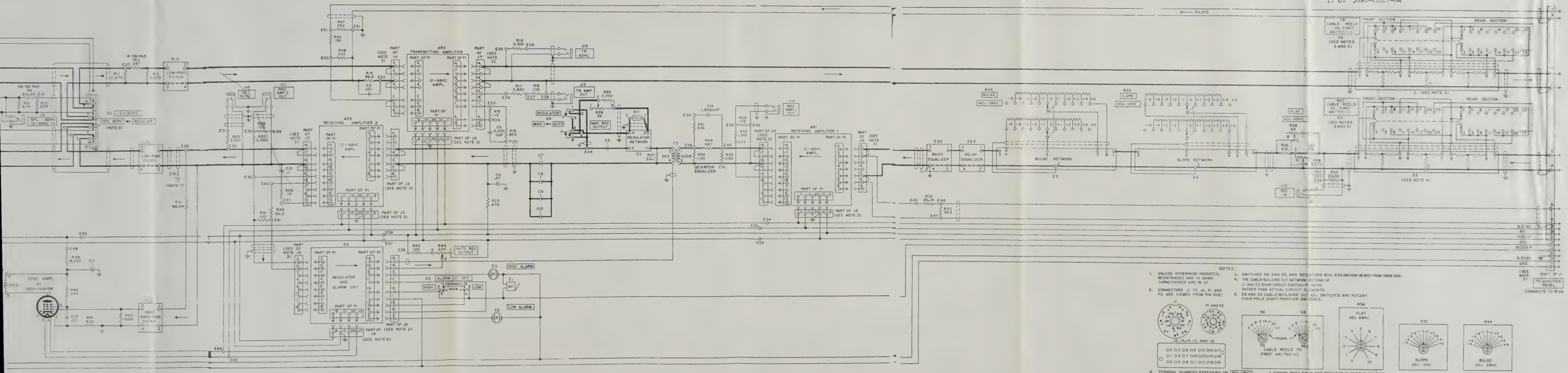


Figure 7. Amplifier-pilot Regulator AM-707/TCC-7, schematic diagram.

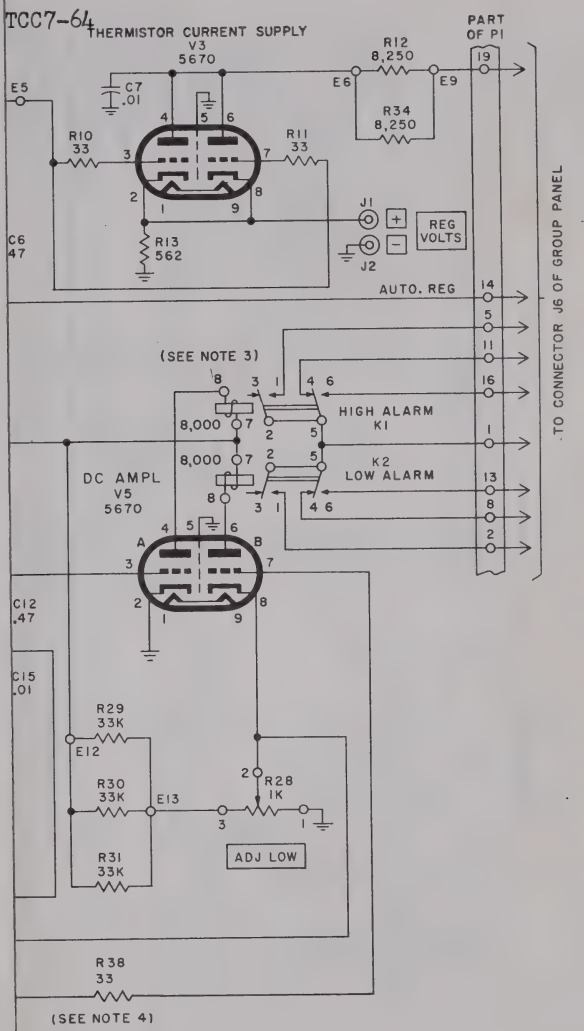
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS CAPACITANCES ARE IN µF.
2. CONNECTORS J1 TO J6, P1 AND P2 ARE VIEWED FROM PIN SIDE.
3. SWITCHES S6 AND S5, AND RESISTORS R34, R35 AND R38 VIEWED FROM KNOB END.
4. THE CABLE-BUILDING OUT NETWORK SECTIONS OF Z1 AND Z5 SHOW CIRCUIT CONTINUITY PATHS RATHER THAN ACTUAL CIRCUIT ELEMENTS.
5. S6 AND S5 CABLE-BUILDING OUT KEY SWITCHES ARE ROTARY FOUR POLE, EIGHT POSITION SWITCHES.

6. TERMINAL NUMBERS APPEARING ON 60-12KC SWITCH S1 AND 12-60KC SWITCH S2 ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

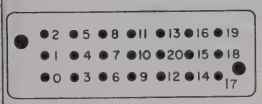
7. BINDING POST E68 IS NOT PROVIDED IN PANELS BEARING ORDER NO. 1448-PH-A-51, SERIAL NOS. 1 THROUGH 749.

TME139-38-14



NOTES:

S OTHERWISE INDICATED;
TANCES ARE IN OHMS, RELAY
NGS ARE IN OHMS, CAPACITANCES
I UF.
CTOR P1 VIEWED FROM PIN SIDE:



3. RELAYS SHOWN IN NORMAL OPERATING CONDITION.
4. RESISTOR R38 IS NOT USED ON ALL EQUIPMENT; HOWEVER, ALL REGULATOR AND ALARM UNITS ARE INTERCHANGEABLE.

TM2139-35-69

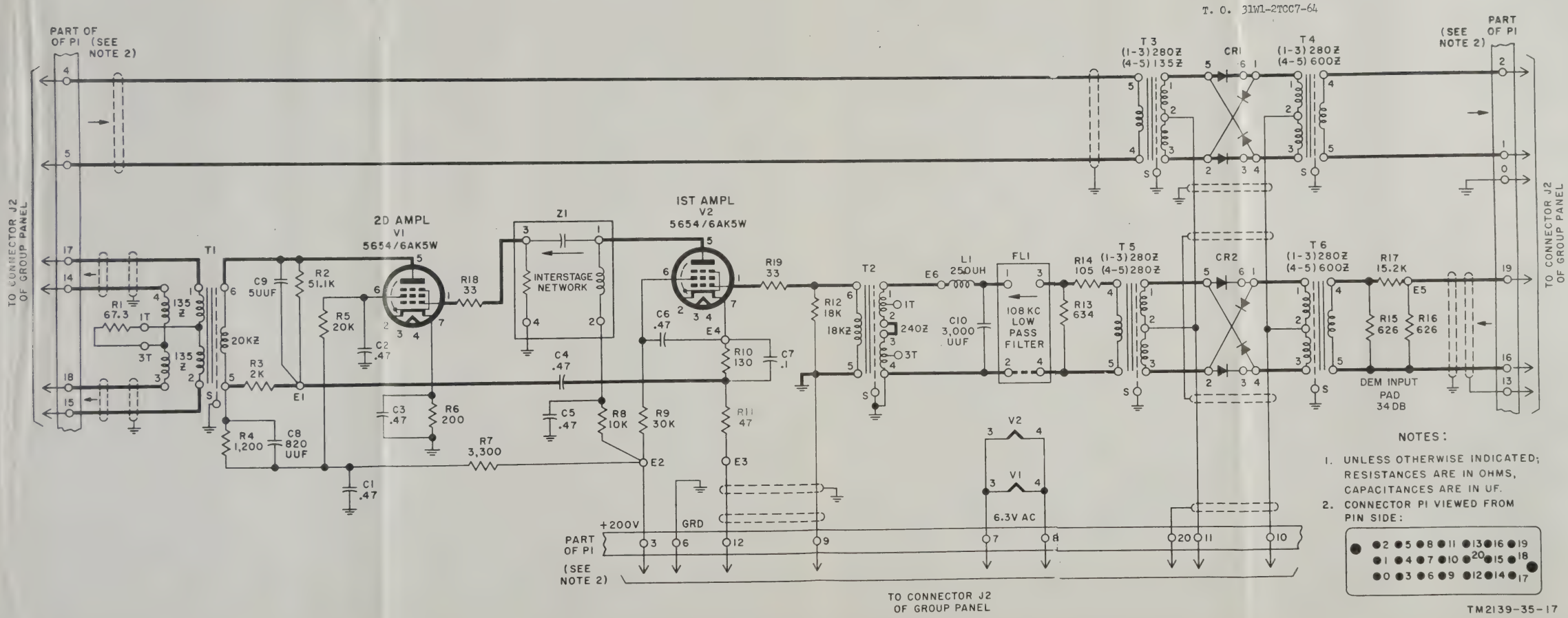


Figure 8. Modem and amplifier AR4 (part of GROUP PANEL), schematic diagram.

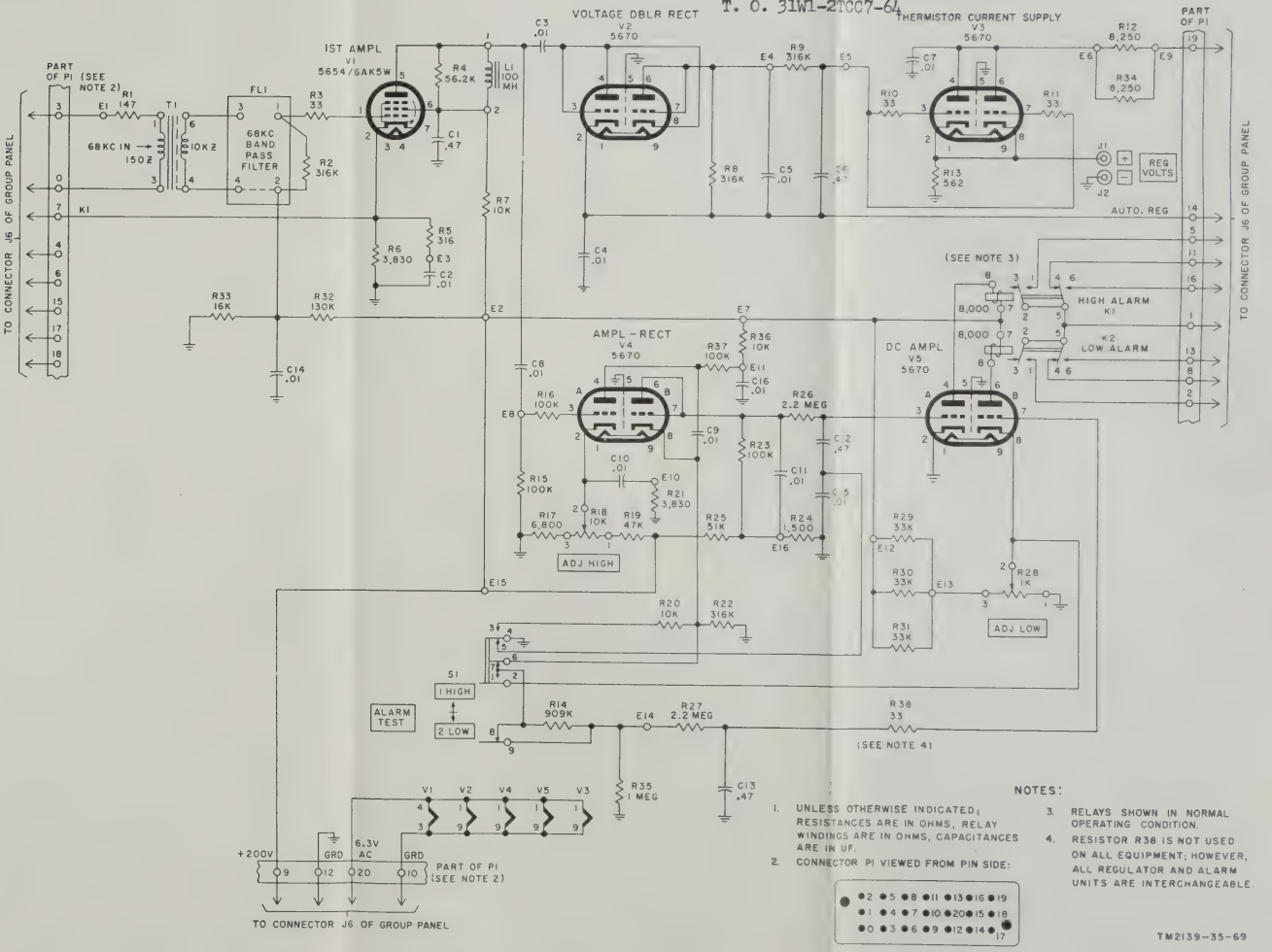


Figure 15.

Figure 15. Regulator and alarm unit Z6, schematic diagram.

TO JUNCTION PANEL
CONNECTS TO P103
PART OF J16
P1
(SEE NOTES 2,7)
W1
W2
W3
P2
P3
TO CONNECTOR J6 OF TELEPHONE MODEM TA-219/U
6.3V AC
GRD
+200V
16KC
8KC
20KC
12KC
22
R139
R140
R141
R142
R143
R145
R146
R147
R148
R149
R150
R151
R152
R153
R154
R157
R158
R159
R160
J9
8KC
8KC ISOLATION RESISTORS
MODEMS 1, 2, AND 3
(1)
(2)
(3)
TM2139-35-27

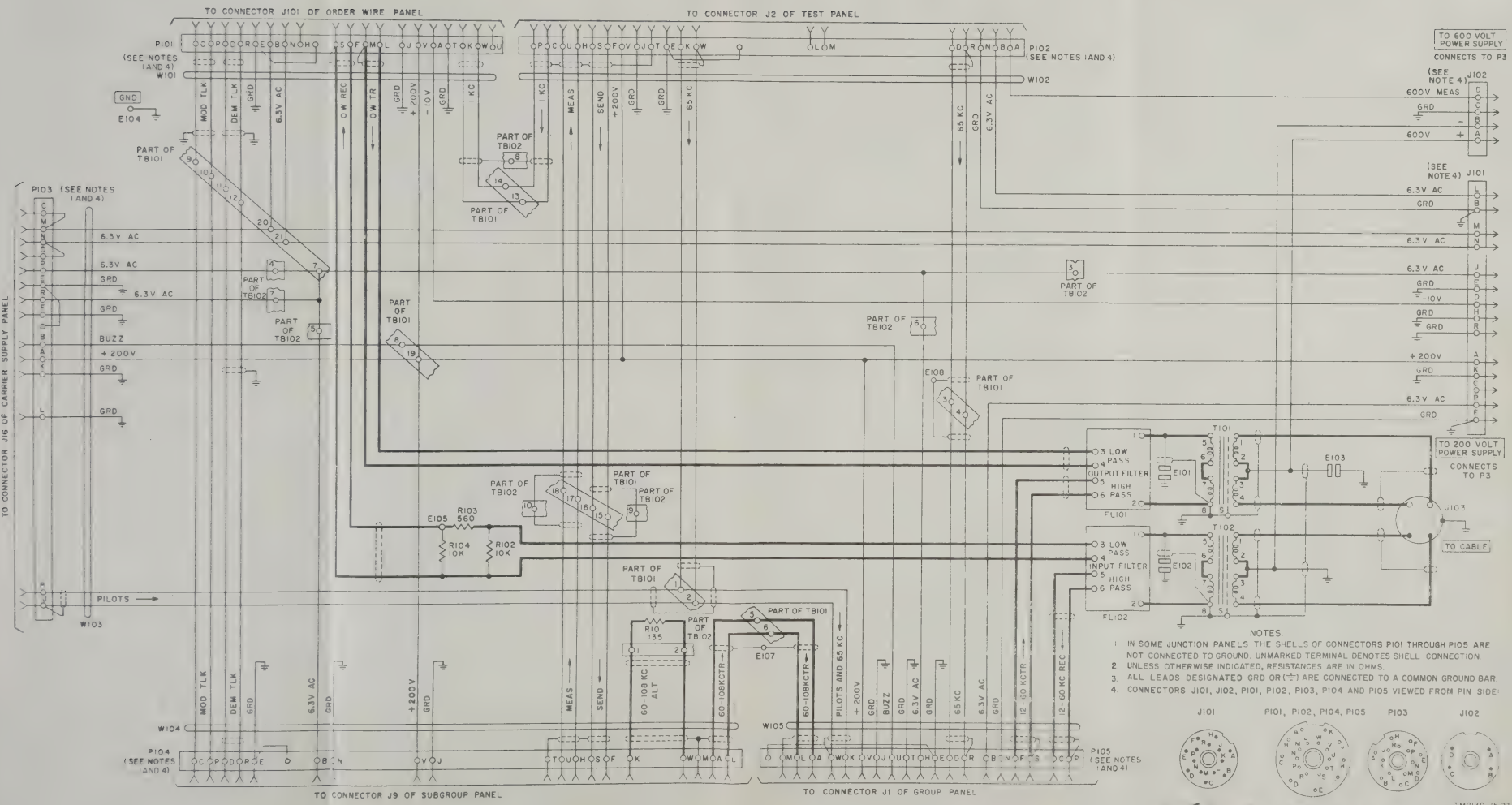


Figure 18. *Junction Panel (Part of Amplifier-Pilot Regulator AM-707/TCC-7), schematic diagram.*

SEE SUPP -LWD

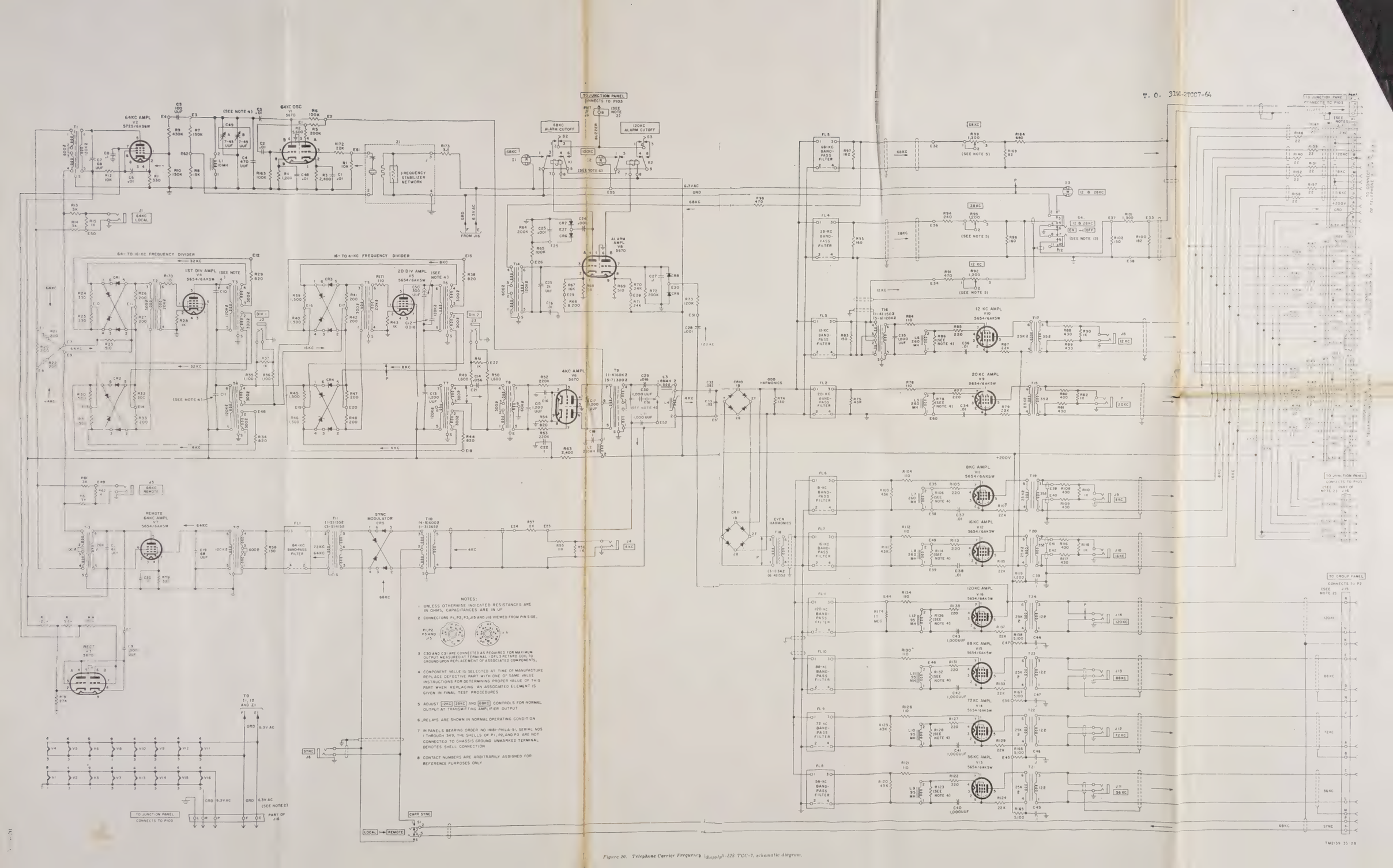
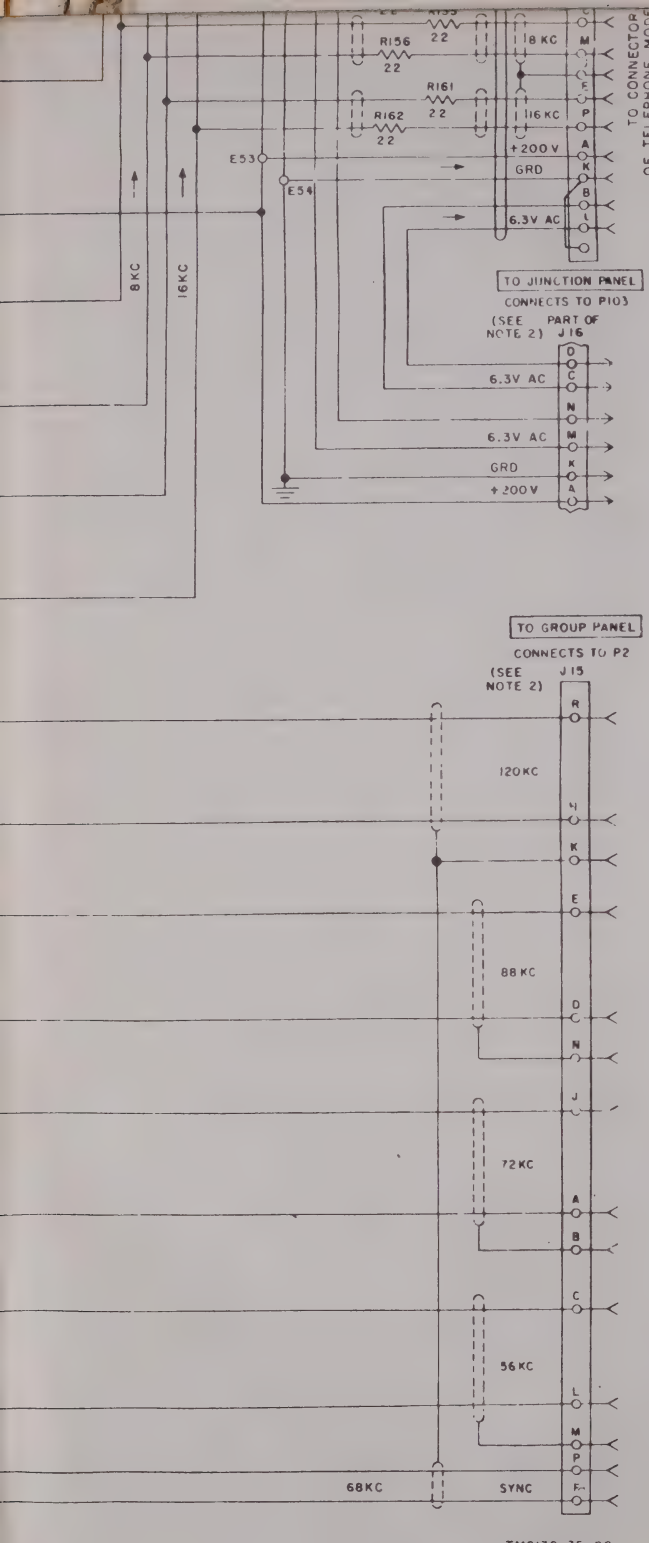
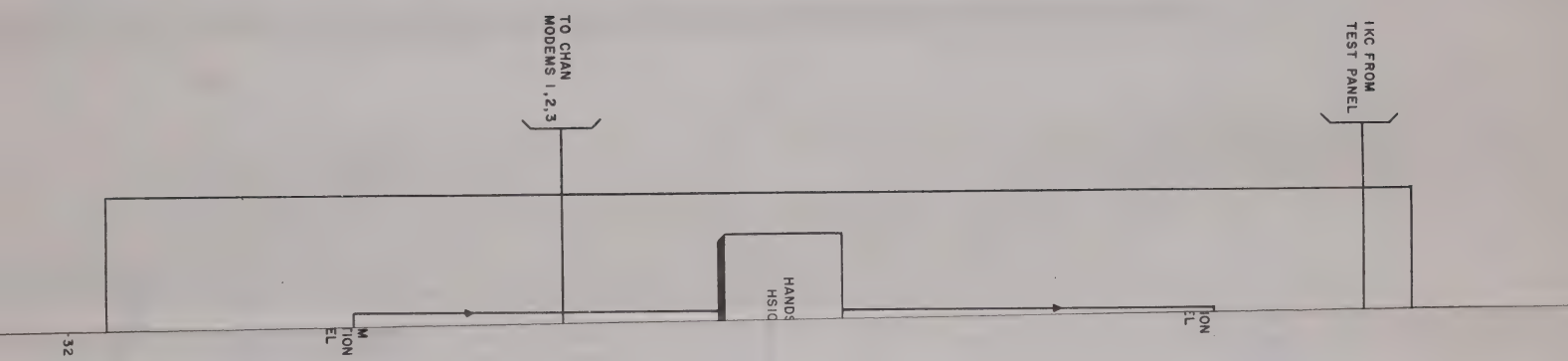


Figure 20. Telephone Carrier Frequency (Supply)-228 TCC-7, schematic diagram.


R156
22
R161
22
R162
22
8 KC
16 KC
+200 V
GRD
6.3V AC
TO CONNECTOR
OF TELEPHONE MODE
E53
E54
8KC
16KC
TO JUNCTION PANEL
CONNECTS TO P103
(SEE NOTE 2)
PART OF J16
6.3V AC
6.3V AC
GRD
+200V
TO GROUP PANEL
CONNECTS TO P2
(SEE NOTE 2)
J15
120KC
88 KC
72 KC
56 KC
68KC
SYNC

TM2139-35-28

Figure 22.


TO CHAN
MODEMS 1,2,3
1KC FROM
TEST PANEL
HANDS
HSIO
M
TION
EL
ION
EL
32

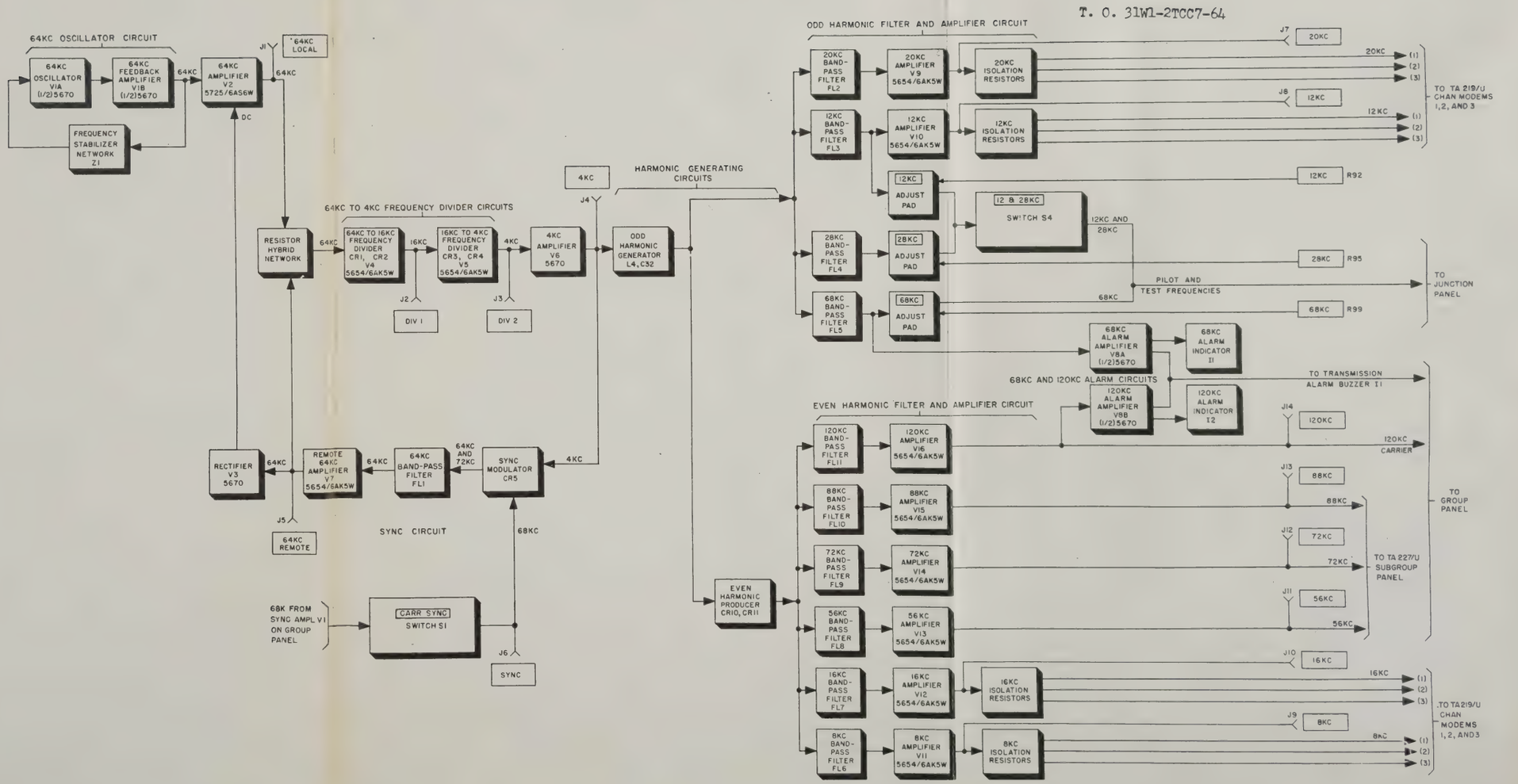


Figure 19.

Figure 19. Telephone Carrier Frequency Supply TA-228/TCC-7, block diagram.

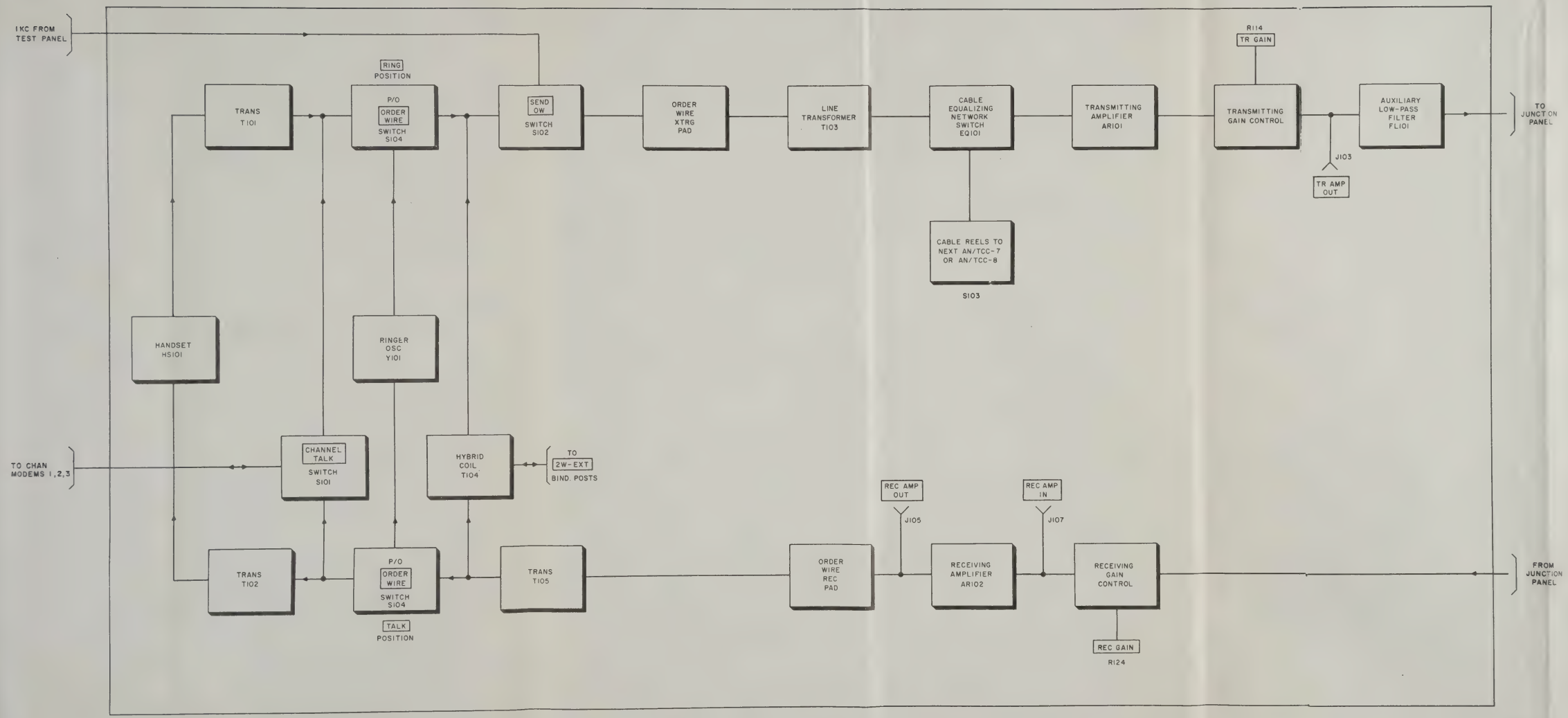


Figure 22.

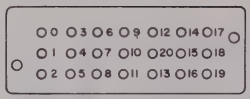
Figure 22. Order Wire Receiver-Transmitter RT-280/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), block diagram.

NOTES:

1. CONNECTORS J101, J102, J104 AND J106 VIEWED FROM PIN SIDE.



J101



J102, J104, J106

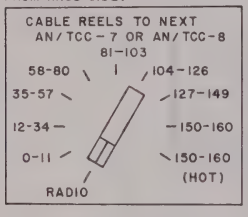
2. WHEN HS101 IS HANDSET TS-9, USE "X" WIRING. WHEN HS101 IS HANDSET H-60 USE "Y" WIRING.

3. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.

4. ADJUST TR GAIN AS PER TABLE BELOW.

OW TR AMP OUT ADJ			
REPEATERS IN POWER LOOP	CABLE REELS TO FIRST AN/TCC-11	TEST PANEL ATTENUATOR	TEST PANEL METER READING
0	2-9	0DB	+2.5DB
0	10-16	5	0
0	17-23	10	-2.0
1	2-9	10	+1.5
1	10-16	5,10	-0.5
1	17-23	5,10	+2.0
2	2-9	20	+0.5
2	10-16	5,20	-1.5
2	17-23	5,20	+1.0
3	2-9	10,20	-0.5
3	10-16	10,20	+2.5
3	17-23	5,10,20	0
RADIO CONNECTION		10,20	+0.5

5. SWITCH S103 VIEWED FROM KNOB SIDE.

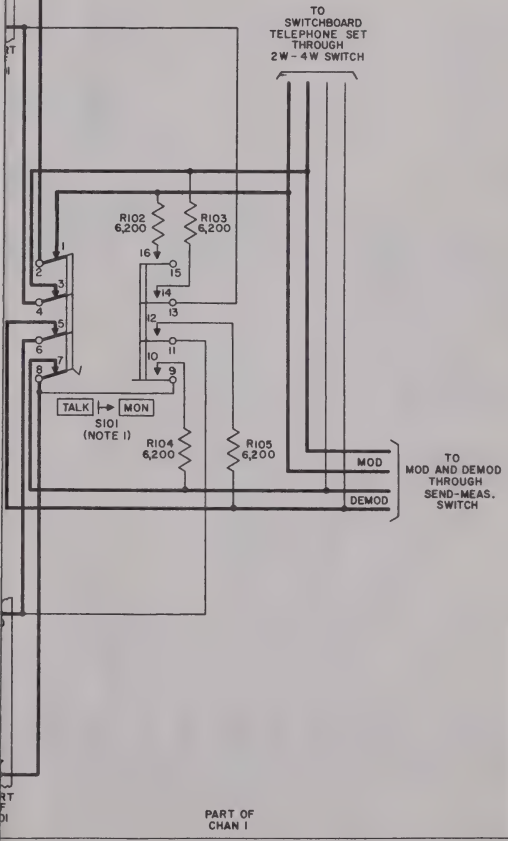


S103 EQUALIZER SWITCH TABLE OF CONTACTS MADE.

SWITCH POSITION	SECTION 1	SECTION 2	SECTION 3	SECTION 4
RADIO	-	-	2-1	2-12
0-11	-	-	-	3-9-12
12-34	4-12	4-12	-	4-9-10
35-57	5-12	5-12	-	5-9-10
58-80	6-12	6-12	-	6-9-10-12
81-103	7-12	7-12	-	7-9-10-12
104-126	8-12	8-12	-	8-9-10-12
127-149	9-12	9-12	-	9-10-12
150-160	10-12	10-12	-	9-10-12
150-160 (HOT)	11-12	11-12	-	9-10-11-12

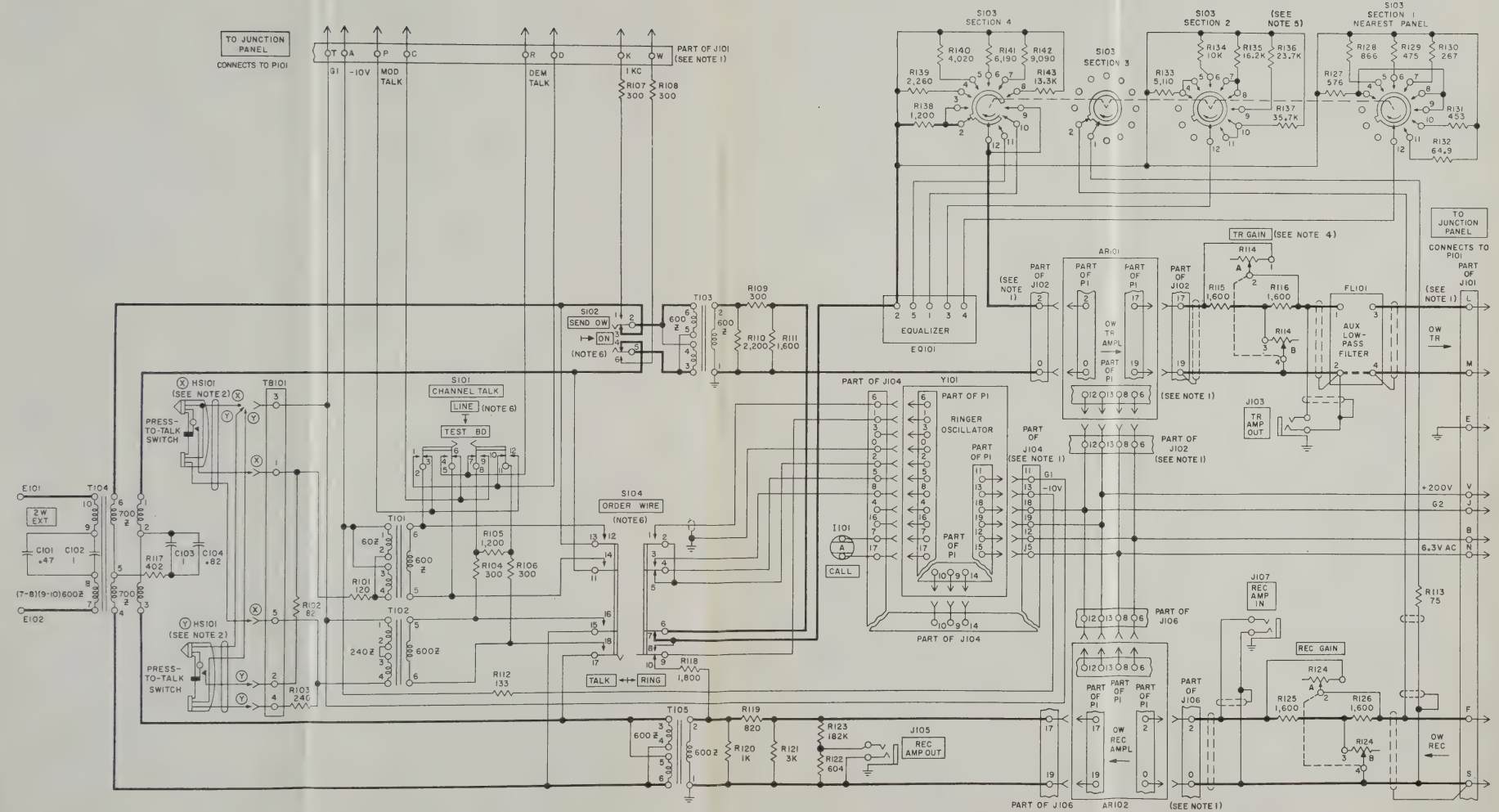
6. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

C7-64



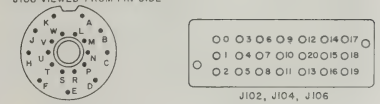
N MODEM NO. 1
E MODEM TA-219/U NO.1

TM2139-35-36



NOTES:

1. CONNECTORS J101, J102, J104 AND J106 VIEWED FROM PIN SIDE



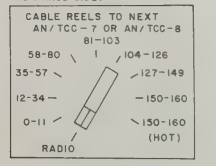
2. WHEN HS101 IS HANDSET TS-9, USE "X" WIRING. WHEN HS101 IS HANDSET H-60 USE "Y" WIRING.

3. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.

4. ADJUST TR GAIN AS PER TABLE BELOW.

OW TR AMP OUT ADJ			
REPEATERS IN POWER LOOP	CABLE REELS TO FIRST AN/TCC-11	TEST PANEL ATTENUATOR	TEST PANEL METER READING
0	2-9	ODB	+2.5DB
0	10-16	5	0
0	17-23	10	-2.0
1	2-9	10	+1.5
1	10-16	5,10	-0.5
1	17-23	5,10	+2.0
2	2-9	20	+0.5
2	10-16	5,20	-1.5
2	17-23	5,20	+1.0
3	2-9	10,20	-0.5
3	10-16	10,20	+2.5
3	17-23	5,10,20	0
RADIO CONNECTION		10,20	+0.5

5. SWITCH S103 VIEWED FROM KNOB SIDE.



S103 EQUALIZER SWITCH TABLE OF CONTACTS MADE.

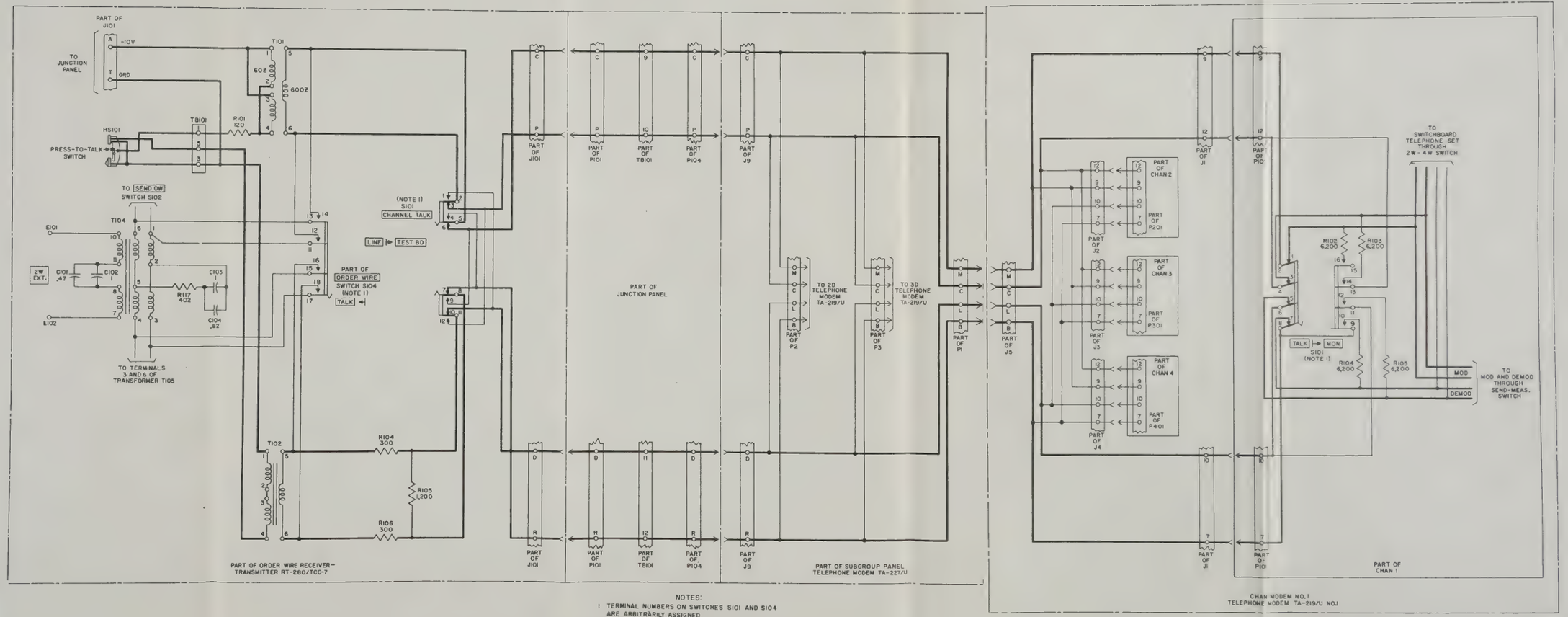
SWITCH POSITION	SECTION 1	SECTION 2	SECTION 3	SECTION 4
RADIO	–	–	2-1	2-12
0-11	–	–	–	3-9-12
12-34	4-12	4-12	–	4-9-10
35-57	5-12	5-12	–	5-9-10
58-80	6-12	6-12	–	6-9-10-12
81-103	7-12	7-12	–	7-9-10-12
104-126	8-12	8-12	–	8-9-10-12
127-149	9-12	9-12	–	9-10-12
150-160	10-12	10-12	–	9-10-12
150-160 (HOT)	11-12	11-12	–	9-10-11-12

6. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY

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Figure 23.

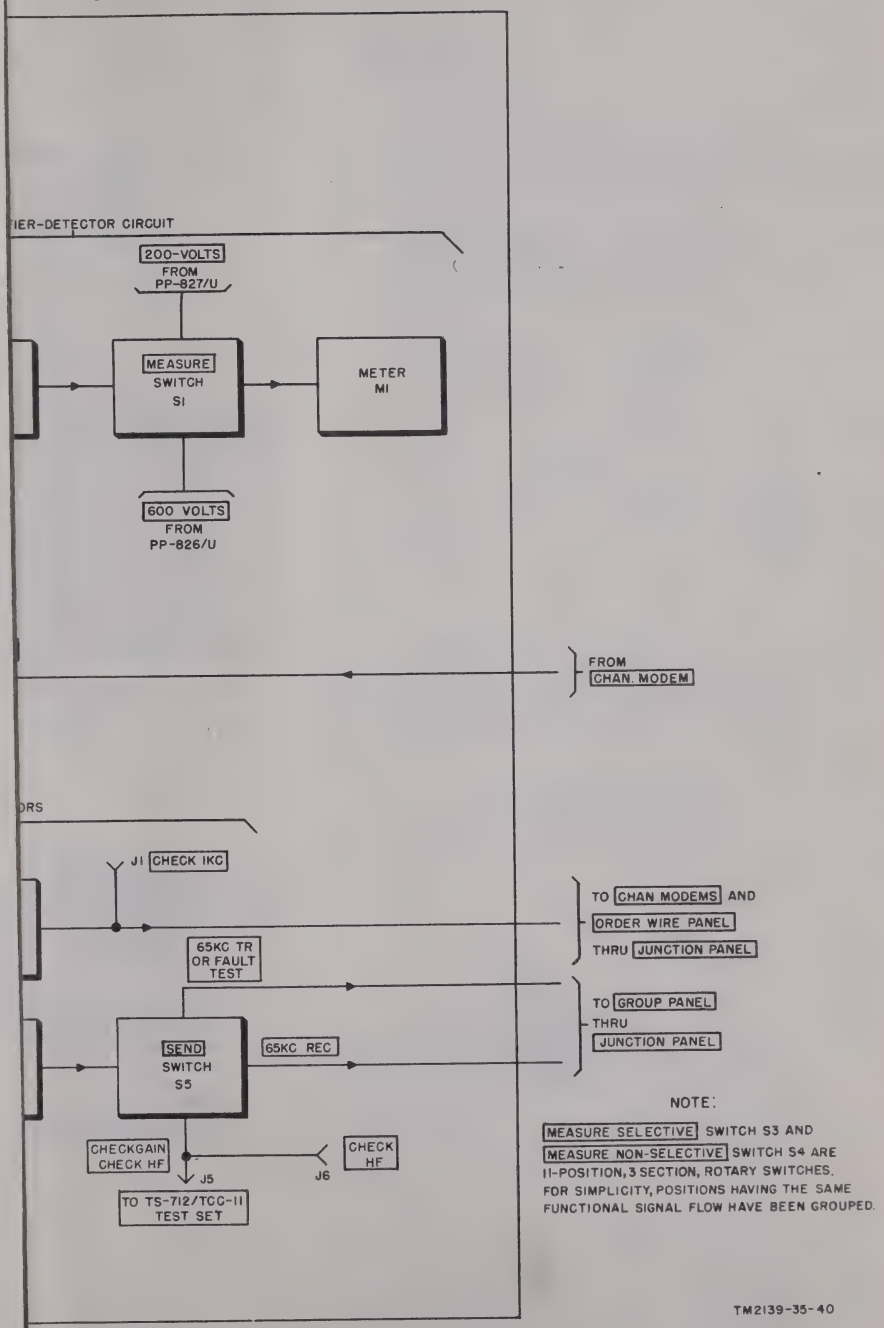
Figure 23. Order Wire Receiver-Transmitter RT-280/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), schematic diagram.

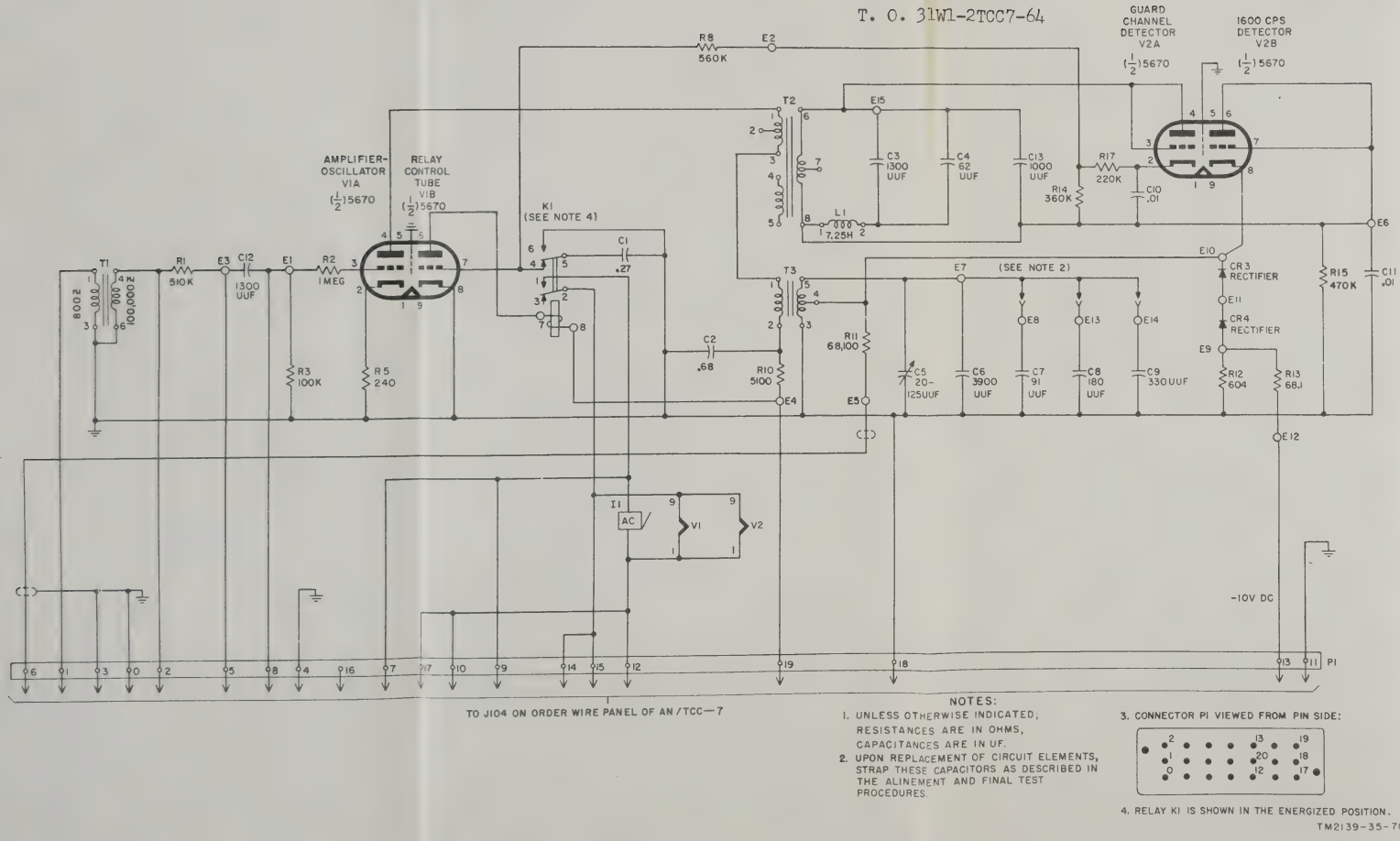


NOTES:
1. TERMINAL NUMBERS ON SWITCHES SI01 AND SI04 ARE ARBITRARILY ASSIGNED
2. RESISTANCES ARE IN OHMS, AND CAPACITANCES ARE IN UF

Figure 26.

Figure 26. Order Wire Receiver-Transmitter RT-280/TCC-7, handset connected to CHAN MODEM, functional schematic diagram.


IER-DETECTOR CIRCUIT
200-VOLTS FROM PP-827/U
MEASURE SWITCH S1
METER M1
600 VOLTS FROM PP-826/U
FROM CHAN. MODEM
ORS
J1 CHECK IKC
TO CHAN MODEMS AND ORDER WIRE PANEL THRU JUNCTION PANEL
65KC TR OR FAULT TEST
TO GROUP PANEL THRU JUNCTION PANEL
SEND SWITCH S3
65KC REC
CHECKGAIN CHECK HF
J5
J6
CHECK HF
TO TS-712/TCC-11 TEST SET
NOTE:
MEASURE SELECTIVE SWITCH S3 AND MEASURE NON-SELECTIVE SWITCH S4 ARE 11-POSITION, 3 SECTION, ROTARY SWITCHES. FOR SIMPLICITY, POSITIONS HAVING THE SAME FUNCTIONAL SIGNAL FLOW HAVE BEEN GROUPED.
TM2139-35-40



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
2. UPON REPLACEMENT OF CIRCUIT ELEMENTS, STRAP THESE CAPACITORS AS DESCRIBED IN THE ALINEMENT AND FINAL TEST PROCEDURES.
3. CONNECTOR P1 VIEWED FROM PIN SIDE:

4. RELAY K1 IS SHOWN IN THE ENERGIZED POSITION.

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Figure 27.

Figure 27. Ringer-oscillator Y101 (part of Order Wire Receiver-Transmitter RT-280/TCC-7), schematic diagram.

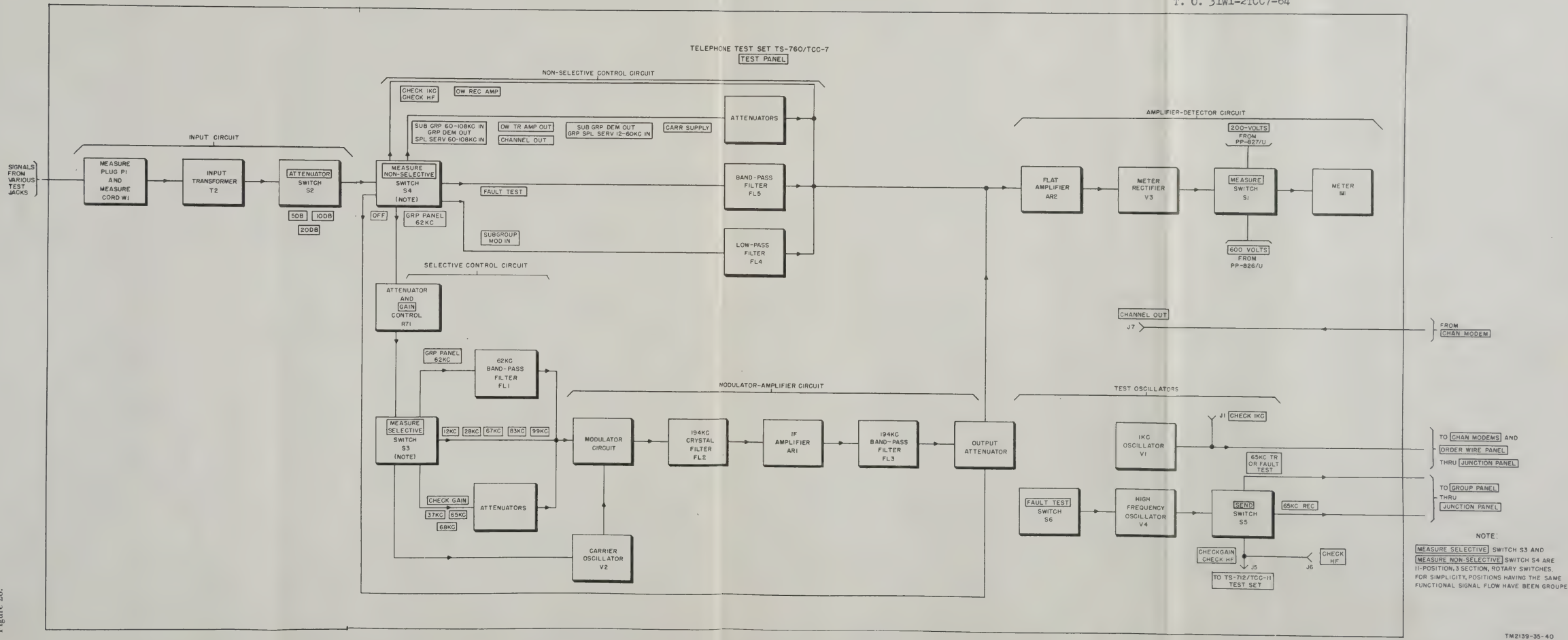
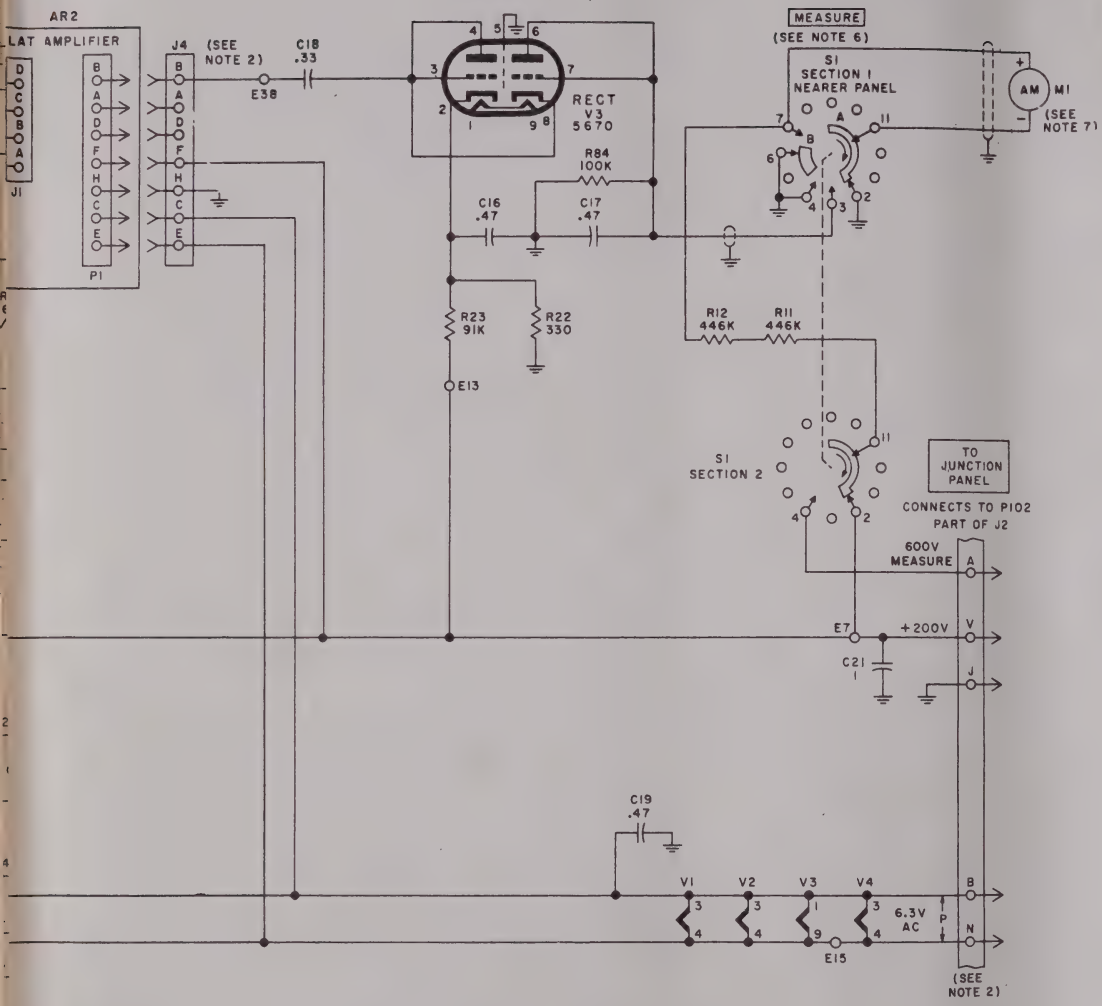


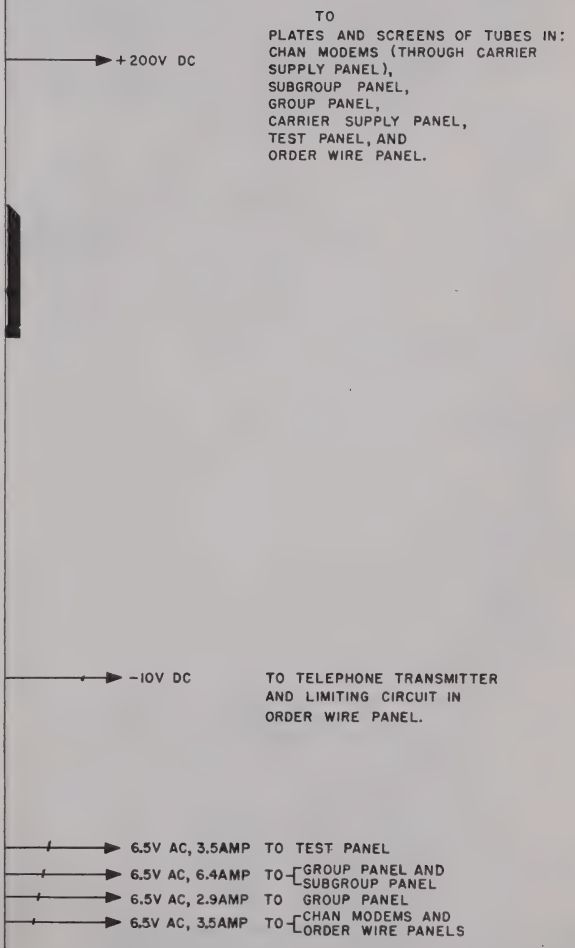
Figure 28.

Figure 28. Telephone Test Set TS-760/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), block diagram.

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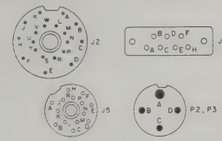
2TCC7-64



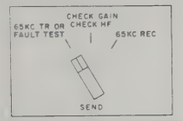
TM2139-35-48

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
2. CONNECTORS J2, J3, J4, J5, P2, P3 VIEWED FROM PIN SIDE.

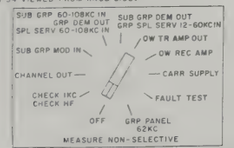


3. SWITCH S5 VIEWED FROM KNOB SIDE.



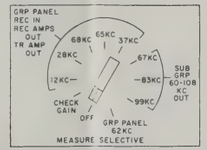
S5 SEND SWITCH TABLE OF CONTACTS MADE			
SWITCH POSITION	SECTION 1A	SECTION 1B	SECTION 2
65KC TR OR FAULT TEST	6-7	12-1	12-1
CHECK GAIN CHECK HF	6-8	–	–
65KC REC	6-9	12-3	12-3

4. SWITCH S4 VIEWED FROM KNOB SIDE.



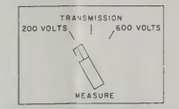
S4 MEASURE NON-SELECTIVE SWITCH TABLE OF CONTACTS MADE			
SWITCH POSITION	SECTION 1	SECTION 2	SECTION 3
OFF	12-1	1-12	12-1
CHECK IKC CHECK HF	12-2	2-12	12-2
CHANNEL OUT	12-3	3-12	12-3
SUB GRP MOD IN	12-4	4-12	12-4
SUB GRP 60-108KC IN GRP DEM OUT SPL SERV 60-108KC IN	12-5	5-12	12-5
SUB GRP DEM OUT GRP SPL SERV 12-60KC IN	12-6	6-12	12-6
OW TR AMP OUT	12-7	7-12	12-7
OW REC AMP	12-8	8-12	12-8
CARR SUPPLY	12-9	9-12	12-9
FAULT TEST	12-10	10-12	12-10
GRP PANEL 62KC	12-11	11-12	12-11

5. SWITCH S3 VIEWED FROM KNOB SIDE.



S3 MEASURE SELECTIVE SWITCH TABLE OF CONTACTS MADE				
SWITCH POSITION	SECTION 1	SECTION 2	SECTION 3A	SECTION 3B
OFF	12-1	12-1	–	–
CHECK GAIN	12-2	12-2	2-1	–
12KC	12-3	12-3	3-1	–
28KC	12-4	12-4	4-1	–
68KC	12-5	12-5	5-1	–
65KC	12-6	12-6	6-1	–
37KC	12-7	12-7	7-1	–
67KC	12-8	12-8	8-1	–
83KC	12-9	12-9	9-1	–
99KC	12-10	12-10	10-1	–
GRP PANEL 62KC	12-11	12-11	–	1-12

6. SWITCH S1 VIEWED FROM KNOB SIDE.



S1 MEASURE SWITCH TABLE OF CONTACTS MADE			
SWITCH POSITION	SECTION 1A	SECTION 1B	SECTION 2
200 VOLTS	2-11	–	11-2
TRANSMISSION	3-11	7-6	–
600 VOLTS	4-11	–	11-4

7. METER M1 IS A MICROAMMETER CALIBRATED IN DECIBELS.
8. THE SHIELD AROUND THE LEAD CONNECTED FROM STANDOFF E16 TO CHECK HF JACK J6 IS NOT GROUNDED IN PANELS BEARING ORDER NO. 14181-PHILA-51, SERIAL NOS. 1 THROUGH 364.
9. IN PANELS BEARING ORDER NO. 14181-PHILA-51, SERIAL NOS. 1 THROUGH 873, C22 IS A .27UF, 100V DC CAPACITOR. IF C22 FAILS, REPLACE IT WITH A .47 UF, 400V DC CAPACITOR.

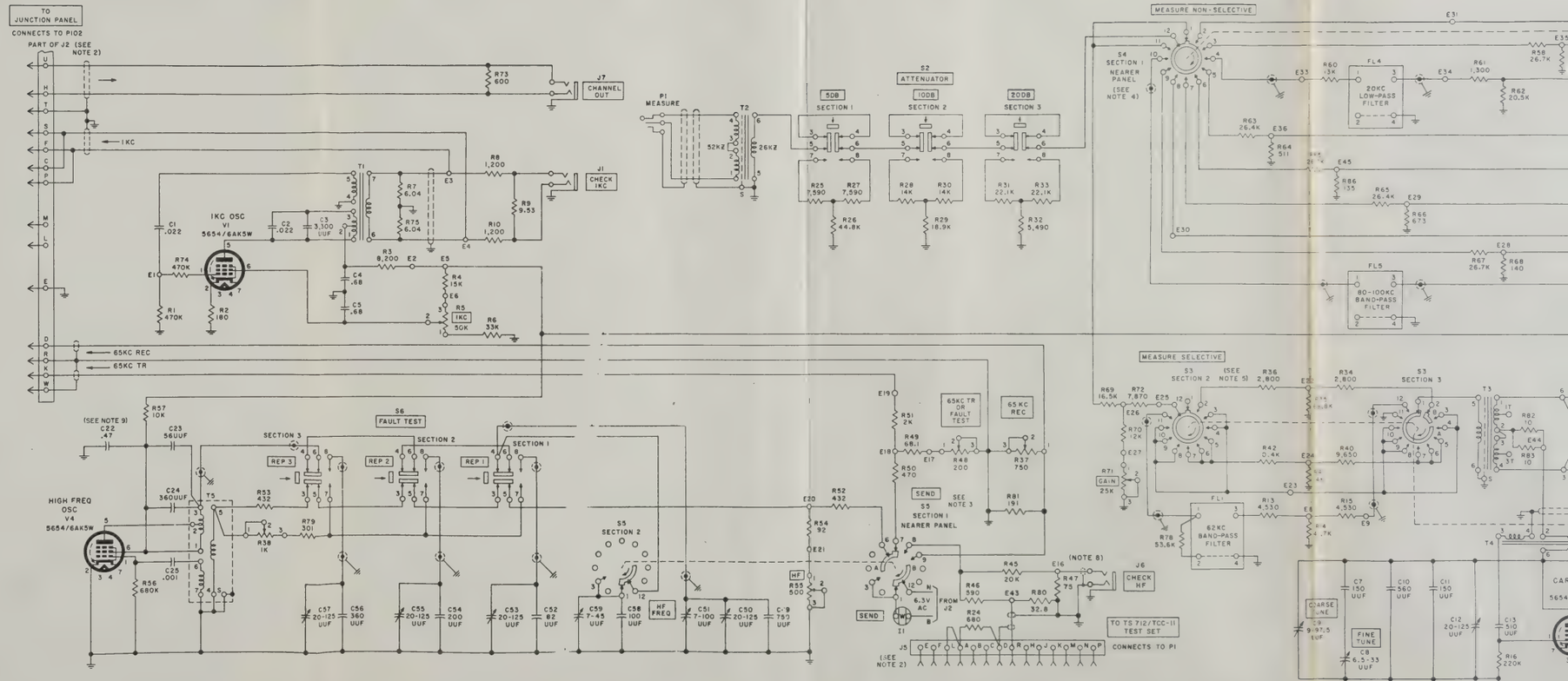


Figure 29. Telephone Test Set TS-760/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), schematic diagram.

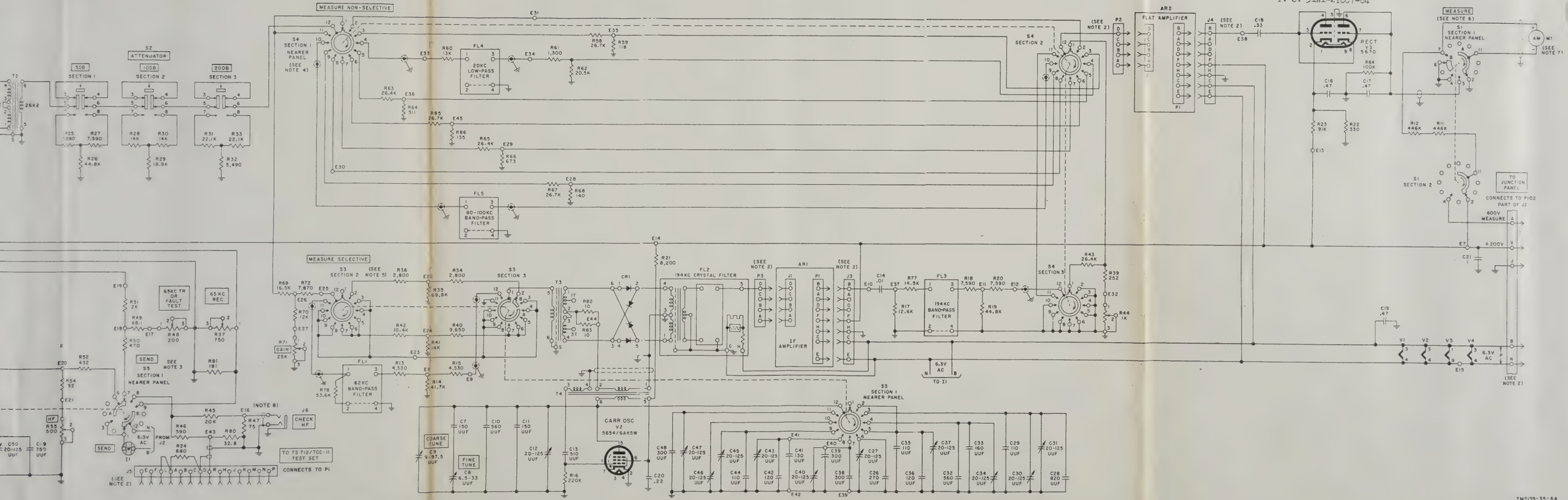
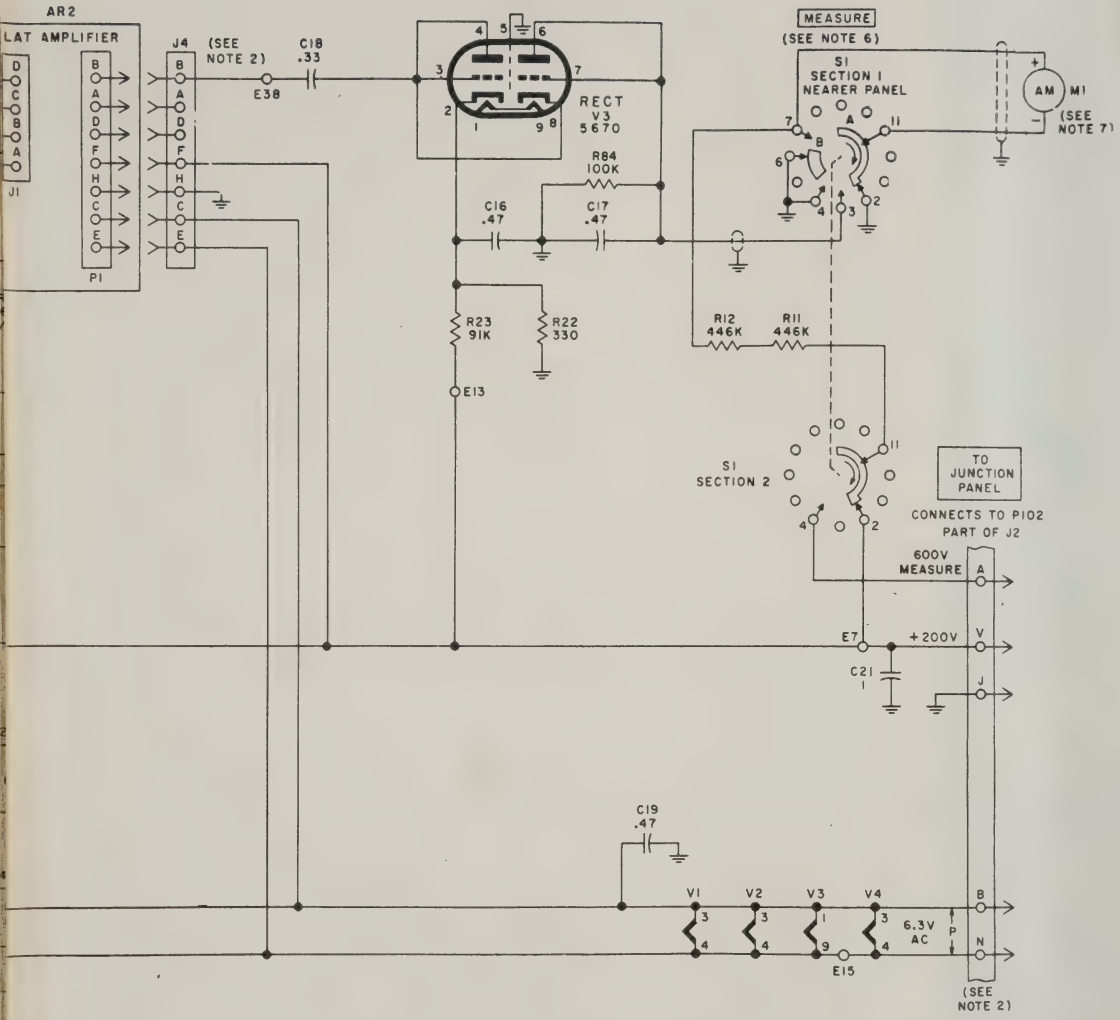


Figure 29. Telephone Test Set TS-760/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), schematic diagram.

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T. O. 31W1-2TCC7-64



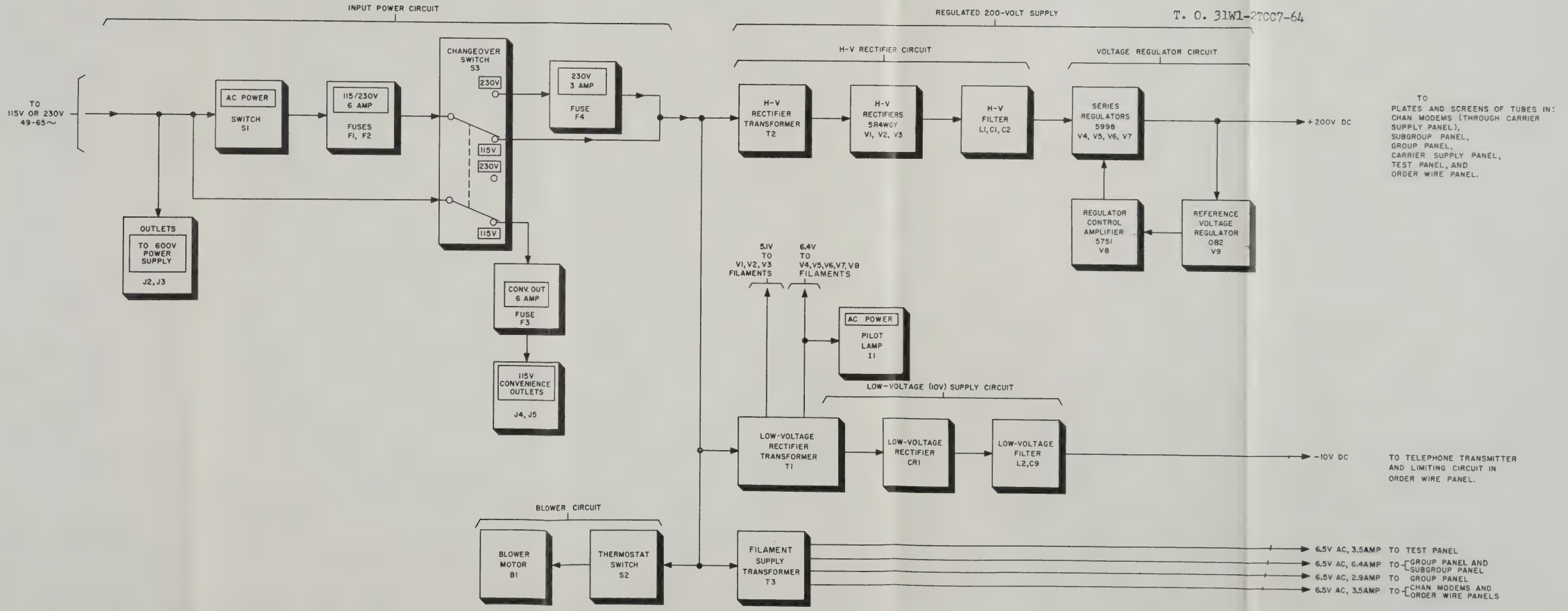
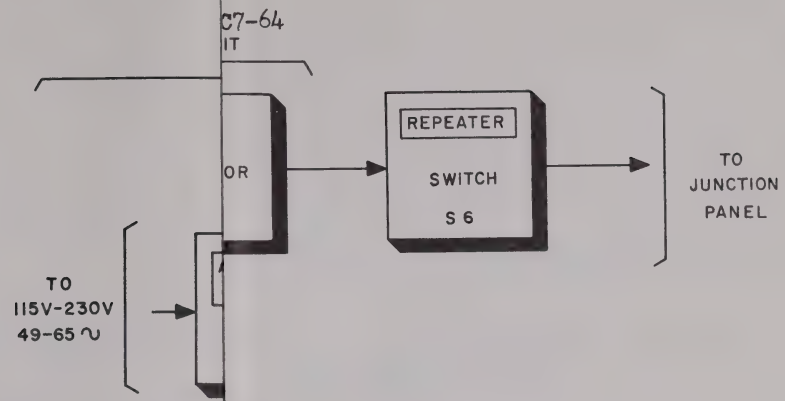


Figure 32.

Figure 32. Power Supply PP-827/U, block diagram.



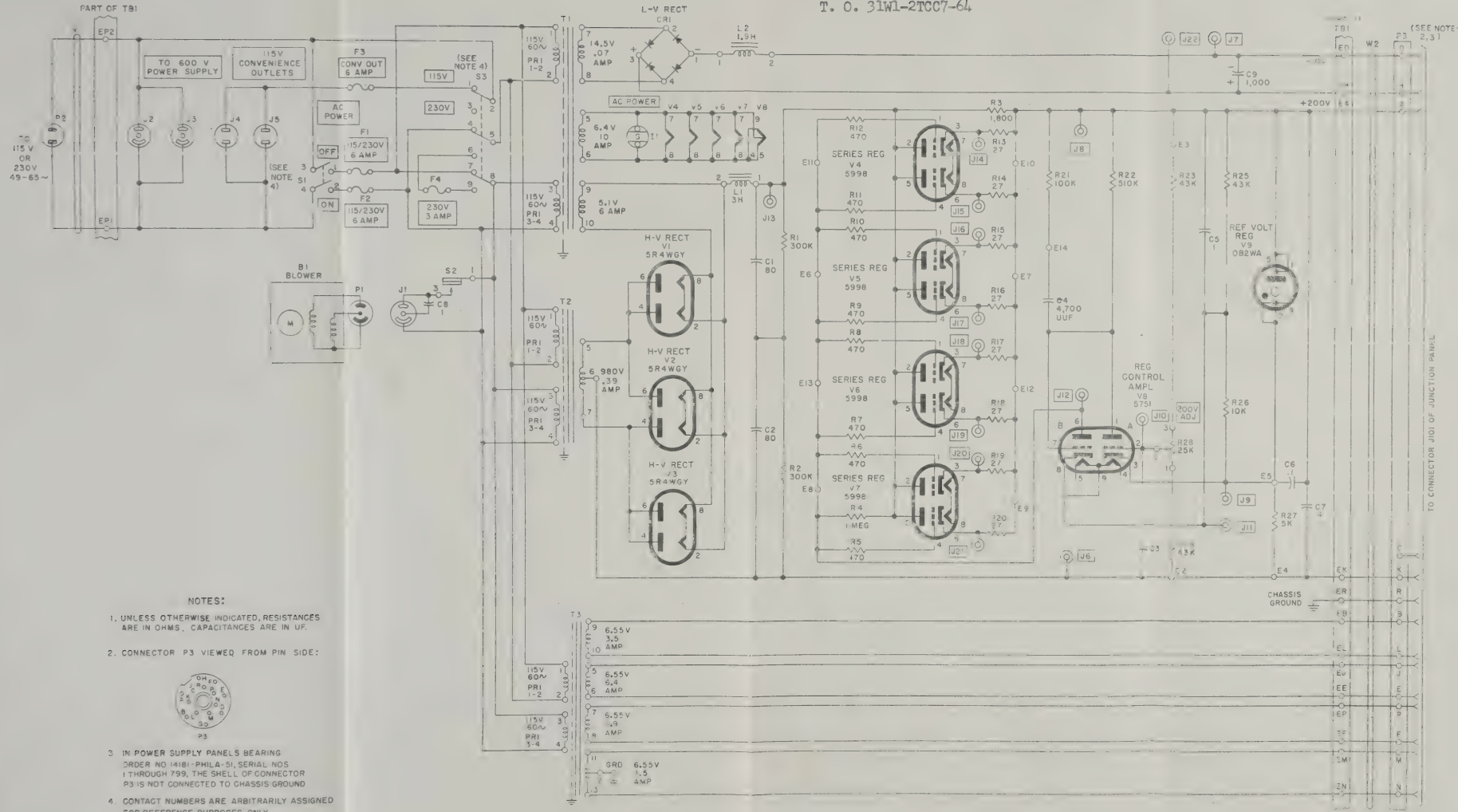
OLTAGE RECTIFIER
OW VOLTAGE

Z1, THE HIGH AND
K5, K7, K8 AND

M Z2, THE HIGH
3, K5, AND K10.

Figure 34.

TM2139-35-50



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
2. CONNECTOR P3 VIEWED FROM PIN SIDE:

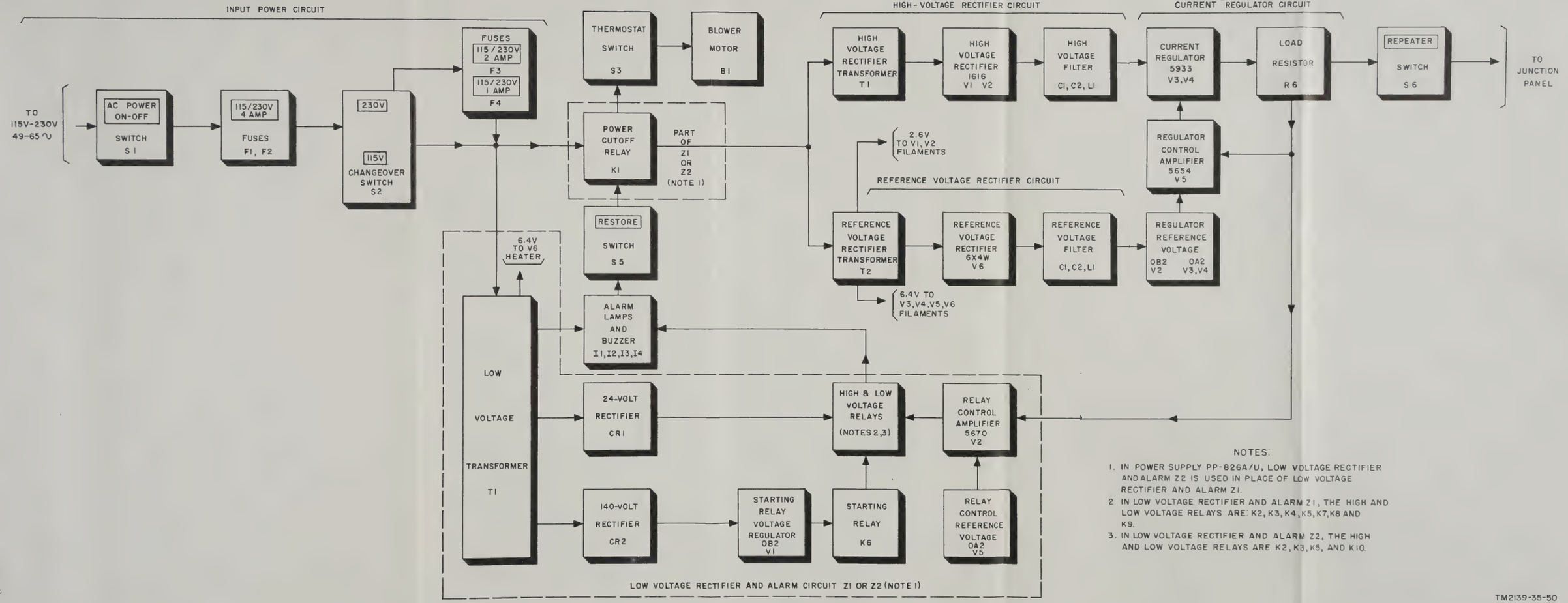
P3

3. IN POWER SUPPLY PANELS BEARING ORDER NO 14181-PHILA-51, SERIAL NOS 1 THROUGH 799, THE SHELL OF CONNECTOR P3 IS NOT CONNECTED TO CHASSIS GROUND
4. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

Figure 33. Power Supply PP-827/U, schematic diagram.

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Figure 33.



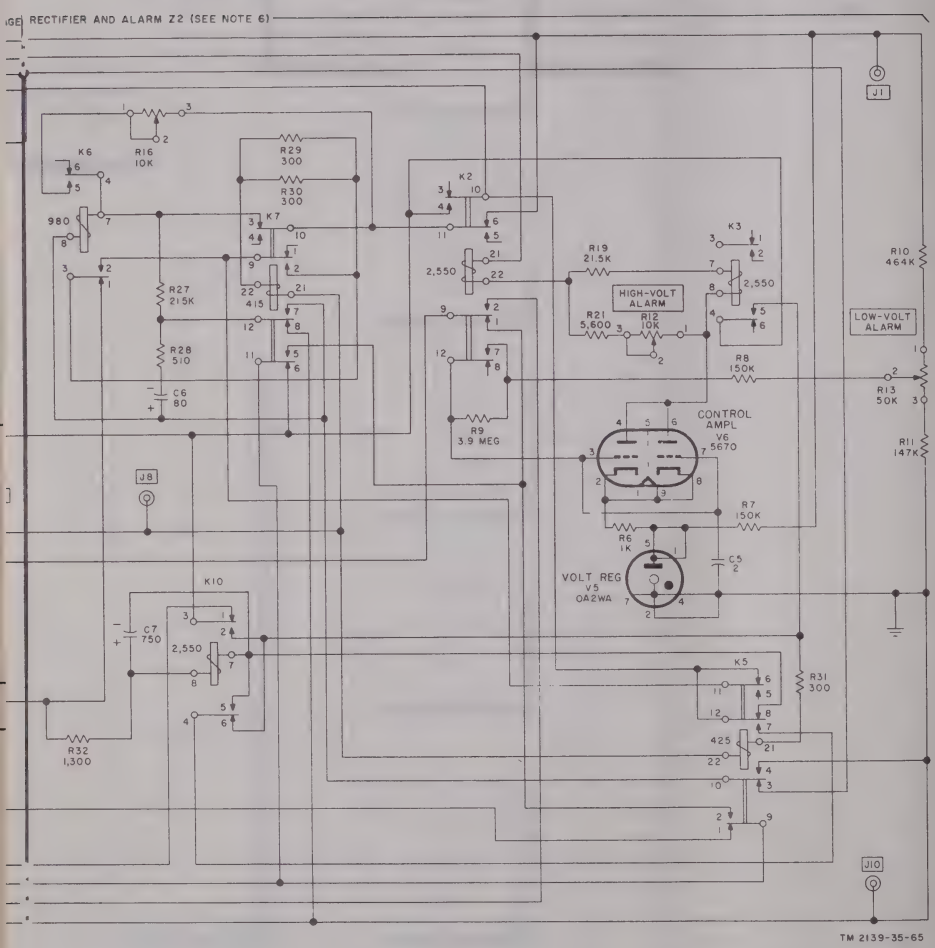
NOTES:

1. IN POWER SUPPLY PP-826A/U, LOW VOLTAGE RECTIFIER AND ALARM Z2 IS USED IN PLACE OF LOW VOLTAGE RECTIFIER AND ALARM Z1.
2. IN LOW VOLTAGE RECTIFIER AND ALARM Z1, THE HIGH AND LOW VOLTAGE RELAYS ARE: K2, K3, K4, K5, K7, K8 AND K9.
3. IN LOW VOLTAGE RECTIFIER AND ALARM Z2, THE HIGH AND LOW VOLTAGE RELAYS ARE K2, K3, K5, AND K10.

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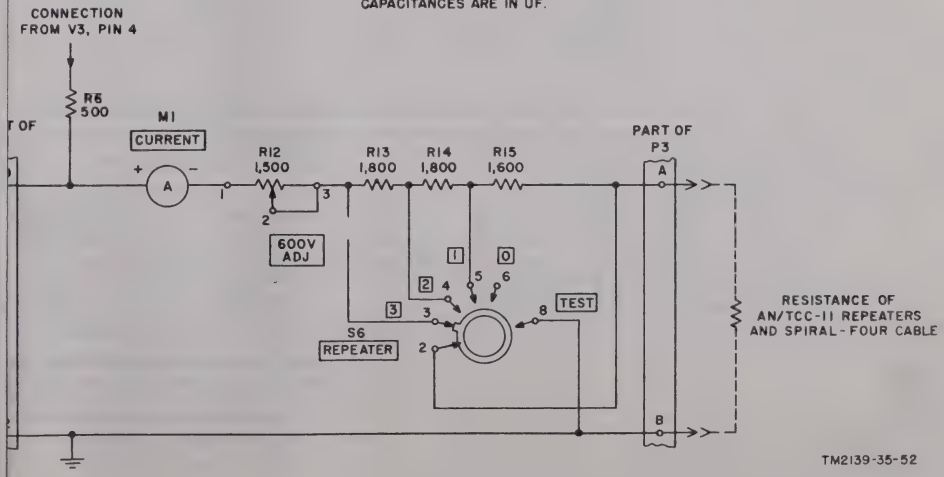
Figure 34. Power Supply PP-826A/U, block diagram.

Figure 34.

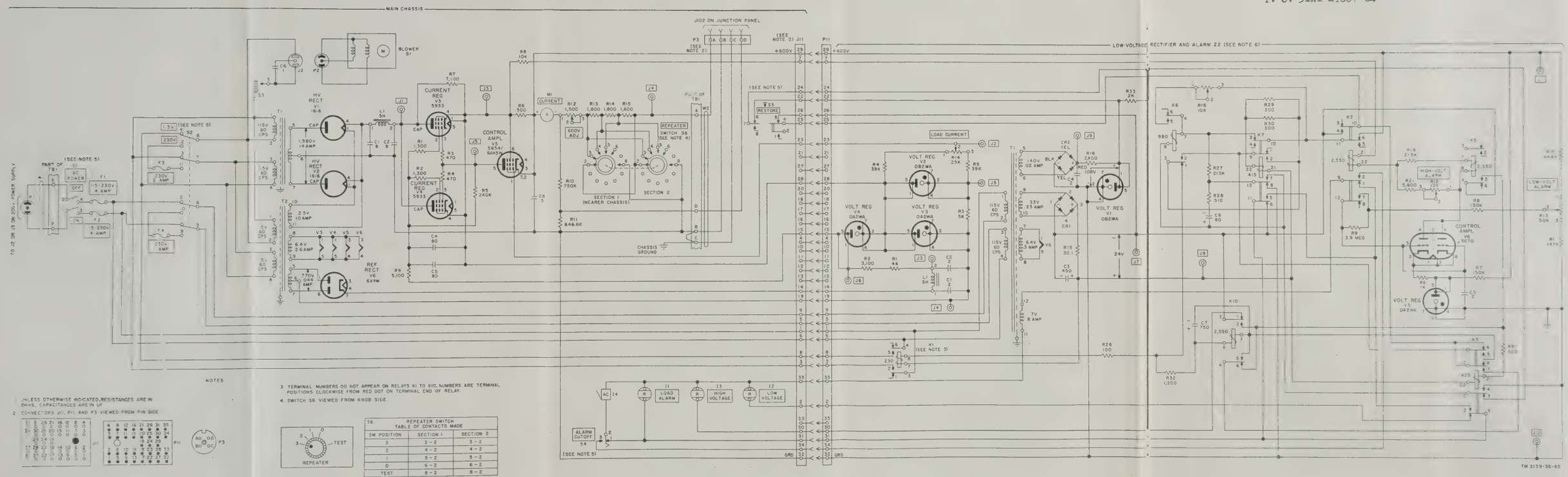

RECTIFIER AND ALARM Z2 (SEE NOTE 6)
J1
R16 10K
K6
980
R27 215K
R28 510
C6 80
R29 300
R30 300
K7
415
K2
2,550
R19 21.5K
HIGH-VOLT ALARM
R21 5,600
R12 10K
K3
2,550
R10 464K
LOW-VOLT ALARM
R13 50K
R11 147K
R8 150K
R9 3.9 MEG
CONTROL AMPL V6 5670
R7 150K
R6 1K
C5 2
VOLT REG V5 OA2WA
J8
K10
C7 750
2,550
R32 1,300
K5
425
R31 300
J10
TM 2139-35-65

NOTES:

1. RELAYS ARE SHOWN DE-ENERGIZED.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.



ensing circuits, schematic diagram.



NOTES

1 UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.

2 CONNECTORS J11, P11, AND P3 VIEWED FROM PIN SIDE

3 TERMINAL NUMBERS DO NOT APPEAR ON RELAYS K1 TO K10. NUMBERS ARE TERMINAL POSITIONS CLOCKWISE FROM RED DOT ON TERMINAL END OF RELAY.

4 SWITCH S6 VIEWED FROM KNOB SIDE.

S6 REPEATER SWITCH TABLE OF CONTACTS MADE

SW POSITION	SECTION 1	SECTION 2
3	3 - 2	3 - 2
2	4 - 2	4 - 2
1	5 - 2	5 - 2
0	6 - 2	6 - 2
TEST	8 - 2	8 - 2

5 CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY

6 ALL LOW-VOLTAGE RECTIFIER AND ALARM UNITS ARE INTERCHANGEABLE

7 ALL RELAYS ARE SHOWN DE-ENERGIZED

Figure 35. Power Supply PP-826A/U, schematic diagram.

Figure 35.

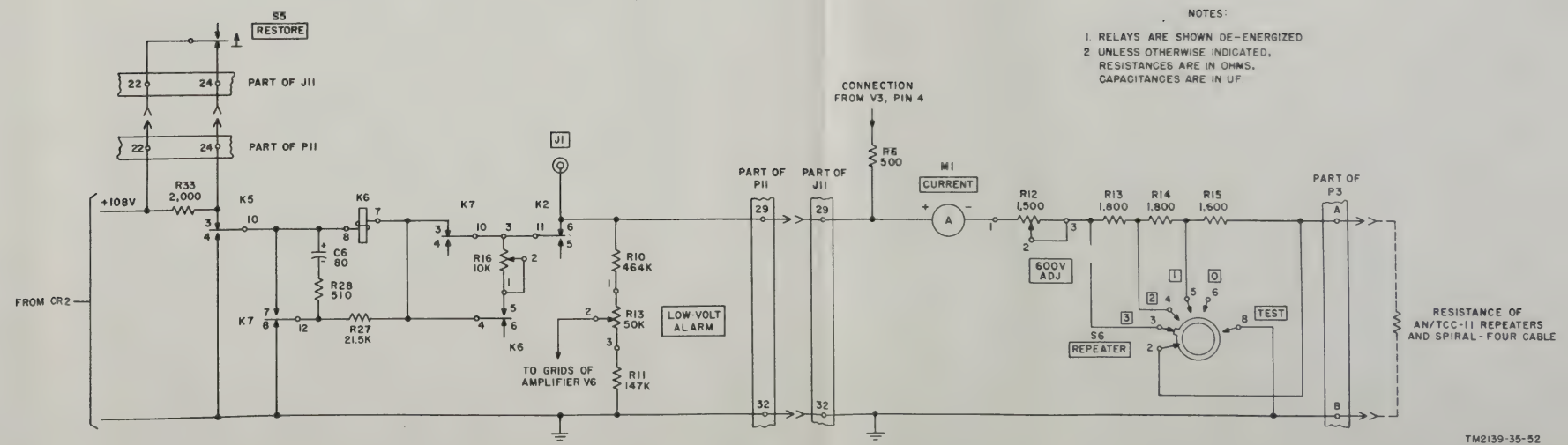
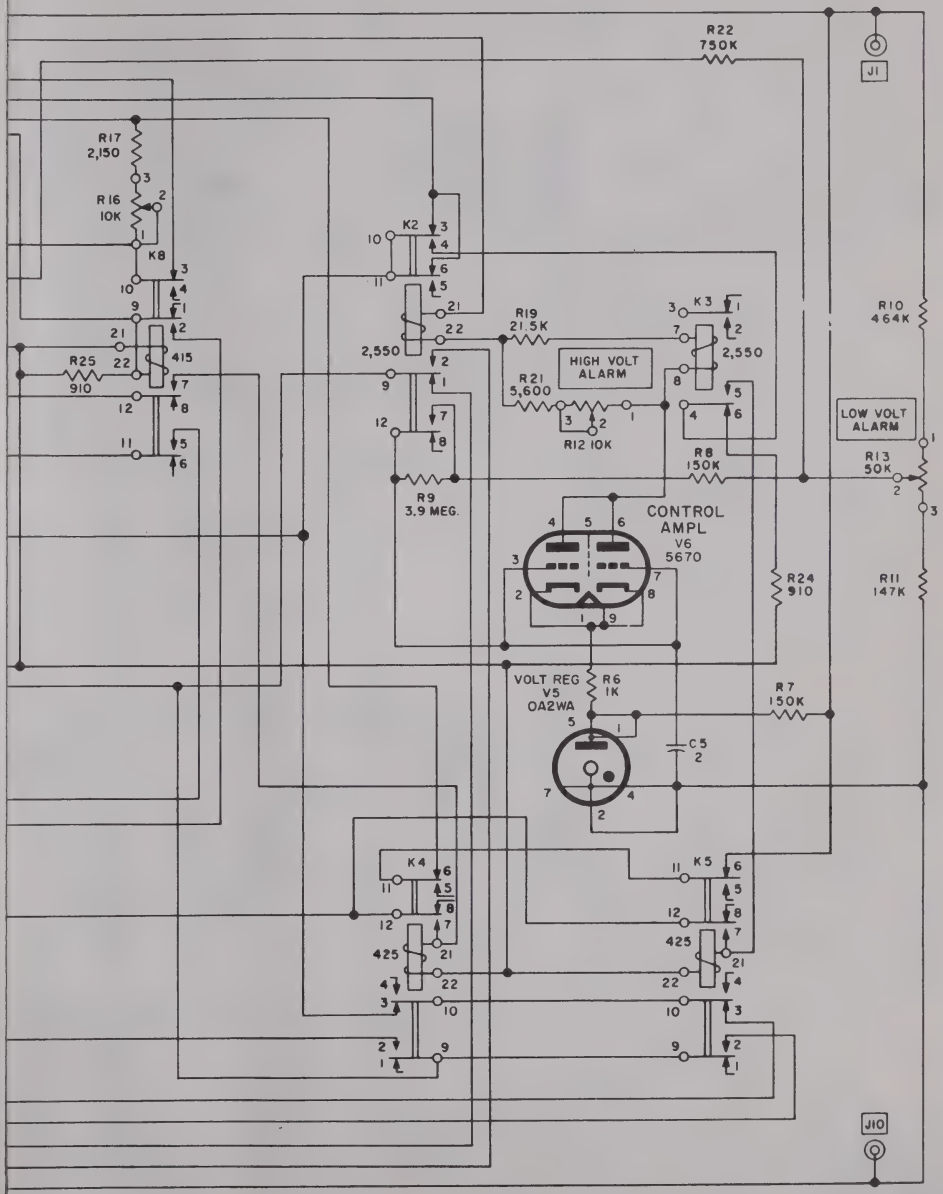


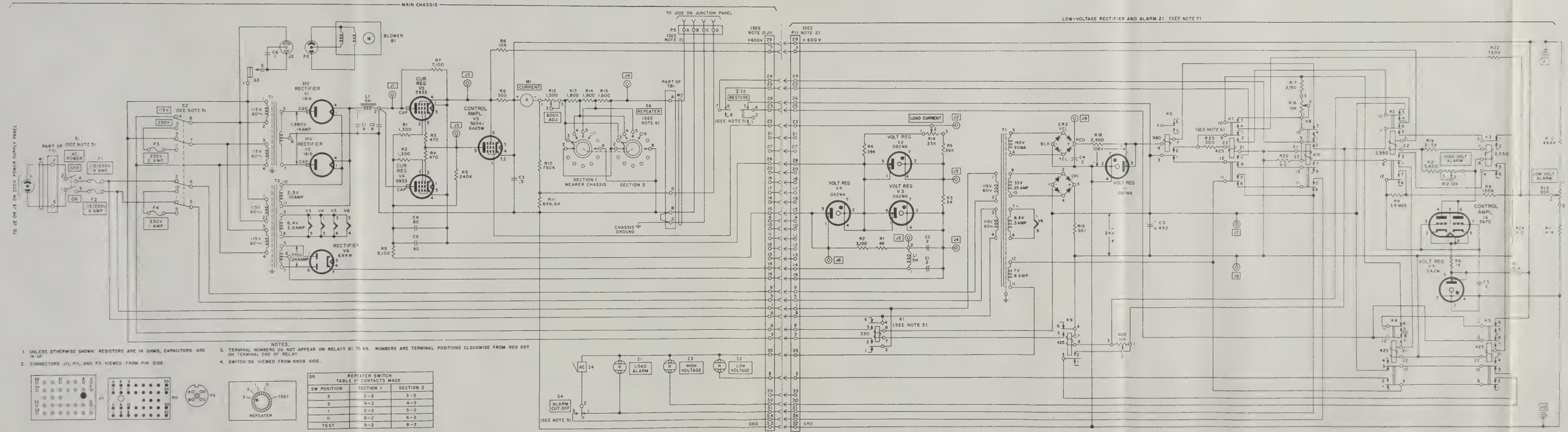
Figure 36.

Figure 36. Power Supply PP-826A/U, sensing circuits, schematic diagram.


J
R10
464K
LOW VOLT
ALARM
R13
50K
1
2
3
R24
910
R11
147K
R7
150K
J10

TM2139-35-55


R22
750K
J1
R17
2,150
R16
10K
K8
K2
R19
21.5K
K3
R10
464K
HIGH VOLT
ALARM
2,550
R21
5,600
R12 10K
LOW VOLT
ALARM
R25
910
R8
150K
R13
50K
R9
3.9 MEG.
CONTROL
AMPL
V6
5670
R24
910
R11
147K
VOLT REG
V5
OA2WA
R6
1K
R7
150K
C5
K4
K5
425
J10



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF
2. CONNECTORS J11, P11, AND P3 VIEWED FROM PIN SIDE.
3. TERMINAL NUMBERS DO NOT APPEAR ON RELAYS K1 TO K9. NUMBERS ARE TERMINAL POSITIONS CLOCKWISE FROM RED DOT ON TERMINAL END OF RELAY
4. SWITCH S6 VIEWED FROM KNOB SIDE.
5. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.
6. ON SOME LOW-VOLTAGE RECTIFIER AND ALARM UNITS, RESISTOR RE3 IS REPLACED BY A STRAP AND THE WINDING RESISTANCE OF RELAY K7 IS 415 OHMS.
7. ALL LOW-VOLTAGE RECTIFIER AND ALARM UNITS ARE INTERCHANGEABLE.
8. ALL RELAYS ARE SHOWN DE-ENERGIZED.

S6 REPEATER SWITCH TABLE OF CONTACTS MADE

S6 POSITION	SECTION 1	SECTION 2
3	3-2	3-2
2	4-2	4-2
1	5-2	5-2
0	6-2	6-2
TEST	8-2	8-2

Figure 39. Power Supply PP-826/U, schematic diagram (original units).

Figure 39.

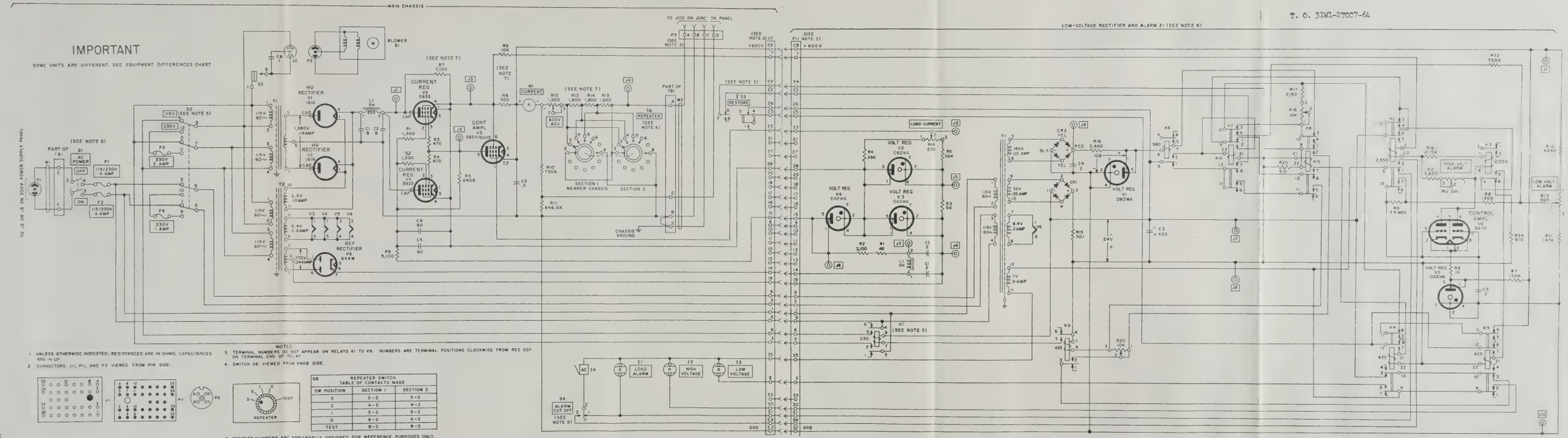
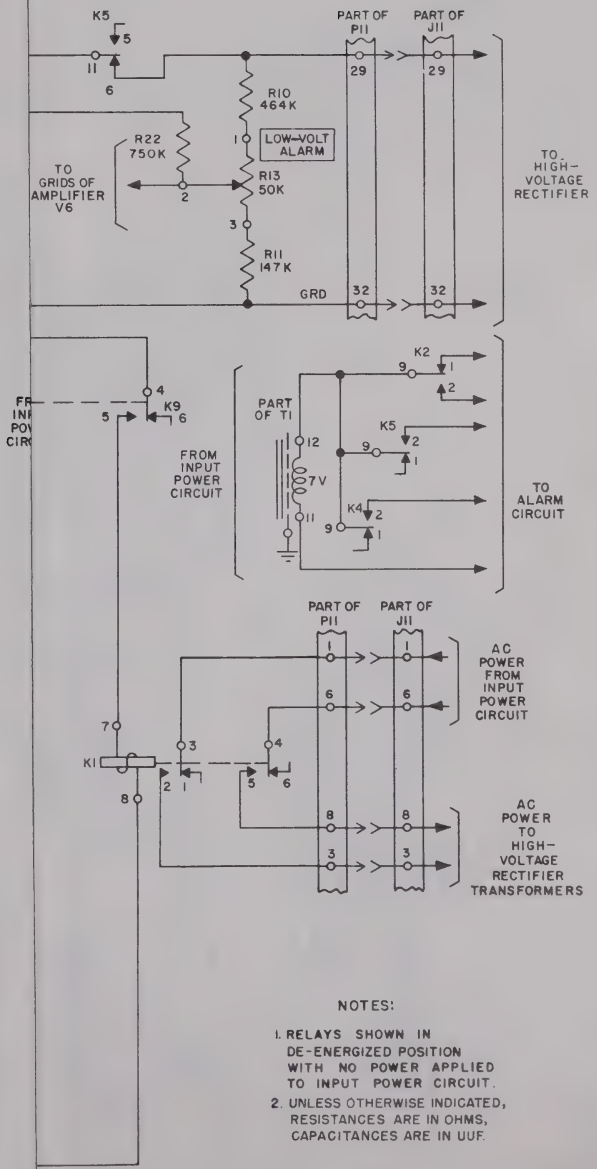


Figure 40. Power Supply PP-82[illegible]/U, schematic diagram (revised units).

TCC7-64

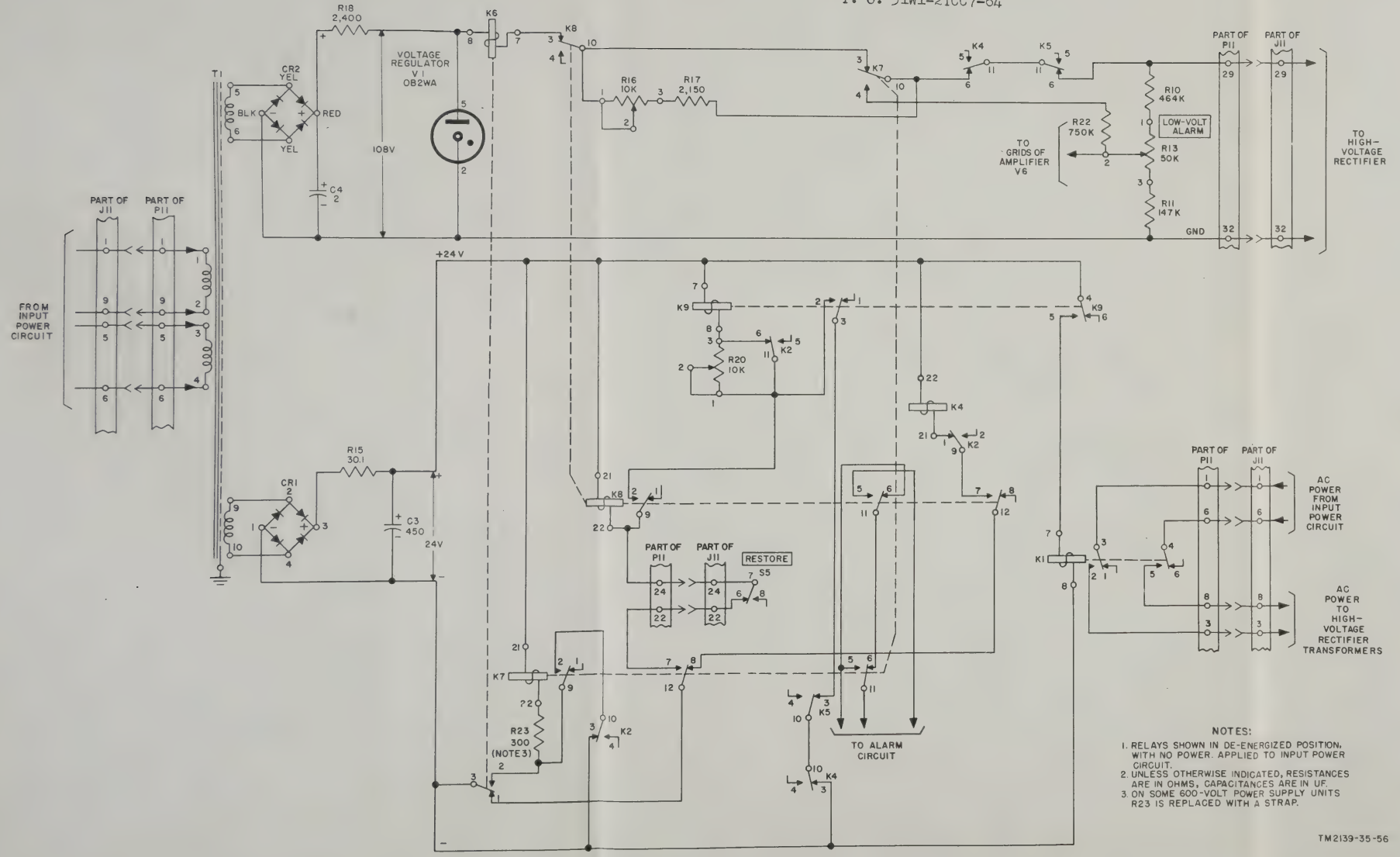


NOTES:

1. RELAYS SHOWN IN DE-ENERGIZED POSITION WITH NO POWER APPLIED TO INPUT POWER CIRCUIT.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.

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Figure 42.



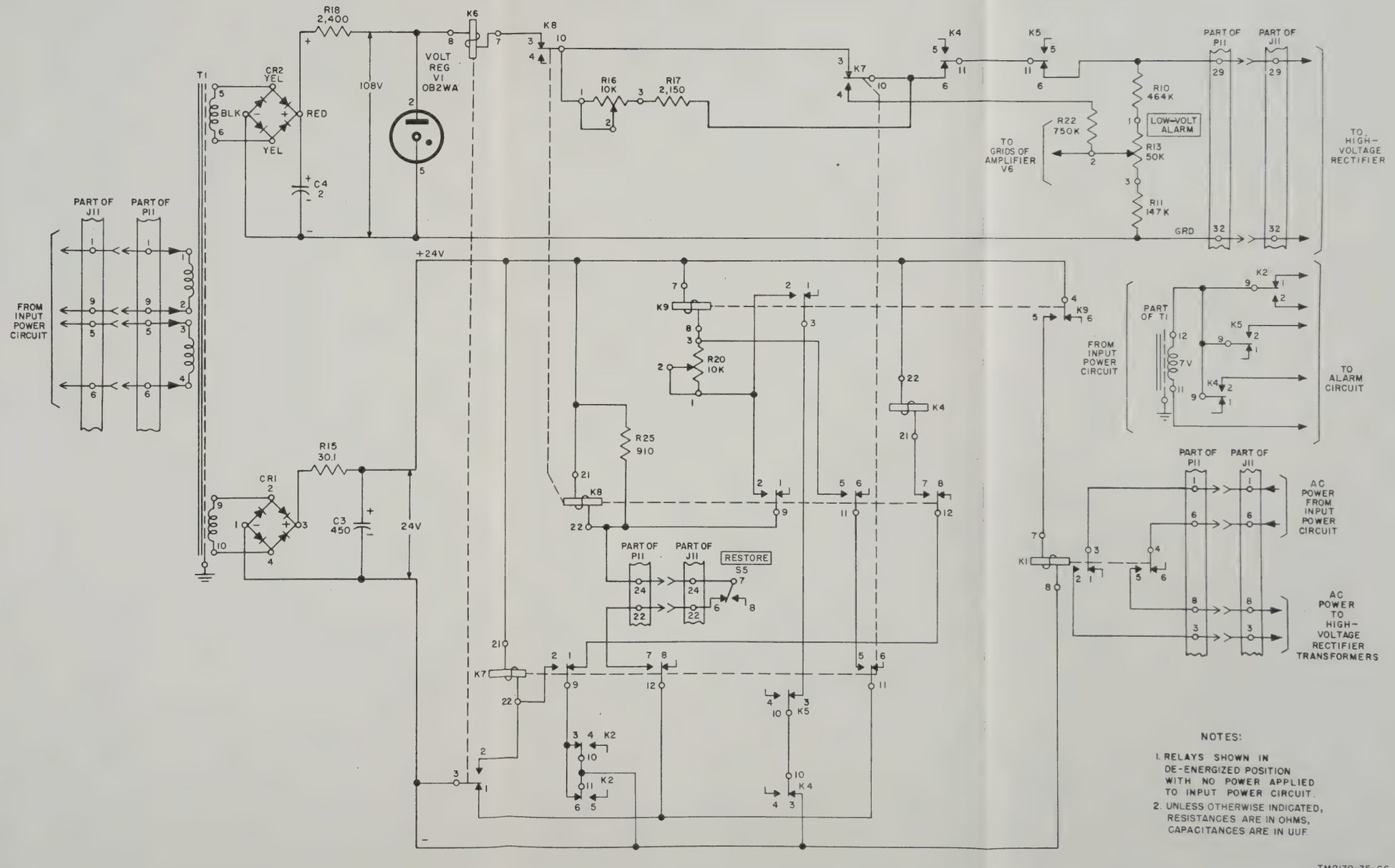
NOTES:

1. RELAYS SHOWN IN DE-ENERGIZED POSITION, WITH NO POWER APPLIED TO INPUT POWER CIRCUIT.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
3. ON SOME 600-VOLT POWER SUPPLY UNITS R23 IS REPLACED WITH A STRAP.

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Figure 41. Power Supply PP-826/U, starting action, schematic diagram (original units).

Figure 41.



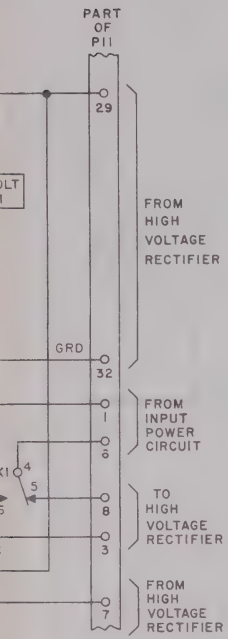
NOTES:

1. RELAYS SHOWN IN DE-ENERGIZED POSITION WITH NO POWER APPLIED TO INPUT POWER CIRCUIT.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.

TM2139-35-66

Figure 42.

Figure 42. Power Supply PP-826/U, starting action, schematic diagram (revised units).



NOTES:

SE SHOWN, RESISTORS ARE IN OHMS,
IN UF.

ITACTS ARE SHOWN UNDER NORMAL
TIONS OF POWER SUPPLY PP-826/U.

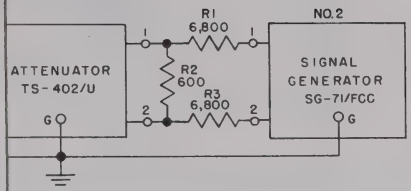
OWN EITHER ENERGIZED OR
INDICATED IN TABLE BELOW.

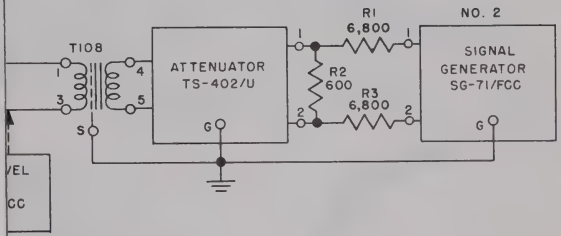
ENERGIZED	DE-ENERGIZED
X	
X	
	X
	X
	X
	X
	X
X	
X	

R23 IS REPLACED BY A STRAP.

S ARE ARBITRARILY ASSIGNED FOR
OSES ONLY.

31W1-2TCC7-64





NOTES:

RESISTANCES ARE IN OHMS.

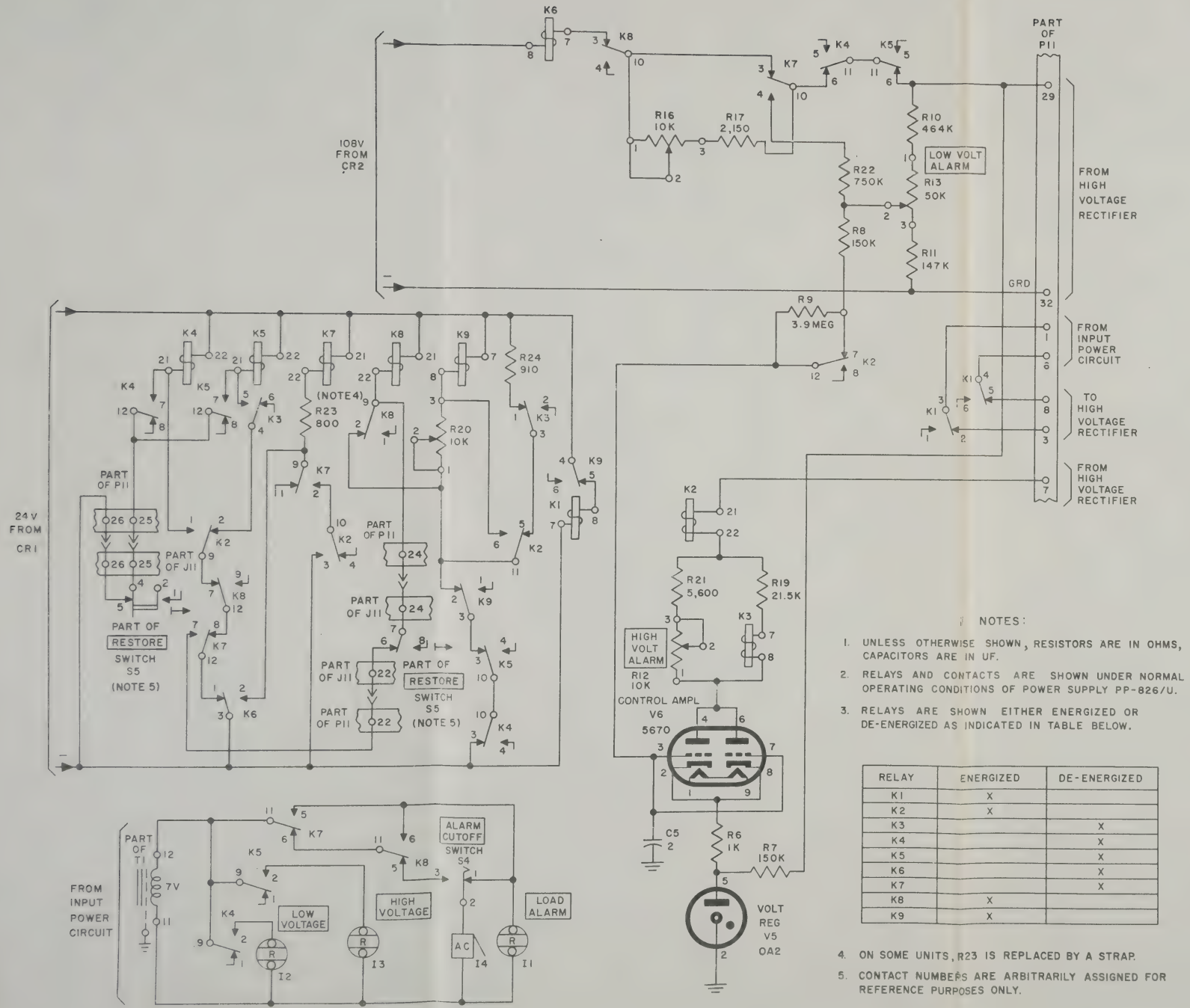
ONLY ONE VOLTMETER, METER ME-30A/U, AND ONE SG-71/FCC, AUDIO LEVEL METER ME-71A/FCC ARE NEEDED FOR TESTS USING THIS SETUP.

CONNECT TO JACKS ON PANEL AS INDICATED IN OPERATIONAL OR FINAL TEST PROCEDURES.

CONNECTIONS INDICATED BY THESE BRACKETS ARE MADE BEHIND FRONT PANEL.

ONLY ONE SUBGROUP TEST CABLE ASSEMBLY IS NEEDED FOR TESTS USING THIS SETUP.

TM2139-35-188



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF.
2. RELAYS AND CONTACTS ARE SHOWN UNDER NORMAL OPERATING CONDITIONS OF POWER SUPPLY PP-826/U.
3. RELAYS ARE SHOWN EITHER ENERGIZED OR DE-ENERGIZED AS INDICATED IN TABLE BELOW.

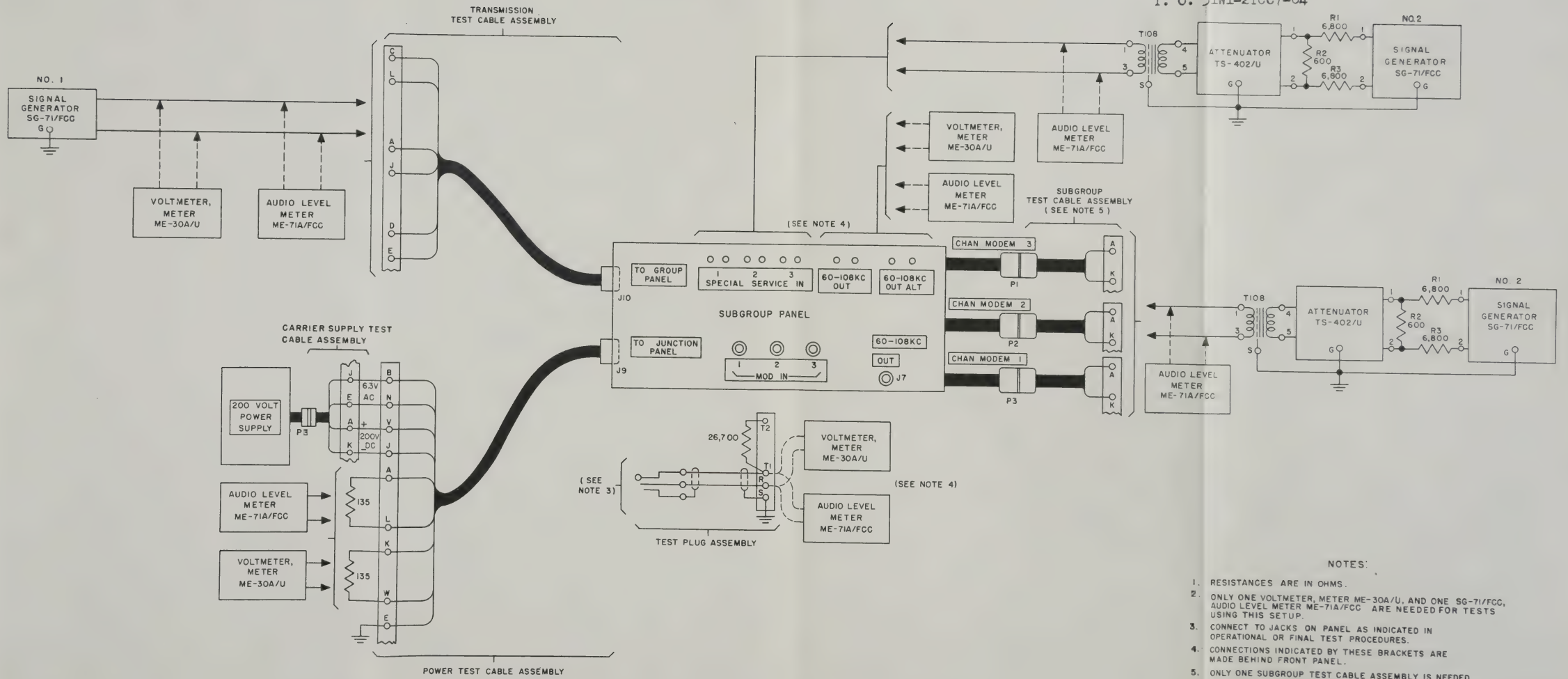
RELAY	ENERGIZED	DE-ENERGIZED
K1	X	
K2	X	
K3		X
K4		X
K5		X
K6		X
K7		X
K8	X	
K9	X	

4. ON SOME UNITS, R23 IS REPLACED BY A STRAP.
5. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

TM2139-35-90

Figure 43.

Figure 43. Power Supply PP-826/U, relays in normal operating condition, schematic diagram (original units).

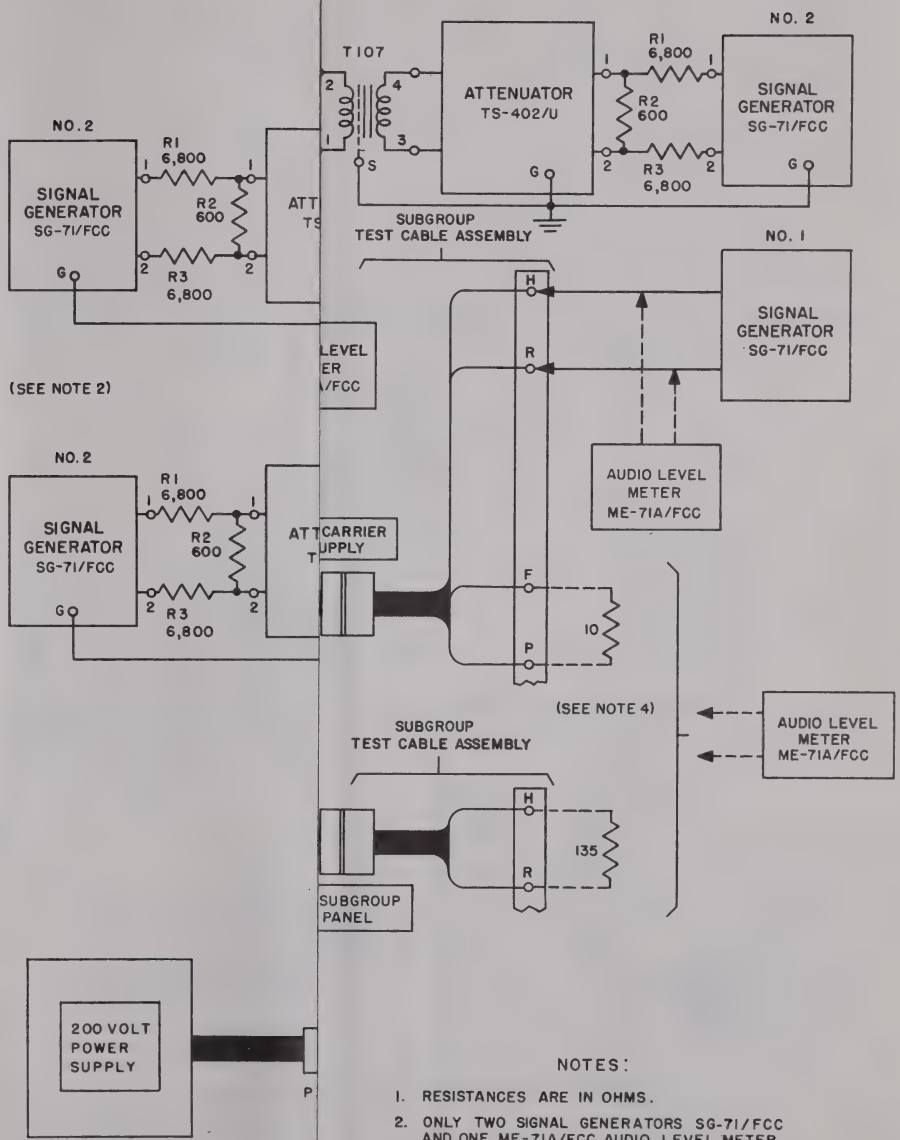


NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY ONE VOLTMETER, METER ME-30A/U, AND ONE SG-71/FCC, AUDIO LEVEL METER ME-71A/FCC ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT TO JACKS ON PANEL AS INDICATED IN OPERATIONAL OR FINAL TEST PROCEDURES.
4. CONNECTIONS INDICATED BY THESE BRACKETS ARE MADE BEHIND FRONT PANEL.
5. ONLY ONE SUBGROUP TEST CABLE ASSEMBLY IS NEEDED FOR TESTS USING THIS SETUP.

TM2139-35-188

Figure 56. SUBGROUP PANEL, operational and final test setup, transmitting direction.



NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY TWO SIGNAL GENERATORS SG-71/FCC AND ONE ME-71A/FCC AUDIO LEVEL METER ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT TO JACKS ON PANEL AS INDICATED IN OPERATIONAL TEST PROCEDURES.
4. CONNECT AS INDICATED IN OPERATIONAL AND TEST PROCEDURES.

TM2139-35-190

Figure 61.

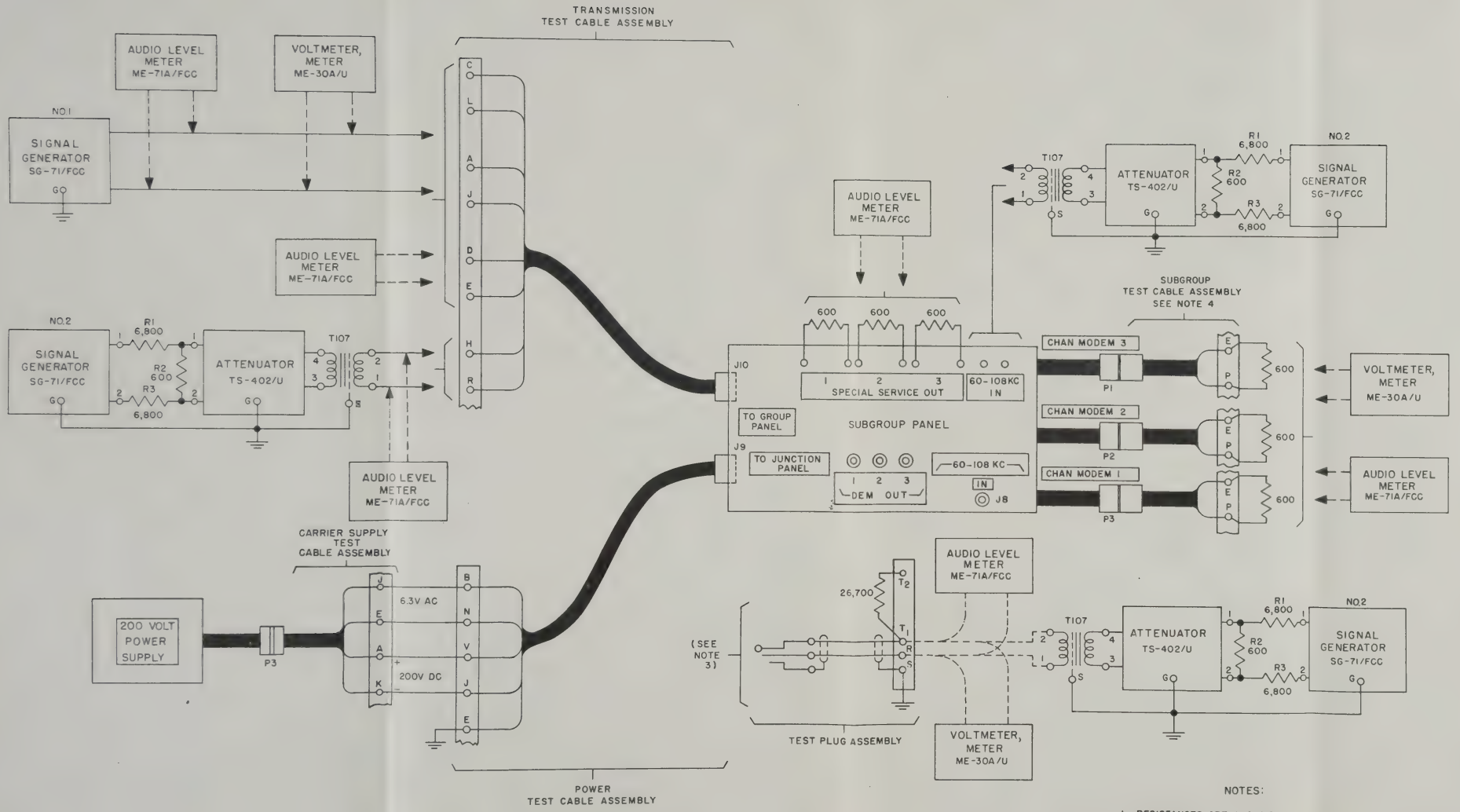


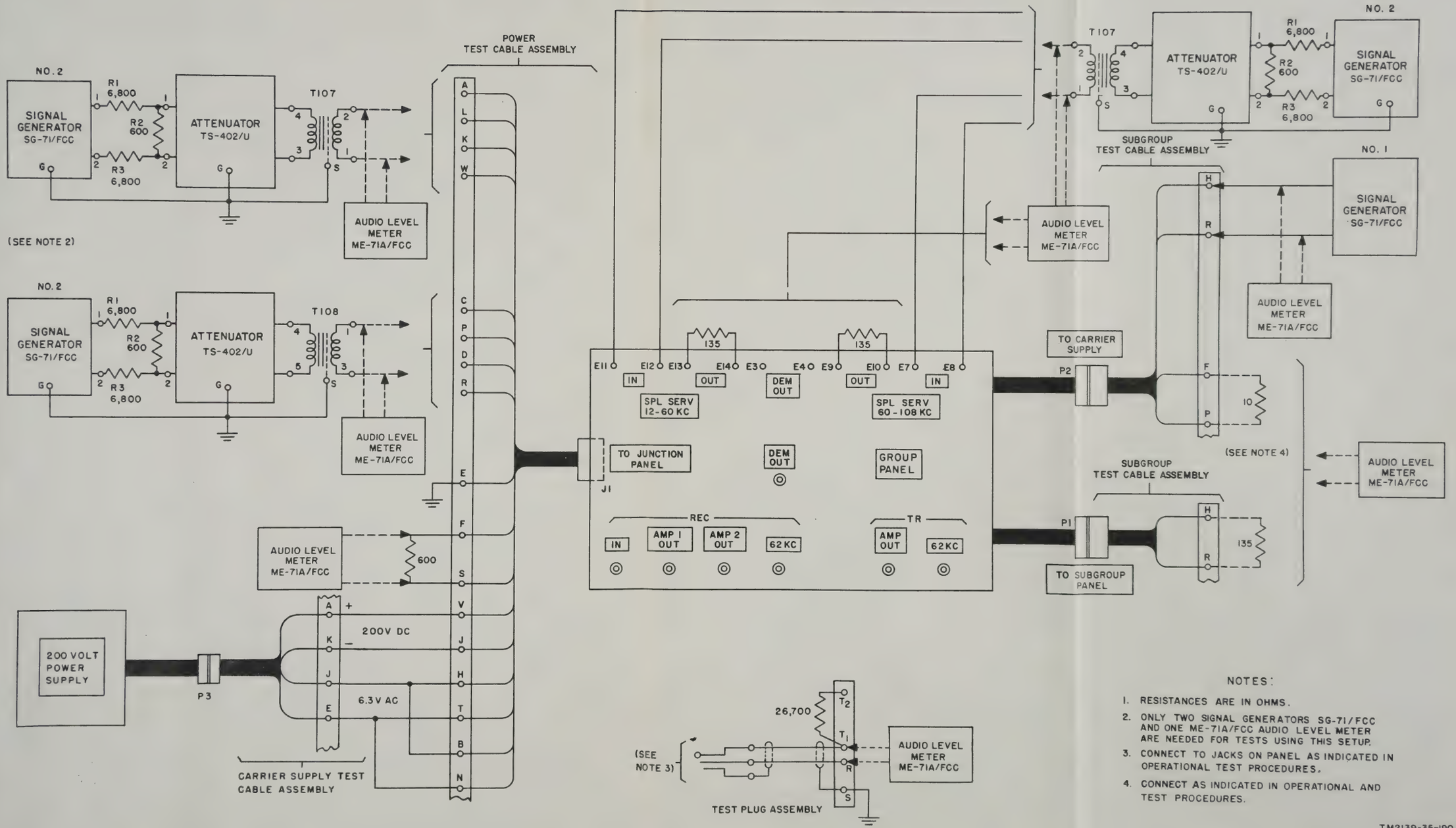
Figure 57.

Figure 57. SUBGROUP PANEL, operational and final test setup, receiving direction.

NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY TWO SIGNAL GENERATORS, SG-71/FCC, ONE VOLTMETER, METER ME-30A/U AND ONE AUDIO LEVEL METER, ME-71A/FCC, ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT TO JACKS ON PANEL AS INDICATED IN OPERATIONAL OR FINAL TEST PROCEDURES.
4. ONLY ONE SUBGROUP TEST CABLE ASSEMBLY IS NEEDED FOR TESTS USING THIS SETUP.

TM2139-35-189



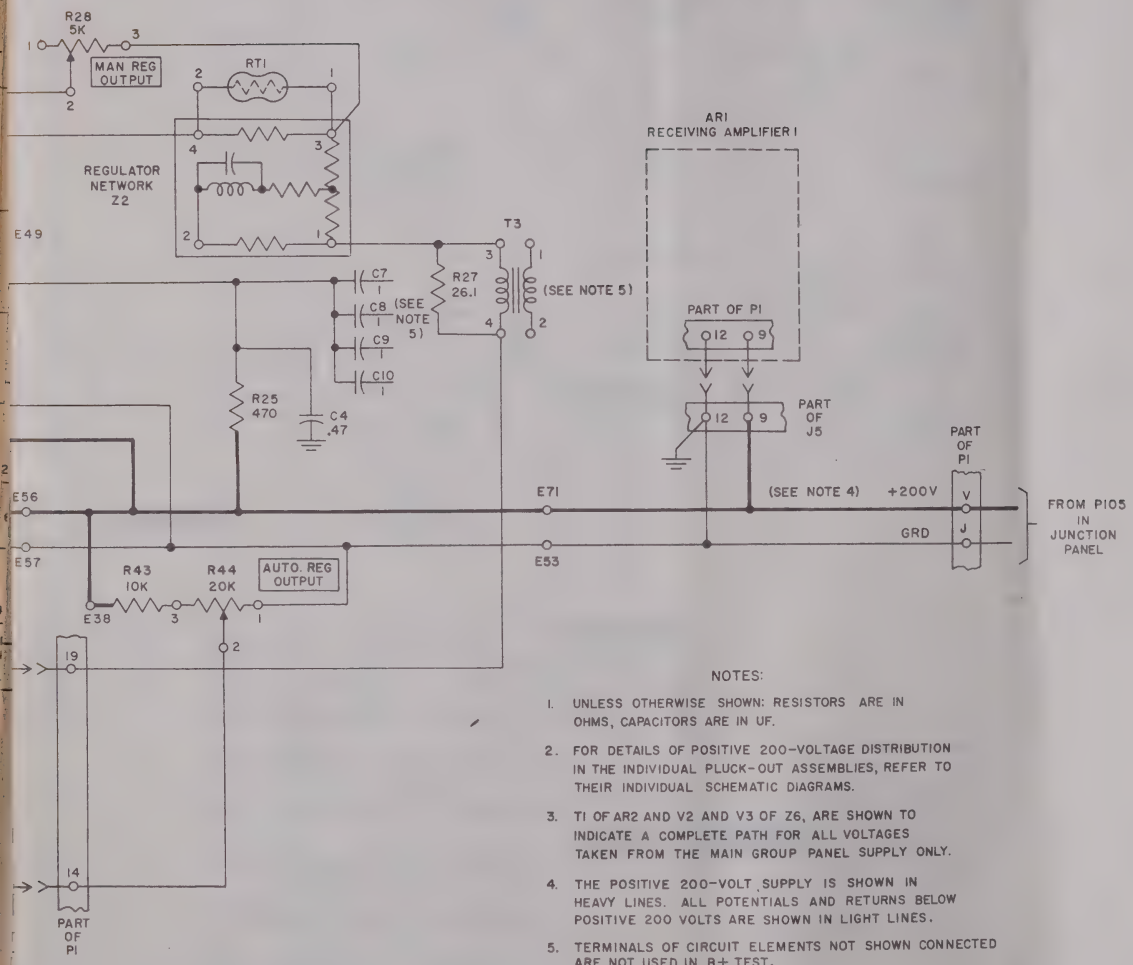
NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY TWO SIGNAL GENERATORS SG-71/FCC AND ONE ME-71A/FCC AUDIO LEVEL METER ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT TO JACKS ON PANEL AS INDICATED IN OPERATIONAL TEST PROCEDURES.
4. CONNECT AS INDICATED IN OPERATIONAL AND TEST PROCEDURES.

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Figure 61. GROUP PANEL, operational test setup.

Figure 61.



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF.
2. FOR DETAILS OF POSITIVE 200-VOLTAGE DISTRIBUTION IN THE INDIVIDUAL PLUCK-OUT ASSEMBLIES, REFER TO THEIR INDIVIDUAL SCHEMATIC DIAGRAMS.
3. T1 OF AR2 AND V2 AND V3 OF Z6, ARE SHOWN TO INDICATE A COMPLETE PATH FOR ALL VOLTAGES TAKEN FROM THE MAIN GROUP PANEL SUPPLY ONLY.
4. THE POSITIVE 200-VOLT SUPPLY IS SHOWN IN HEAVY LINES. ALL POTENTIALS AND RETURNS BELOW POSITIVE 200 VOLTS ARE SHOWN IN LIGHT LINES.
5. TERMINALS OF CIRCUIT ELEMENTS NOT SHOWN CONNECTED ARE NOT USED IN B+ TEST.

TM2139-35-15

distribution diagram.

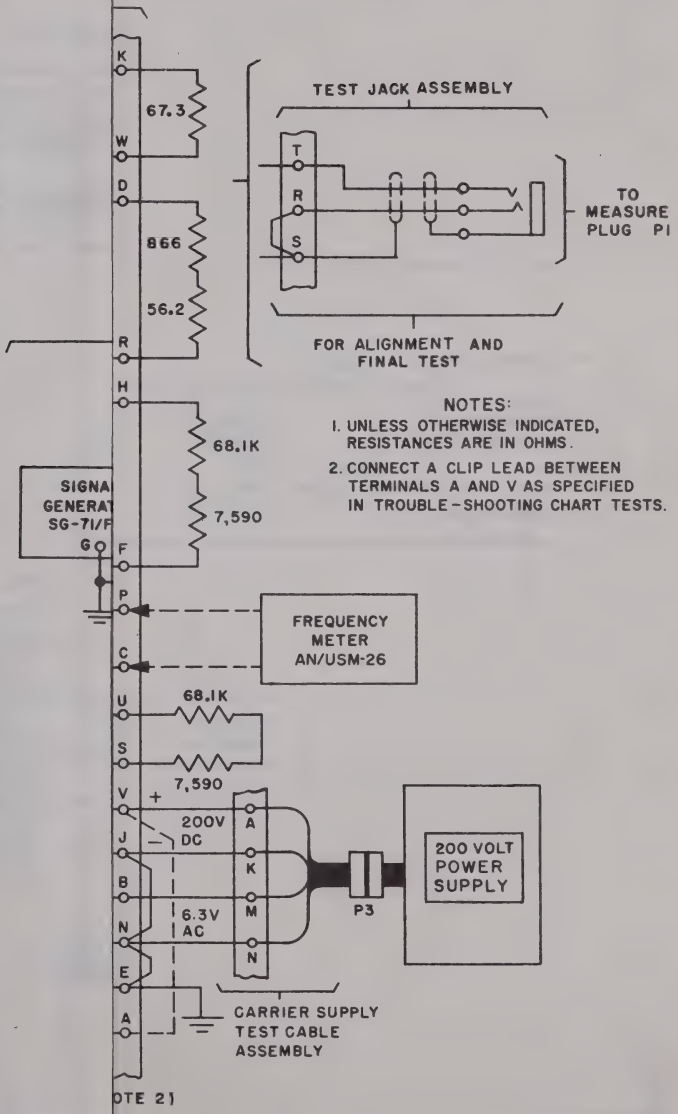
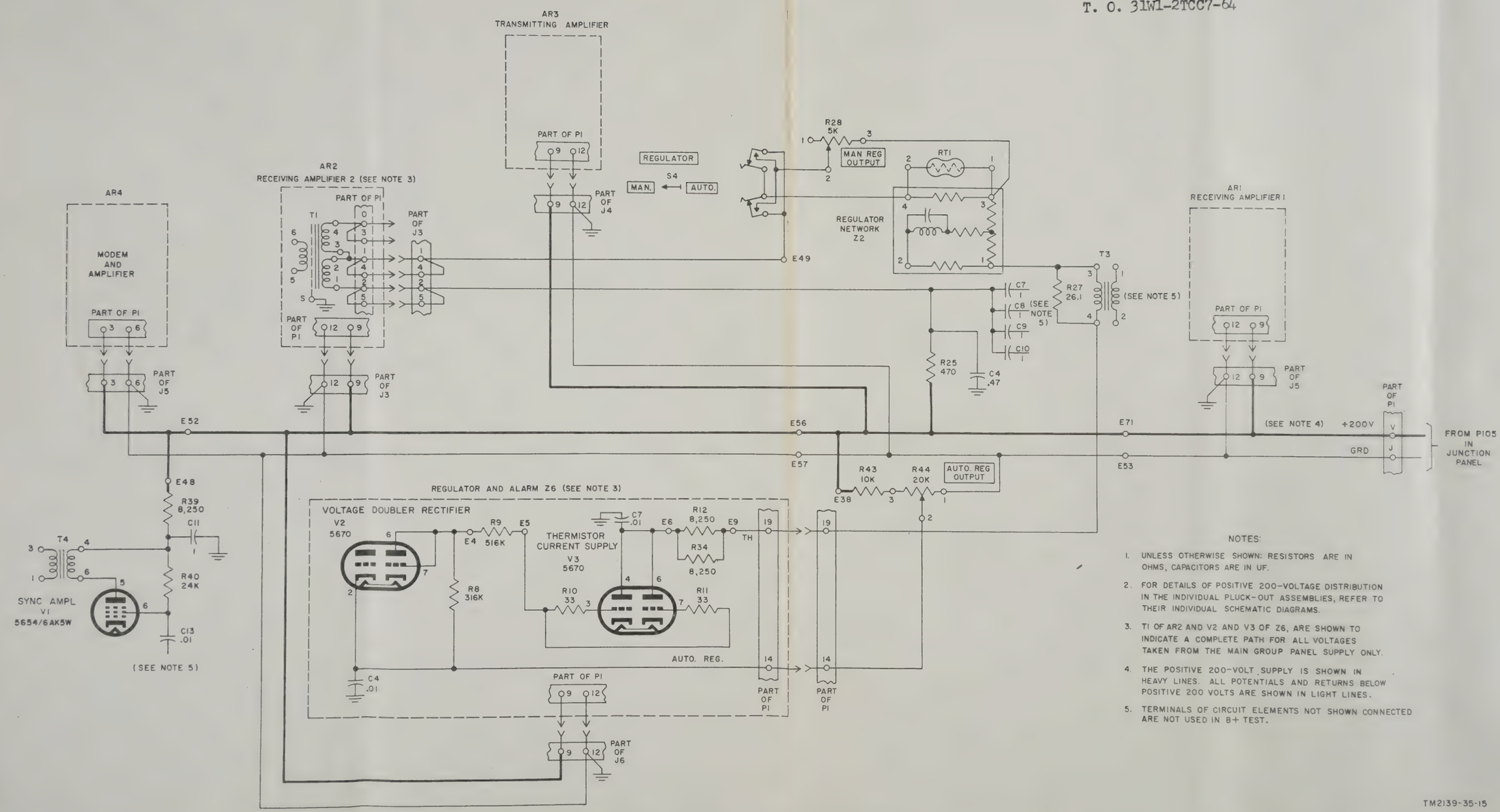

K
67.3
W
D
866
56.2
R
H
68.1K
7,590
F
P
C
U
68.1K
S
7,590
V
+
200V DC
J
B
6.3V AC
N
E
A
TEST JACK ASSEMBLY
T
R
S
TO MEASURE PLUG P1
FOR ALIGNMENT AND FINAL TEST
NOTES:
1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.
2. CONNECT A CLIP LEAD BETWEEN TERMINALS A AND V AS SPECIFIED IN TROUBLE-SHOOTING CHART TESTS.
FREQUENCY METER AN/USM-26
A
K
M
N
P3
200 VOLT POWER SUPPLY
CARRIER SUPPLY TEST CABLE ASSEMBLY
TM2139-35-123

Figure 78.



NOTES:

1. UNLESS OTHERWISE SHOWN: RESISTORS ARE IN OHMS, CAPACITORS ARE IN UF.
2. FOR DETAILS OF POSITIVE 200-VOLTAGE DISTRIBUTION IN THE INDIVIDUAL PLUCK-OUT ASSEMBLIES, REFER TO THEIR INDIVIDUAL SCHEMATIC DIAGRAMS.
3. T1 OF AR2 AND V2 AND V3 OF Z6, ARE SHOWN TO INDICATE A COMPLETE PATH FOR ALL VOLTAGES TAKEN FROM THE MAIN GROUP PANEL SUPPLY ONLY.
4. THE POSITIVE 200-VOLT SUPPLY IS SHOWN IN HEAVY LINES. ALL POTENTIALS AND RETURNS BELOW POSITIVE 200 VOLTS ARE SHOWN IN LIGHT LINES.
5. TERMINALS OF CIRCUIT ELEMENTS NOT SHOWN CONNECTED ARE NOT USED IN B+ TEST.

Figure 74.

TM2139-35-15

Figure 74. GROUP PANEL, B+ distribution diagram.

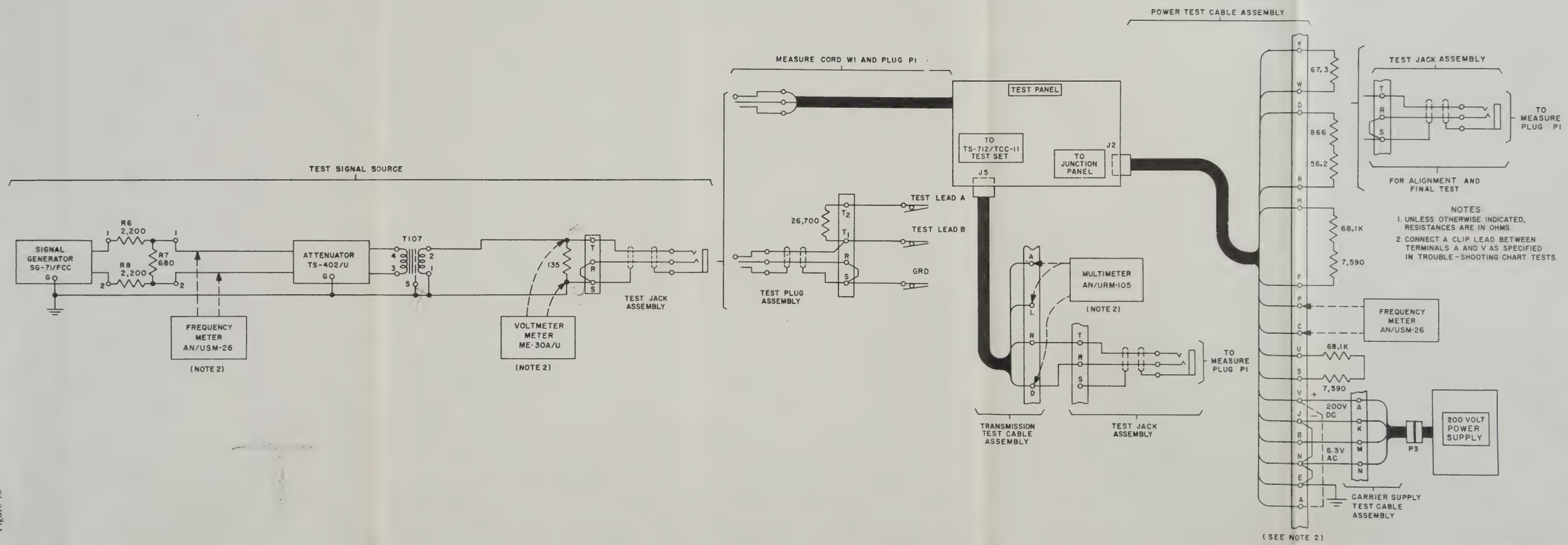
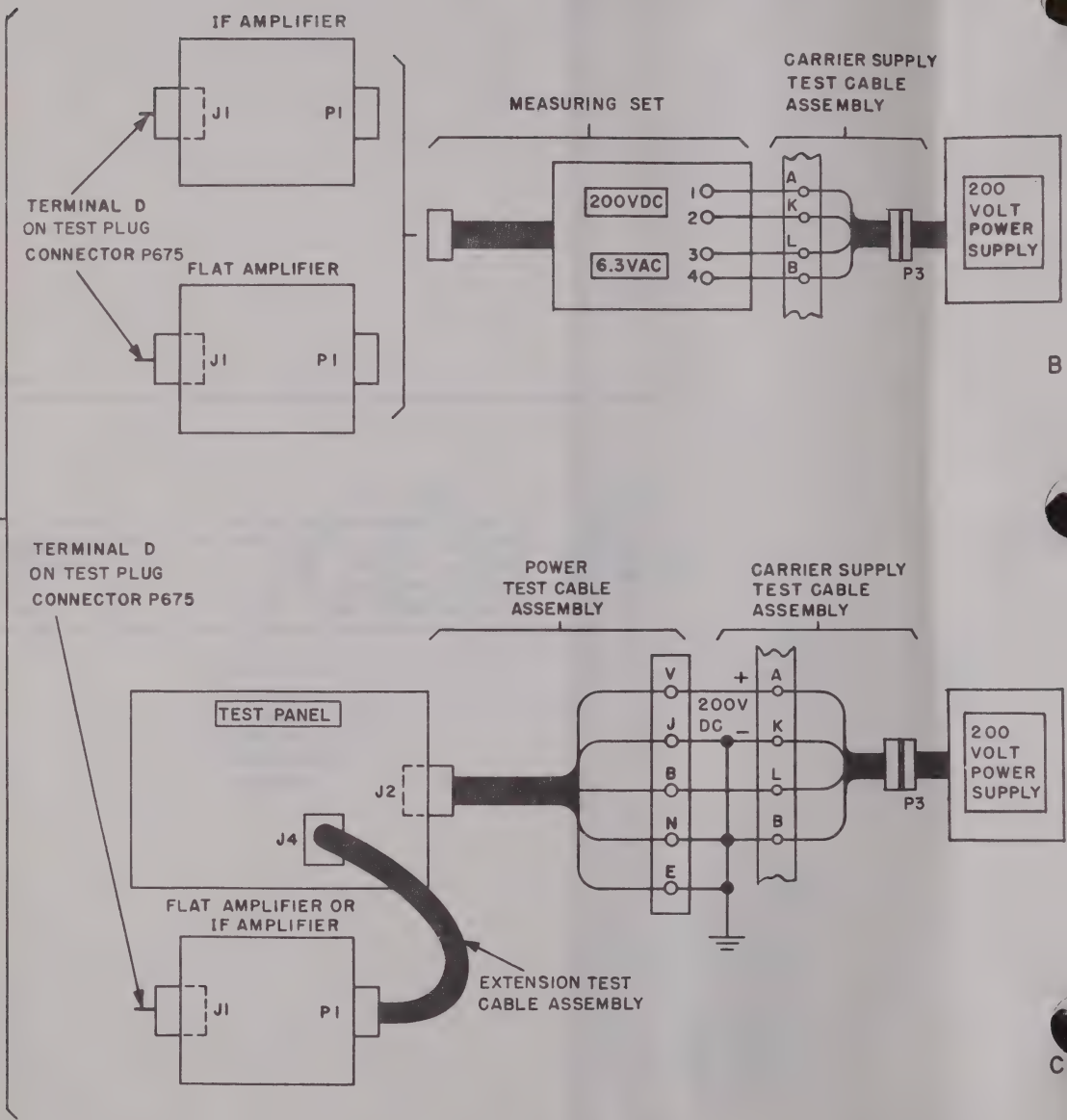


Figure 78

Figure 78. TEST PANEL, operational and final test setup.



NOTE:
RESISTANCES ARE IN OHMS

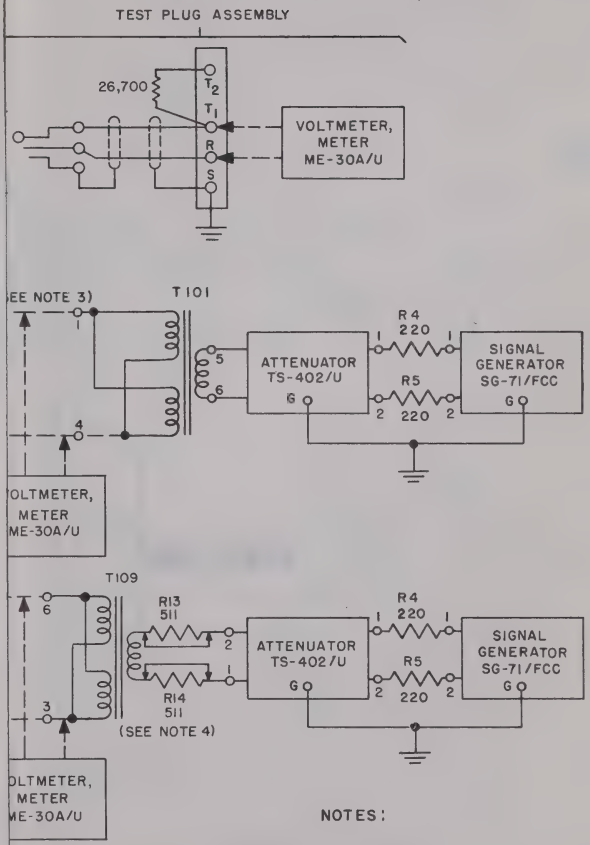


Figure 90.

NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY ONE SIGNAL GENERATOR SG-71/FCC AND ONE VOLTMETER, METER ME-30A/U ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT AS INDICATED IN OPERATIONAL TEST PROCEDURE.
4. RESISTORS R13 AND R14 MUST BE STRAPPED OUT FOR THIS TEST SETUP.

TM2139-35-135

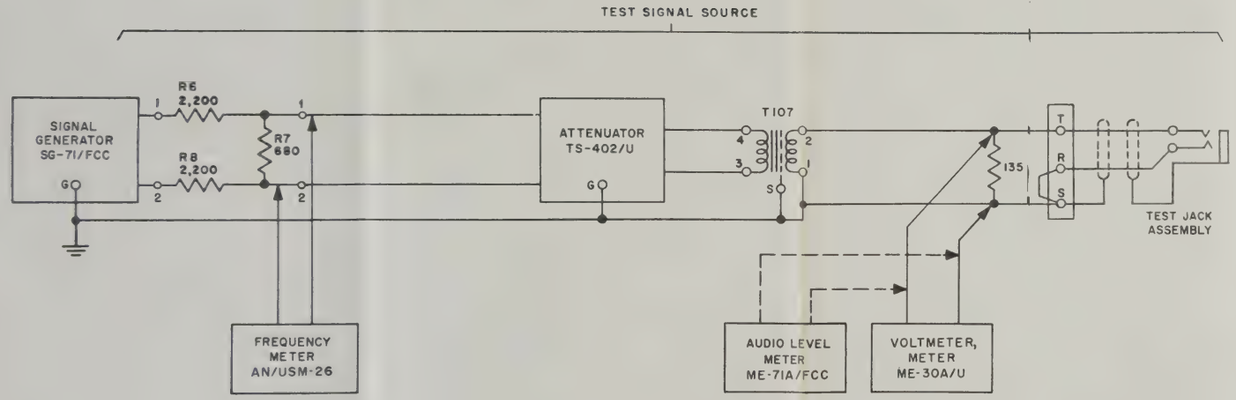


Figure 86. Flat amplifier AR2 or IF amplifier AR1 (part of TEST PANEL), operational and final test setup.

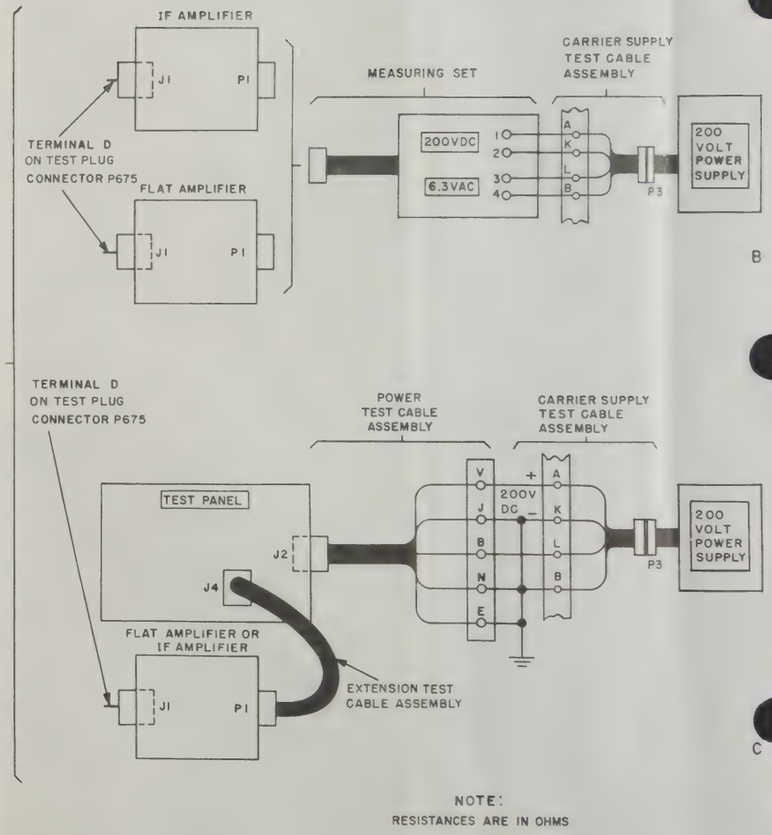


Figure 86.

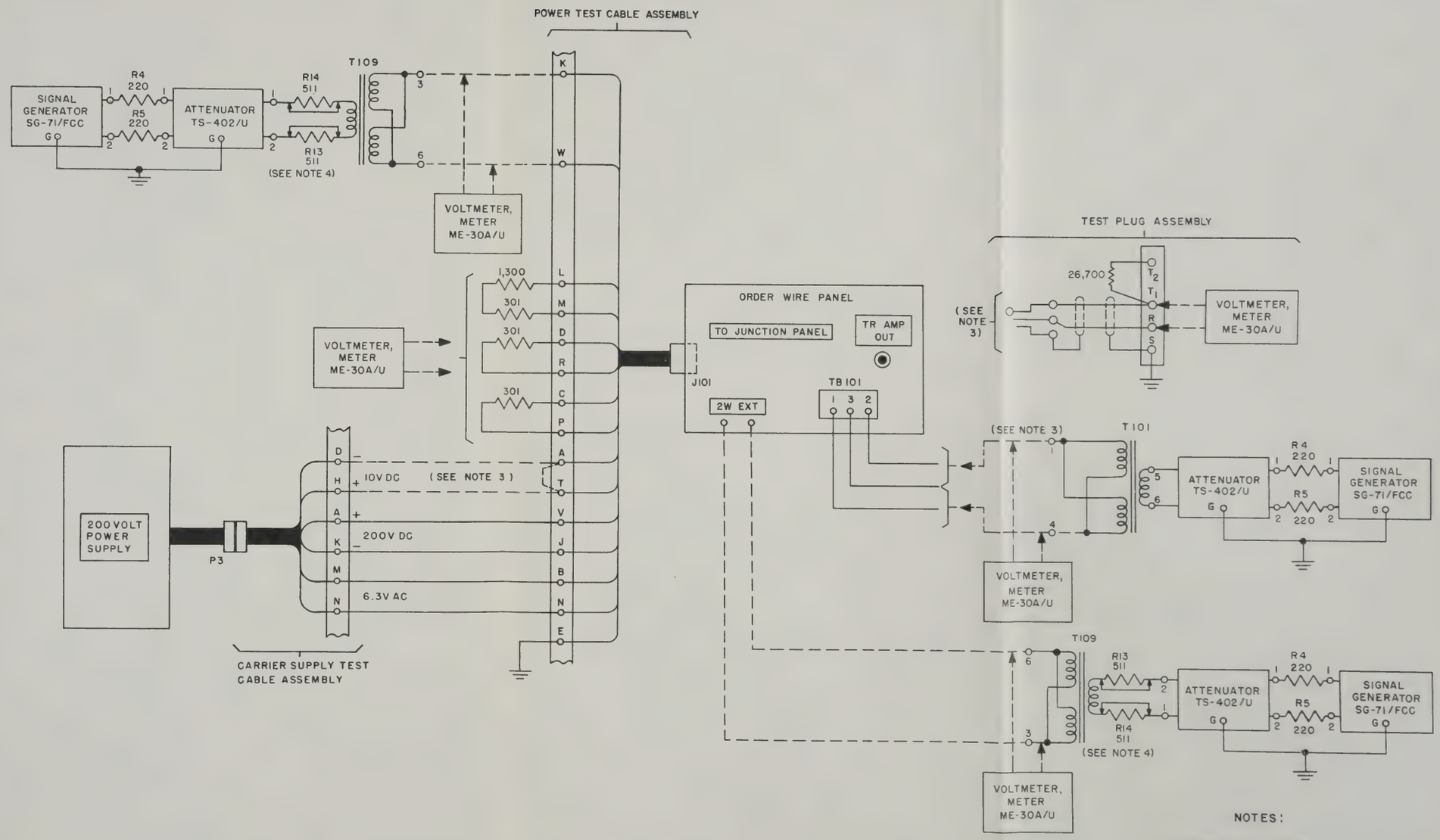
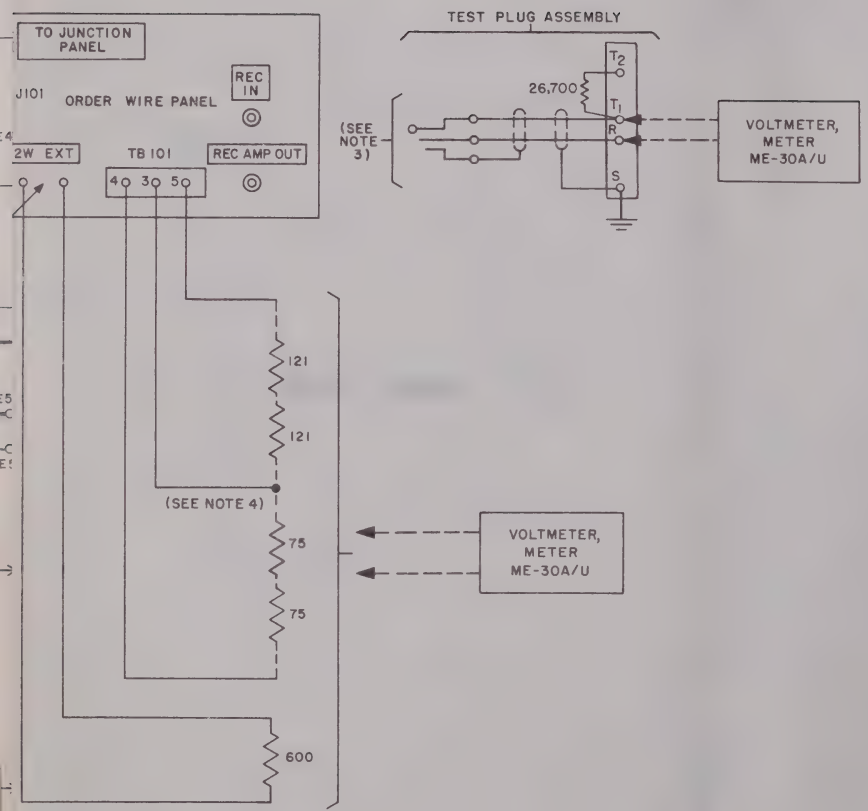


Figure 90.

Figure 90. ORDER WIRE PANEL, operational test setup, transmitting direction.



TO JACKS ON ORDER WIRE PANEL AS INDICATED
TIONAL AND FINAL TEST PROCEDURES.

AS INDICATED IN OPERATIONAL OR FINAL TEST
ES.

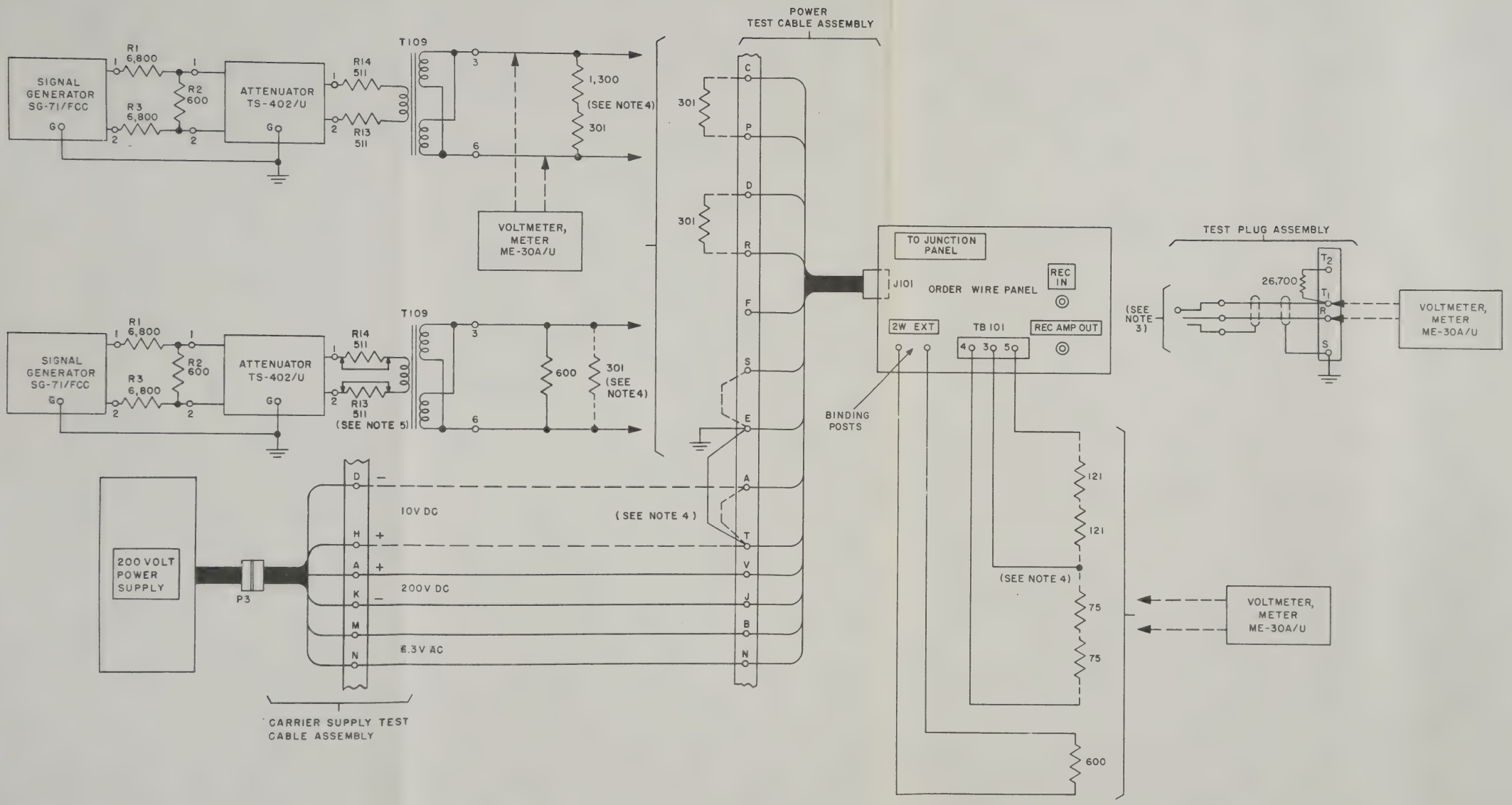
RI3 AND RI4 MUST BE STRAPPED OUT FOR THIS
JP.

TM2139-35-136

tp, receiving direction.

R SUPPLY
ASSEMBLIES
C
M
D
N
E
P
F
R
A
K
B
L
60.4
200
VOLT
POWER
SUPPLY
VOLTMETER,
METER
ME-30A/U
MULTIMETER
AN/URM-105
(SEE NOTE 4)
NOTES:
1. RESISTANCES ARE IN OHMS.
2. ONLY ONE VOLTMETER, METER ME-30A/U AND ONE FREQUENCY METER AN/USM-26 ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT TO JACKS ON PANEL AS INDICATED IN OPERATIONAL AND FINAL TEST PROCEDURES.
4. CONNECT METERS AS INDICATED IN OPERATIONAL AND FINAL TEST PROCEDURES.
TM2139-35-148

Figure 103.



NOTES:

1. RESISTANCES ARE IN OHMS.
2. ONLY ONE VOLTMETER, METER ME-30A/U AND ONE SIGNAL GENERATOR SG-71/FCC ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECT TO JACKS ON ORDER WIRE PANEL AS INDICATED IN OPERATIONAL AND FINAL TEST PROCEDURES.
4. CONNECT AS INDICATED IN OPERATIONAL OR FINAL TEST PROCEDURES.
5. RESISTORS R13 AND R14 MUST BE STRAPPED OUT FOR THIS TEST SETUP.

TM2139-35-136

Figure 91.

Figure 91. ORDER WIRE PANEL, operational and final test setup, receiving direction.

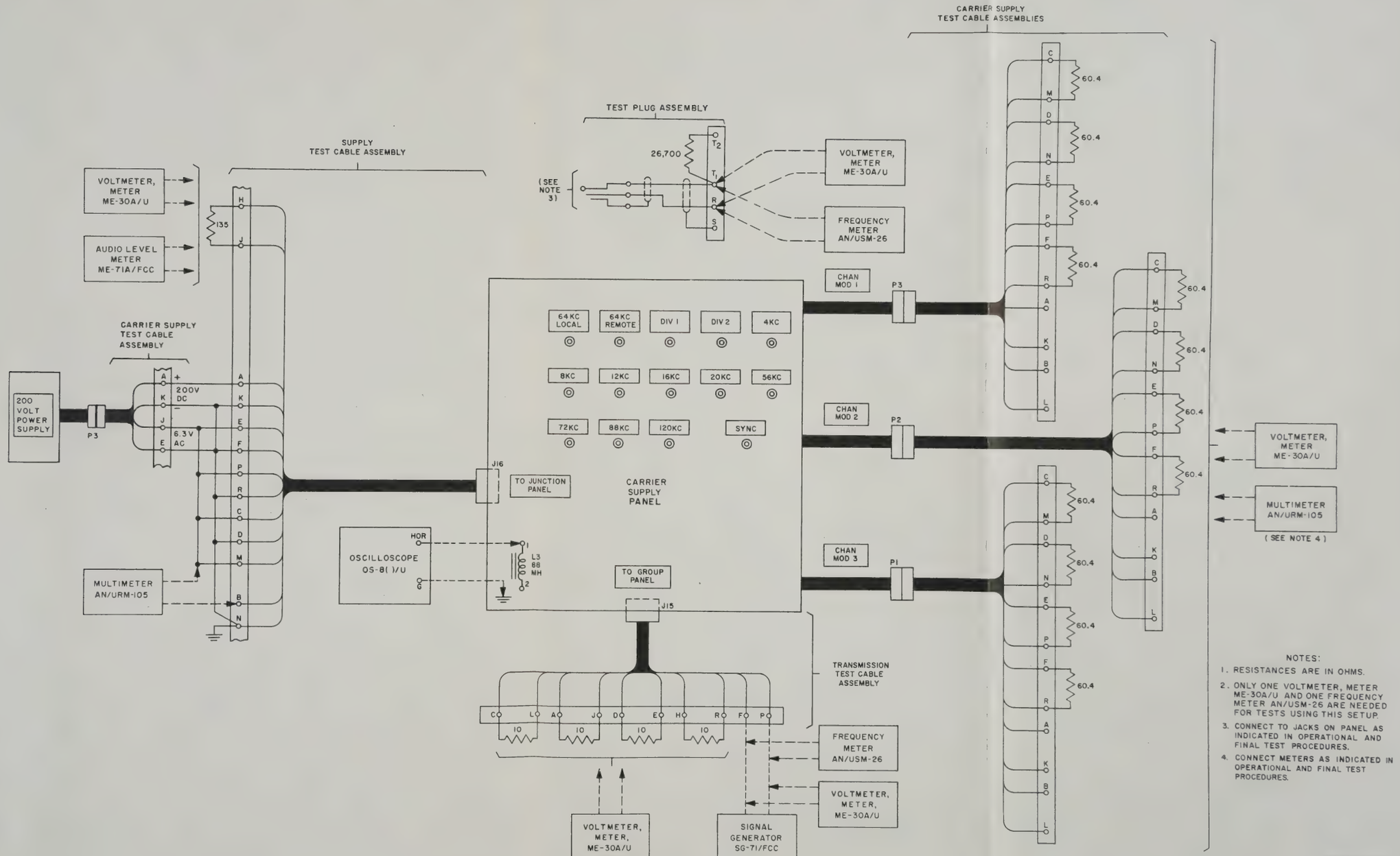
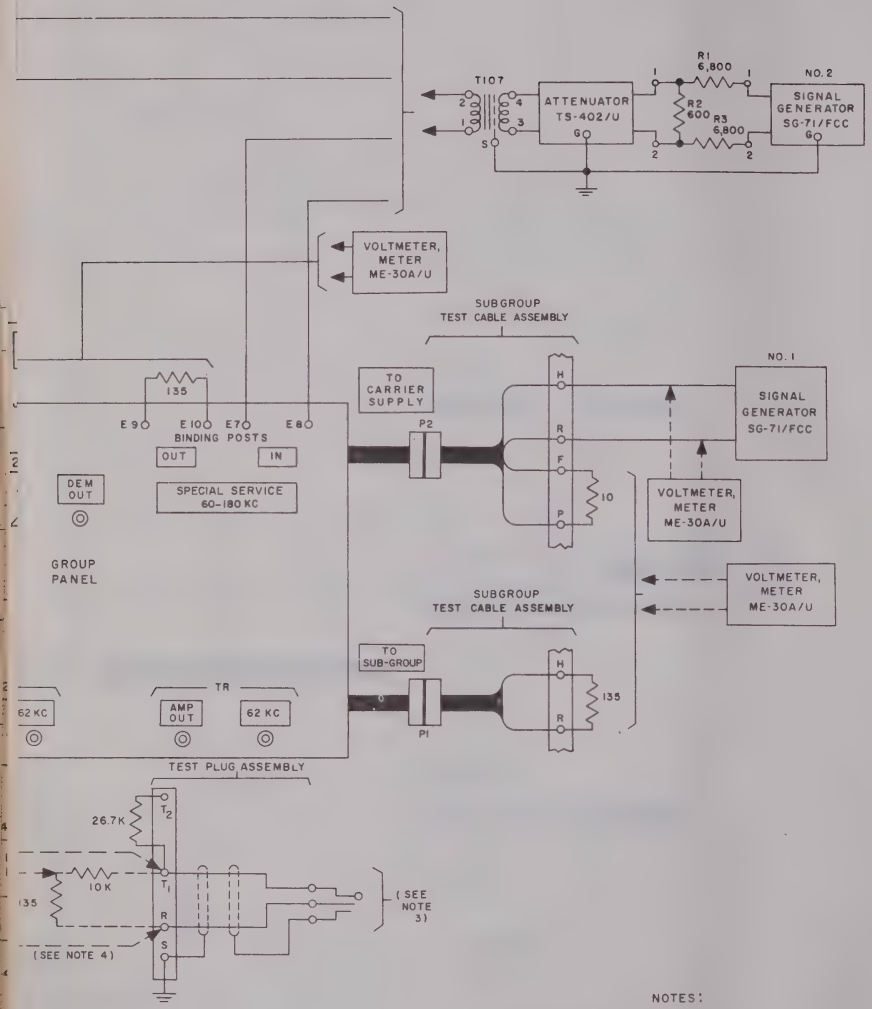


Figure 103.

Figure 103. CARRIER SUPPLY PANEL, operational and final test setup.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS
2. ONLY ONE VOLTMETER, METER ME-30A/U AND TWO SIGNAL GENERATORS SG-71/FCC ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECTED TO JACKS ON PANEL AS INDICATED IN FINAL TEST PROCEDURE.
4. CONNECT AS INDICATED IN FINAL TEST PROCEDURE.
5. ONLY ONE CARRIER SUPPLY TEST CABLE ASSEMBLY IS NEEDED FOR TEST USING THIS SETUP.

TM2139-35-179

ual test setup.

1. UNLESS OTHERWISE INDICATED, RESISTANCE VALUES ARE IN OHMS

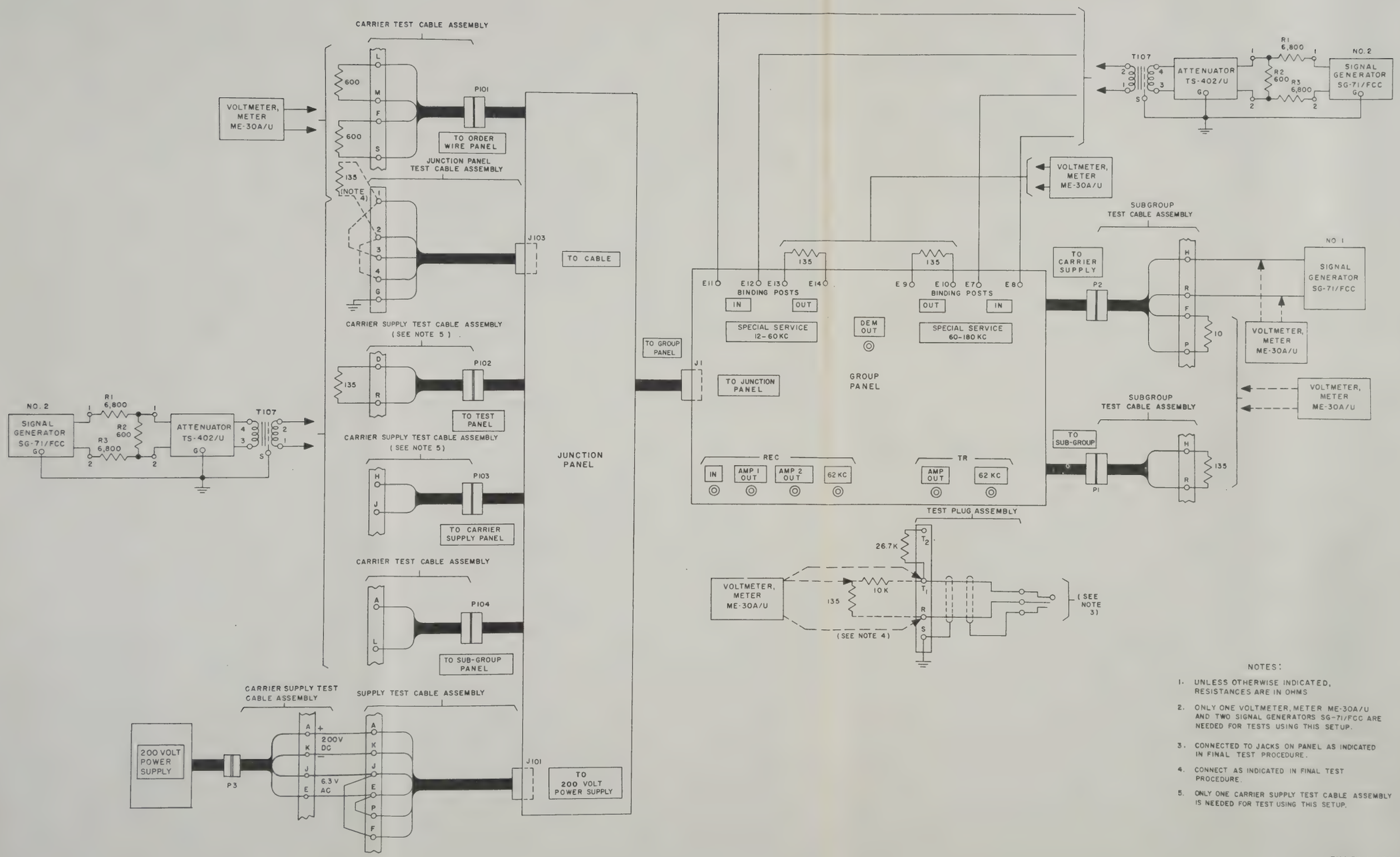
2. ONLY ONE SIGNAL GENERATORS SG-71/FCC IS NEEDED. FOR TESTS USING THIS SETUP.

3. CONNECT AS INDICATED IN FINAL TEST PROCEDURE.

4. RESISTORS R13 AND R14 MUST BE STRAPPED OUT FOR THIS TEST SETUP.

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setup, transmitting direction.



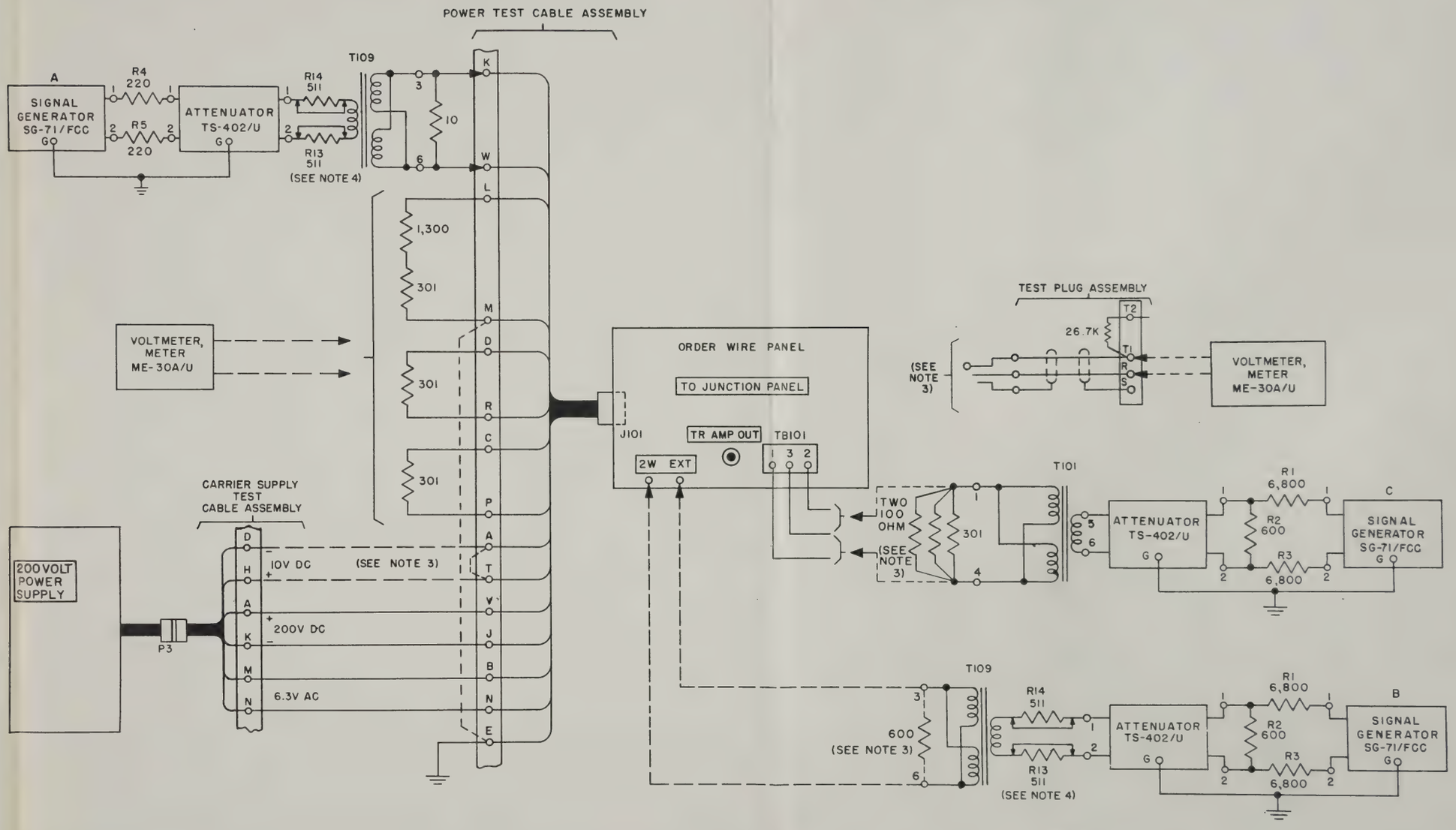
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS
2. ONLY ONE VOLTMETER, METER ME-30A/U AND TWO SIGNAL GENERATORS SG-71/FCC ARE NEEDED FOR TESTS USING THIS SETUP.
3. CONNECTED TO JACKS ON PANEL AS INDICATED IN FINAL TEST PROCEDURE.
4. CONNECT AS INDICATED IN FINAL TEST PROCEDURE.
5. ONLY ONE CARRIER SUPPLY TEST CABLE ASSEMBLY IS NEEDED FOR TEST USING THIS SETUP.

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Figure 131.

Figure 131. GROUP PANEL and JUNCTION PANEL, final test setup.



NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.
2. ONLY ONE SIGNAL GENERATORS SG-71/FCC IS NEEDED. FOR TESTS USING THIS SETUP.
3. CONNECT AS INDICATED IN FINAL TEST PROCEDURE.
4. RESISTORS R13 AND R14 MUST BE STRAPPED OUT FOR THIS TEST SETUP.

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Figure 133.

Figure 133. ORDER WIRE PANEL, final test setup, transmitting direction.

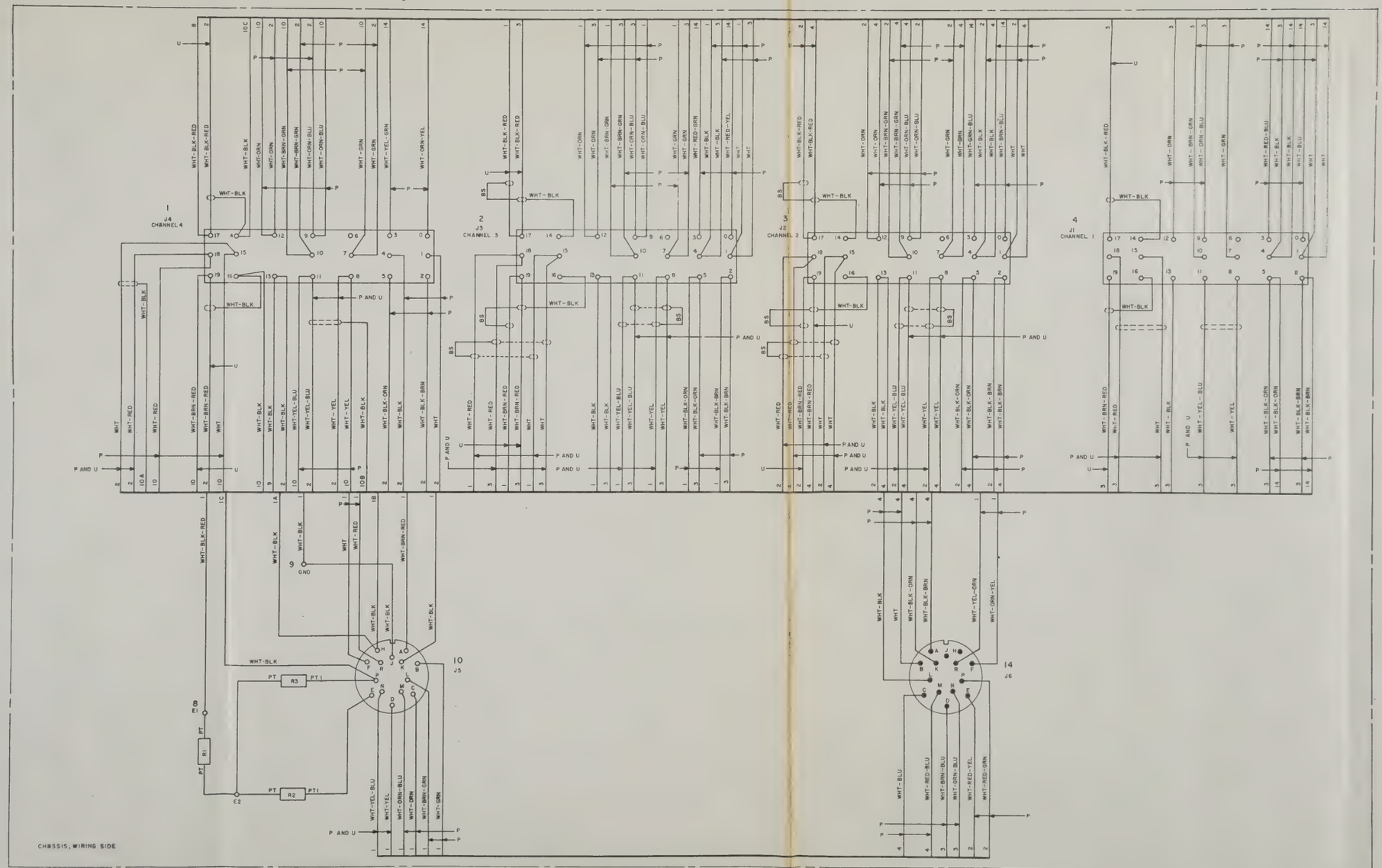
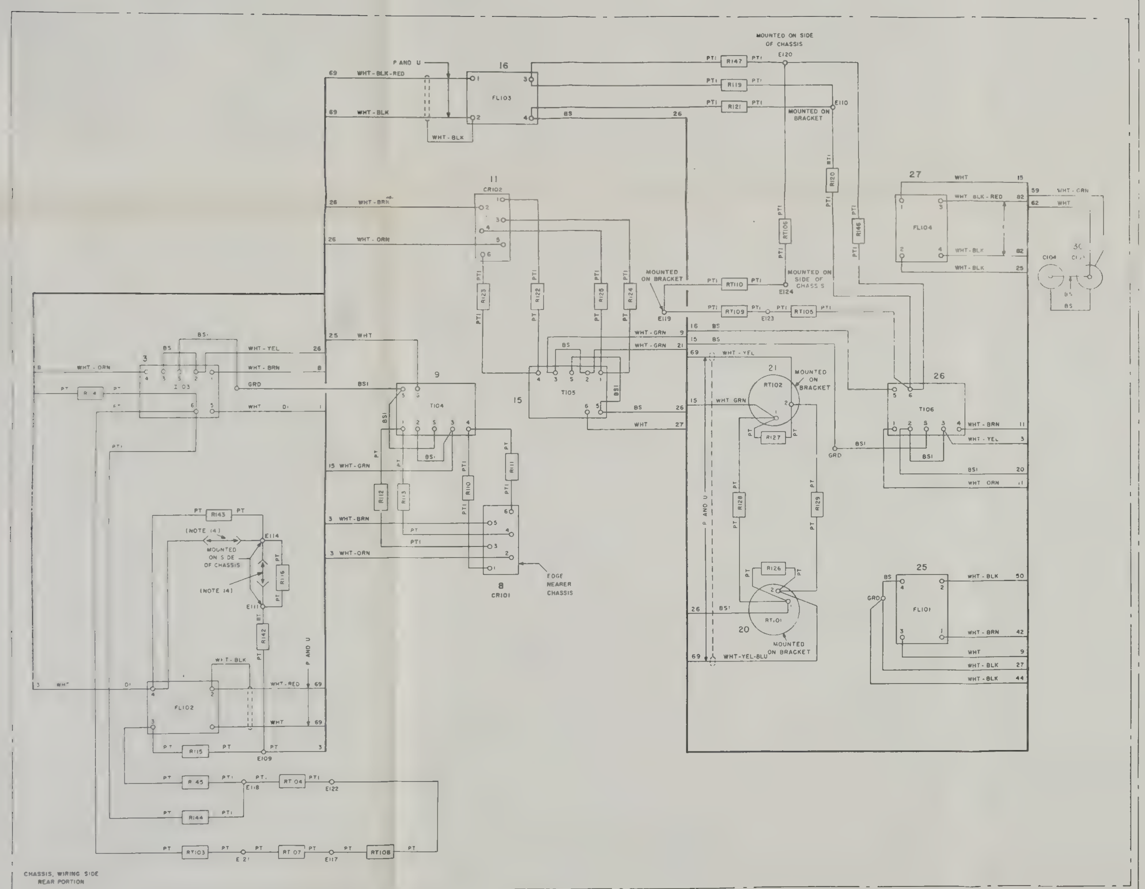
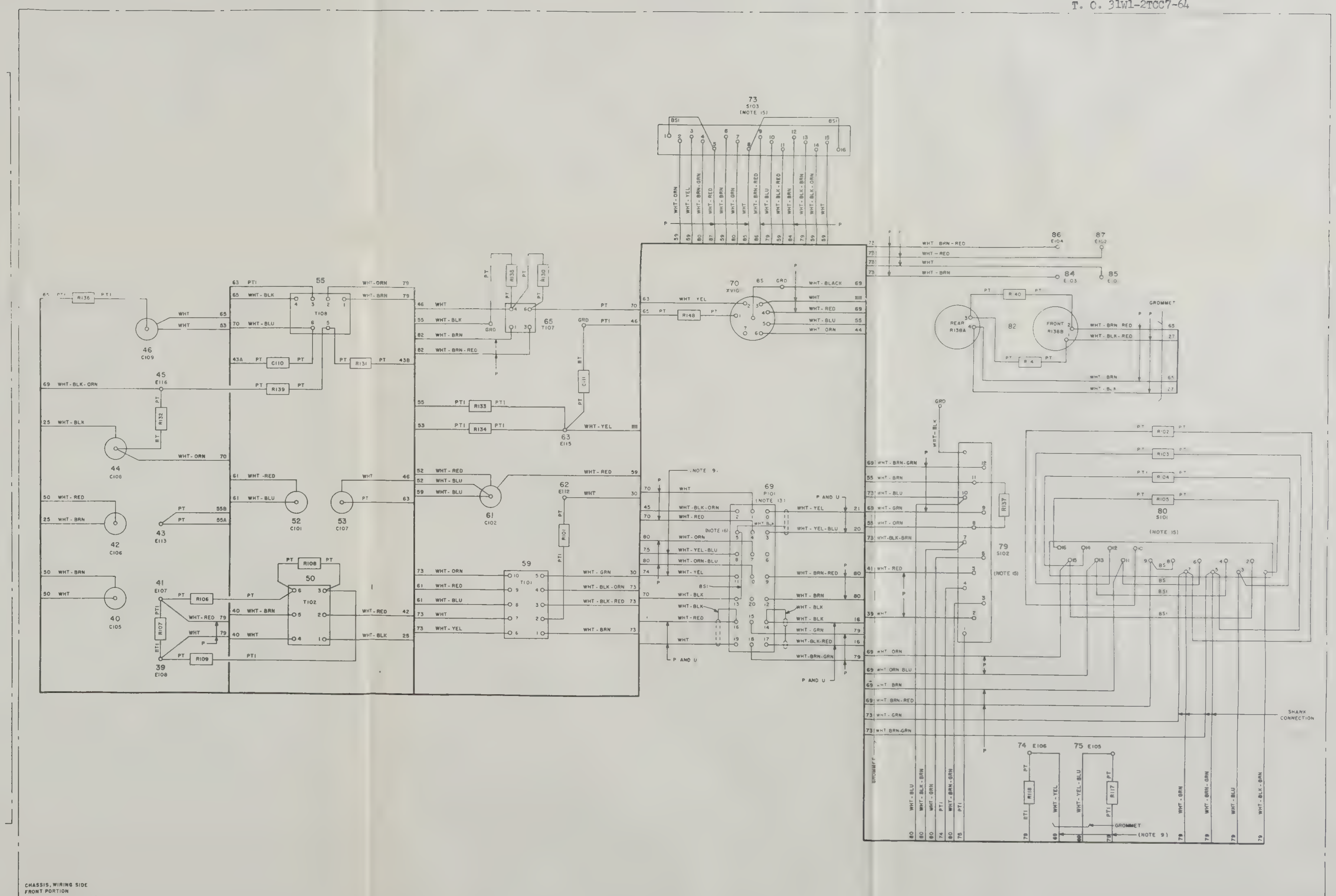


Figure 138. Telephone Modem TA-219/U, wiring diagram.

TM2139-35-4



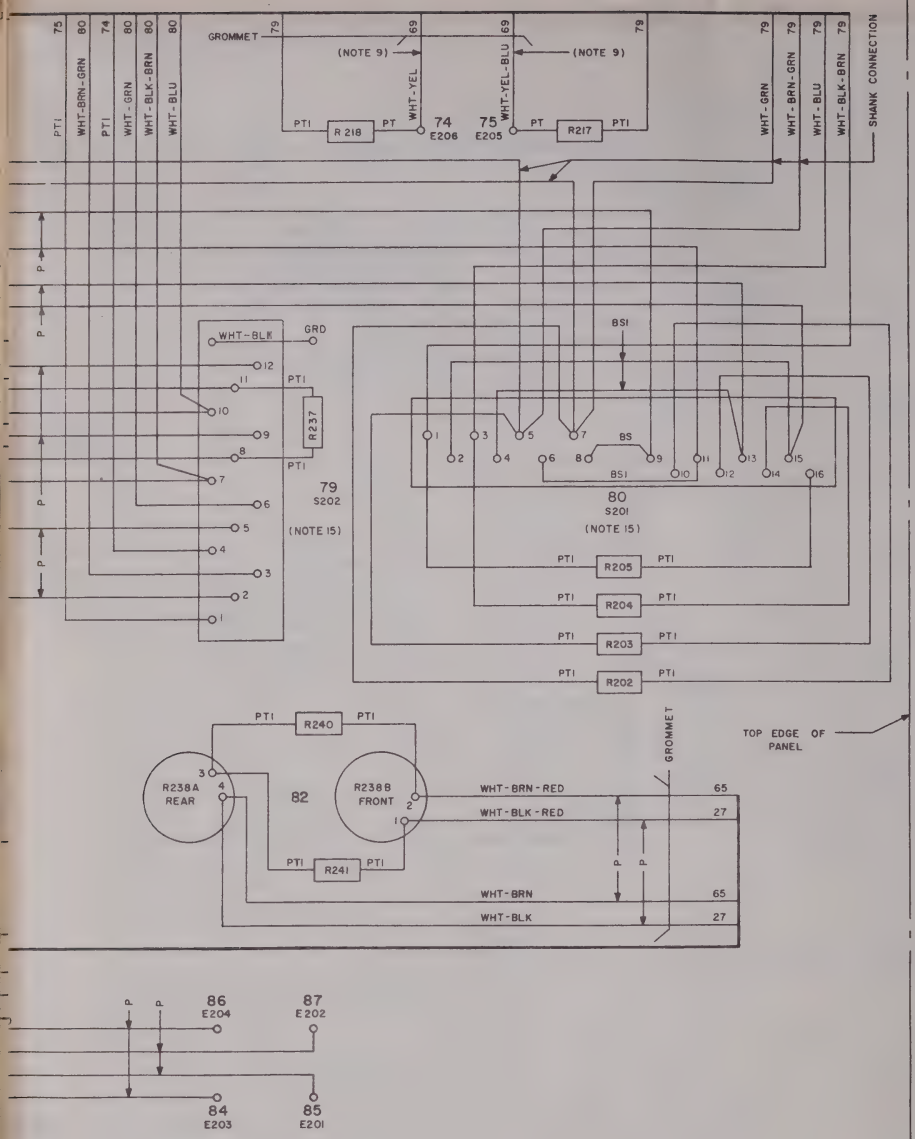


NOTES

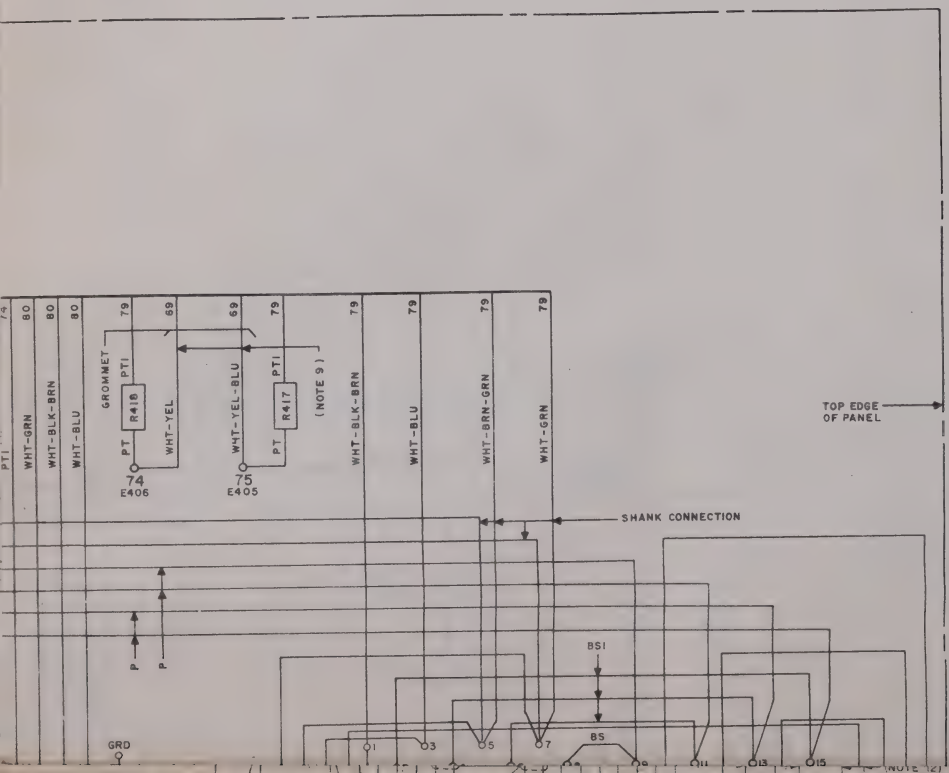
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET
3. DI WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER
4. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING
5. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING
6. PT DENOTES LEADS PART OF APPARATUS
7. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING
8. P DENOTES PAIR
9. THESE WIRES ARE TWISTED 1/2 INCH LAY AND RUN SEPARATELY FROM OTHER WIRES
10. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET
11. C)—— DENOTES SHIELDED CONNECTION.
12. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER
13. LEADS TO CONNECTOR P101 HAVE SUFFICIENT SLACK SO THAT THIS CONNECTOR MAY BE UNFASTENED AND ACCESS OBTAINED TO THE WIRING SIDE WITHOUT UNSOLDERING CONNECTIONS
14. THESE RESISTORS ARE STRAPPED FOR PROPER OUTPUT OF CHANNEL AND UPON REPLACEMENT OF ASSOCIATED COMPONENTS THEY MAY HAVE TO BE RESTRAPPED
15. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSE ONLY
16. IN UNITS BEARING ORDER NO 14181-PHILA-51, SERIAL NUMBERS 1 THROUGH 205F AND 2058 THROUGH 2107, THE SHIELD IS CONNECTED TO PIN 6

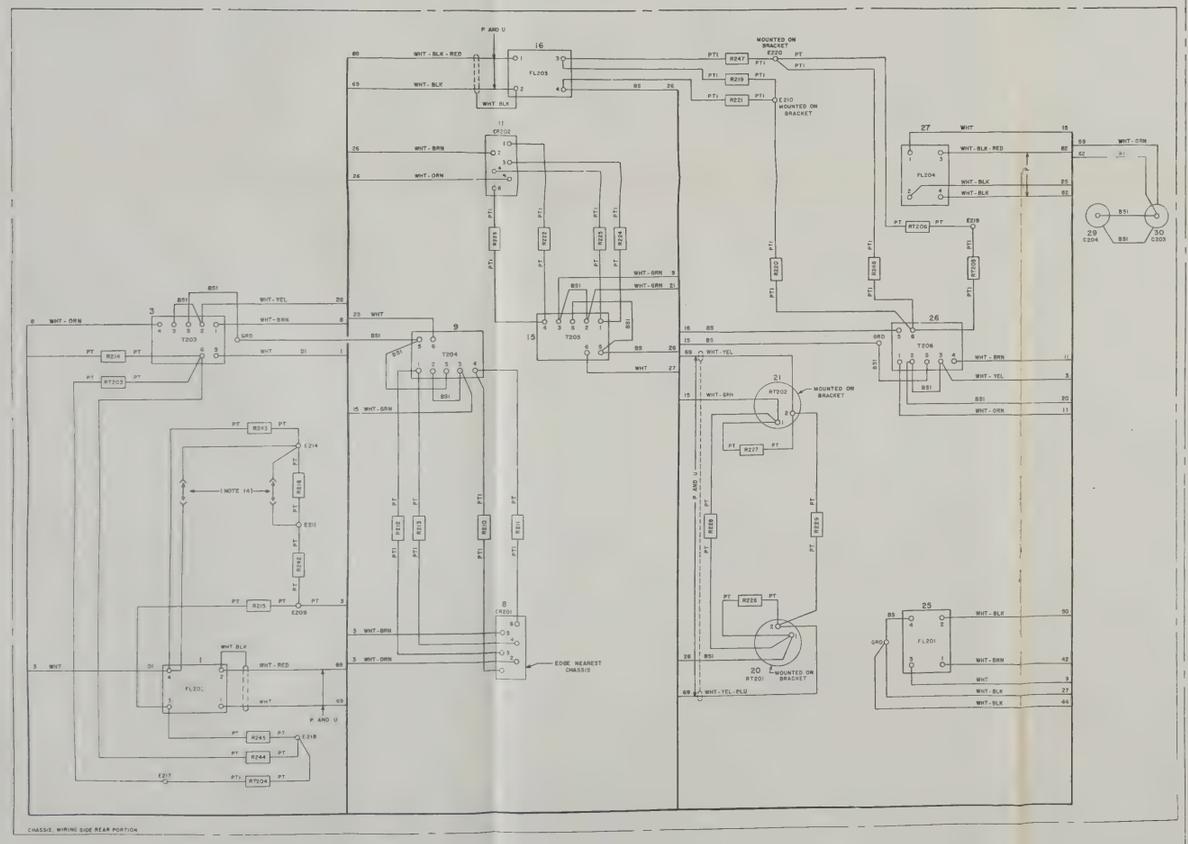
Figure 139. CHAN 1 (part of Telephone Modem TA-219/U), wiring diagram.

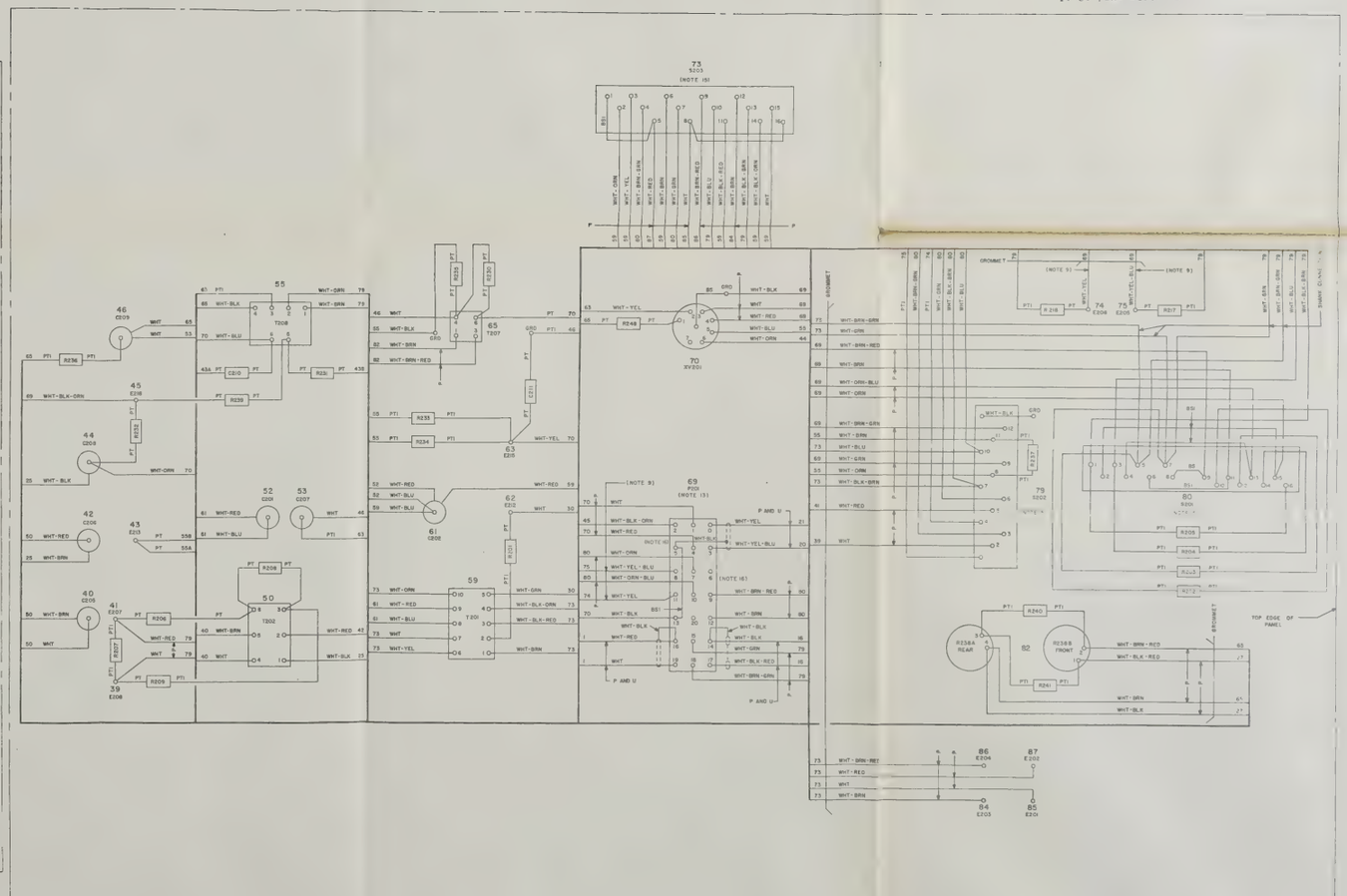
TM2138-31-5


GROMMET
(NOTE 9)
(NOTE 9)
WHT-YEL
WHT-YEL-BLU
R 218
R217
74
E206
75
E205
PTI
PT
WHT-BRN-GRN
WHT-GRN
WHT-BLK-BRN
WHT-BLU
WHT-BLK-BRN
SHANK CONNECTION
WHT-BLK
GRD
R237
79
S202
(NOTE 15)
BSI
BS
80
S201
(NOTE 15)
R205
R204
R203
R202
R240
R238A
REAR
82
R238B
FRONT
R241
WHT-BRN-RED
WHT-BLK-RED
WHT-BRN
WHT-BLK
65
27
TOP EDGE OF
PANEL
86
E204
87
E202
84
E203
85
E201

TM2139-35-6


WHT-GRN
WHT-BLK-BRN
WHT-BLU
GROMMET
PTI
R416
PT
WHT-YEL
74
E406
WHT-YEL-BLU
R417
75
E405
(NOTE 9)
WHT-BLK-BRN
WHT-BLU
WHT-BRN-GRN
WHT-GRN
TOP EDGE OF PANEL
SHANK CONNECTION
P
BS1
BS
GRD
1
3
5
7
9
11
13
15





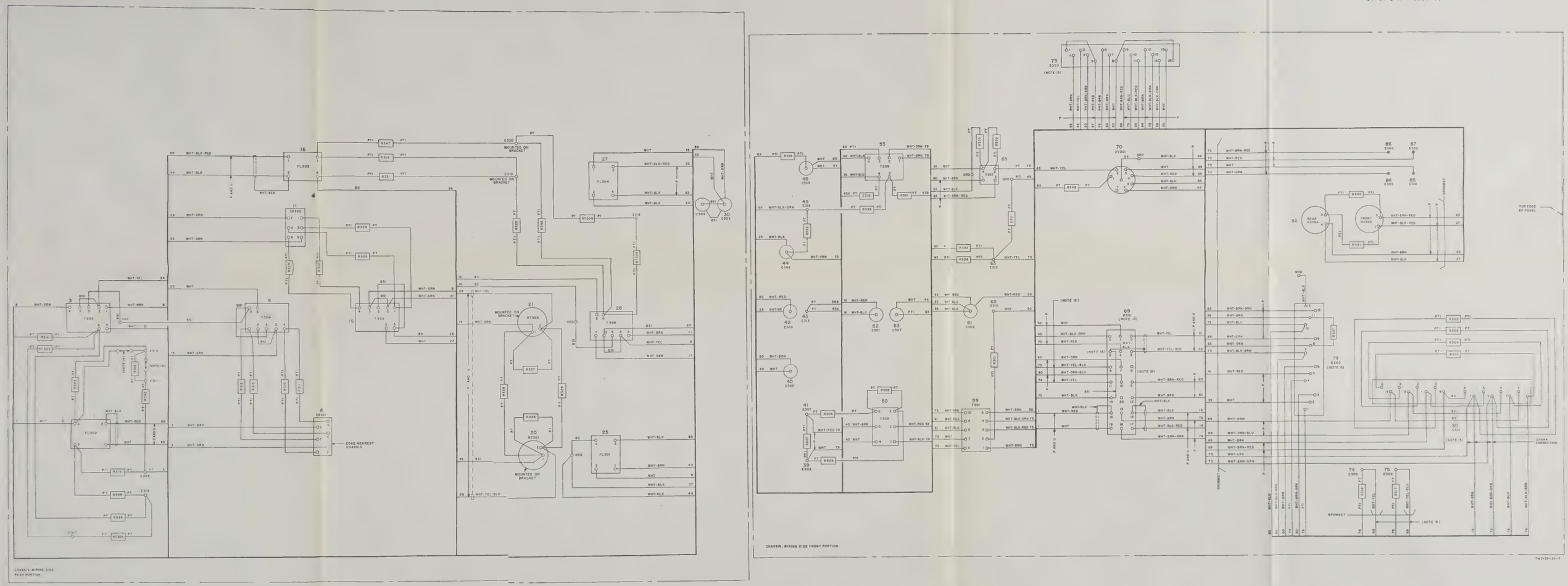
NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. DI WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
4. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
5. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
6. PT DENOTES LEADS PART OF APPARATUS.
7. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE GLASS SLEEVING.
9. THESE WIRES ARE TWISTED 1/2 INCH LAY AND RUN SEPARATELY FROM OTHER WIRES.
10. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
11. ⊂⊃ DENOTES SHIELDED CONNECTOR.
12. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
13. LEADS TO CONNECTOR P201 HAVE SUFFICIENT SLACK SO THAT THIS CONNECTOR MAY BE UNFASTENED AND ACCESS OBTAINED TO THE WIRING SIDE WITHOUT UNSOLDERING CONNECTIONS.
14. THESE RESISTORS ARE STRAPPED FOR PROPER OUTPUT OF CHANNEL AND UPON REPLACEMENT OF ASSOCIATED COMPONENTS THEY MAY HAVE TO BE RESTRAPPED.
15. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.
16. IN UNITS BEARING ORDER NO. 1488-PHILCO SERIAL NUMBERS 1 THROUGH 2056 AND 2058 THROUGH 2107, THE SHIELD IS CONNECTED TO PIN 6.

Figure 140. CHAN 2 (part of Telephone Modem TA-219/U), wiring diagram.

TM2139-35-6

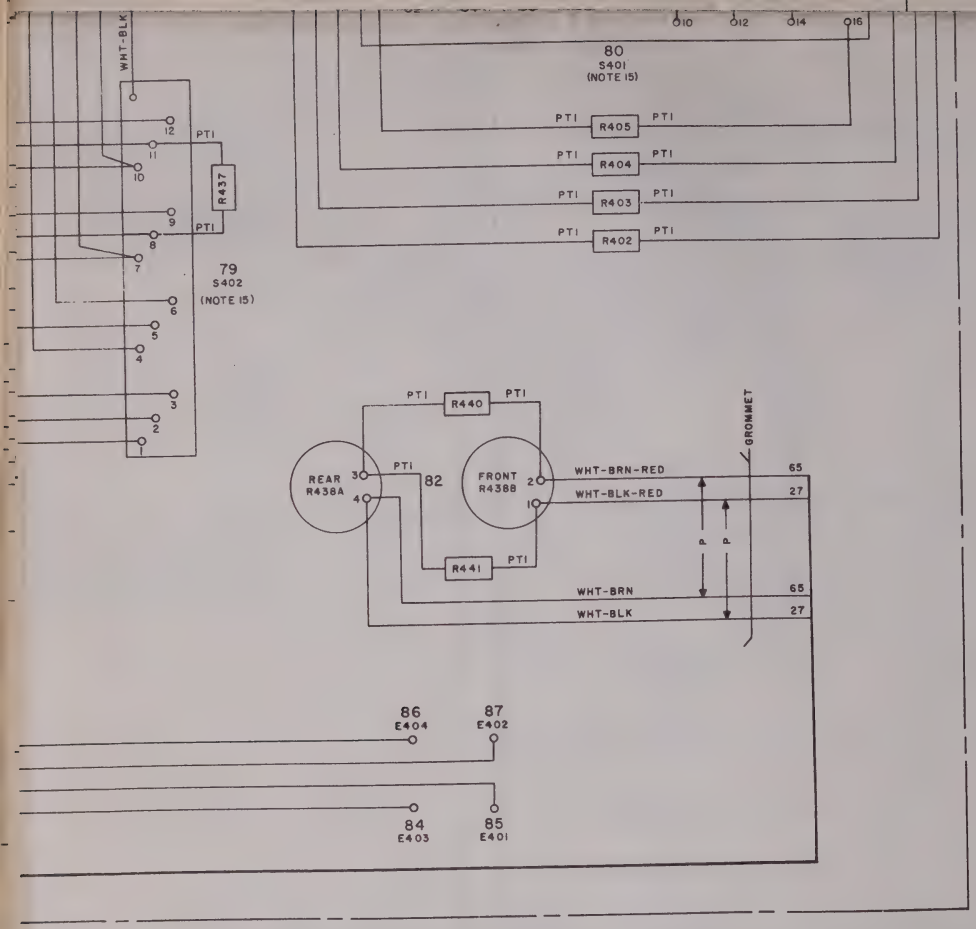
Figure 140.



NOTES

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. C# WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
4. B5 DENOTES 22 GAGE TINNED ANNEALED COPPER WIRING COVERED WITH
5. B5- DENOTES 22 GAGE TINNED ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING
6. PT DENOTES LEADS PART OF APPARATUS
7. PT DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING
8. P DENOTES PAIR.
9. THESE WIRES ARE TWISTED 1/2 INCH LAY AND RUN SEPARATELY FROM OTHER WIRES
11. ⟨ ⟩ DENOTES SHIELDED CONNECTION
12. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
13. LEADS TO CONNECTOR P301 HAVE SUFFICIENT SLACK SO THAT THIS CONNECTOR MAY BE UNFASTENED AND ACCESS OBTAINED TO THE WIRING SIDE WITHOUT UNSOLDERING CONNECTIONS.
14. THESE RESISTORS ARE STRAPPED FOR PROPER OUTPUT OF CHANNEL AND UPON REPLACEMENT OF ASSOCIATED COMPONENTS THEY MAY HAVE TO BE RESTRAPPED.
15. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY
16. IN UNITS BEARING ORDER NO. 14181-PHILA-51, SERIAL NUMBERS 1 THROUGH 2036 AND 2058 THROUGH 2107, THE SHIELD IS CONNECTED TO PIN 6

Figure 141. CHAN 3 (part of Telephone Modem T-21B/U), wiring diagram.


WHT-BLK
12
11
10
9
8
7
6
5
4
3
2
1
PTI
R437
79
S402
(NOTE 15)
10
12
14
16
80
S401
(NOTE 15)
PTI
R405
PTI
R404
PTI
R403
PTI
R402
PTI
R440
PTI
REAR
R438A
3
4
PTI
82
FRONT
R4388
2
1
WHT-BRN-RED
65
WHT-BLK-RED
27
GROMMET
a
a
R441
PTI
WHT-BRN
65
WHT-BLK
27
86
E404
87
E402
84
E403
85
E401

TM2139-35-8

TM2139-35-11①

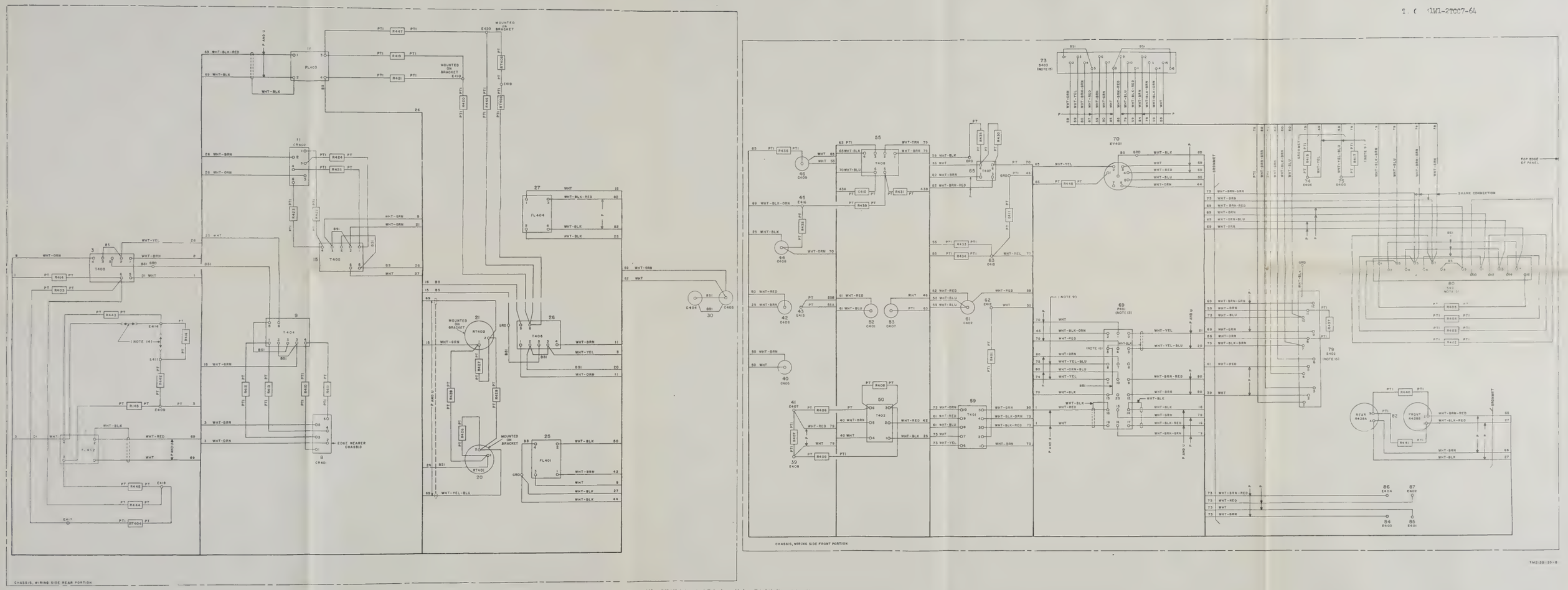


Figure 142. CHAN 4 (part of Telephone Modem TA-219/U), wiring diagram.

Figure 142.

1. THE SMALL NUMBER ON EACH WIRE ADJACENT TO TH COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WI RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS A TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN T WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. DI WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL.
4. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIR
5. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIR COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
6. PT DENOTES LEADS PART OF APPARATUS.
7. PTI DENOTES LEADS PART OF APPARATUS COVERED WIT SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
8. P DENOTES PAIR.

EXTRUDED NYLON JACKET

11. ◇—— DENOTES SHIELDED CONNECTION.
12. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BA THE PANEL AND RUN AT RIGHT ANGLES IN THE MO CONVENIENT MANNER
13. LEADS TO CONNECTOR P401 HAVE SUFFICIENT SLAC THAT THIS CONNECTOR MAY BE UNFASTENED AND AC OBTAINED TO THE WIRING SIDE WITHOUT UNSOLDERI CONNECTIONS.
14. THESE RESISTORS ARE STRAPPED FOR PROPER OUT OF CHANNEL AND UPON REPLACEMENT OF ASSOCIATE COMPONENTS THEY MAY HAVE TO BE RESTRAPPED.
15. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFER PURPOSES ONLY.
16. RE UNITS BEARING ORDER NO 1468-PMCL-54, SERIAL NOS 1 3056 AND 2066 THROUGH 2107, THE SHIELD IS CONNECTED 6

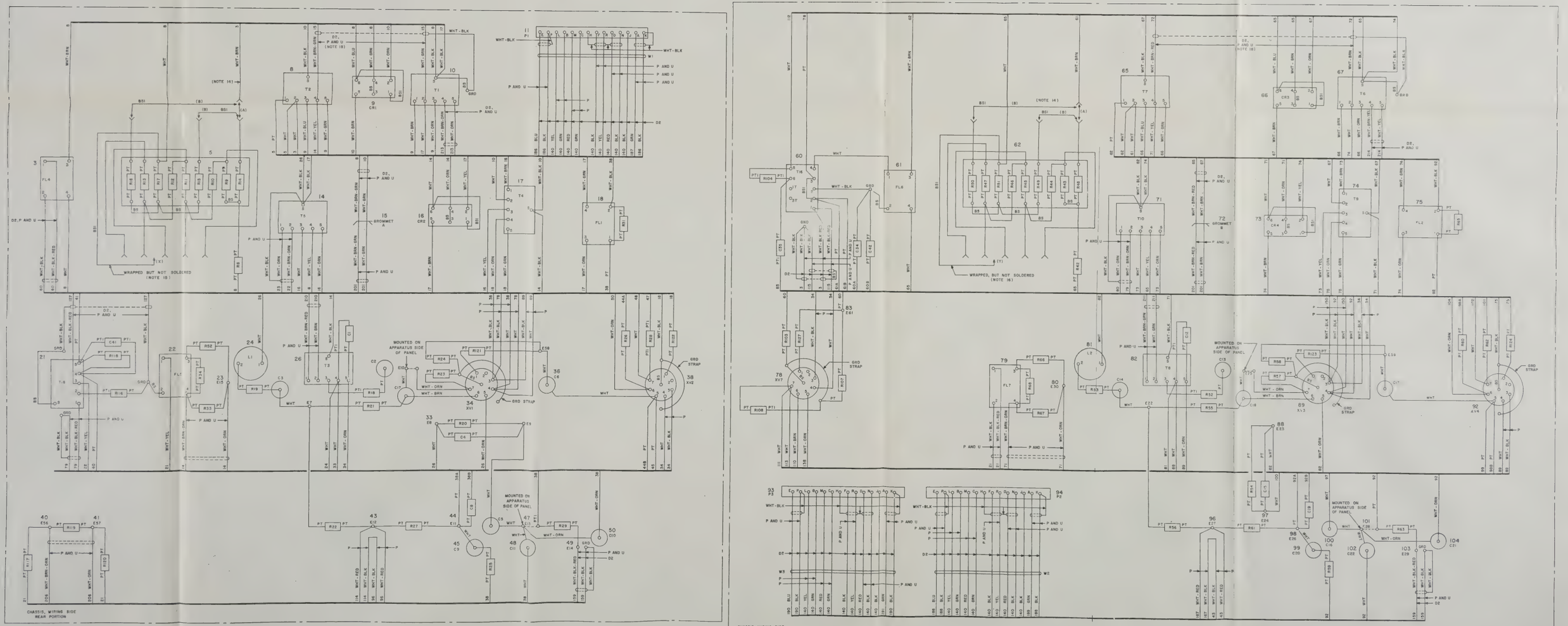
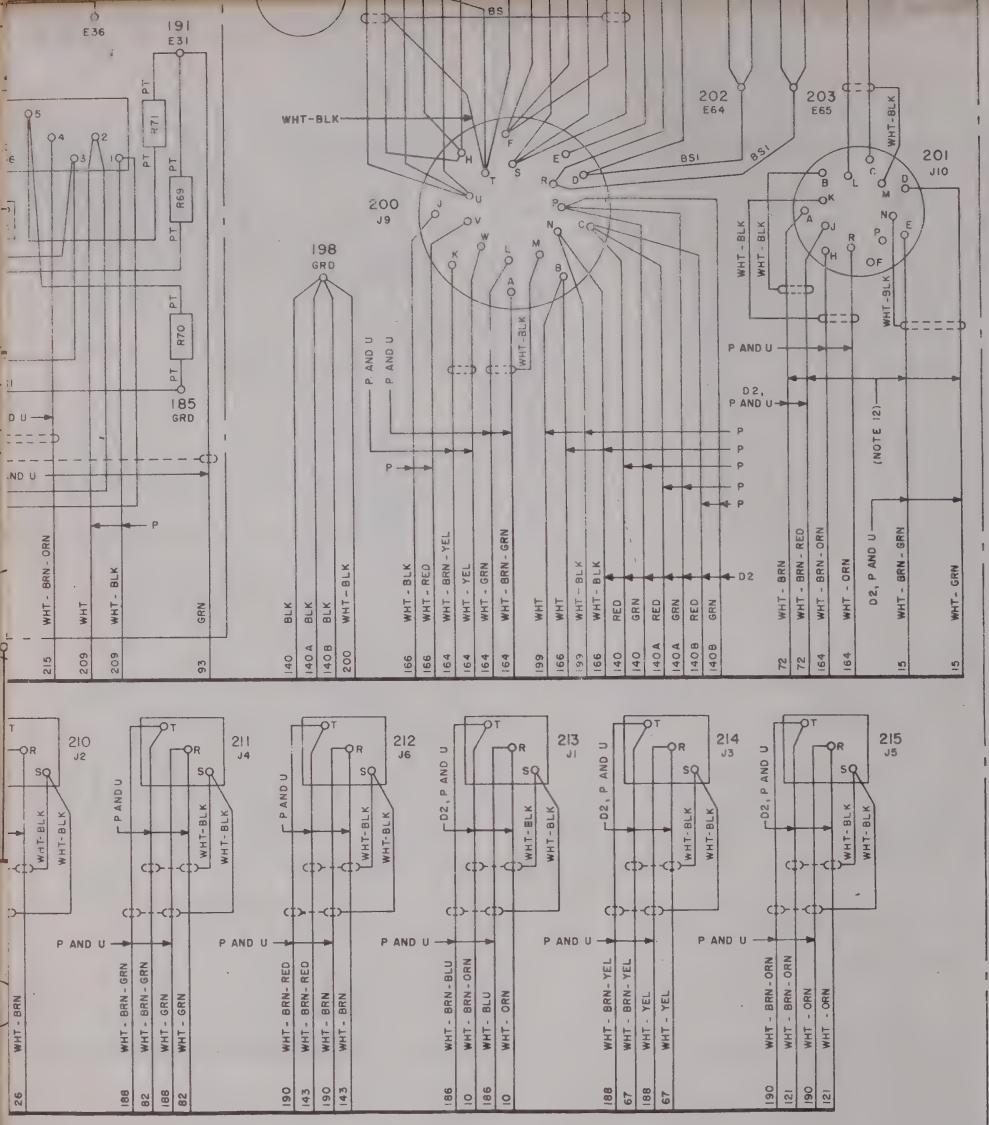


Figure 143. Telephone Modem TA-227/U, wiring diagram.

TM1139-38-1



DENOTES SHIELDED PAIR 22 GAGE WIRE WITH NYLON JACKET.

ENOTES SHIELDED CONNECTION.

EXTEND TO WITHIN 1 INCH OF TERMINAL UNLESS E SPECIFIED.

EXTEND TO WITHIN 1/2 INCH OF TERMINAL.

IOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE ID RUN AT RIGHT ANGLES IN THE MOST CONVENIENT

IPTION (A) IS PROVIDED AT THE TIME OF MANUFACTURE. PLACEMENT OF ASSOCIATED CIRCUIT ELEMENTS, IF OPTIO NOT PROVIDE THE DESIRED OUTPUT, IT MAY BE Y TO USE OPTION (B) TO PROVIDE PROPER OUTPUT.

ETION (X) PROVIDES FOR THE SELECTION OF ANY OF FIVE SERIES COMBINATIONS OF RESISTORS R9 THROUGH R HE PROPER SERIES COMBINATION TO OBTAIN THE OUTPUT.

16. WIRING OPTION (Y) PROVIDES FOR THE SELECTION OF ANY OF FIVE DIFFERENT SERIES COMBINATIONS OF RESISTORS R43 THROUGH R4 SELECT THE PROPER SERIES COMBINATION TO OBTAIN THE DESIRED OUTPUT.

17. WIRING OPTION (Z) PROVIDES FOR THE SELECTION OF ANY OF FIVE DIFFERENT SERIES COMBINATIONS OF RESISTORS R77 THROUGH R SELECT THE PROPER SERIES COMBINATION TO OBTAIN THE DESIRE OUTPUT.

18. SHIELDS EXTEND TO WITHIN 1 1/2 INCH OF TERMINAL.

19. DI WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.

20. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

T. O. 31W1-2TCC7-64

TM2139-35-16 ①

NOTES

1. THE SMALL NUMBER ON EACH WIRE INDICATES TO THE COMMON OR BASE LINE. CONNECTIONS TO THE LARGE NUMBER ADJACENT TO STATION TO WHICH THE WIRE RUNS. THESE ARE TWO OR M WIRES OF THE SAME COLOR BETWEEN TWO STATIONS. A LETTER BETWEEN THE NUMBERS

2. P DENOTES PAIR. PAIRED WIRES ARE TWISTED TOGETHER.

3. DZ MEANS IS CROSSED BACK ON THE PANEL OR CHASSIS AND RUN N

4. BS DENOTES 22 GAGE TINNED. ANNEALED COPPER WIRING.

5. BSS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING

6. PT DENOTES LEADS MADE OF APPARATUS

7. PTL DENOTES LEADS MADE OF APPARATUS CO-CRED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.

8. WIRE'S NOT DIAGRAMED SPECIFIED ARE 4 LEAD WITH NYLON JACKET

9. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH

10. SHIELDS EXTEND TO WITHIN 1/8 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED.

11. WIRING OMITTED (2) PROVIDES FOR SELECTION OF ANY FIVE DIFFERENT SERIES COMBINATIONS OF RESISTORS R47 THROUGH R51 SELECT THE PROPER SERIES COMBINATION TO OBTAIN THE DESIRED OUTPUT

12. SHIELDS EXTEND TO WITHIN 1/8 INCH OF TERMINAL.

13. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES TO THE MOST CONVENIENT

14. WIRING OMITTED (8) PROVIDED AT TIME OF MANUFACTURE. (A) DOES NOT PROVIDE THE DESIRED OUTPUT. IT MAY BE NECESSARY TO USE OPTION (B) TO PROVIDE PROPER OUTPUT.

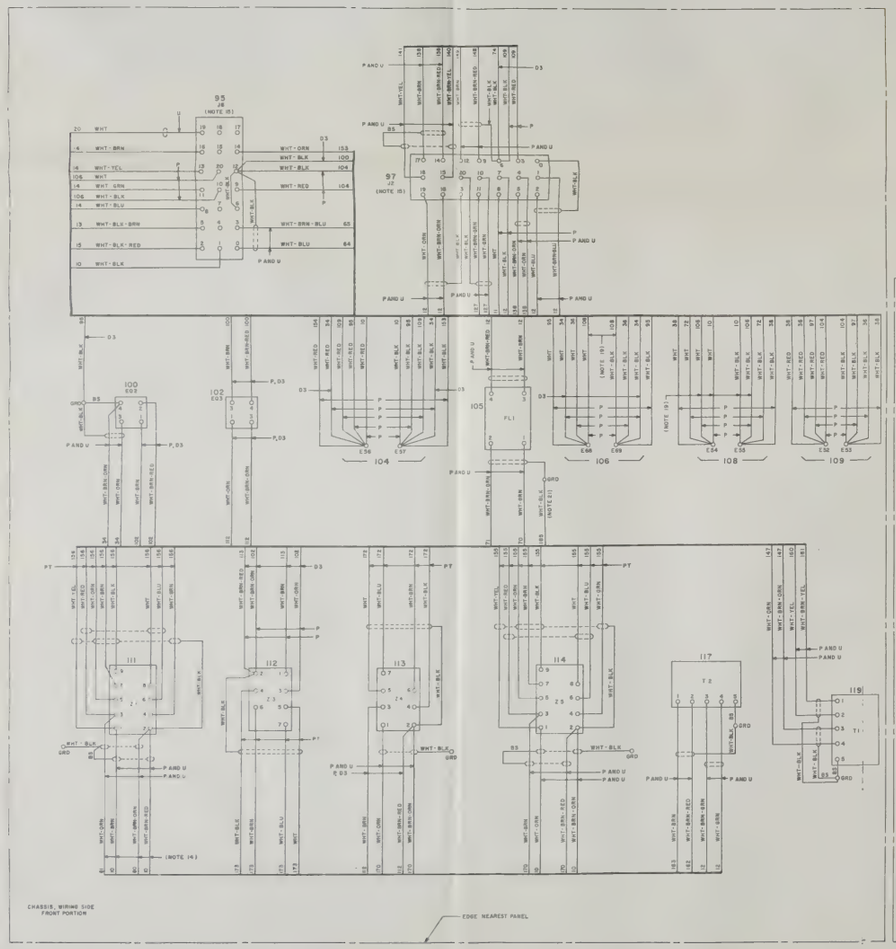
15. WIRING OPTION (V) PROVIDES FOR SELECTION OF ANY FIVE DIFFERENT SERIES COMBINATIONS OF RESISTORS R47 THROUGH R51 SELECT THE PROPER SERIES COMBINATION TO OBTAIN THE DESIRED OUTPUT

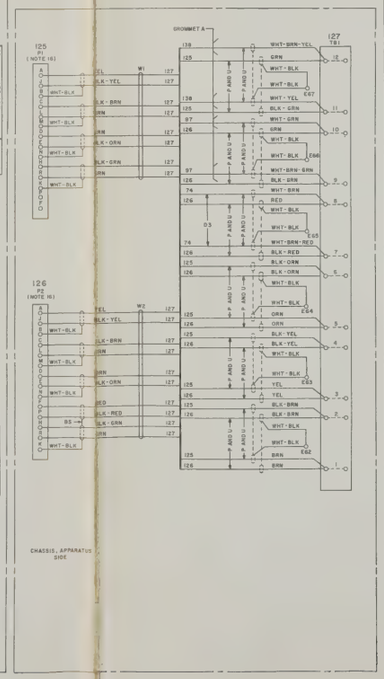
16. SHIELDS EXTEND TO WITHIN 1/8 INCH OF TERMINAL.

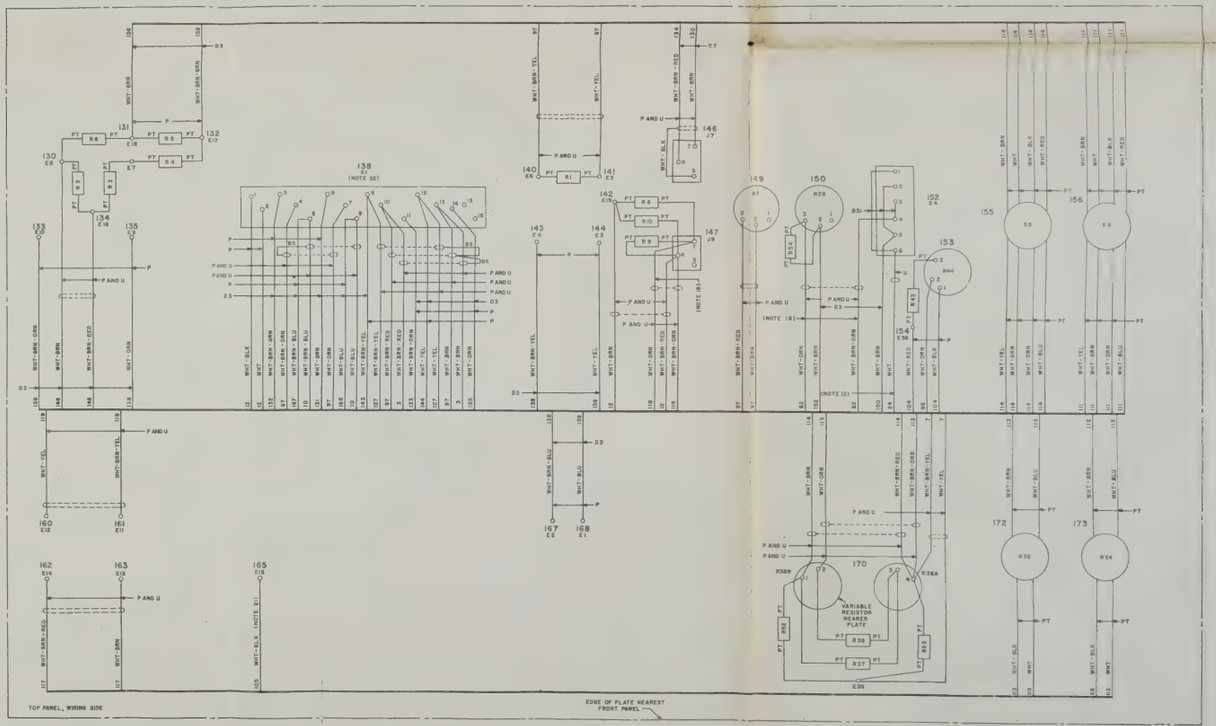
17. WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE MONTEST POSSIBLE MANNER.

18. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

TM 11-390-G







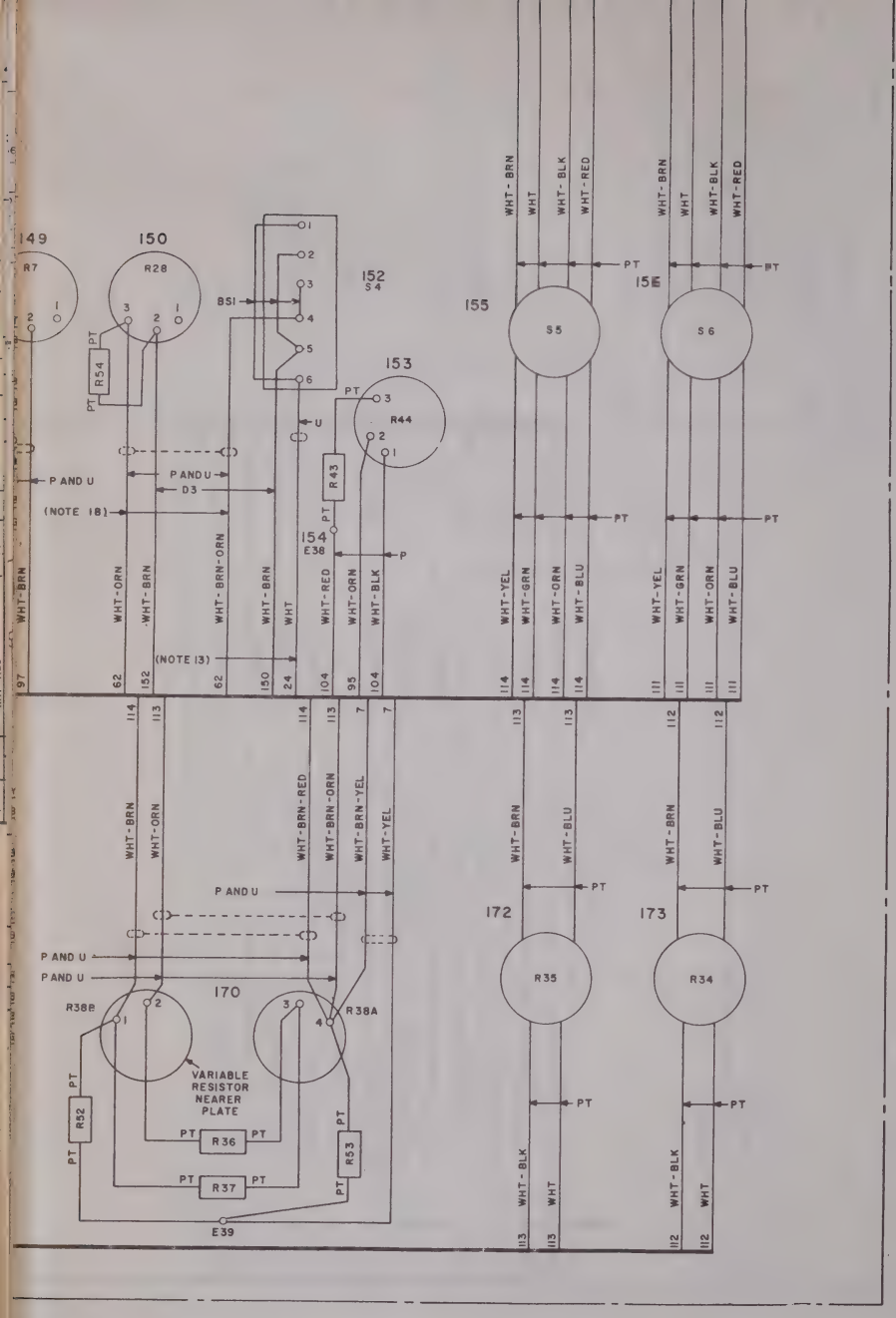
NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. D3 WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
4. D3 WIRING IS DRESSED BACK TO THE CHASSIS AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
5. B9 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
6. B51 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING
7. PT DENOTES LEADS PART OF APPARATUS.
8. P1 AND P2 DENOTE LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. P DENOTES PAIR.
10. U DENOTES SHIELDED 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
11. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
12. ○— DENOTES SHIELDED CONNECTOR.
13. SHIELDS EXTEND TO WITHIN 1/2 INCH OF TERMINAL.
14. SHIELDS EXTEND TO WITHIN 1 INCH OF TERMINAL.
15. LEADS TO CONNECTORS J2 THROUGH J4 HAVE SUFFICIENT SLACK SO THAT THESE CONNECTORS MAY BE UNFASTENED AND ACCESS OBTAINED TO THE WIRING SIDE WITHOUT UNSOLDERING CONNECTIONS.
16. CONNECTORS P1 AND P2 USE CIRCULAR CONNECTORS. PHYSICAL FOR LOCATION IS SHOWN IN SCHEMATIC DIAGRAMS OF THE GROUP PANEL CIRCUIT
17. SHIELDS EXTEND TO WITHIN 3/4 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED
18. SHIELDS EXTEND TO WITHIN 1 1/2 INCH OF TERMINAL
19. THIS WIRING IS 16 GAGE WIRE WITH NYLON JACKET.
20. LEAD AT STATION 2R AND THE WHT-ORN LEAD AT STATION 7E SHALL BE DRESSED TO PROVIDE A MINIMUM SEPARATION OF 1 INCH.
21. BINDING POST E13 AND THE LEAD CONNECTED FROM STATION 16S TO GRD TERMINAL AT STATION 10S IS NOT PROVIDED IN PANELS BEARING ORDER NO 14181-PHILA-51, SERIAL NOS 1 THROUGH 749.
22. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY

Figure 144—Continued.

Figure 144 Continued

TME139-35-16 ③



IS COVERED WITH SILICON IMPREGNATED

WITH EXTRUDED NYLON JACKET.

AGE WIRE WITH EXTRUDED NYLON

ON.

OF TERMINAL.

TERMINAL.

IG HAVE SUFFICIENT SLACK SO THAT
ED AND ACCESS OBTAINED TO THE
ONNECTIONS.

16. CONNECTORS P1 AND P2 USE CIRCULAR CONNECTORS. PHYSICAL PIN LOCATION IS SHOWN IN SCHEMATIC DIAGRAMS OF THE GROUP PANEL CIRCUIT.

17. SHIELDS EXTEND TO WITHIN 3/4 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED.

18. SHIELDS EXTEND TO WITHIN 1 1/2 INCH OF TERMINAL.

19. THIS WIRING IS 16 GAGE WIRE WITH NYLON JACKET.

20. LEAD AT STATION 29 AND THE WHT-ORN LEAD AT STATION 72 SHALL BE DRESSED TO PROVIDE A MINIMUM SEPARATION OF 1 INCH.

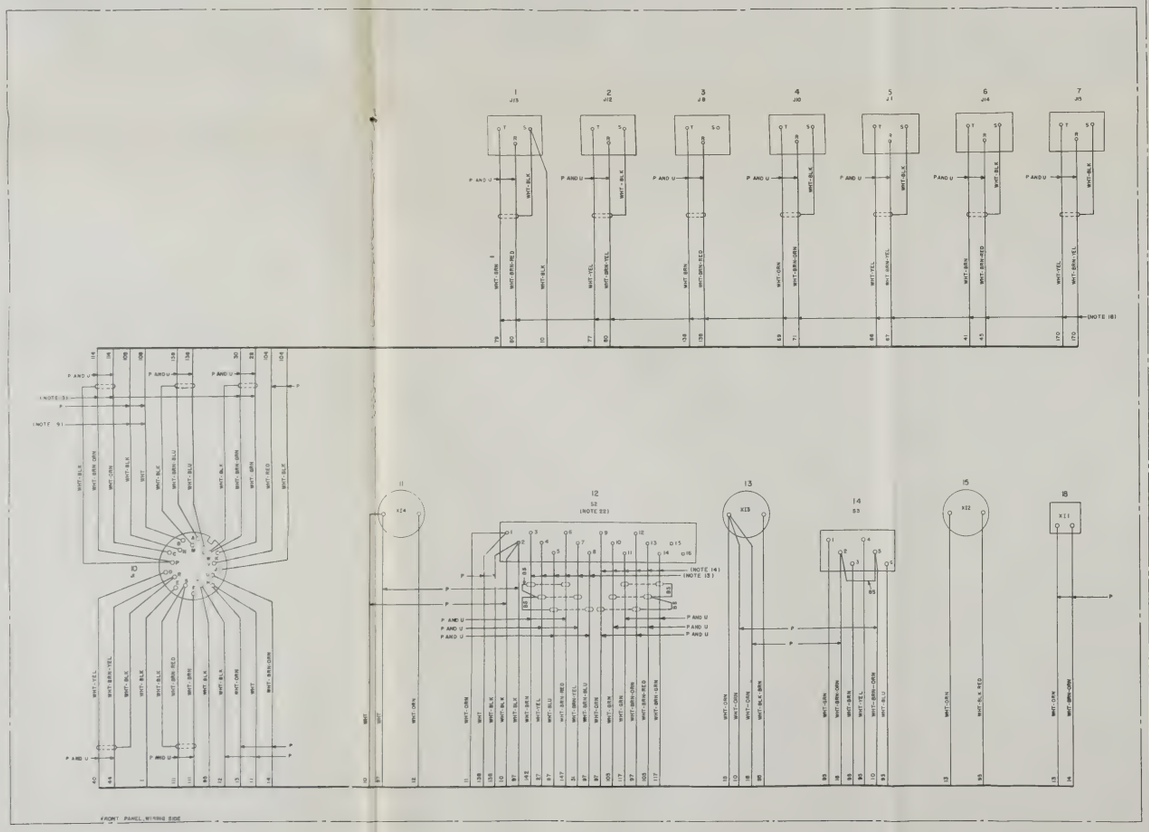
21. BINDING POST E15 AND THE LEAD CONNECTED FROM STATION 165 TO GRD TERMINAL AT STATION 105 IS NOT PROVIDED IN PANELS BEARING ORDER NO. 14181-PHILA-51, SERIAL NOS. 1 THROUGH 749.

22. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.



TM2139-35-73

(*part of GROUP PANEL*), *wiring diagram.*



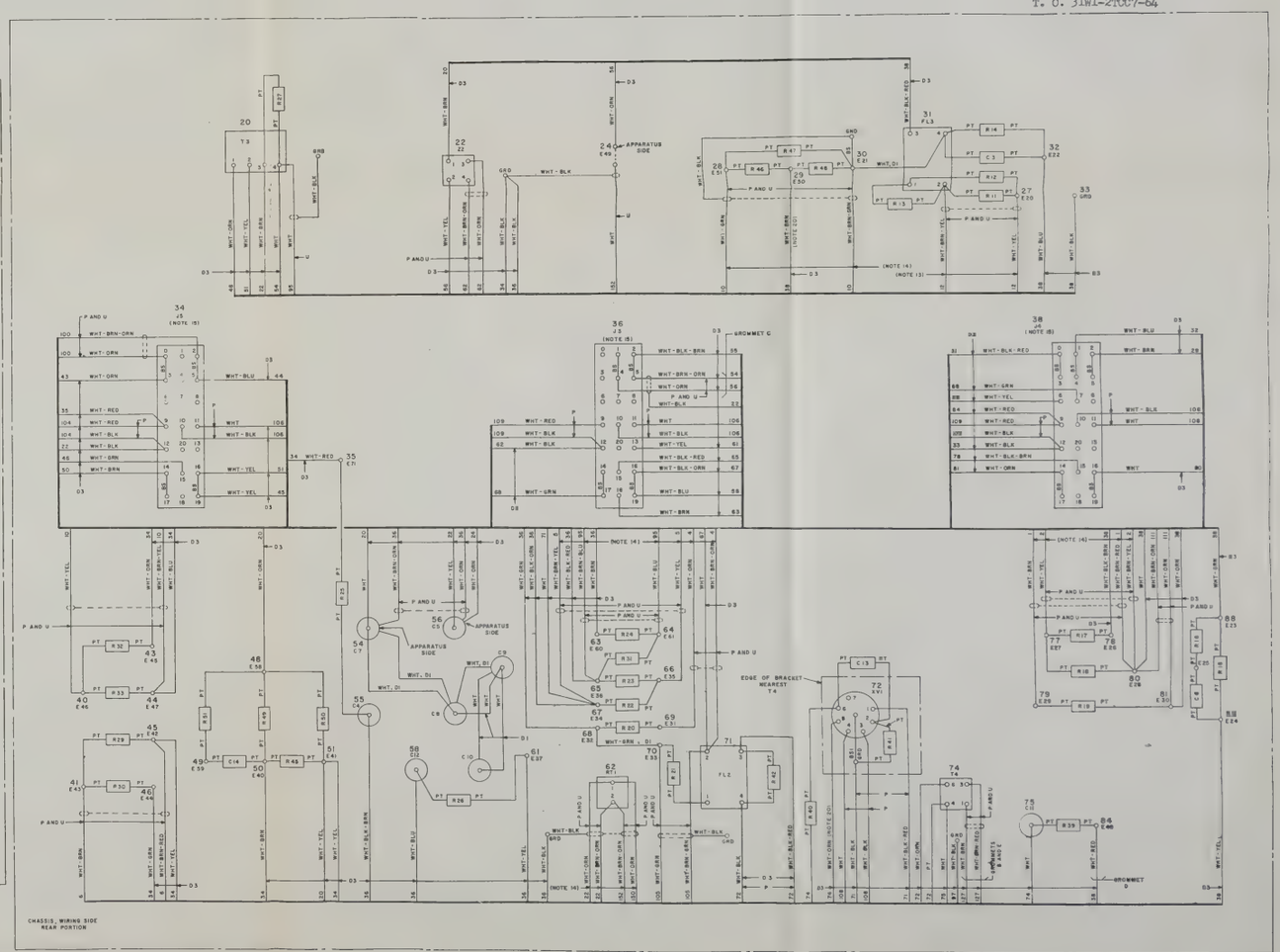
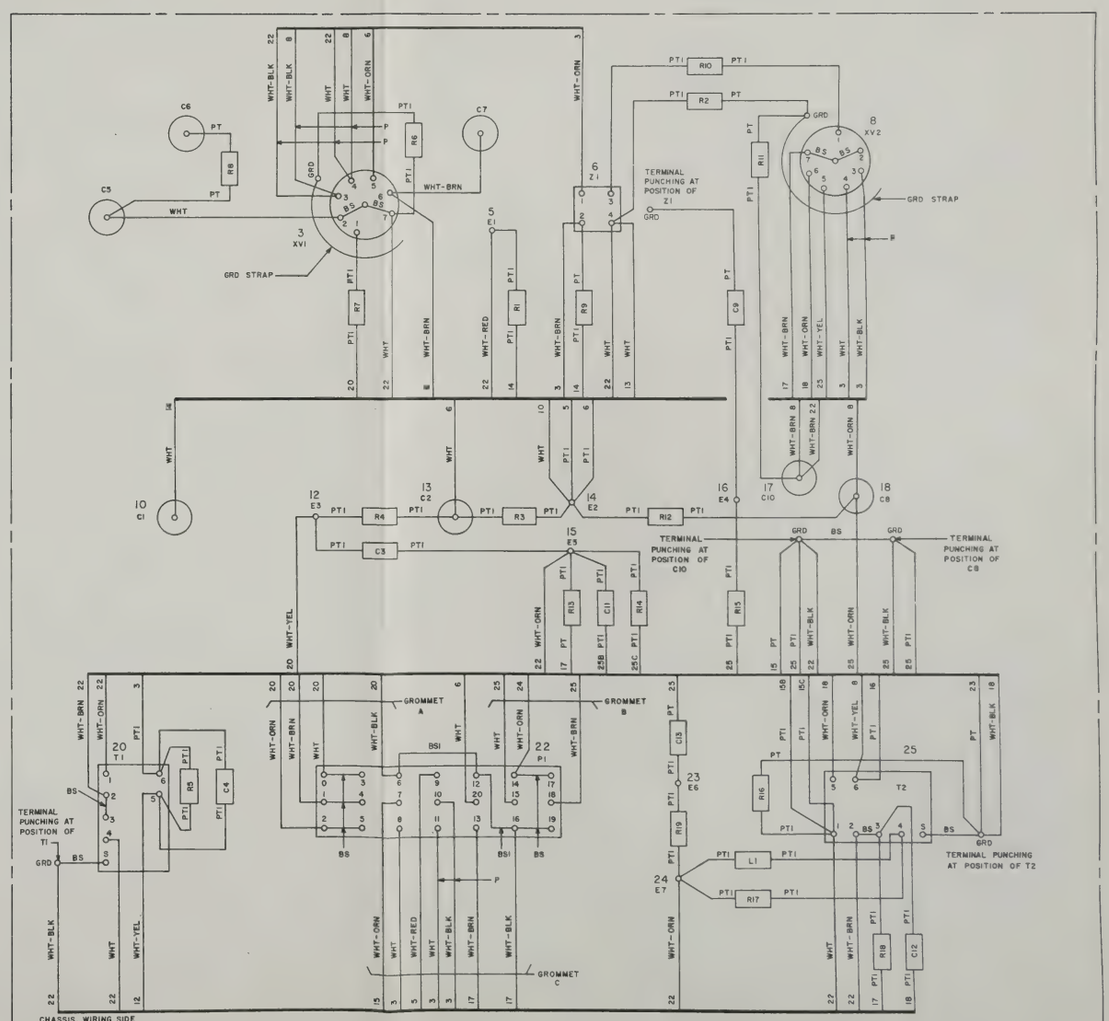


Figure 144. GROUP PANEL (part of Amplifier-Pilot Regulator AM-707/TCC-7), wiring diagram.

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
4. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
5. PT DENOTES LEADS PART OF APPARATUS.
6. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. P DENOTES PAIR.
8. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.



TM2139-35-73

Figure 145. 12-68 kc amplifier (AR1, AR2, or AR3) (part of GROUP PANEL), wiring diagram.

Figure 145.

TM 2139-35-72

viring diagram.

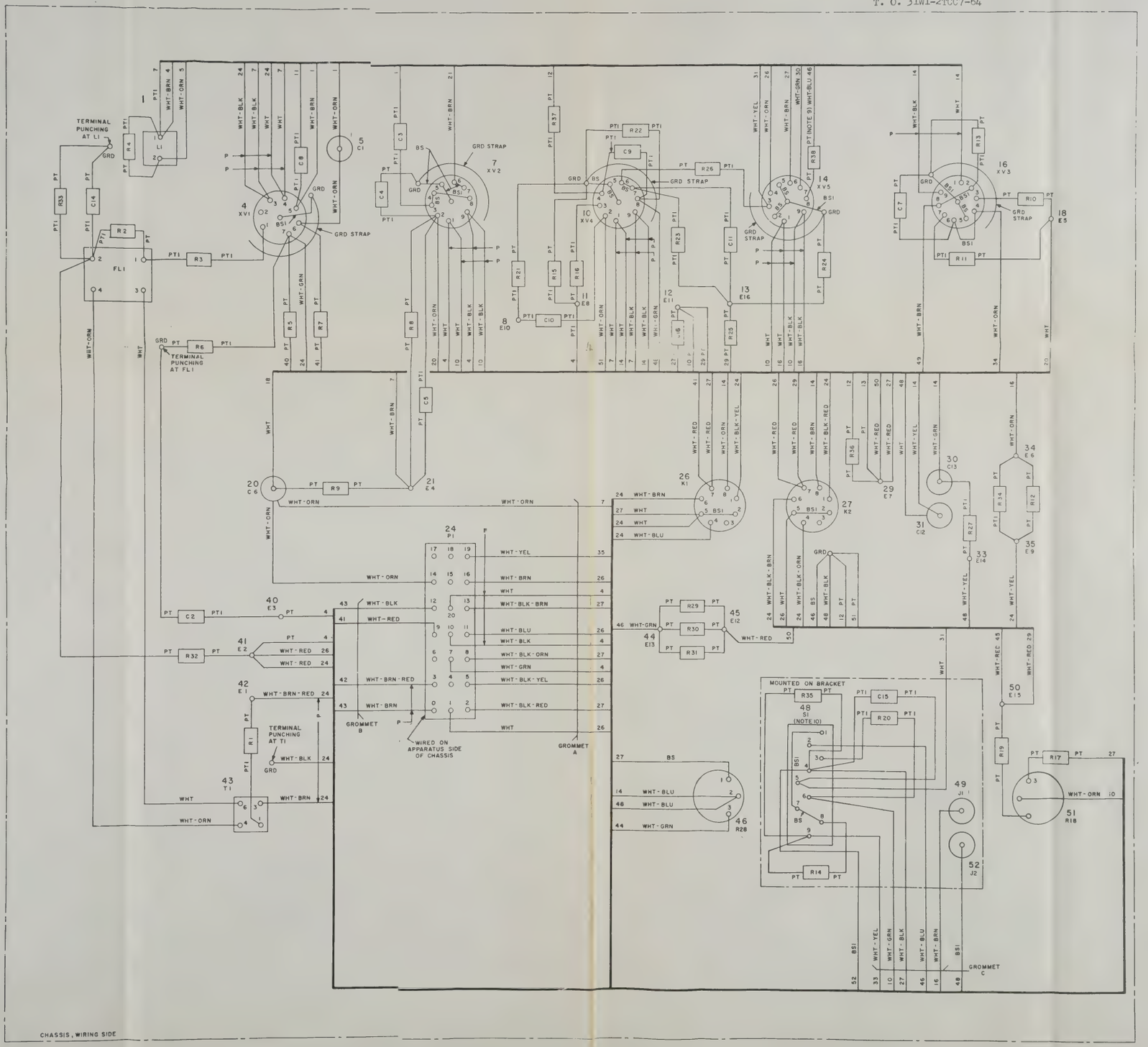
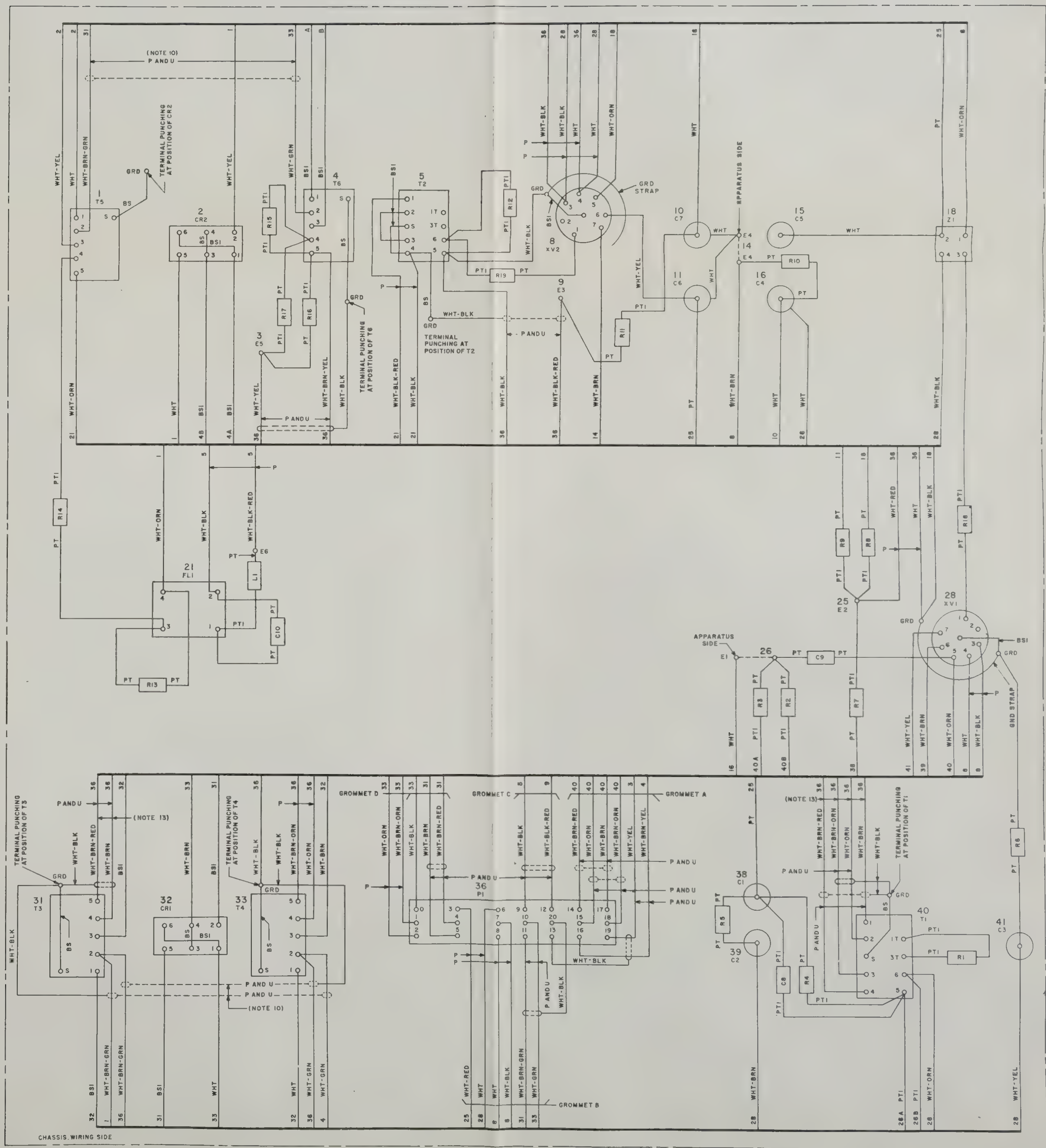


Figure 146. Regulator and alarm unit Z6 (part of GROUP PANEL), wiring diagram.



NOTES:

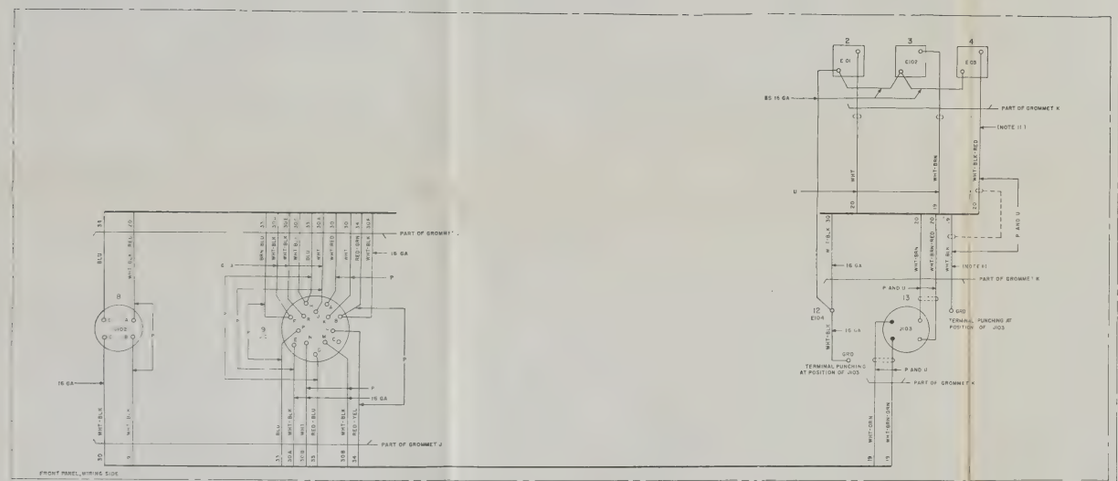
1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
4. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
5. PT DENOTES LEADS PART OF APPARATUS.
6. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. P DENOTES PAIR.
8. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
9. (shielded connection symbol) DENOTES SHIELDED CONNECTION.
10. SHIELDS EXTEND TO WITHIN 1 1/4 INCH OF TERMINAL.
11. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
12. SHIELDS EXTEND TO WITHIN 1/2 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED.
13. SHIELDS EXTEND TO WITHIN 3/4 INCH OF TERMINAL.

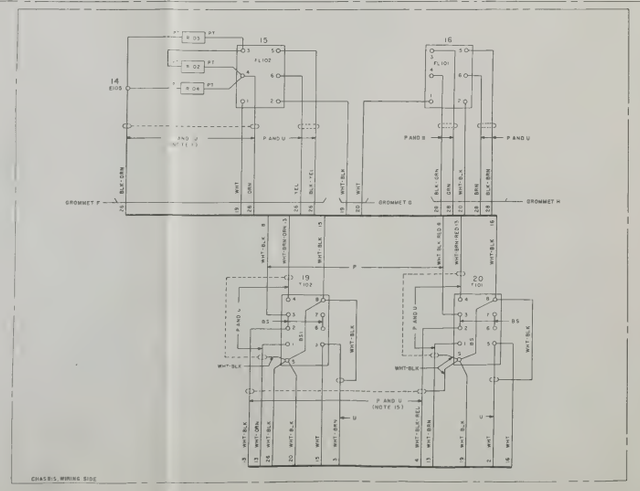
Figure 147.

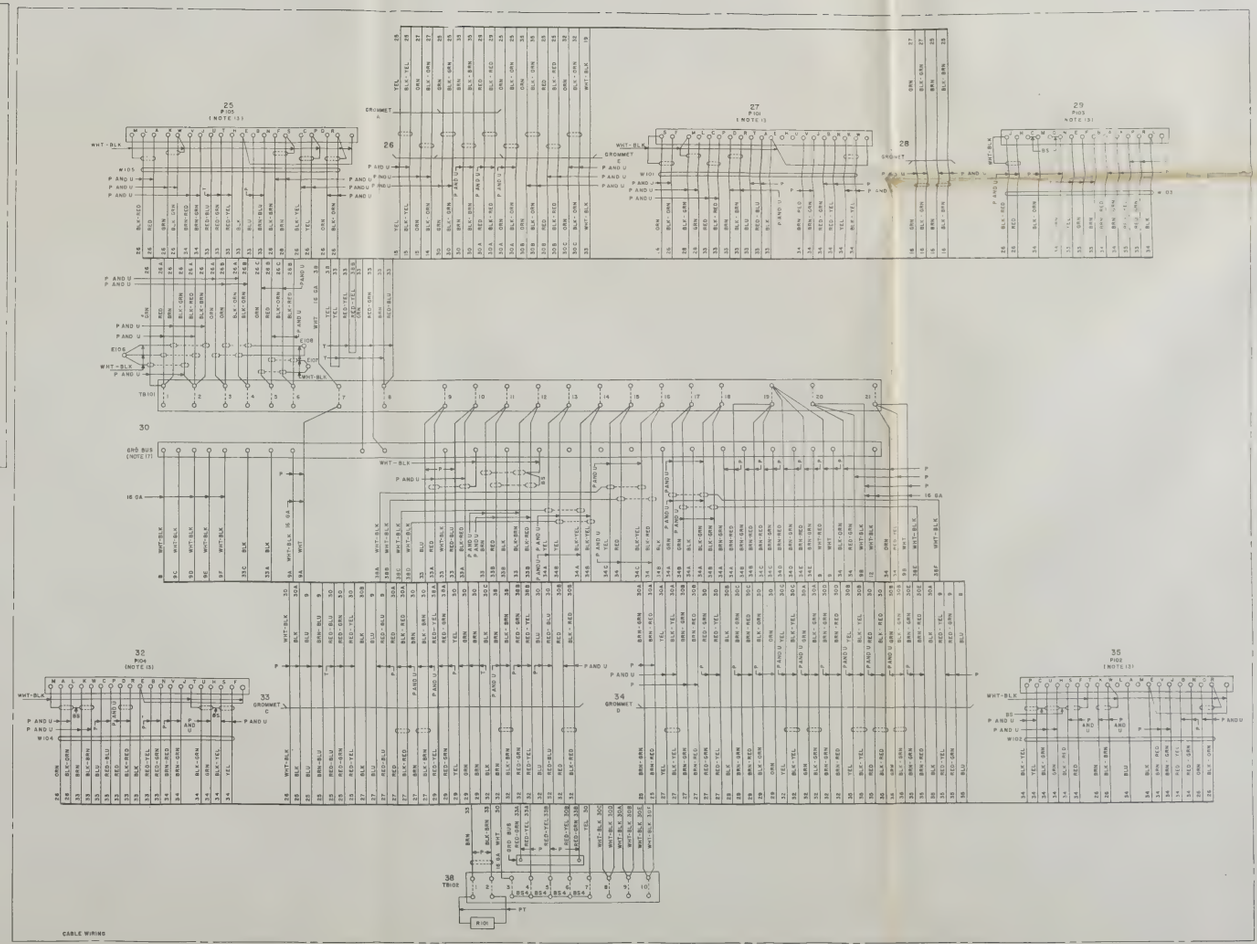
Figure 147. Modem and amplifier AR4 (part of GROUP PANEL), wiring diagram.

35
BLK - GRN
35
BRN - GRN
35
BRN - RED
35
BLK
35
RED - YEL
35
RED - GRN
35
BLU
P
16 GA
WHT - BLK
WHT
BLK - GRN
BRN - GRN
BRN - RED
BLK
RED - YEL
RED - GRN
BLU
308
98
38E
30E
30A
9
9
8
38F
35
P102
(NOTE 13)
P C U H S F T K W L A M E V J B N D R
WHT-BLK
BS
P AND U
P AND U
W102
P AND U
P AND U
P
P AND U
34 BLK - YEL
34 YEL
34 BLK - GRN
34 GRN
34 BLK - RED
34 RED
26 BRN
26 BLK - BRN
34 BLU
34 BLK
34 BRN - RED
34 BRN - GRN
34 RED - YEL
34 RED - GRN
26 ORN
26 BLK - ORN
P AND U
W103
26 BLK - RED
26 RED
34 BLK - ORN
34 ORN
33 YEL
33 GRN
33 BRN
34 BRN - RED
34 BRN - GRN
33 RED - YEL
33 RED - GRN
34 BLK
16 GRN
16 BLK - GRN
16 BRN
16 BLK - BRN

TM 21







NOTES

THE SMALL NUMBER ON EACH WIRE ADJACENT TO THE COMMON OR BASE L ME CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES

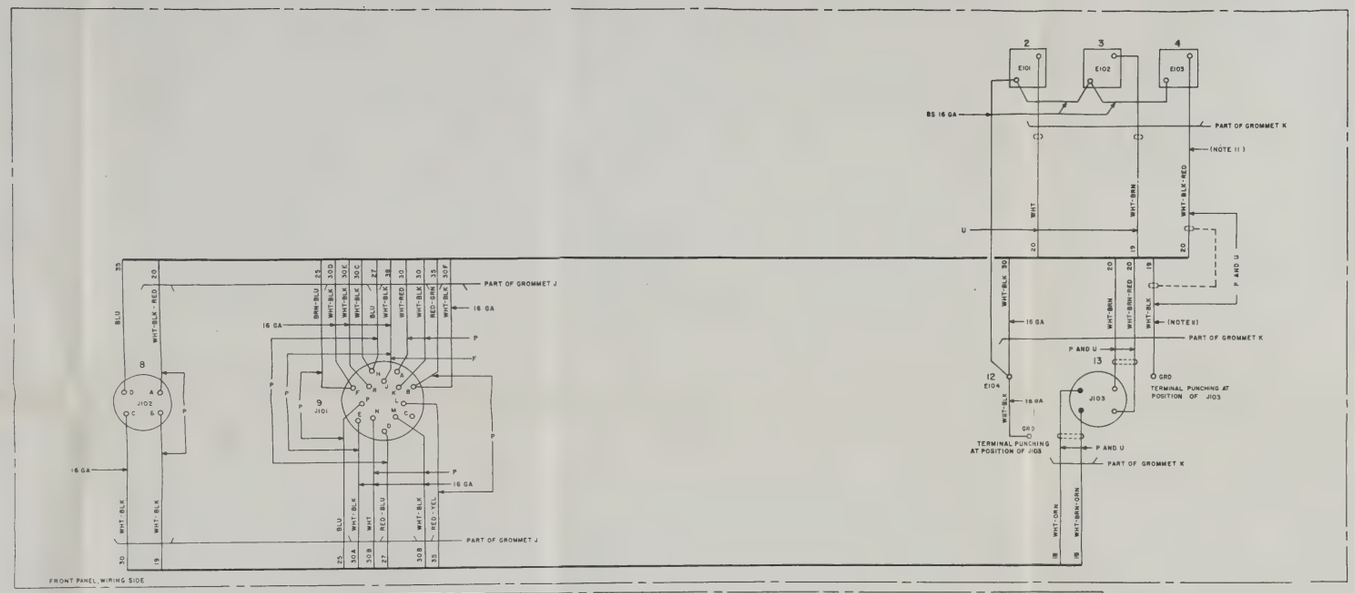
- WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
- BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
- BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
- PT DENOTES LEADS PART OF APPARATUS.
- P DENOTES PAIR.
- T DENOTES TRIPLE
- U DENOTES SHIELDED 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
- P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET
- C DENOTES SHIELDED CONNECTION

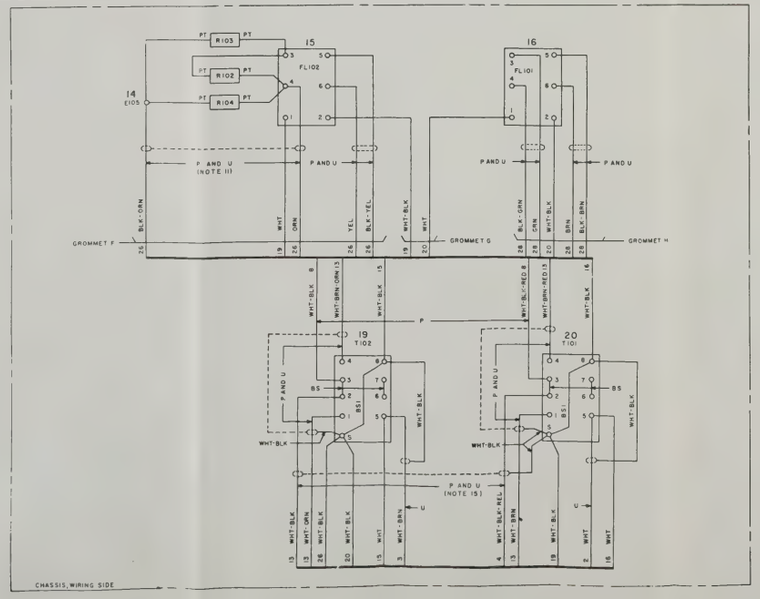
SHIELDS EXTEND TO WITHIN 1 INCH OF TERMINAL

2. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
3. CONNECTORS P101, P102, P103, P104 AND P105 ARE CIRCULAR CONNECTORS. PHYSICAL PIN LOCATION IS SHOWN ON SCHEMATIC DIAGRAM OF THE JUNCTION PANEL. CIRCUIT UNWIRED TERMINAL (X DENOTES SHELL CONNECTION
4. SHIELDS EXTEND TO WITHIN 1/2 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED.
5. SHIELDS EXTEND TO WITHIN 1 1/2 INCH OF TERMINAL.
6. BS4 DENOTES 16 GAGE TINNED, ANNEALED COPPER WIRING.
7. ON SOME JUNCTION PANELS, THE WIRING TO THE GRD BUS HAS BEEN MODIFIED. REFER TO THE MODIFIED GRD BUS WIRING DIAGRAM OF THE JUNCTION PANEL.

Figure 148.

Figure 148. JUNCTION PANEL (part of Amplifier-Pilot Regulator AM-707/TCC-7), wiring diagram.





NOTES:

THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.

2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
4. BS1 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
5. PT DENOTES LEADS PART OF APPARATUS.
6. P, P1, P2, P3 DENOTES PAIR
7. T DENOTES TRIPLE
8. U DENOTES SHIELDED 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
9. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET
10. DENOTES SHIELDED CONNECTION.
11. SHIELDS EXTEND TO WITHIN 1 INCH OF TERMINAL.
12. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
13. CONNECTORS P101, P102, P103, P104 AND P105 ARE CIRCULAR CONNECTORS. PHYSICAL PIN LOCATION IS SHOWN ON SCHEMATIC DIAGRAM OF THE JUNCTION PANEL CIRCUIT. UNMARKED TERMINAL DENOTES SHELL CONNECTION.
14. SHIELDS EXTEND TO WITHIN 1/2 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED
15. SHIELDS EXTEND TO WITHIN 1-1/2 INCH OF TERMINAL.
16. BS4 DENOTES 16 GAGE TINNED, ANNEALED COPPER WIRING

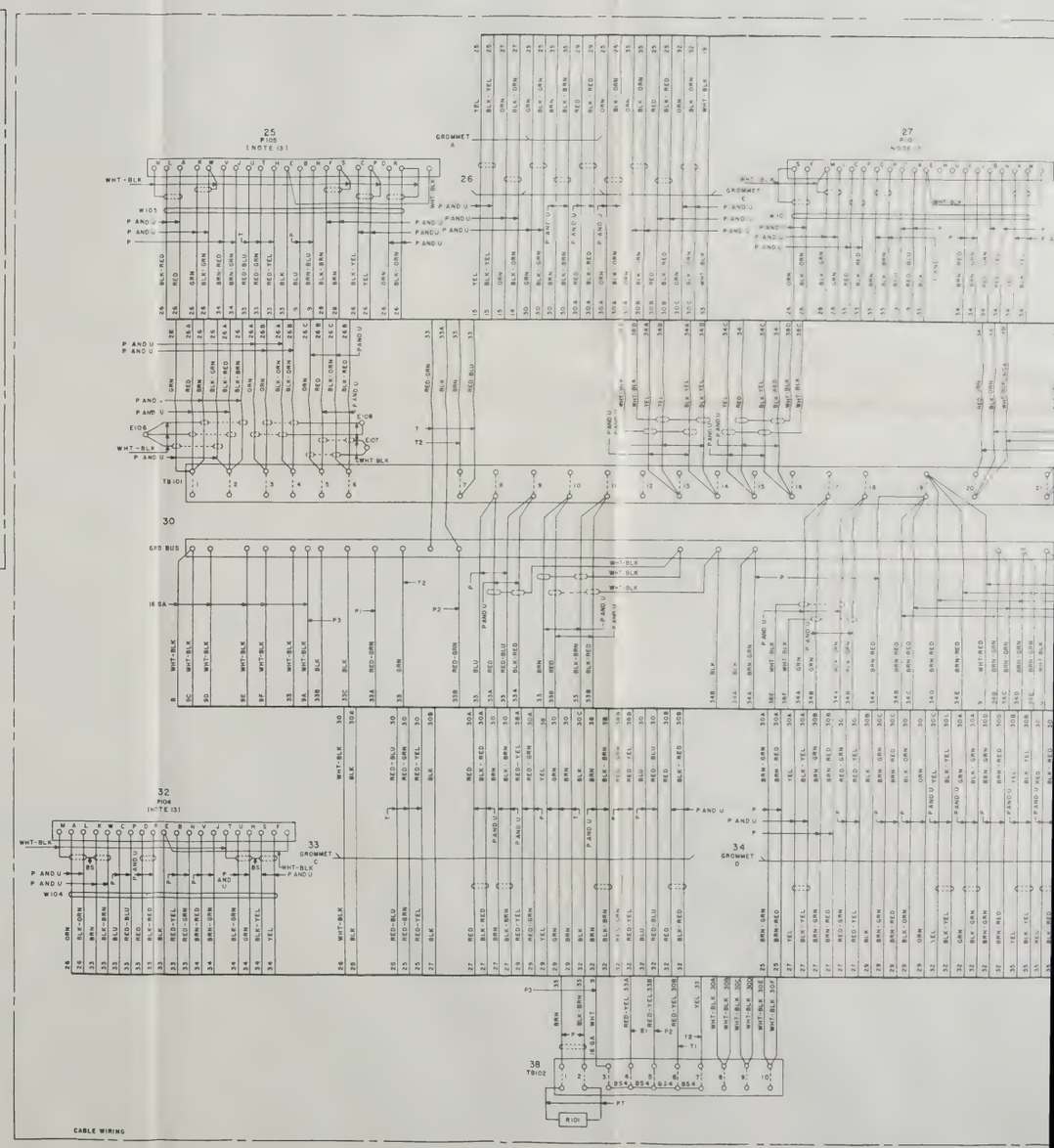
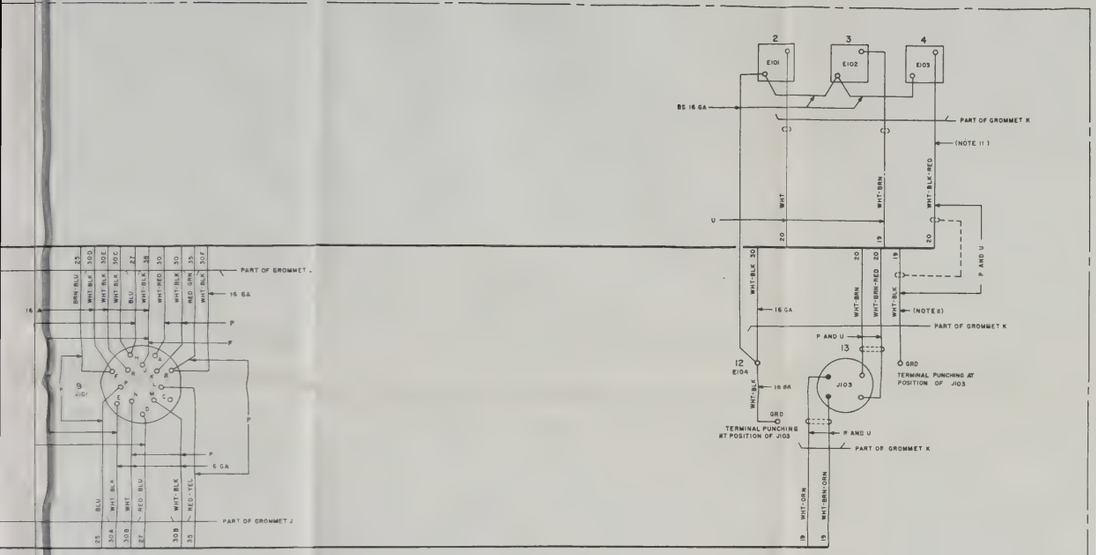
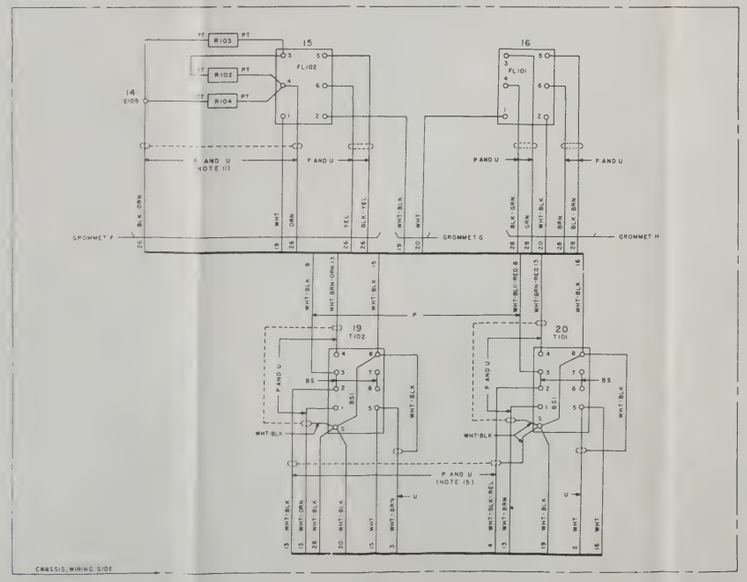


Figure 149. JUNCTION PANEL (part of Amplifier-Pilot Regulator AM-707/TCC-7), with modified ground bus, wiring diagram.





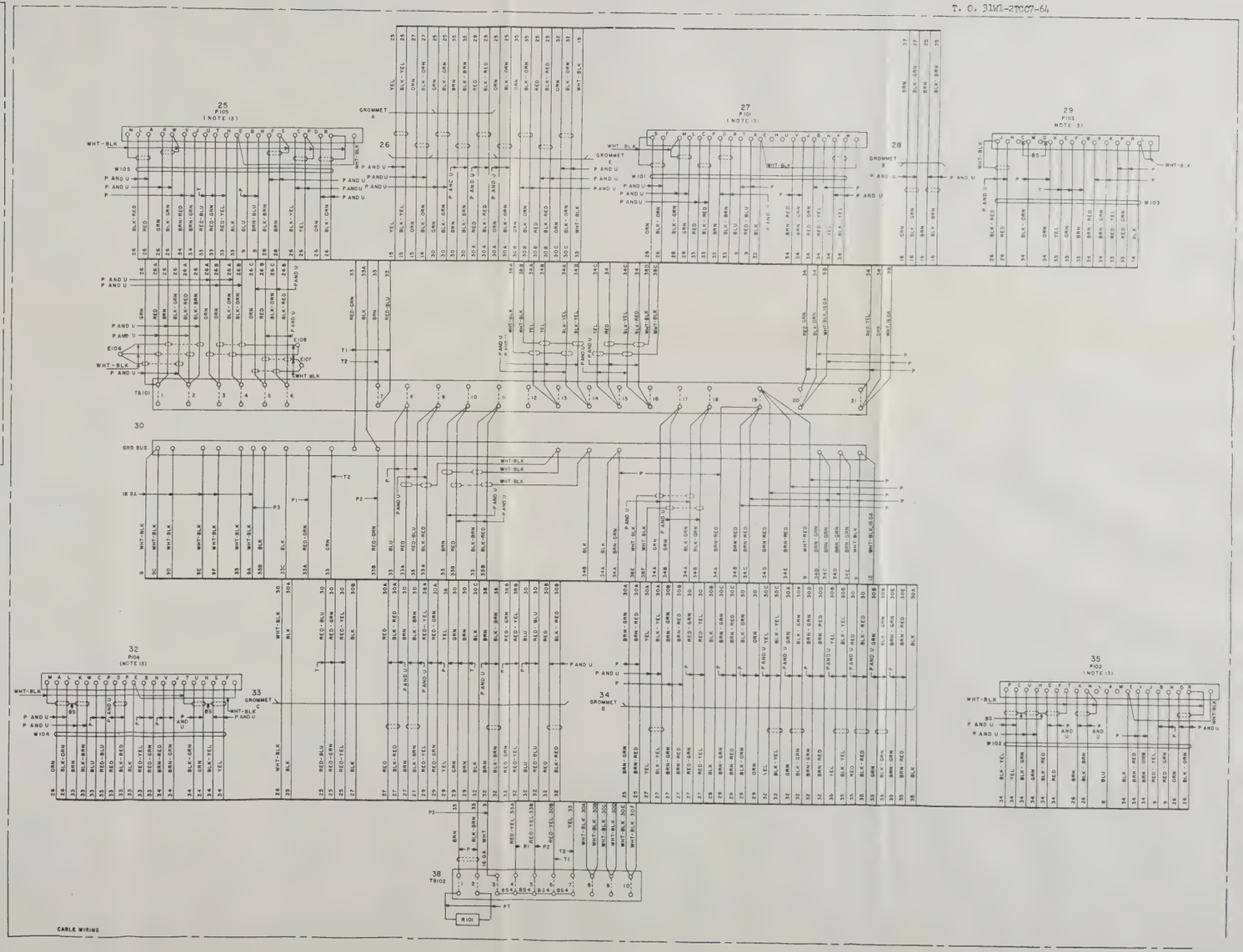


Figure 149. JUNCTION PANEL (part of Amplifier-Pilot Regulator AM-707/TCC-7), with modified ground bus, wiring diagram.

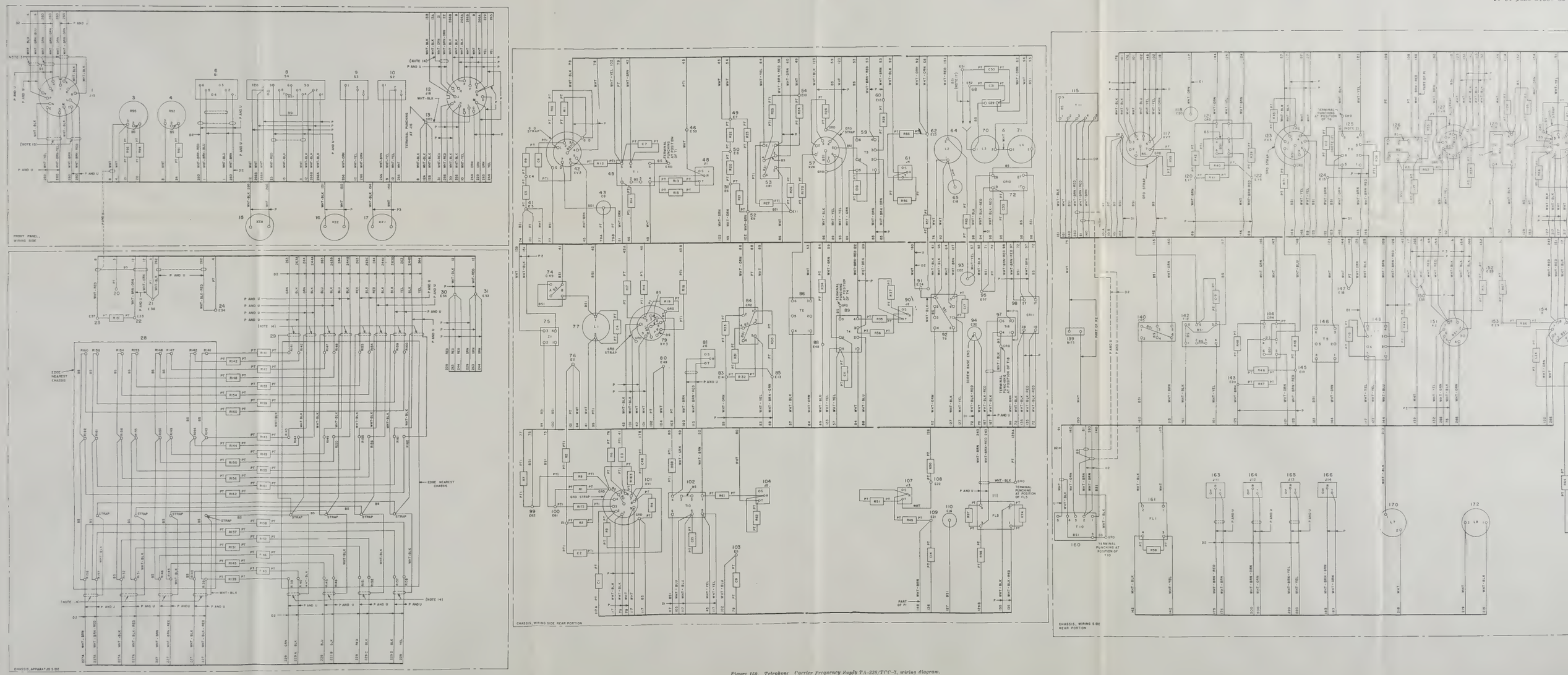


Figure 150. Telephone Carrier Frequency Supply TA-228/TCC-7, wiring diagram.

Figure 150.

2H
1V

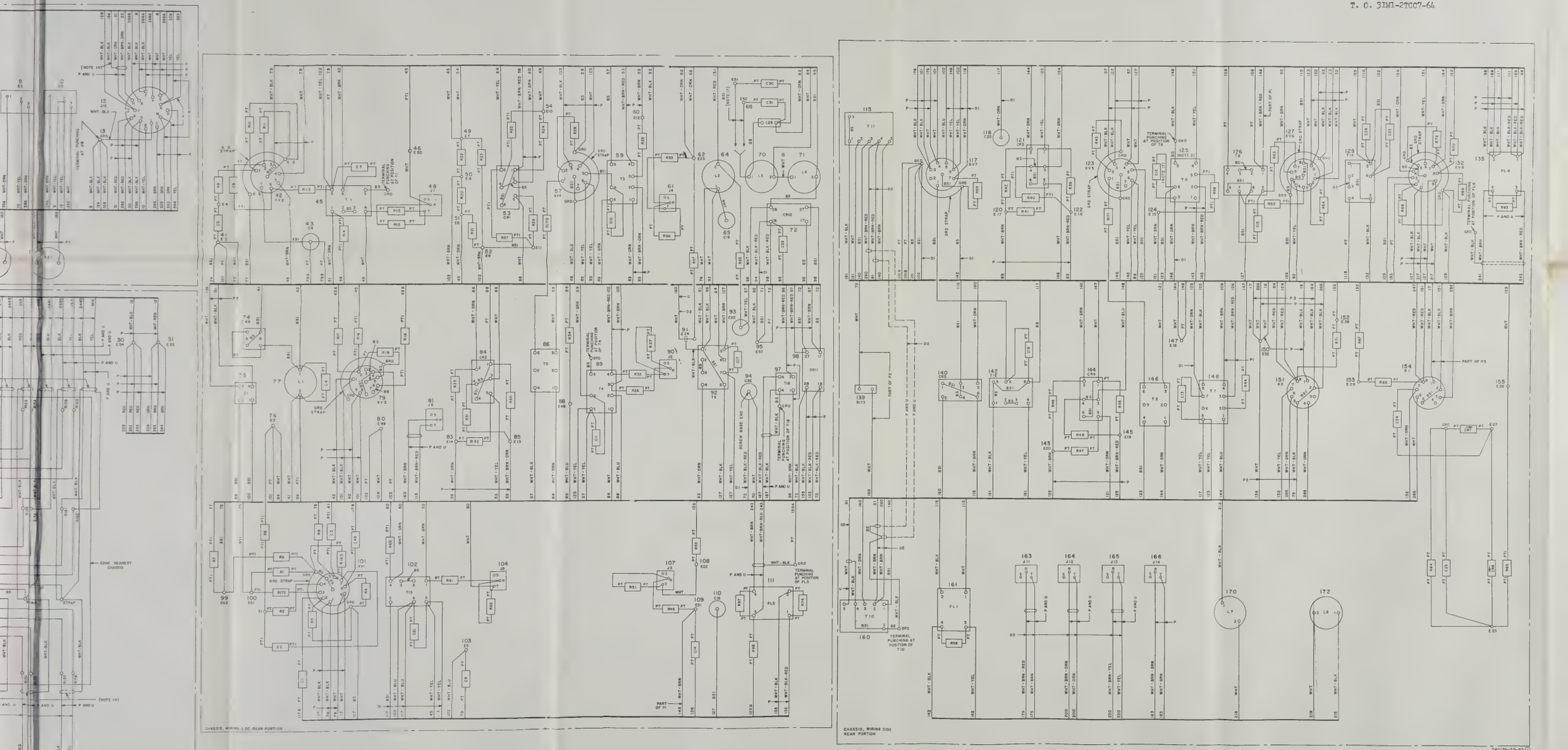


Figure 150. Telephone Carrier Frequency Supply TA-228/TCC-7, wiring diagram.

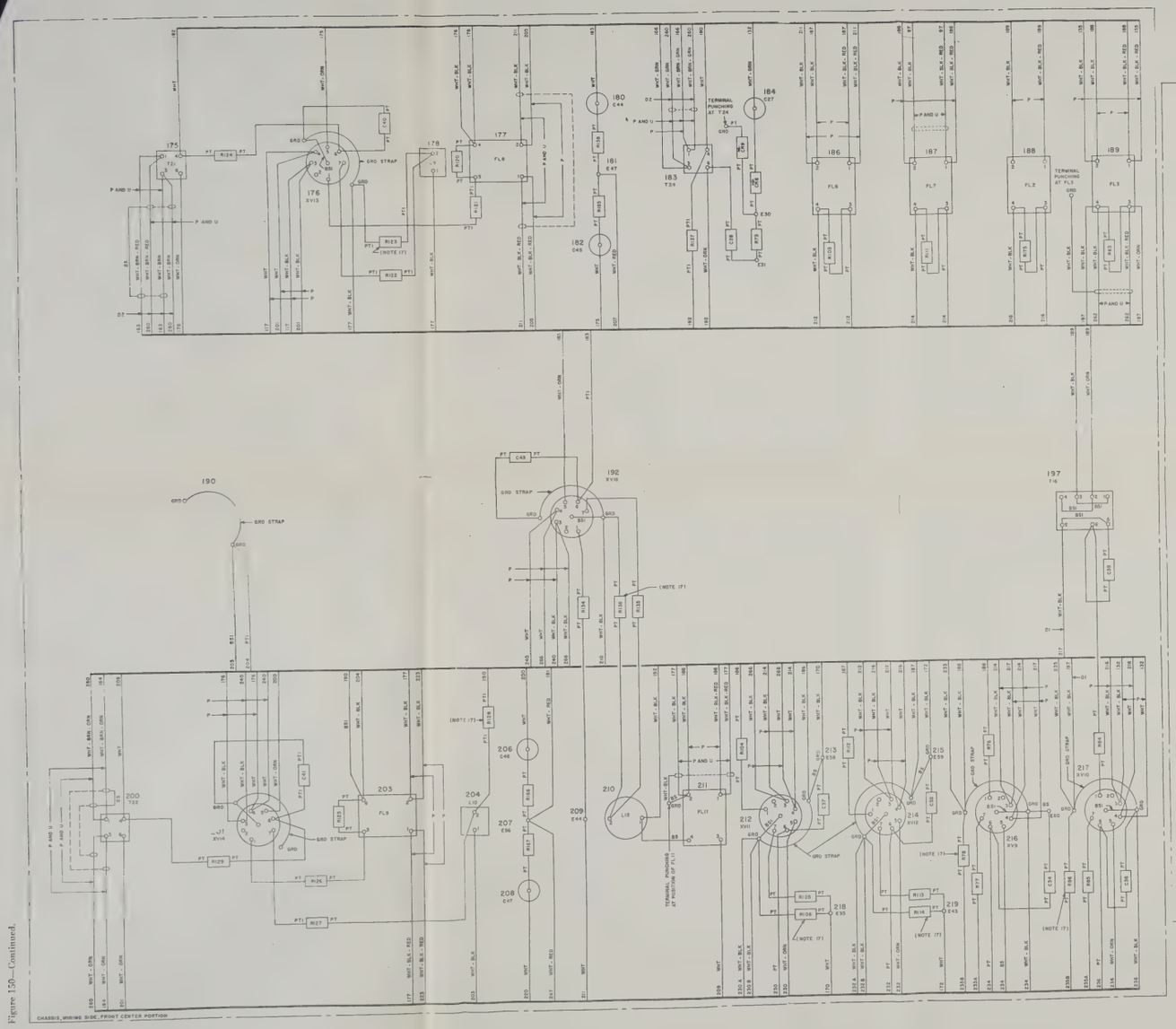


Figure 150—Continued.

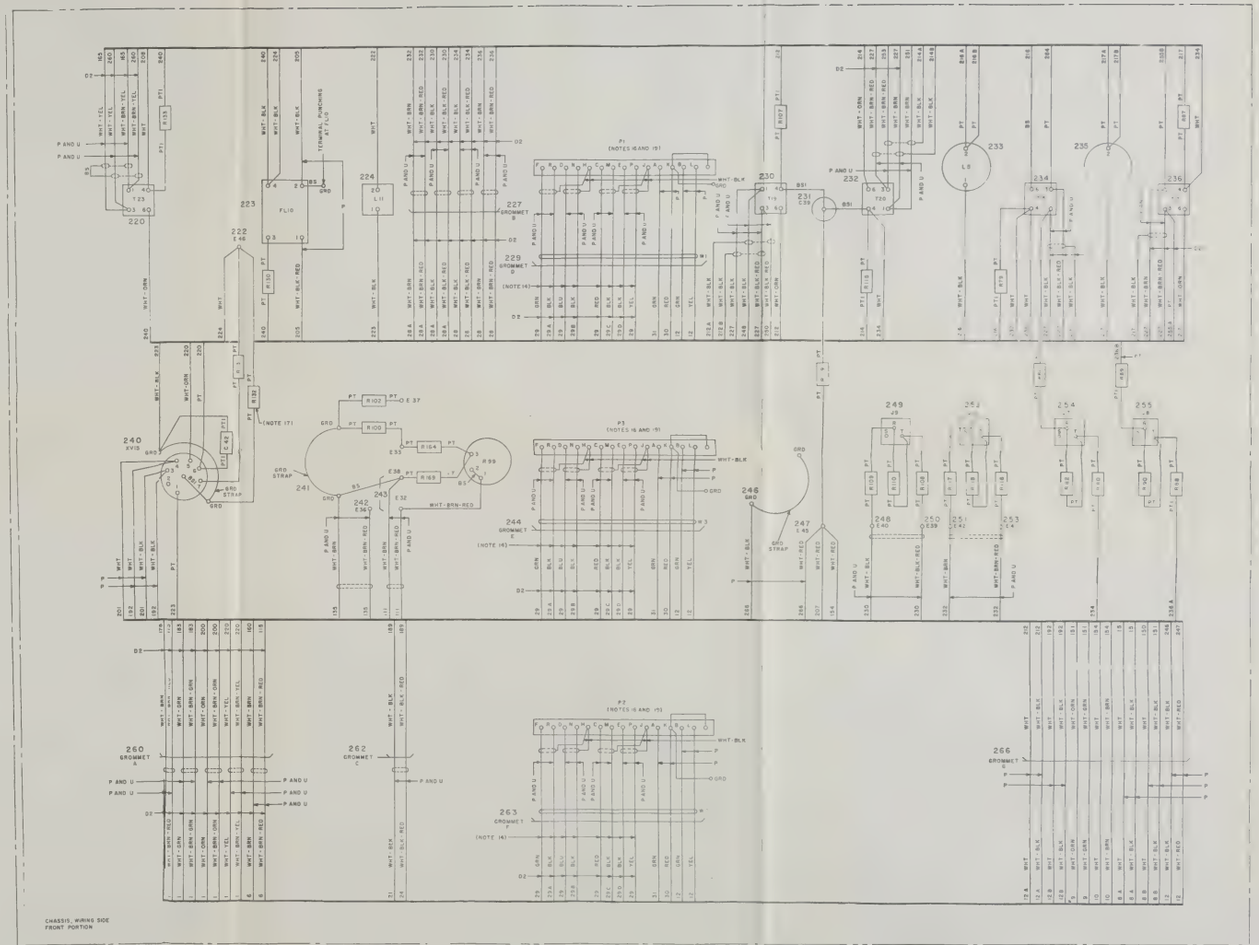
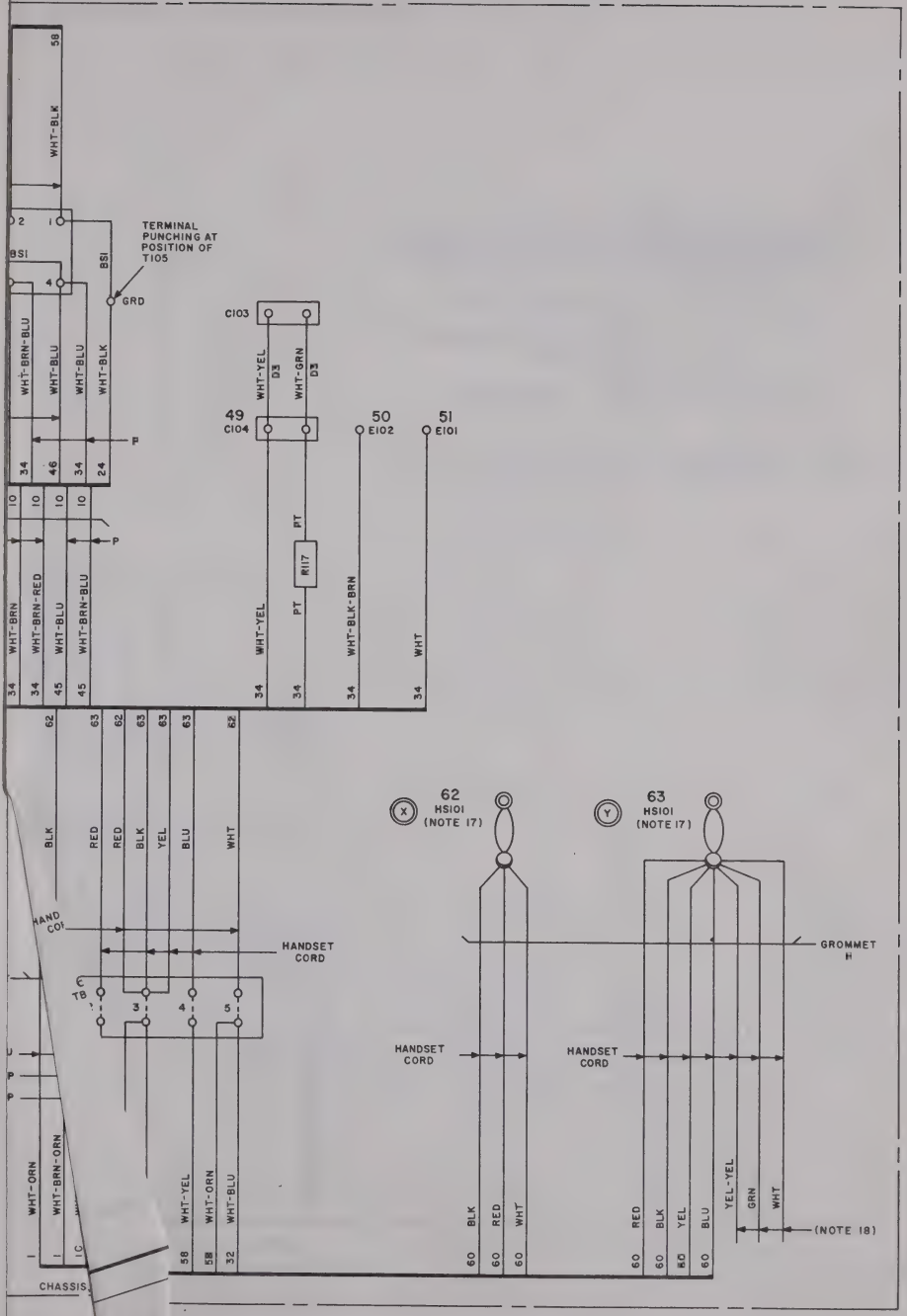


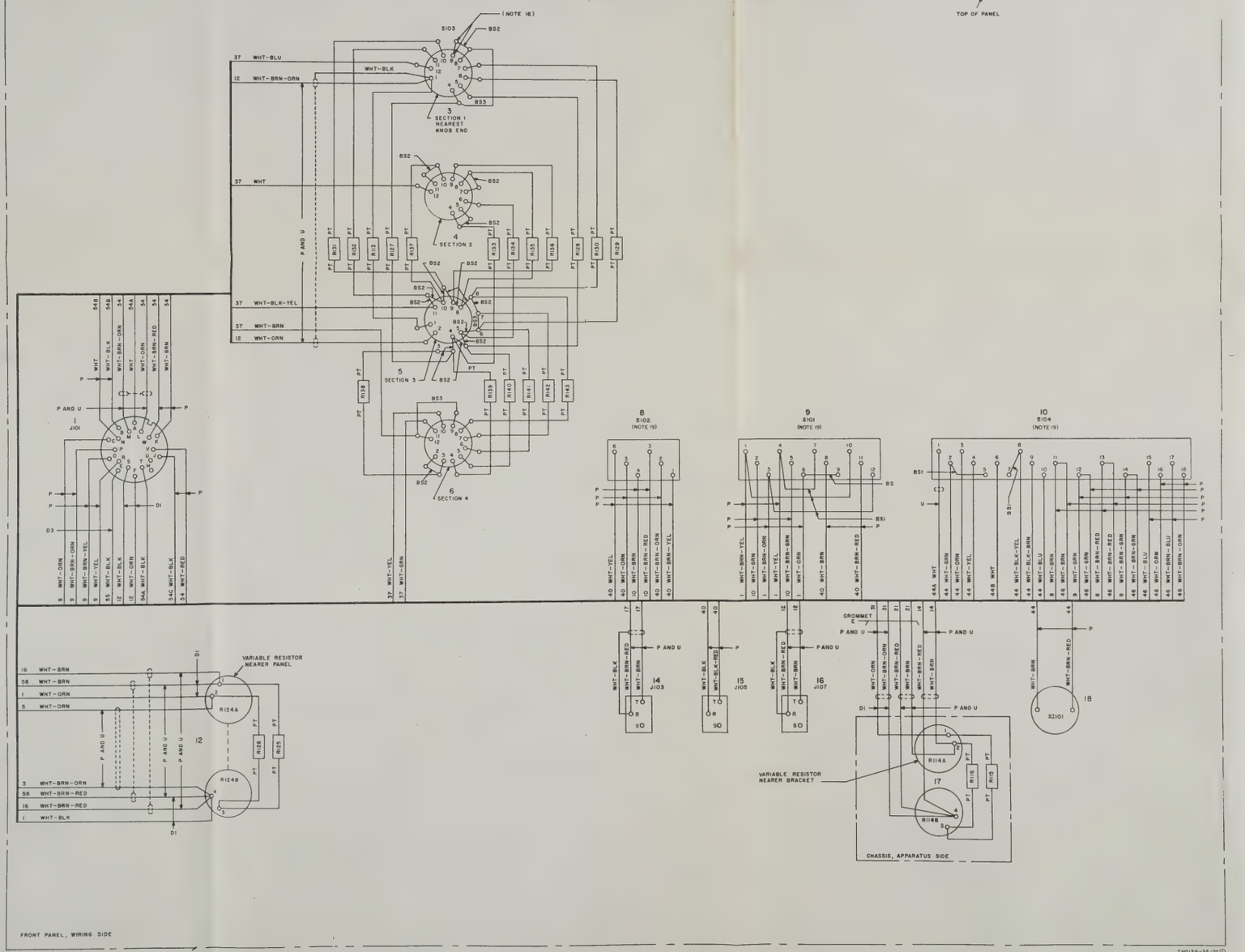
Figure 150—Continued.

NOTES

1. THE SMALL NUMBER ON EACH WIRE ADJACENT TO THE COMMON OR BASE LINE CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET
3. D1 WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
4. D2 WIRING IS DRESSED BACK TO THE PANEL OR CHASSIS AND RUN IN A SPECIFIC PATH AT TIME OF MANUFACTURE. ON REPLACEMENT OF D2 WIRING, DO NOT DEVIATE FROM THE ORIGINAL PATH.
5. B9 DENOTES 22 GAGE TINNED ANNEALED COPPER WIRING
6. B5 DENOTES 22 GAGE TINNED ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE GLASS SLEEVING
7. PT DENOTES LEADS PART OF APPARATUS
8. PT* DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE GLASS SLEEVING
9. P, P1, P2, P3 DENOTES PAIR.
10. U DENOTES SHIELDED 22 GAGE WIRE, WITH EXTRUDED NYLON JACKET.
11. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
12. ⊂⊃ DENOTES SHIELDED CONNECTION.
13. SHIELDS EXTEND TO WITHIN 1/2 INCH OF TERMINAL.
14. SHIELDS EXTEND TO WITHIN 1 INCH OF TERMINAL.
15. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
16. CONNECTORS P1, P2 AND P3 ARE CIRCULAR CONNECTORS. PHYSICAL PIN LOCATION IS SHOWN ON SCHEMATIC DIAGRAMS OF THE CARRIER SUPPLY PANEL CIRCUIT.
17. COMPONENT VALUE IS SELECTED AT TIME OF MANUFACTURE. REPLACE DEFECTIVE PART WITH ONE OF SAME VALUE. INSTRUCTIONS FOR DETERMINING PROPER VALUE OF THIS PART WHEN REPLACING AN ASSOCIATED ELEMENT IS GIVEN IN FINAL TEST PROCEDURES.
18. SHIELDS EXTEND TO WITHIN 1 1/4 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED.

WELD BEARING ORDER NO 1418 (PAIRS 3); SERIAL NOS 1 THROUGH 349. (BL K) IS NOT CONNECTED TO GRD UNMARKED TERMINAL DENOTES CONNECTION


TERMINAL PUNCHING AT POSITION OF T105
GRD
BSI
C103
C104
49
50
51
E102
E101
WHT-YEL
WHT-GRN
WHT-BRN-BLU
WHT-BLU
WHT-BLK
WHT-BRN
WHT-BRN-RED
WHT-BRN-BLU
WHT-BLK-BRN
WHT
PT
R117
62
63
HS101
(NOTE 17)
BLK
RED
BLU
YEL
HANDSET CORD
GROMMET H
YEL-YEL
GRN
(NOTE 18)
WHT-ORN
WHT-BRN-ORN
CHASSIS



NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. D1 WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
4. D3 WIRING IS DRESSED BACK TO THE CHASSIS AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
5. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
6. BS1 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. BS2 DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING.
8. BS3 DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. PT DENOTES LEADS PART OF APPARATUS.
10. P DENOTES PAIR.
11. U DENOTES SHIELDED 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
12. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
13. ⊂⊃ DENOTES SHIELDED CONNECTION.
14. SHIELDS EXTEND TO WITHIN 3/4 INCH OF TERMINAL UNLESS OTHERWISE SPECIFIED.
15. SHIELDS EXTEND TO WITHIN 1 INCH OF TERMINAL.
16. TERMINALS INSIDE OF CIRCLE ARE ON SIDE OF DISC FARTHEST FROM KNOB END AND TERMINALS ON OUTSIDE OF CIRCLE ARE ON SIDE OF DISC NEAREST TO KNOB END.
17. WHEN HANDSET HS101 IS A T33F, X APPARATUS IS FURNISHED. WHEN HANDSET HS101 IS AN H60, Y APPARATUS IS FURNISHED.
18. THESE WIRES ARE CUT AND COVERED WITH TAPE. WHT LEAD IS INSULATED FROM YEL-YEL AND GRN LEADS.
19. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES.

Figure 151.

Figure 151. Receiver-Transmitter Order Wire RT-280/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), wiring diagram.

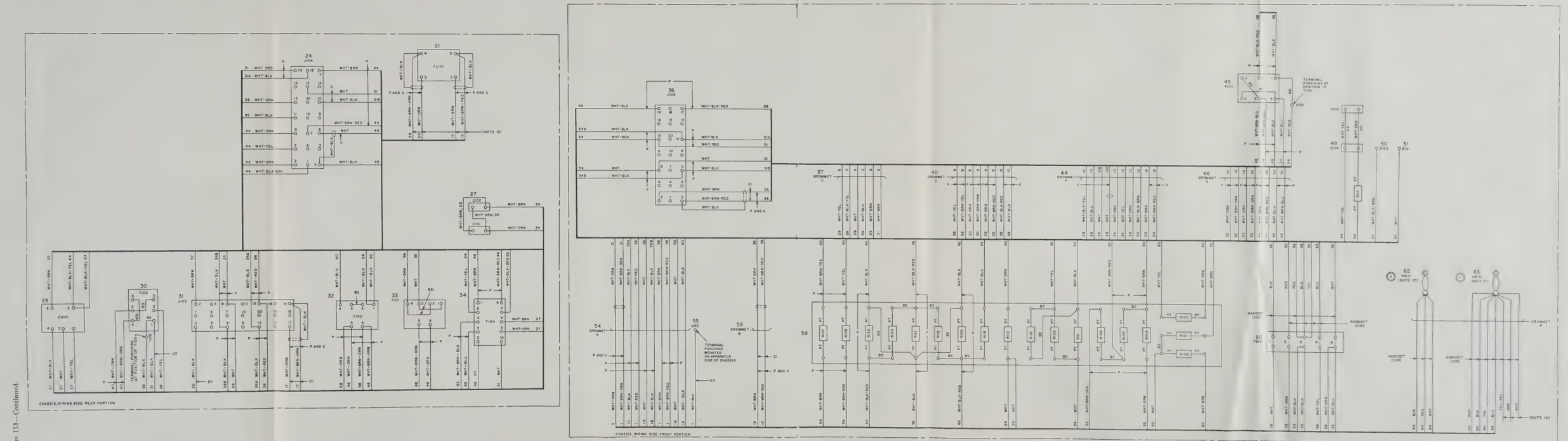
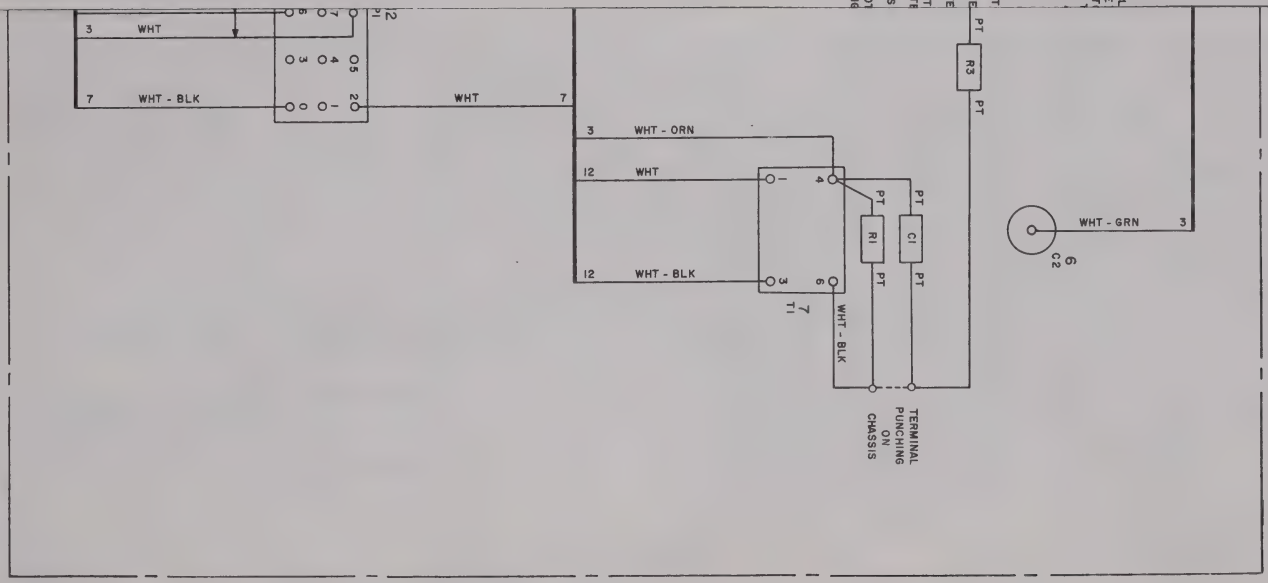


Figure 151—Continued.

Figure 153.


1. THE SMALL
BASE LINE
STATION T
WIRES OF T
SUFFIX IS
BETWEEN
2. WIRES NOT
3. BS DENOTE
4. PT DENOTE
5. PTI DENOT
IMPREGNATE
6. P DENOTES
7. WIRING NOT
RUN AT RIG
PT
R3
PT
WHT - GRN
3
6
C2
PT
C1
PT
PT
R1
PT
WHT - BLK
7
T1
TERMINAL
PUNCHING
ON
CHASSIS
3 WHT - ORN
12 WHT
12 WHT - BLK
4
3
6
12
P1
3 WHT
7 WHT - BLK
WHT
7
TM2139-35-88

NOTES

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENTIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
4. BS1 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
5. PT DENOTES LEADS PART OF APPARATUS.
6. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. P DENOTES PAIR.
8. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.

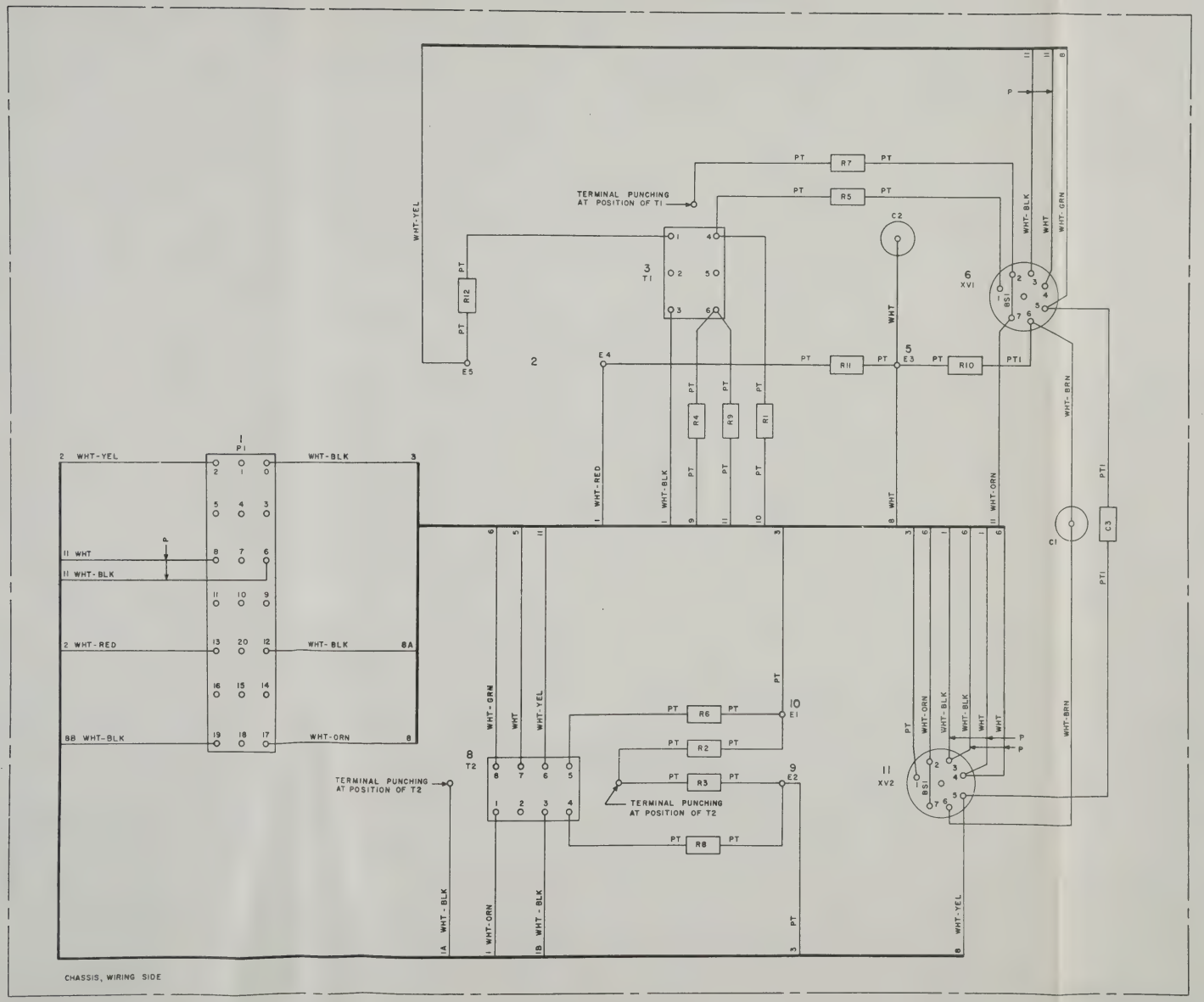


*Figure 152. Transmitting Amplifier AR101 (**part of ORDER WIRE PANEL**), wiring diagram.*

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS. WHEN THERE ARE TWO OR MORE WIRES OF THE SAME COLOR BETWEEN TWO STATIONS, A LETTER SUFFIX IS ADDED TO THE SMALL NUMBER TO DIFFERENIATE BETWEEN THE WIRES.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
4. PT DENOTES LEADS PART OF APPARATUS.
5. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
6. P DENOTES PAIR.
7. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.

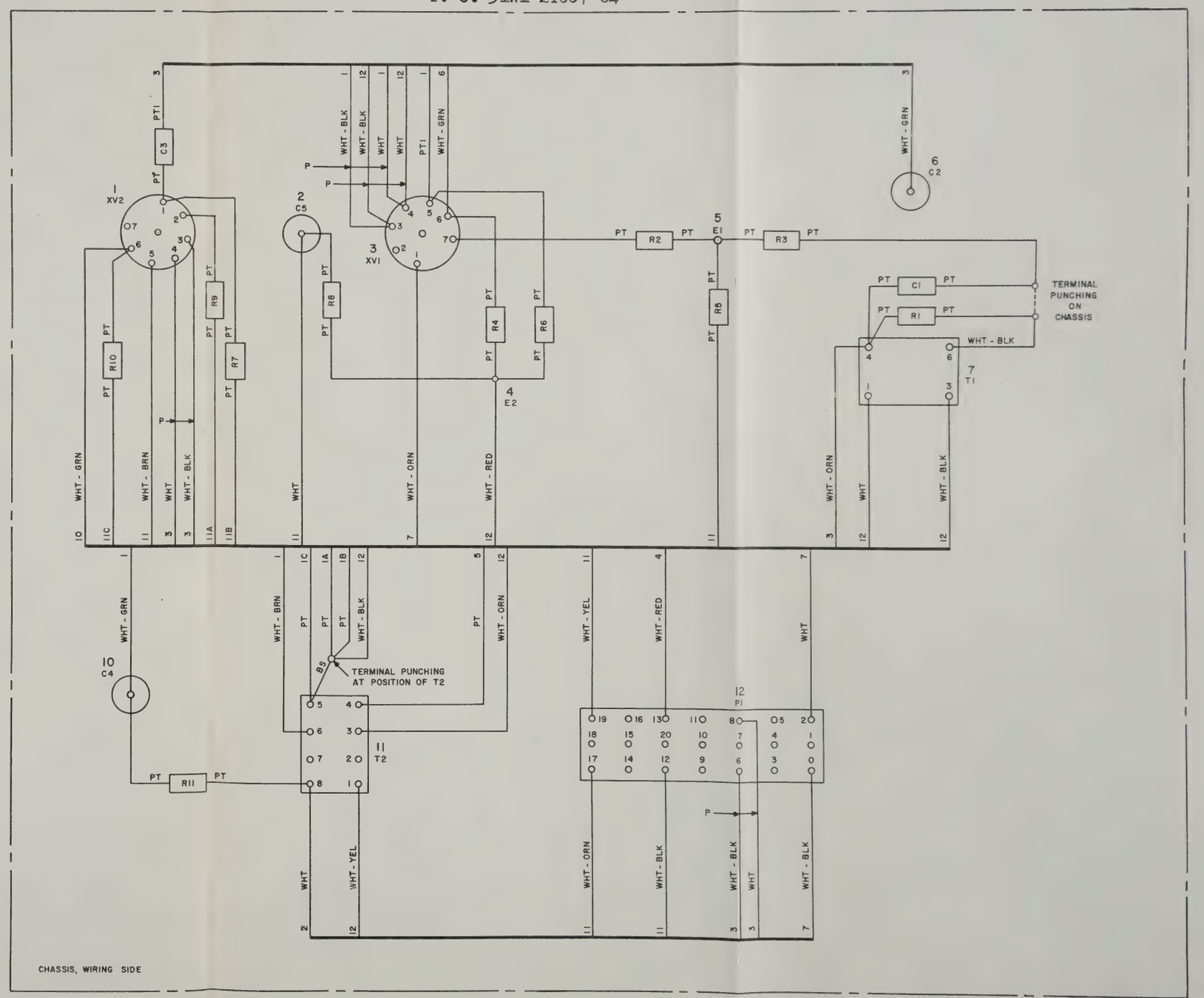
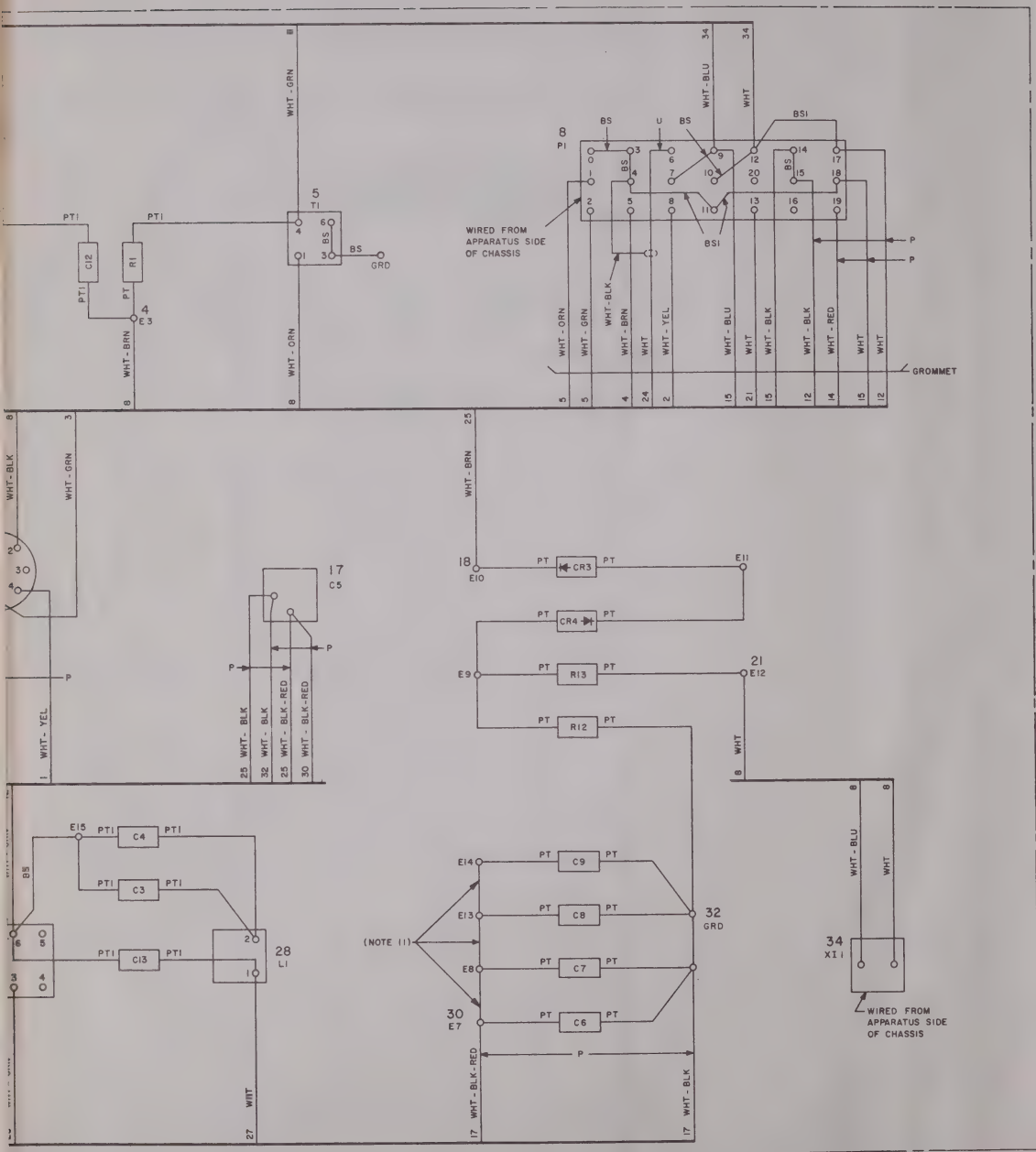


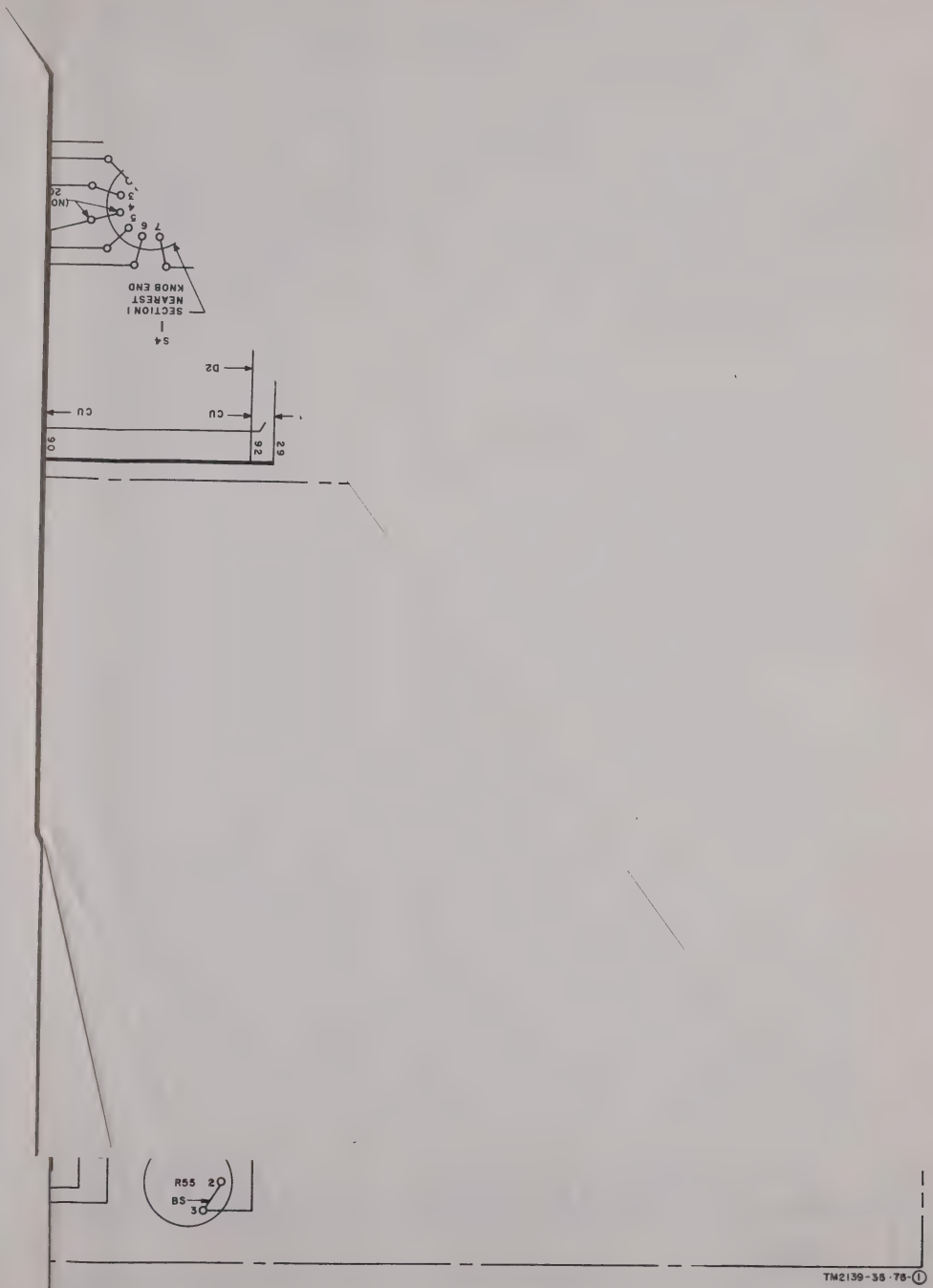
Figure 153.

Figure 153. Receiving amplifier AR102 (part of ORDER WIRE PANEL), wiring diagram



TM2139-35-89

ORDER WIRE PANEL), wiring diagram.



TM2139-38-78-①

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
4. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
5. PT DENOTES LEADS PART OF APPARATUS.
6. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. P DENOTES PAIR.
8. U DENOTES SHIELDED 22 GAGE WIRE WITH EXTRUDED NYLON JACKET.
9. ⊂⊃—— DENOTES SHIELDED CONNECTION.
10. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
11. THESE CAPACITORS ARE STRAPPED FOR PROPER TUNING AND MAY HAVE TO BE RESTRAPPED UPON REPLACEMENT OF ASSOCIATED COMPONENTS.

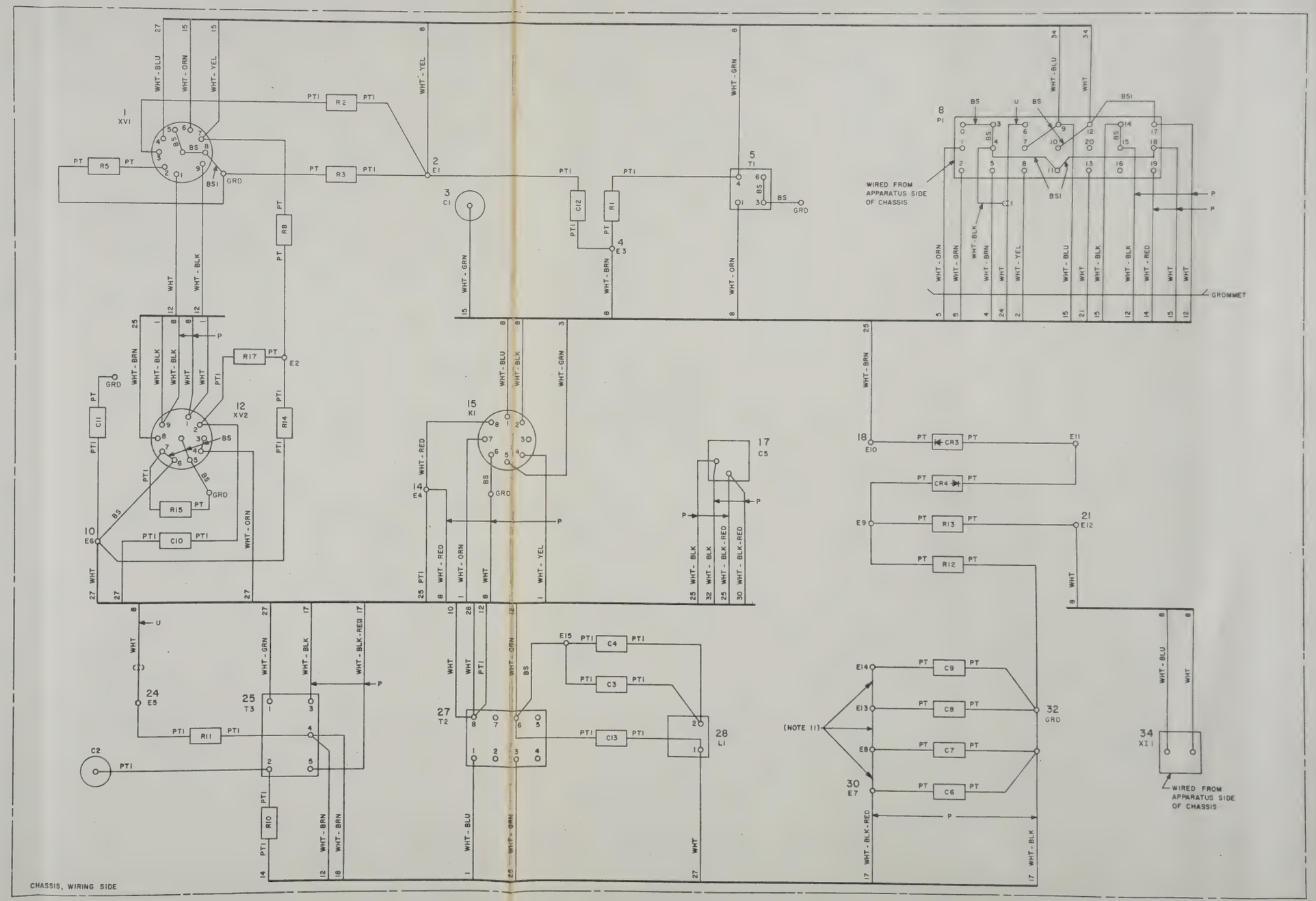
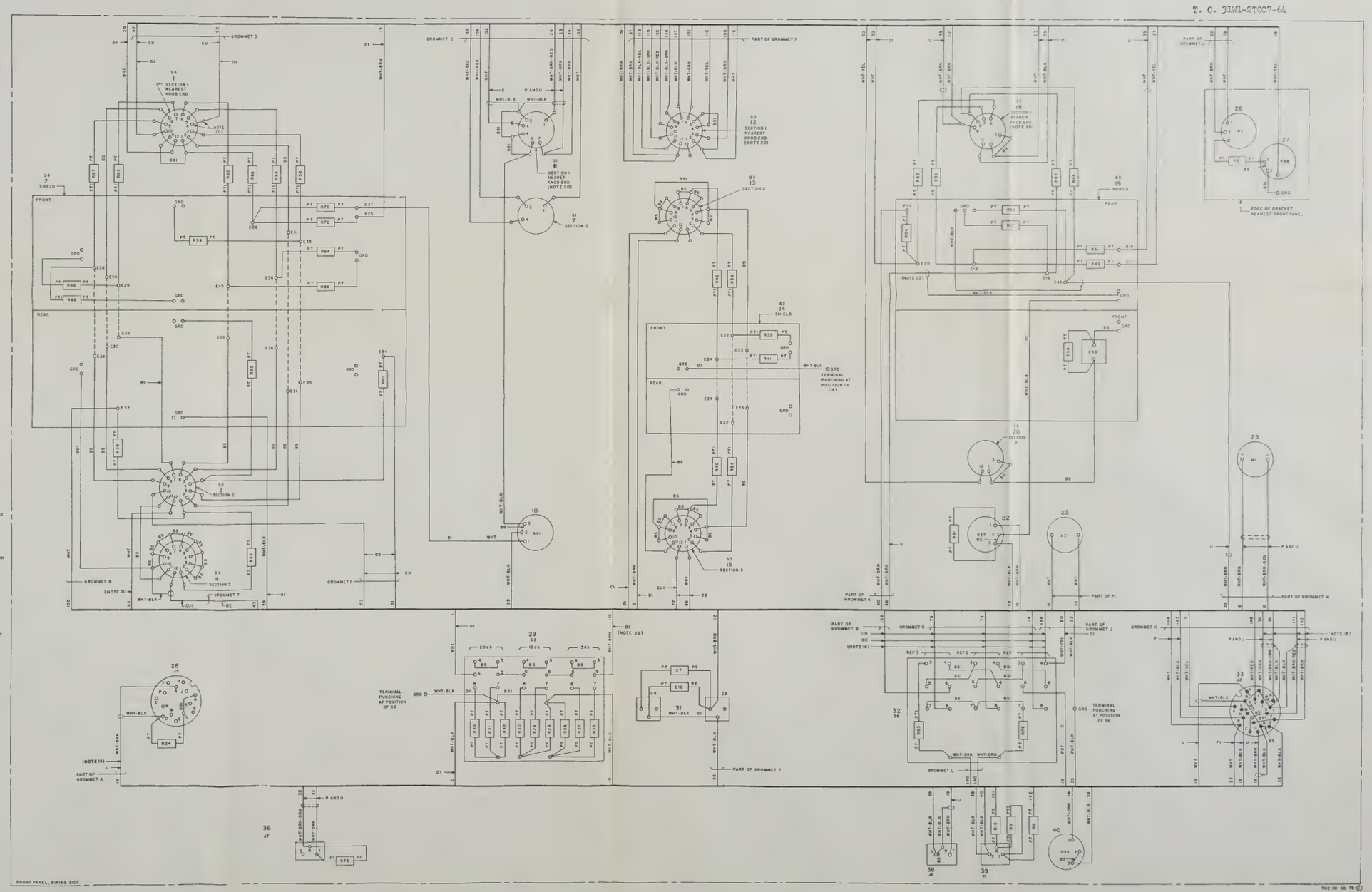


Figure 154. Ringer-oscillator Y101 (part of ORDER WIRE PANEL), wiring diagram.

Figure 154.

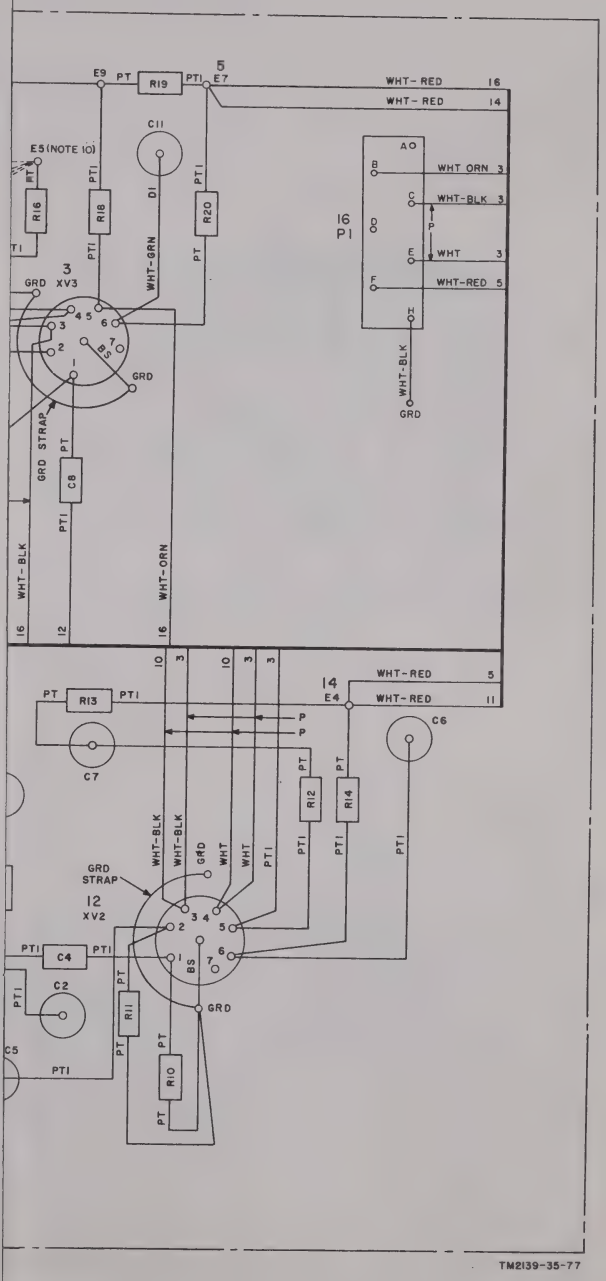


NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET
3. D1 WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER
4. D2 WIRING IS DRESSED BACK TO THE PANEL OR CHASSIS AND RUN IN A SPECIFIC PATH AT TIME OF MANUFACTURE OR REPLACEMENT OF D2 WIRING. DO NOT DEVIATE FROM THE ORIGINAL PATH
5. B5 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
6. B51 DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING
7. LEADS TO CONNECTORS J3 AND J4 HAVE SUFFICIENT SLACK SO THAT THESE CONNECTORS MAY BE UNFASTENED AND ACCESS OBTAINED TO THE WIRING SIDE WITHOUT UNSOLDERING CONNECTIONS
8. PT DENOTES LEADS PART OF APPARATUS
9. PT1 DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON
10. P,P1 DENOTES PAIR
11. U DENOTES SHIELDED 22 GAGE WIRE WITH EXTRUDED NYLON JACKET
12. P AND U DENOTES SHIELDED PAIR 22 GAGE WIRE WITH EXTRUDED NYLON JACKET
13. CU DENOTES RADIO FREQUENCY CABLE RG-58A/U (COAXIAL SHIELDED CABLE.)
14. CU1 DENOTES RADIO FREQUENCY CABLE RG-58/U (COAXIAL SHIELDED CABLE.)
15. ⊂⊃ DENOTES SHIELDED CONNECTION
16. O—— DENOTES COAXIAL SHIELDED CONNECTION
17. SHIELDS EXTEND TO WITHIN 1/2 INCH OF TERMINAL UNLESS OTHERWISE INDICATED
18. SHIELDS EXTEND TO WITHIN 1 INCH OF TERMINAL
19. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER
20. TERMINALS INSIDE OF CIRCLE ARE ON SIDE OF DISC FARTHEST FROM KNOB END AND TERMINALS ON OUTSIDE OF CIRCLE ARE ON SIDE OF DISC NEAREST TO KNOB END
21. THIS LEAD IS RUN DIRECT WITH SUFFICIENT SLACK TO PERMIT REMOVAL OF PLUG FROM SOCKET
22. THIS LEAD MUST BE PLACED IN FRONT (TOWARD THE FRONT PANEL) OF ALL LEADS ROUTED THROUGH GROMMET D
23. IN PANELS BEARING ORDER NO. 1418-PHILA-51, SERIAL NOS. 1 THROUGH 364, THE SHIELD IS NOT GROUNDED
24. IN PANELS BEARING ORDER NO. 1418-PHILA-51, SERIAL NOS. 1 THROUGH 873, C22 IS 0.01 MFD AT 175 VAC, 1000 VDC. IF C22 FAILS, REPLACE IT WITH A .47 UF, 400 VDC CAPACITOR.
25. IN PANELS BEARING ORDER NO 1418-PHILA-51, SERIAL NOS. 1 THROUGH 947, RADIO FREQUENCY CABLE RG-62/U IS USED INSTEAD OF RG-58/U.
26. IN PANELS BEARING ORDER NO 1418-PHILA-51, SERIAL NOS. 1 THROUGH 419, THE FOLLOWING DIFFERENCES IN WIRING EXIST:
AT STATION 46, THE PAIRED LEADS FROM TERMINALS C AND E ARE ROUTED TO STATION 60.
AT STATION 60, THE PAIRED LEADS ROUTED FROM TERMINALS C AND E AT STATION 46 ARE TERMINATED ON PINS 3 AND 4, RESPECTIVELY OF XV1
AT STATION 69, THE PAIRED LEADS ON TERMINALS H AND G ROUTED FROM STATION 46 ARE NOT USED

Figure 155. Telephone Test Set TA-769/TCC-7 (part of Receiver-Transmitter Test Set Group OA-443/TCC-7), wiring diagram.

WHT-BLK
WHT-BLK
PTI
107
XV4
GRD STRAP
GRD
PT
R56
PT
BS
BSI
P
P
DI
76 WHT-YEL
128 WHT-YEL
128 WHT-BRN
60 WHT-BLK
145 WHT-BLK
60 WHT
128 BSI
144 WHT
78 WHT-RED
136 WHT-RED
146
C21


E9
PT
R19
PTI
5
E7
WHT-RED 16
WHT-RED 14
C11
E5 (NOTE 10)
R16
R18
R20
DI
WHT-GRN
16 P1
A
B WHT ORN 3
C WHT-BLK 3
D
E WHT 3
F WHT-RED 5
H
WHT-BLK
GRD
3 XV3
GRD STRAP
C8
WHT-BLK
WHT-ORN
14
E4
WHT-RED 5
WHT-RED 11
R13
C7
C6
R12
R14
GRD STRAP
12 XV2
C4
C2
R11
R10
C5
GRD
TM2139-35-77

ram.

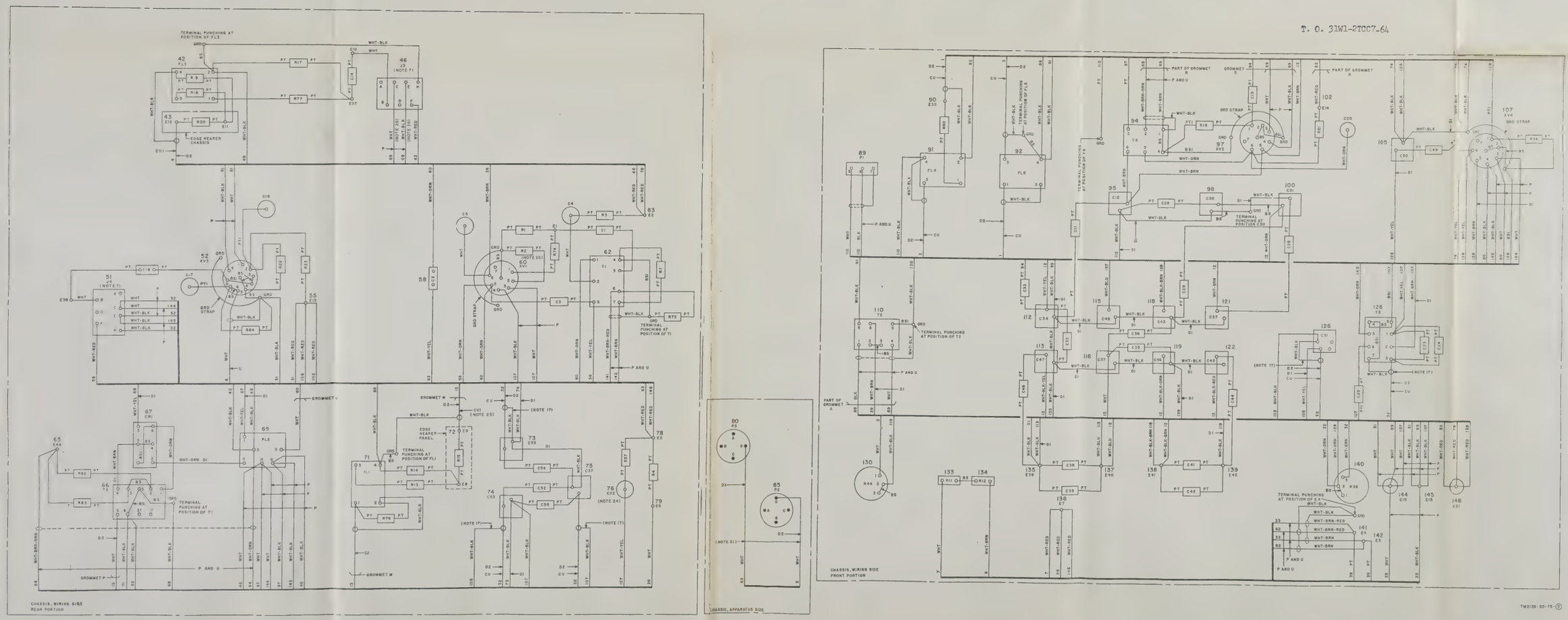


Figure 155.—Continued.

Figure 155—Continued.

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
4. DI WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
5. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
6. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. PT DENOTES LEADS PART OF APPARATUS.
8. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. P DENOTES PAIR.
10. ON SOME UNITS, R6 AND R21 ARE CONNECTED TO C10.
11. COMPONENTS AND LEADS SHOWN BY DASHED LINES ARE ON TOP OF CHASSIS.

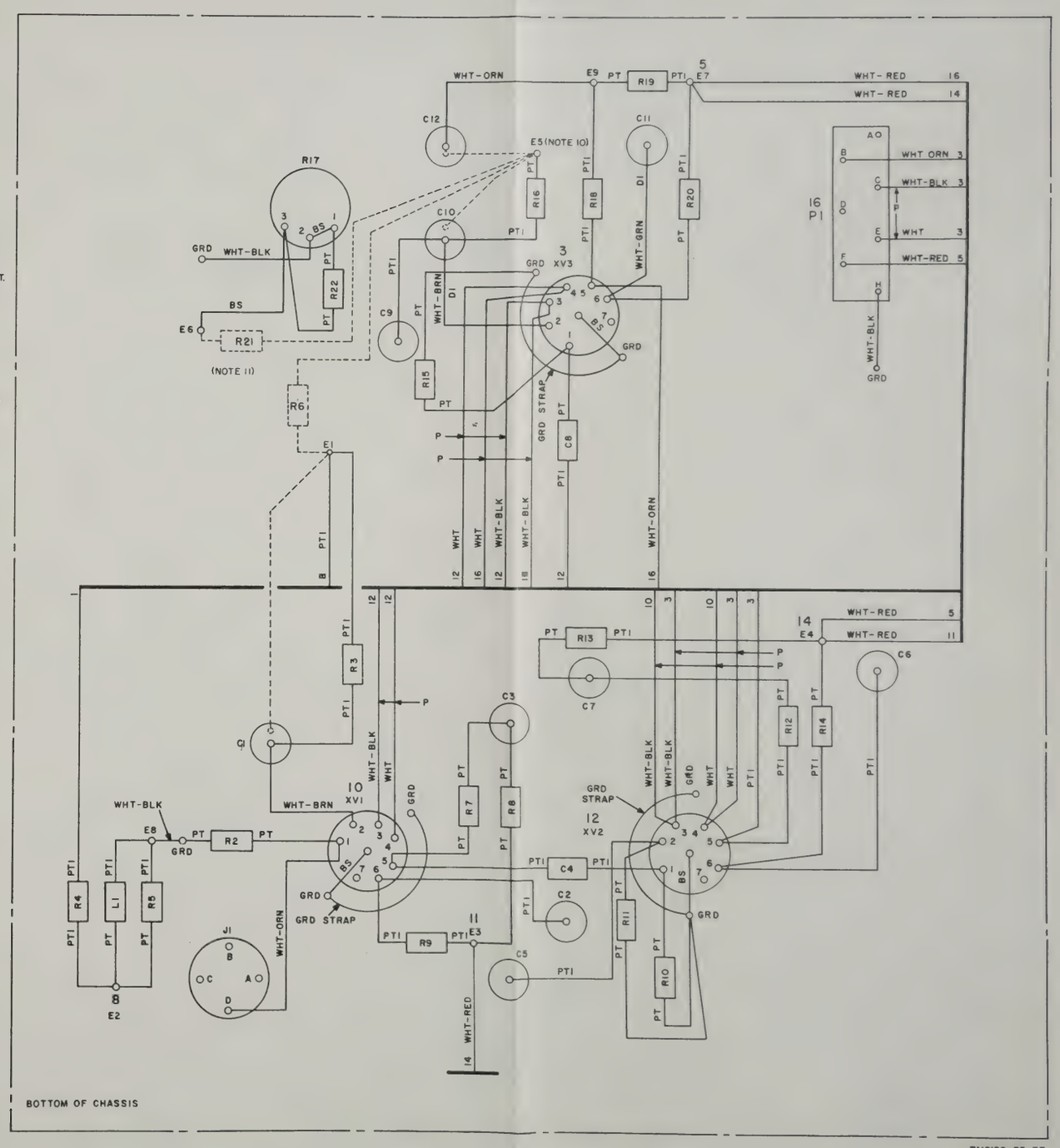
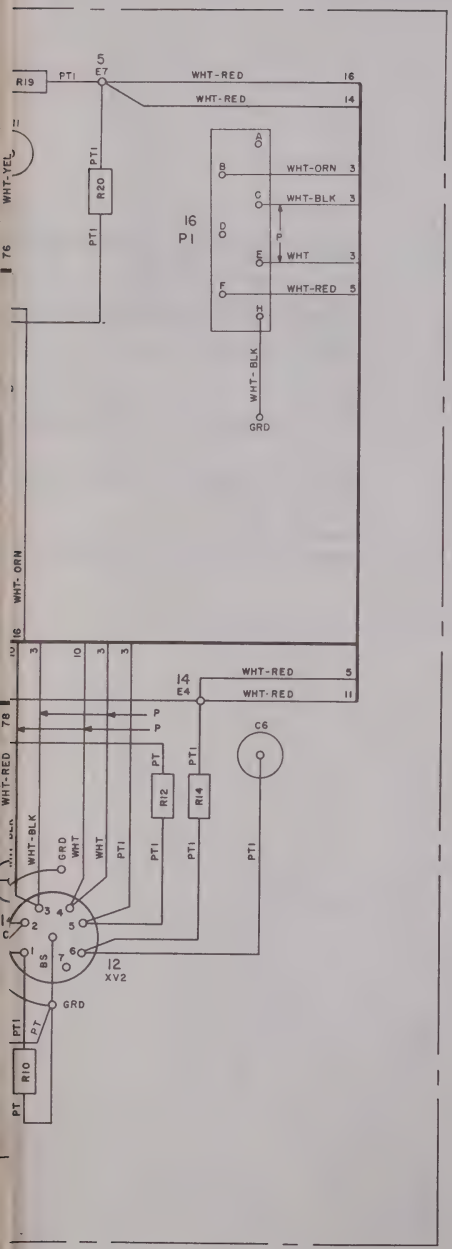
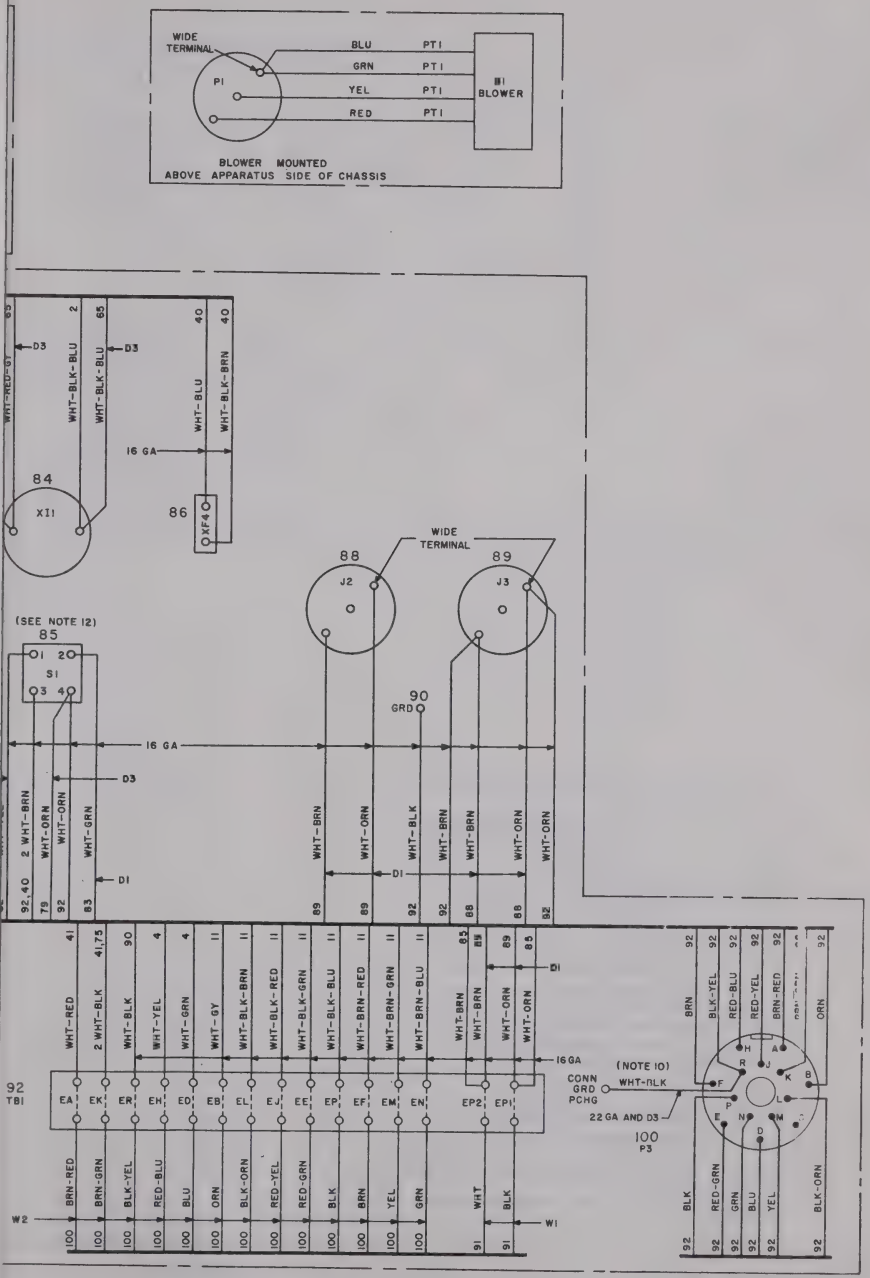


Figure 156. If amplifier AR1 (part of TEST PANEL), wiring diagram.

Figure 156.

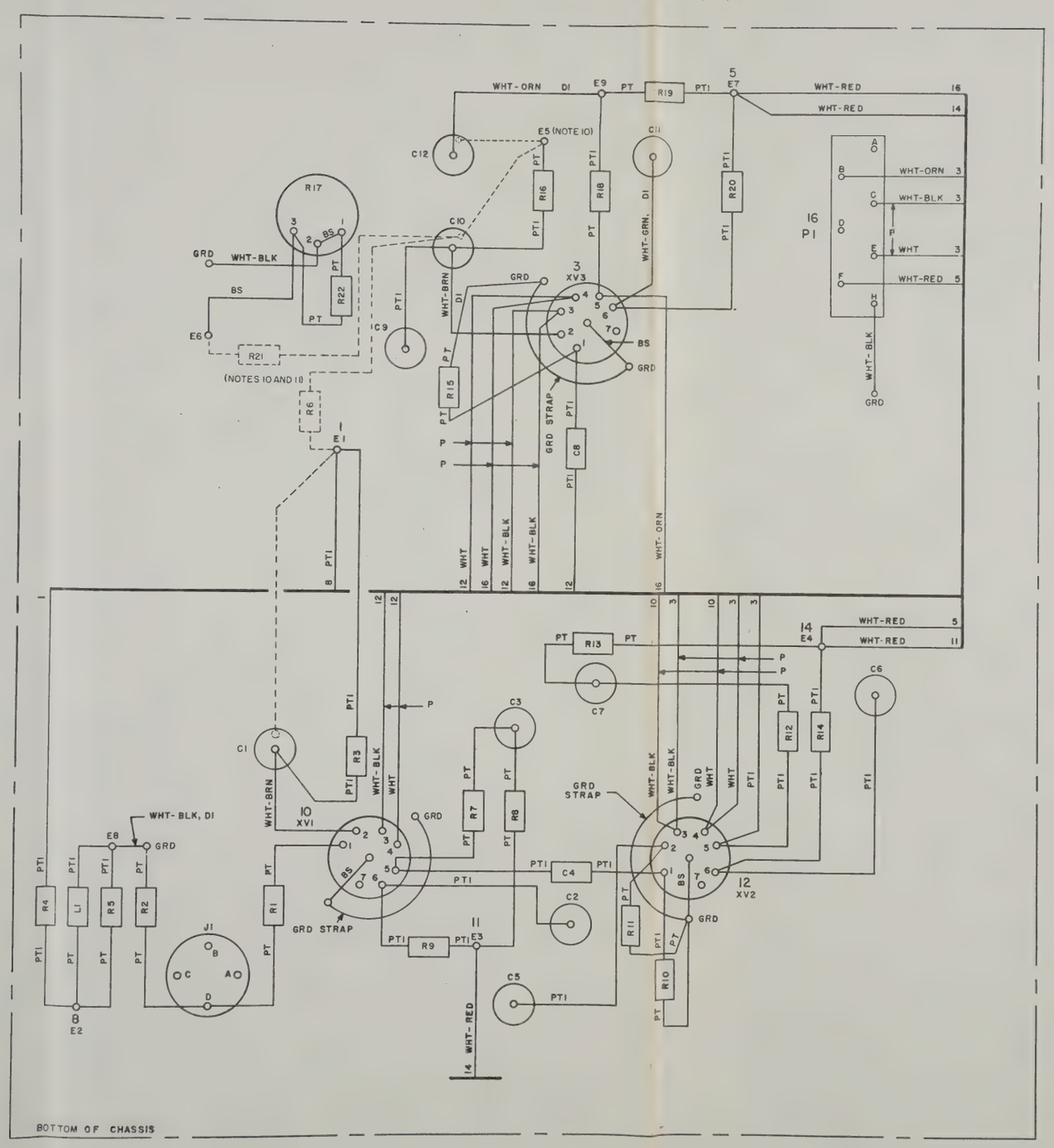
2TCC7-64


5
E7
R19
PT1
WHT-RED
16
WHT-RED
14
WHT-YEL
R20
PT1
PT1
16
P1
A
B
WHT-ORN
3
C
WHT-BLK
3
D
P
M
WHT
3
F
WHT-RED
5
H
WHT-BLK
GRD
WHT-ORN
16
14
E4
WHT-RED
5
WHT-RED
11
P
P
C6
WHT-RED
PT
PT1
R12
R14
PT1
WHT-BLK
GRD
WHT
WHT
PT1
PT1
PT1
PT1
1
2
3
4
5
6
7
BS
12
XV2
GRD
PT1
PT
R10
PT


WIDE TERMINAL
P1
BLU PT1
GRN PT1
YEL PT1
RED PT1
B1 BLOWER
BLOWER MOUNTED ABOVE APPARATUS SIDE OF CHASSIS
WHT-RED-GY
WHT-BLK-BLU
WHT-BLK-BLU
WHT-BLU
WHT-BLK-BRN
D3
16 GA
84
X11
86
XF4
WIDE TERMINAL
88
J2
89
J3
(SEE NOTE 12)
85
S1
90
GRD
16 GA
D3
D1
2 WHT-BRN
WHT-ORN
WHT-ORN
WHT-GRN
WHT-BRN
WHT-ORN
WHT-BLK
WHT-BRN
WHT-BRN
WHT-ORN
WHT-ORN
92 TB1
WHT-RED
2 WHT-BLK
WHT-BLK
WHT-YEL
WHT-GRN
WHT-GY
WHT-BLK-BRN
WHT-BLK-RED
WHT-BLK-GRN
WHT-BLK-BLU
WHT-BRN-RED
WHT-BRN-GRN
WHT-BRN-BLU
WHT-BRN
WHT-BRN
WHT-ORN
WHT-ORN
16GA
EA EK ER EH ED EB EL EJ EE EP EF EM EN EP2 EP1
W2
W1
BRN-RED
BRN-GRN
BLK-YEL
RED-BLU
BLU
ORN
BLK-ORN
RED-YEL
RED-GRN
BLK
BRN
YEL
GRN
WHT
BLK
(NOTE 10)
CONN GRD PCHG
WHT-BLK
22 GA AND D3
100 P3
BRN
BLK-YEL
RED-BLU
RED-YEL
BRN-RED
ORN
BLK
RED-GRN
GRN
BLU
YEL
BLK-ORN

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.
3. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
4. DI WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
5. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING.
6. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. PT DENOTES LEADS PART OF APPARATUS.
8. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. P DENOTES PAIR.
10. ON SOME UNITS, R6 AND R21 ARE CONNECTED DIRECTLY TO E5.
11. COMPONENTS AND LEADS SHOWN BY DASHED LINES ARE ON TOP OF CHASSIS.



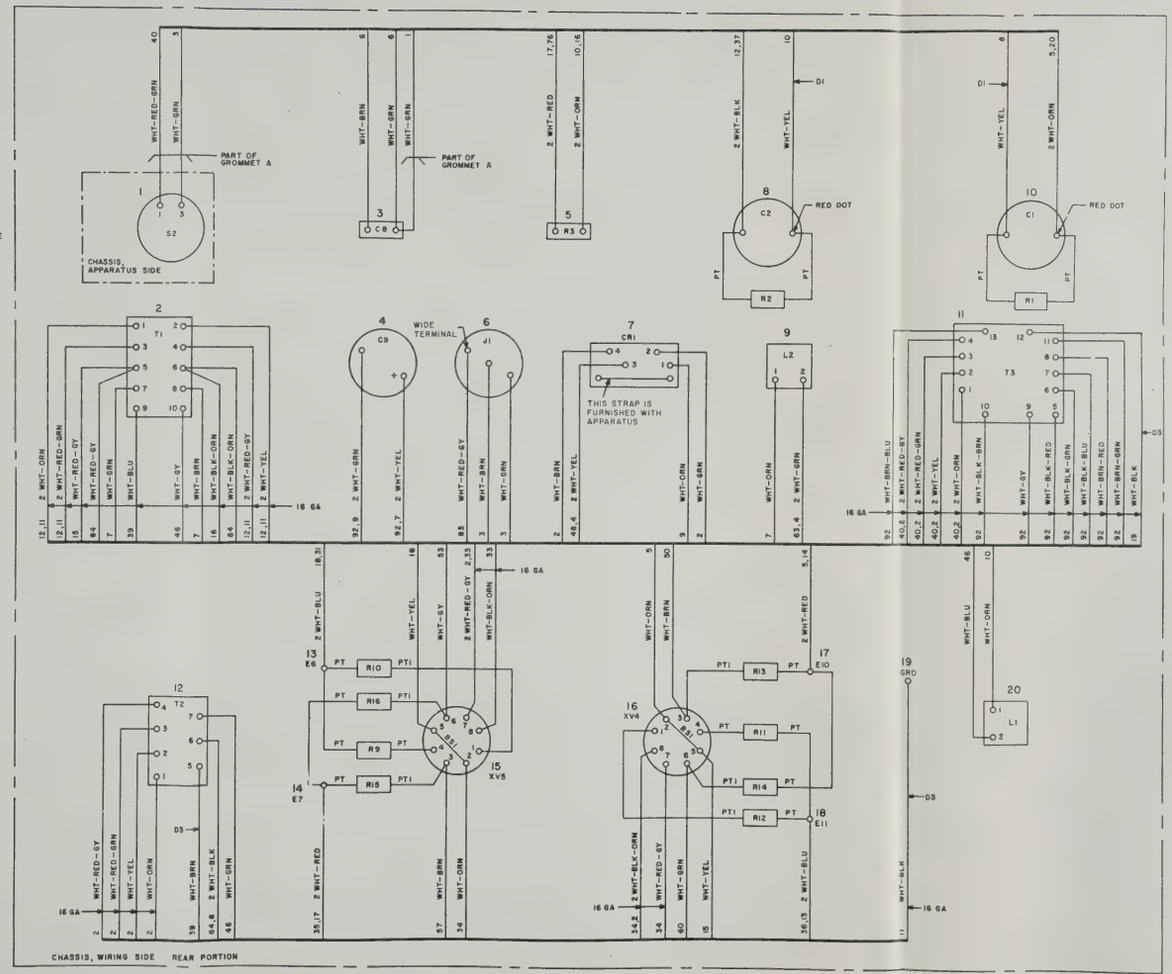
TM2139-35-78

Figure 157.

Figure 157. Flat amplifier AR2 (part of TEST PANEL), wiring diagram.

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 20 GAGE WITH NYLON JACKET.
3. WIRES MARKED 16 GAGE HAVE A NYLON JACKET.
4. D1 WIRING IS CONNECTED DIRECTLY FROM TERMINAL TO TERMINAL IN THE SHORTEST POSSIBLE MANNER.
5. BS DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING.
6. BSI DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. PT DENOTES LEADS PART OF APPARATUS.
8. PTI DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. D3 WIRING SHALL BE RUN DIRECTLY FROM TERMINAL TO TERMINAL AND DRESSED BACK AGAINST THE PANEL IN THE MOST CONVENIENT MANNER.
10. CORRECTION OF WHT-BLK STRAP INCORPORATED ONLY ON PP-827/U, BEARING ORDER NO. 14181-PHILA-51, SERIAL NUMBERS 1 THROUGH 799.
11. AFTER CHECKING OR REPLACING RESISTOR R27 OR ADJACENT WIRING, BE SURE THAT RESISTOR AND ADJACENT WIRING ARE DRESSED SO THAT THE AXIS OF RESISTOR R27 LIES IN A LINE BETWEEN STANDOFF TERMINALS E4 AND E5, AND THAT THE WIRING IS AS FAR AWAY FROM THE RESISTOR AS POSSIBLE.
12. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES.



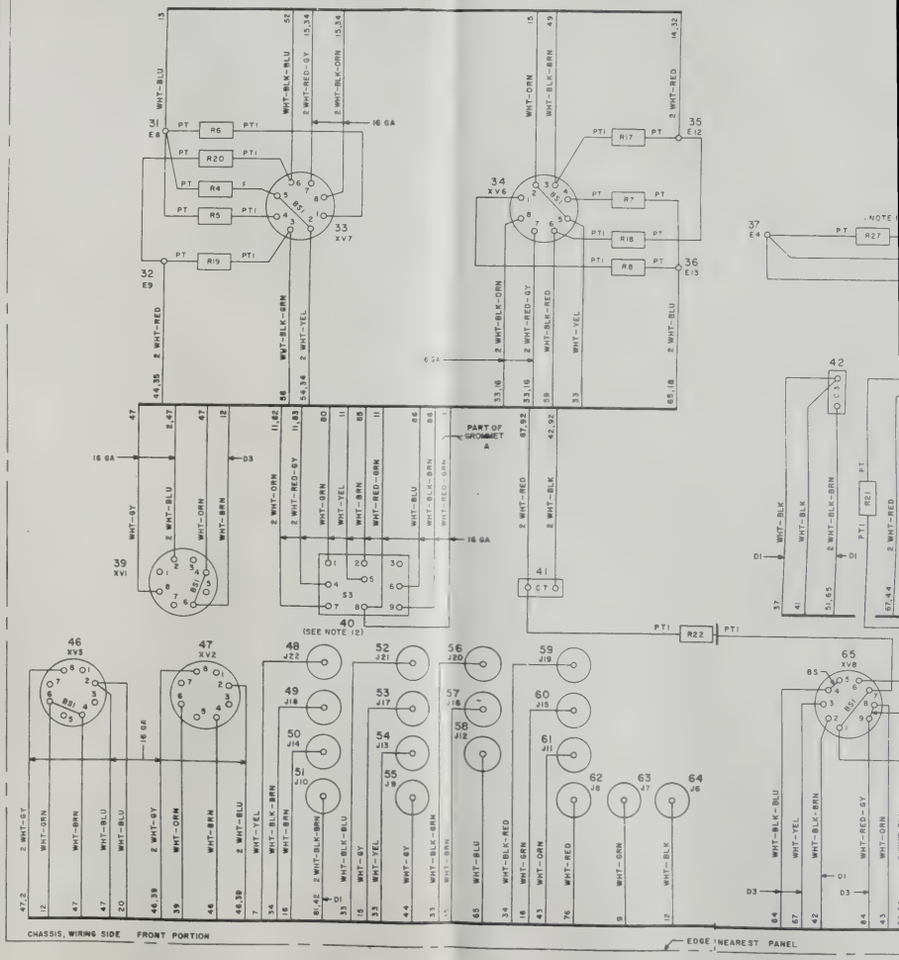


Figure 158. *Power Supply PP-827/U (200 VOLT POWER SUPPLY), wiring diagram.*

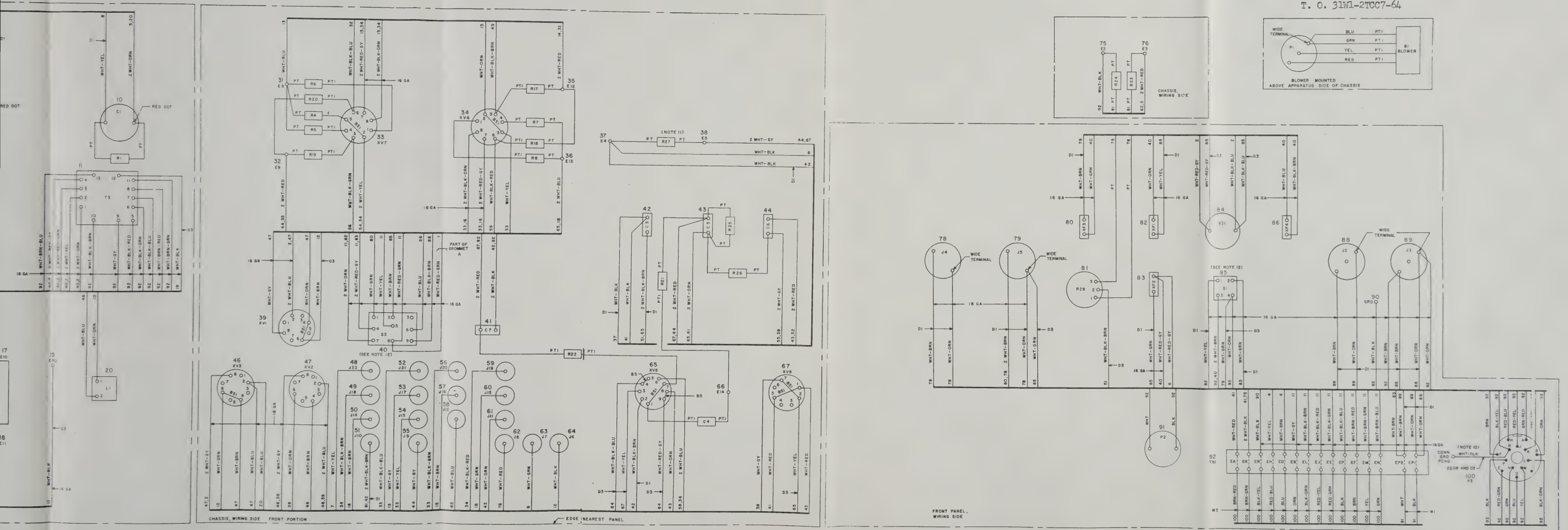


Figure 158. Power Supply PP-827/U (200 VOLT POWER SUPPLY), wiring diagram.

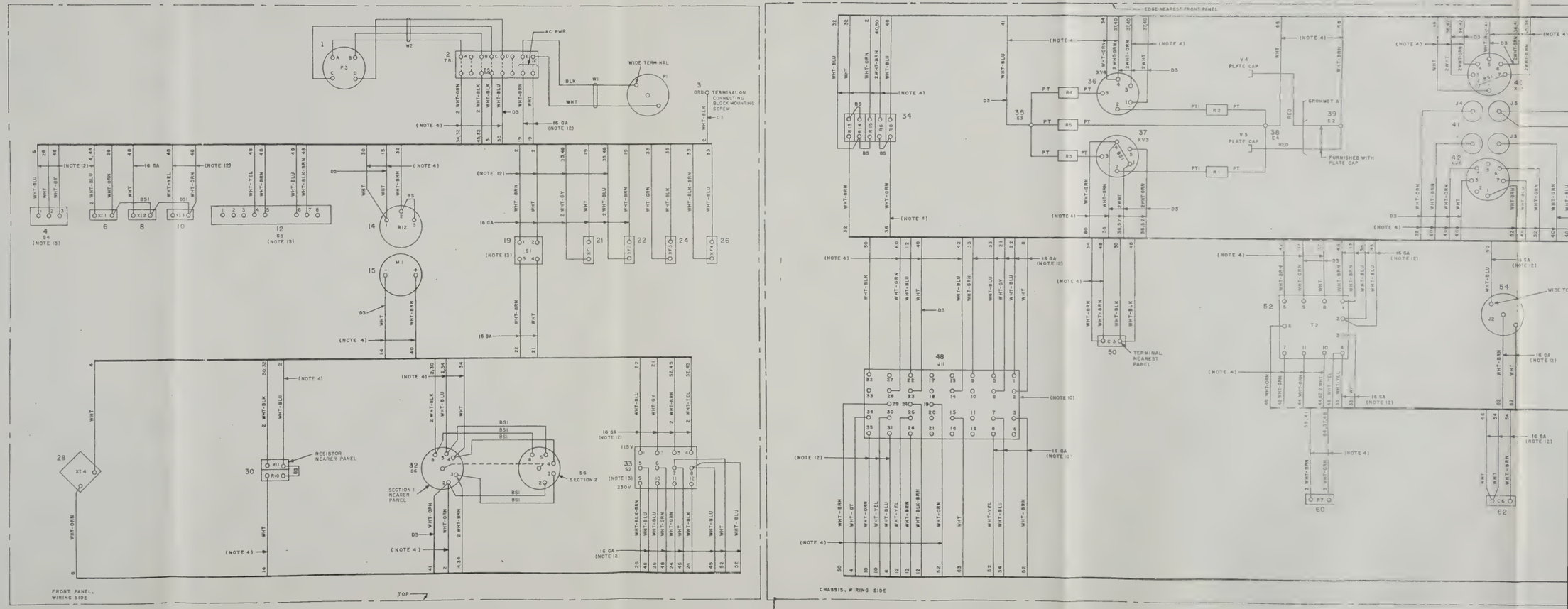
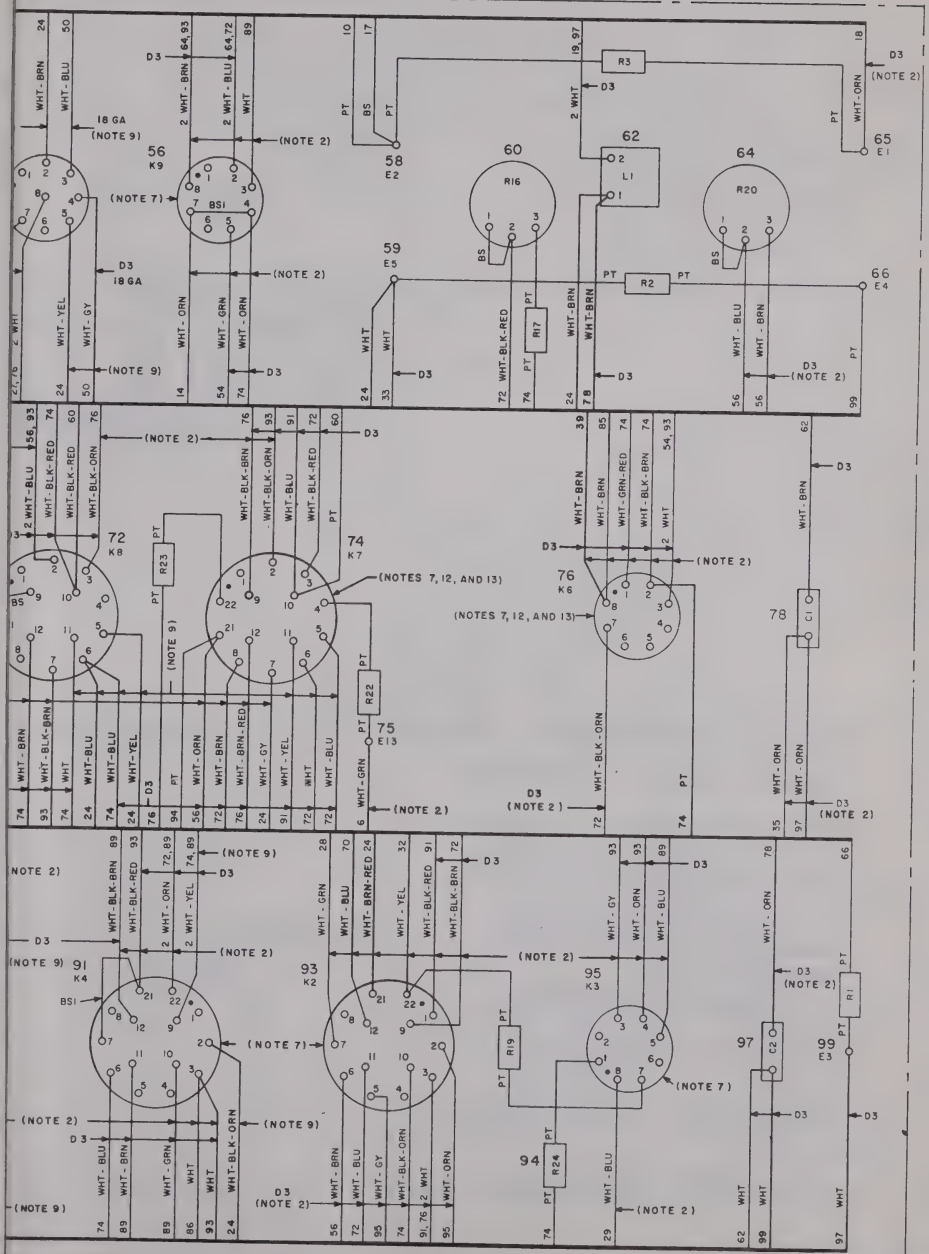


Figure 159. Power Supply PP-826/U (600 VOLT POWER SUPPLY), wiring diagram (original units).


56
K9
58
E2
59
E5
60
R16
62
L1
64
R20
65
E1
66
E4
72
K8
74
K7
75
E13
76
K6
78
C1
91
K4
93
K2
94
R24
95
K3
97
C2
99
E3
R1
R2
R3
R17
R19
R22
R23
(NOTE 2)
(NOTE 7)
(NOTE 9)
(NOTES 7, 12, AND 13)
18 GA
(NOTE 2)

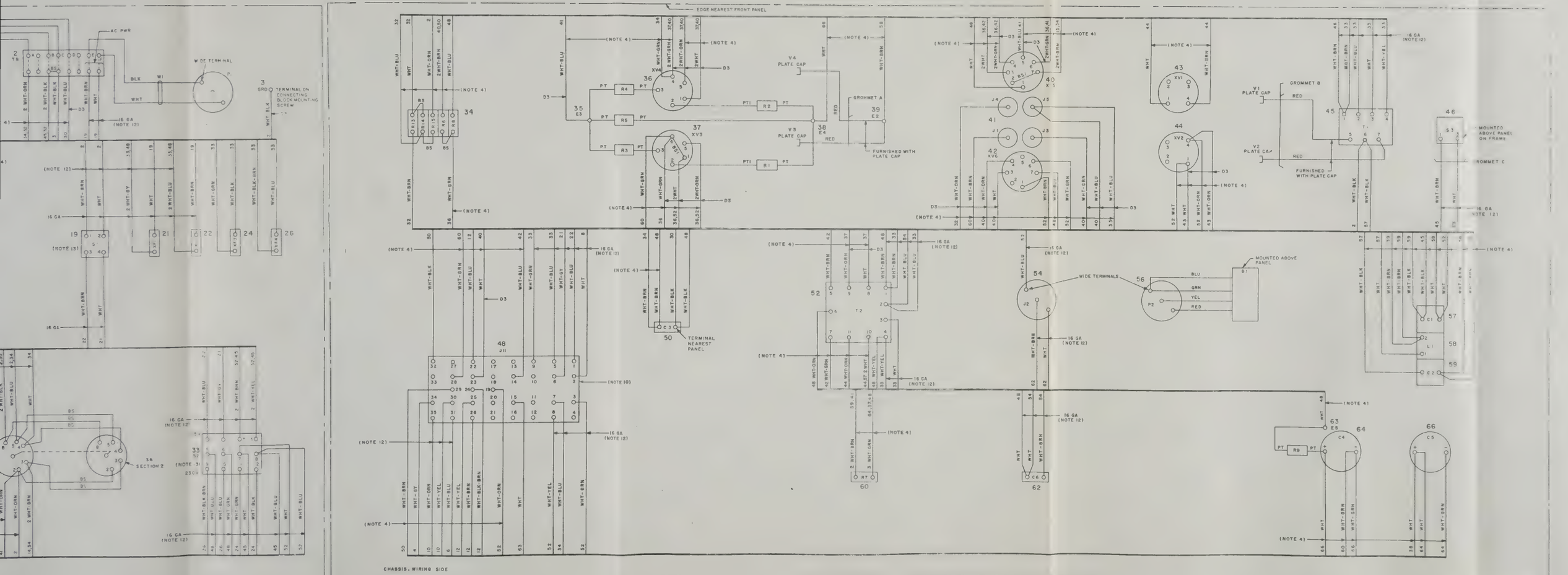
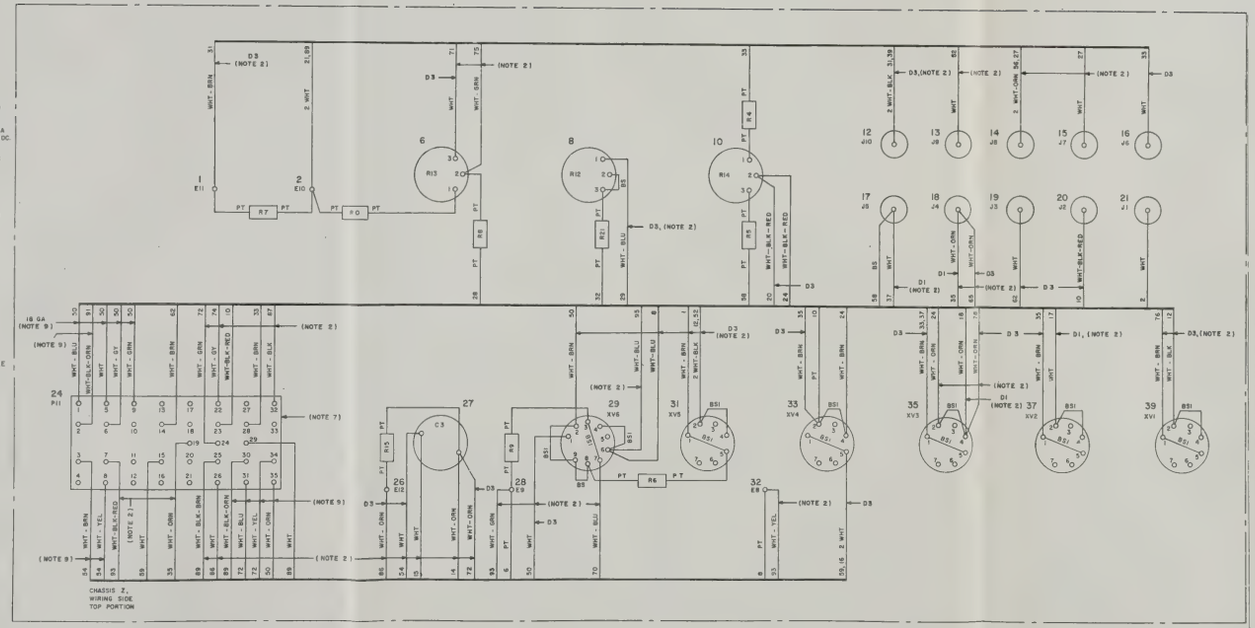


Figure 159. Power Supply PP-826/U (600 VOLT POWER SUPPLY), wiring diagram (original units).

NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPOND; TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 1000 VOLTS AC RMS AND 1400 VOLTS DC.
3. WIRING NOT OTHERWISE SPECIFIED HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 1500 VOLTS AC RMS AND 2500 VOLTS DC.
4. D3 WIRING IS DRESSED BACK TO THE CHASSIS AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
5. D5 DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING.
6. D51 DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. ON THIS PIECE OF APPARATUS AN INSULATED SLEEVE 1/2 INCH LONG IS PROVIDED ON ALL WIRED TERMINALS.
8. PT DENOTES LEADS PART OF APPARATUS.
9. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED VOLTAGE OF 600 VOLTS AC RMS AND 1000 VOLTS DC.
10. WIRING NOT OTHERWISE SPECIFIED IS 20 GAGE.
11. WIRING NOT OTHERWISE SPECIFIED IS RUN IN A CABLE FORM
12. ON SOME LOW VOLTAGE RECTIFIER AND ALARM UNITS, BEARING ORDER NO. 14181-PHILA-51 R23 IS REMOVED AND A STRAP IS CONNECTED BETWEEN TERMINALS 9 AND EE OF STATION 74.
13. ALL LOW VOLTAGE RECTIFIER AND ALARM UNITS ARE INTERCHANGEABLE



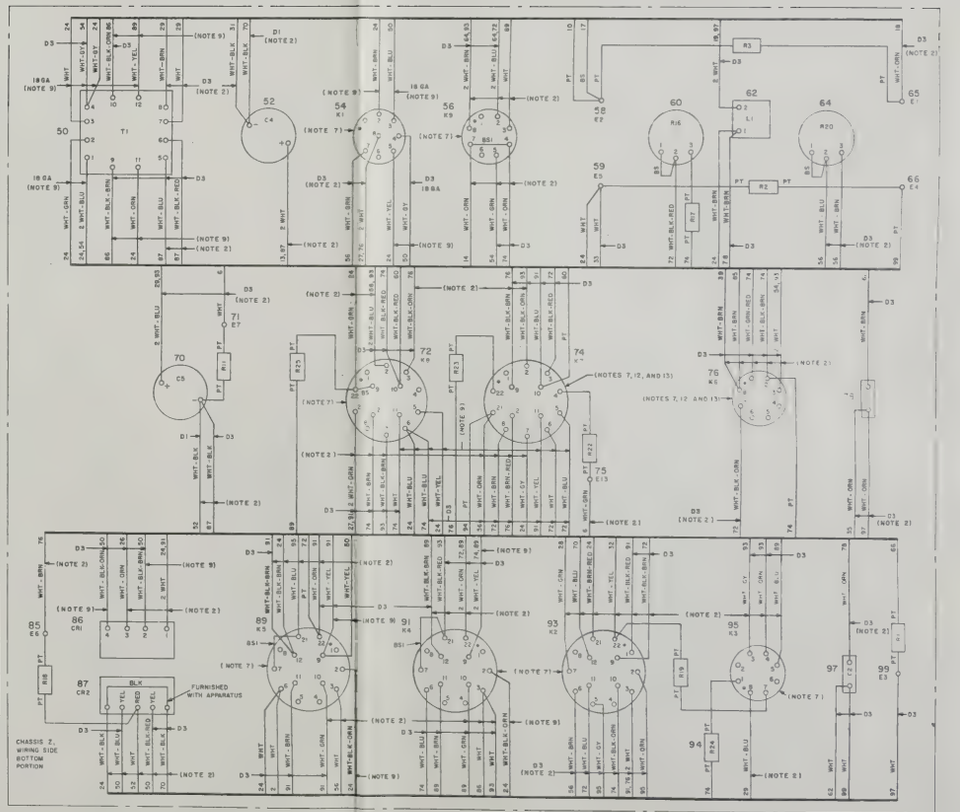
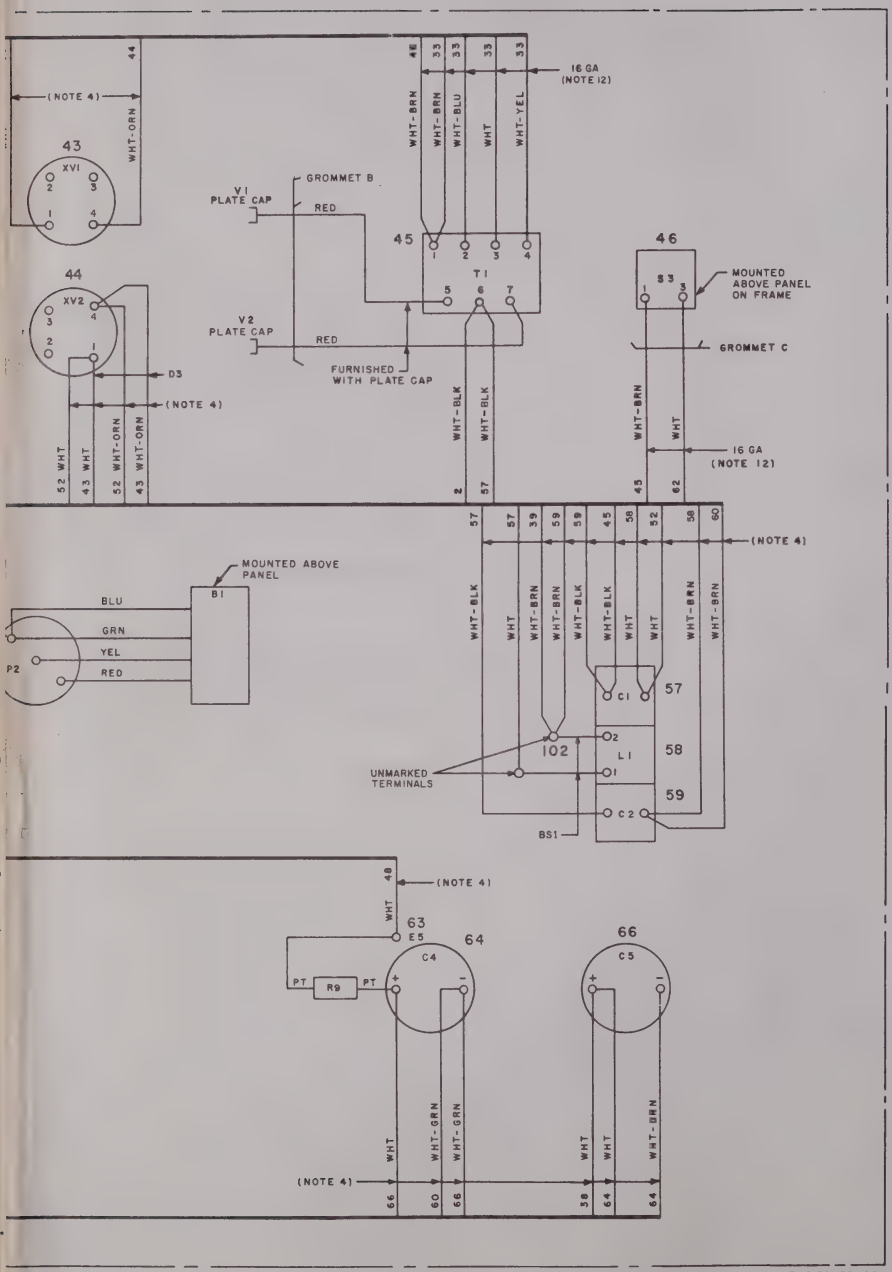
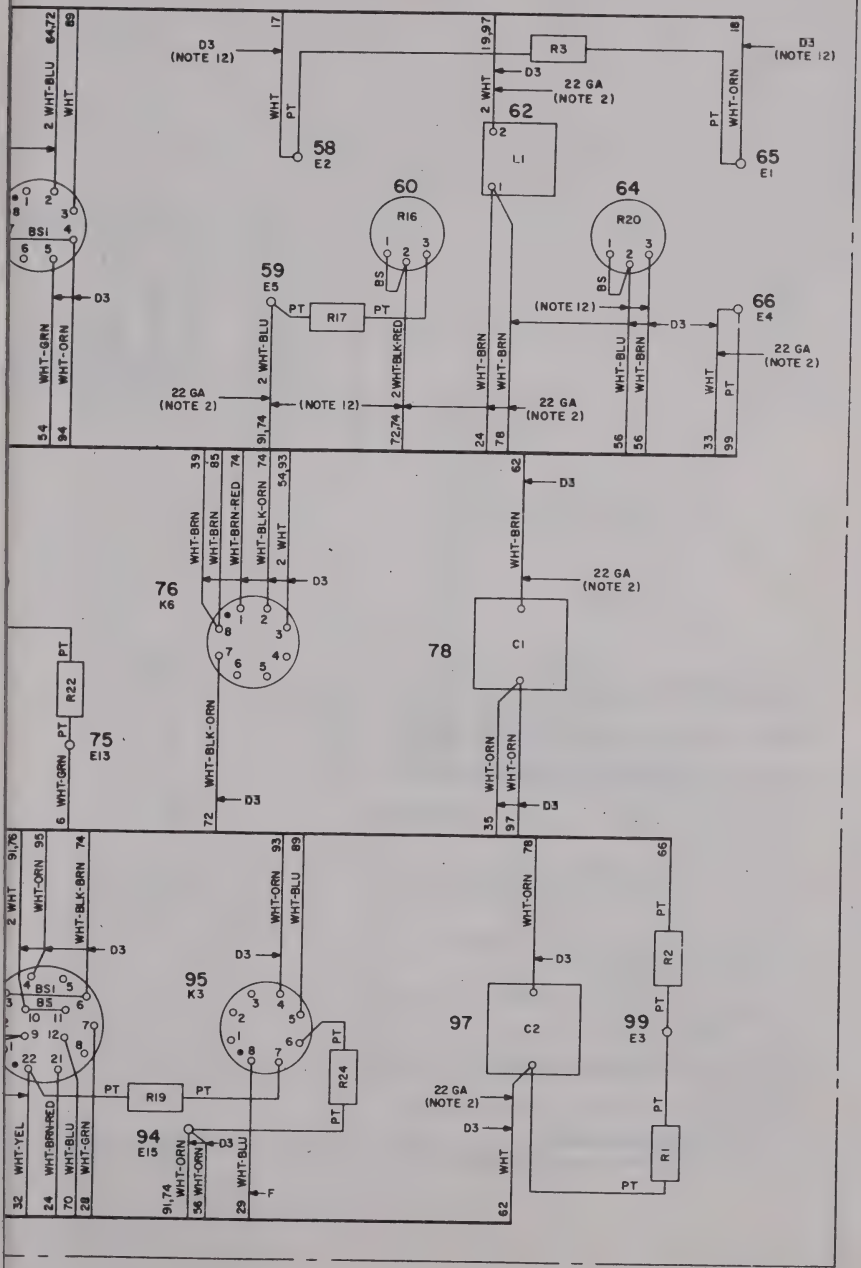


Figure 160. Low-Voltage rectifier and alarm unit Z1 (part of Power Supply PP-826/U, wiring diagram (original units).

Figure 160.


(NOTE 4)
44
WHT-ORN
43
XV1
2
3
1
4
48
33
33
33
33
WHT-BRN
WHT-BRN
WHT-BLU
WHT
WHT-YEL
16 GA
(NOTE 12)
GROMMET B
V1
PLATE CAP
RED
45
T1
1
2
3
4
5
6
7
46
S3
1
3
MOUNTED
ABOVE PANEL
ON FRAME
GROMMET C
44
XV2
3
4
2
1
D3
(NOTE 4)
V2
PLATE CAP
RED
FURNISHED
WITH PLATE CAP
WHT-BLK
WHT-BLK
WHT-BRN
WHT
16 GA
(NOTE 12)
52 WHT
43 WHT
52 WHT-ORN
43 WHT-ORN
2
57
45
62
57
57
39
59
59
45
58
52
58
60
(NOTE 4)
MOUNTED ABOVE
PANEL
B1
BLU
GRN
YEL
RED
P2
WHT-BLK
WHT
WHT-BRN
WHT-BRN
WHT-BLK
WHT-BLK
WHT
WHT
WHT-BRN
WHT-BRN
C1
57
102
2
L1
58
UNMARKED
TERMINALS
1
59
C2
BS1
49
(NOTE 4)
WHT
63
E5
64
C4
66
C5
PT
R9
PT
+
-
+
-
WHT
WHT-GRN
WHT-GRN
WHT
WHT
WHT-BRN
(NOTE 4)
66
60
66
38
64
64


D3 (NOTE 12)
WHT
PT
58
E2
R3
D3
22 GA (NOTE 2)
62
L1
2 WHT
PT
WHT-ORN
65
E1
D3 (NOTE 12)
60
R16
64
R20
BS1
BS
59
E5
R17
(NOTE 12)
66
E4
22 GA (NOTE 2)
2 WHT-BLU
2 WHT-BLK-RED
WHT-BRN
WHT-GRN
WHT-ORN
76
K6
78
C1
R22
75
E13
WHT-BLK-ORN
WHT-BRN-RED
WHT-BLK-ORN
95
K3
97
C2
99
E3
R2
R1
R19
R24
94
E15
WHT-YEL
WHT-BLU
F

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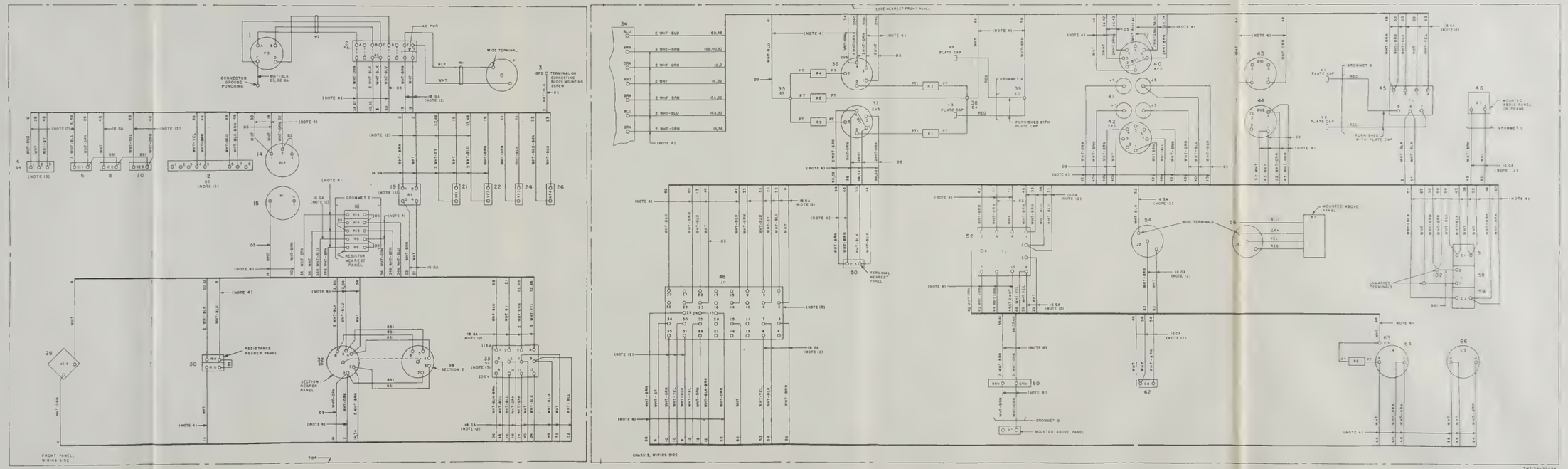


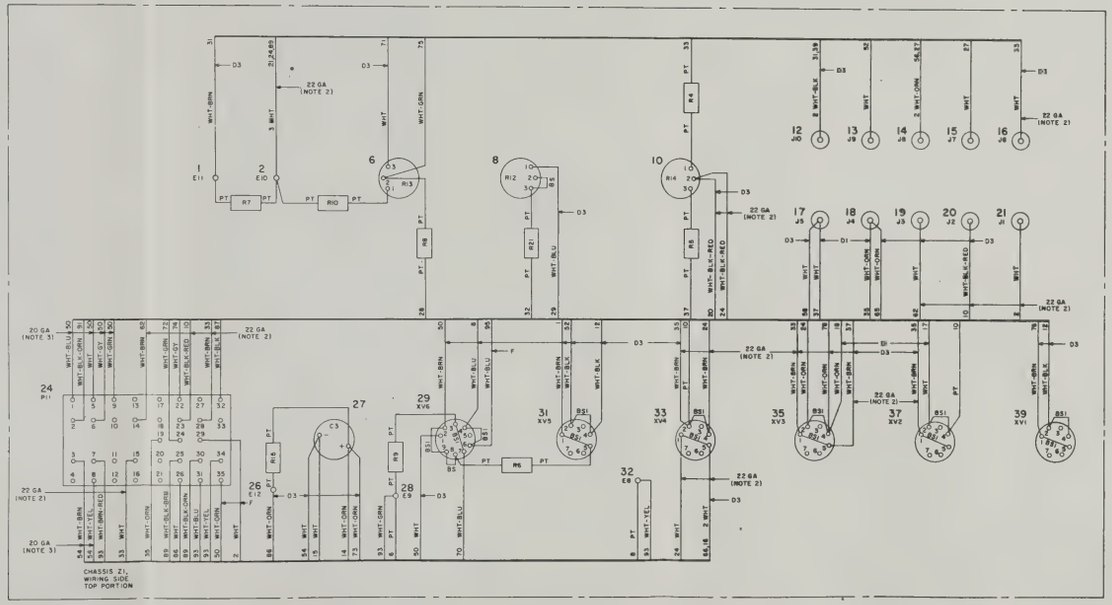
Figure 161. Power Supply PP-826/U (600 VOLT POWER SUPPLY), wiring diagram (revised units).

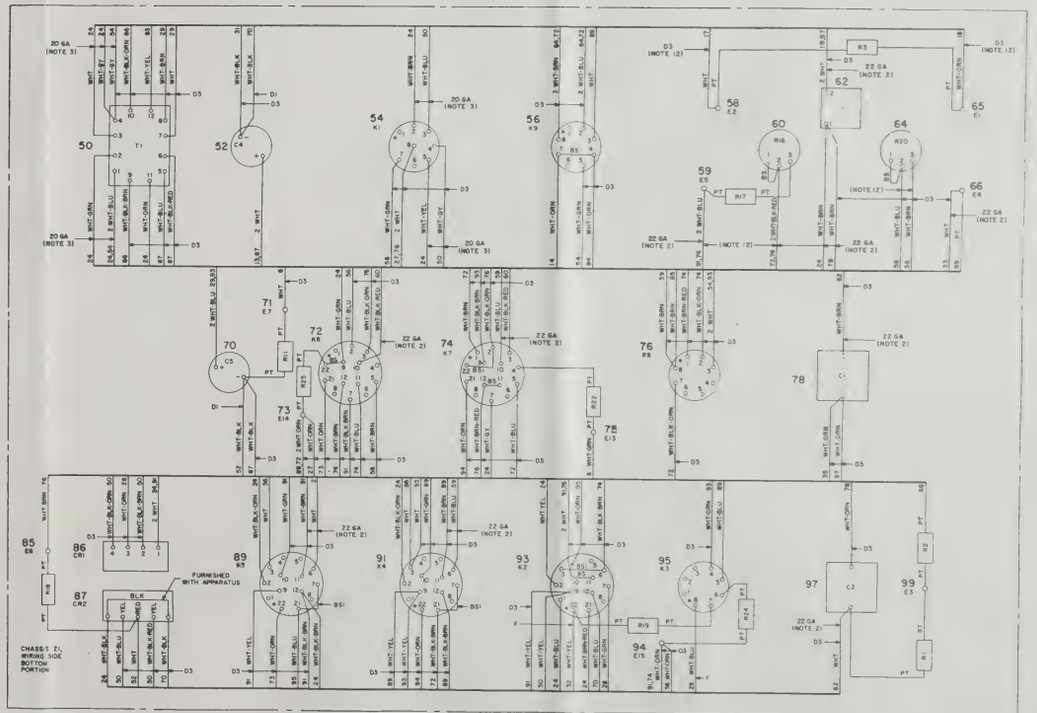
NOTES

1. THE SMALL NUMBER ON EACH WIRE ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 2500 VOLTS AC RMS AND 3500 VOLTS DC.
3. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 600 VOLTS AC RMS AND 850 VOLTS DC.
4. WIRING NOT OTHERWISE SPECIFIED IS 22 GAGE AND HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 600 VOLTS AC RMS AND 850 VOLTS DC.
5. D3 WIRING IS DRESSED BACK TO THE CHASSIS AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
6. D1 WIRING IS RUN DIRECTLY BETWEEN TERMINALS WITH 1/8 INCH SLACK PROVIDED.
7. BS DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING.
8. BSI DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. PT DENOTES PART OF APPARATUS.
10. WIRING NOT OTHERWISE SPECIFIED IS RUN IN A CABLE FORM.
11. F DENOTES WIRING BROUGHT OUT OF A CABLE FORM AT A SEPARATE STITCH.
12. WIRING HAS SUFFICIENT SLACK TO ALLOW MOVING BRACKET THAT SUPPORTS VARIABLE RESISTORS R16 AND R20, PROVIDING ACCESS TO CHASSIS WIRING FOR MAINTENANCE PURPOSES.

IMPORTANT

SOME UNITS ARE DIFFERENT SEE EQUIPMENT DIFFERENCES CHART.

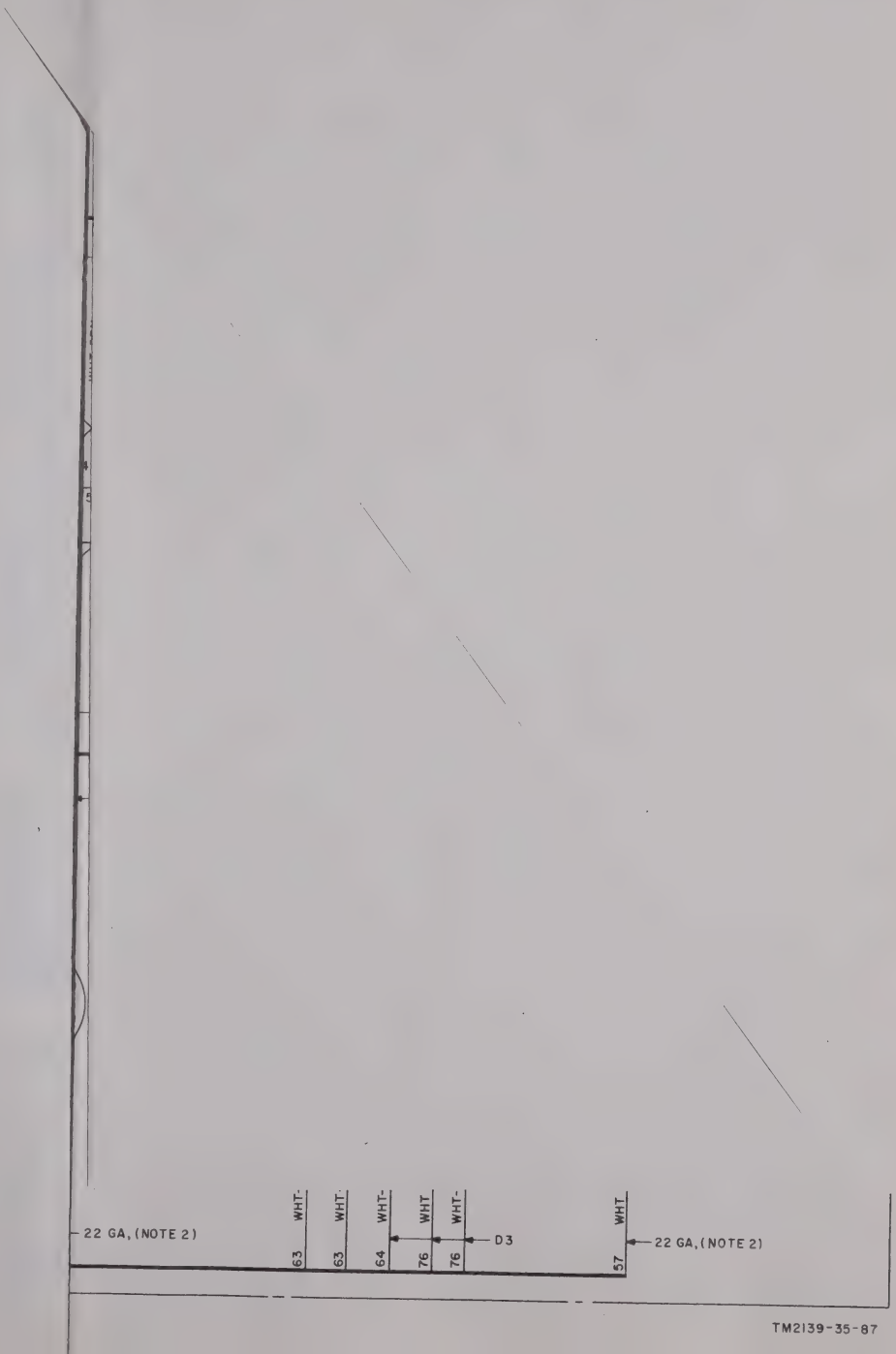




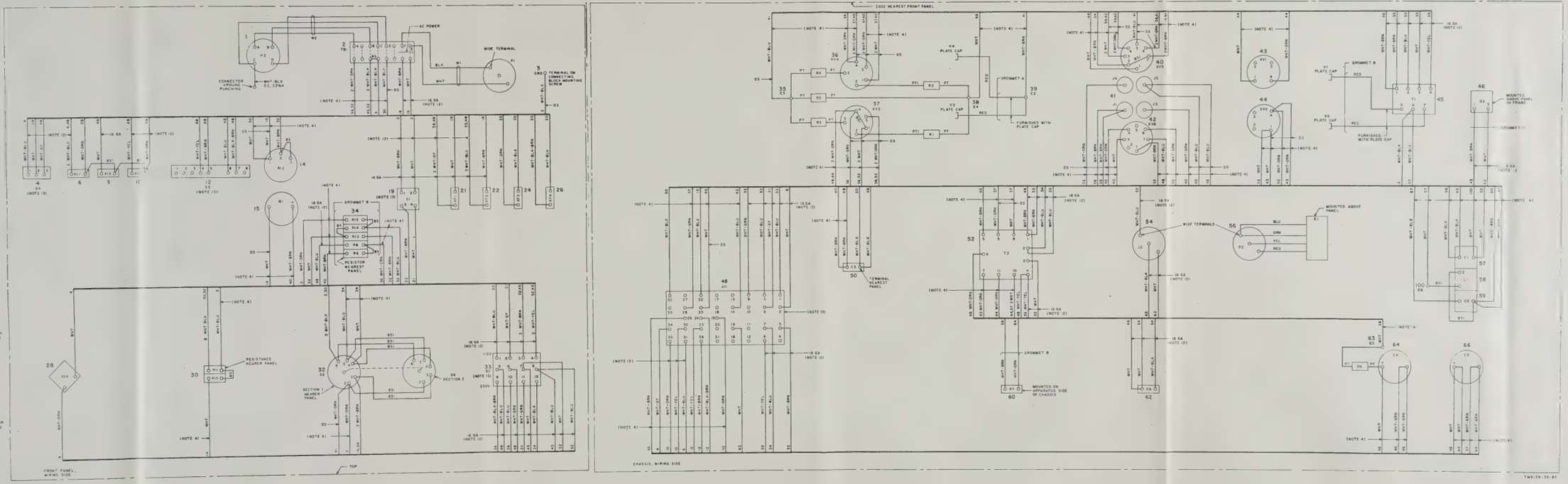
TM2139-35-86

Figure 162.

Figure 162. Low-Voltage rectifier and alarm unit Z1 (part of Power Supply PP-826/U), wiring diagram (revised units).


22 GA, (NOTE 2)
63 WHT-
63 WHT-
64 WHT-
76 WHT
76 WHT-
D3
57 WHT
22 GA, (NOTE 2)

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NOTES:

1. THE SMALL NUMBER ON EACH WIRE ADJACENT TO THE COMMON OR BASE LINE CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRING NOT OTHERWISE SPECIFIED IS DRESSED BACK TO THE PANEL AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
3. WIRING NOT OTHERWISE SPECIFIED HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 1,000 VOLTS AC RMS AND 1,400 VOLTS DC.
4. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 1,500 VOLTS AC RMS AND 2,500 VOLTS DC.
5. 85 DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING.
6. 85A DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
7. PT DENOTES LEADS PART OF APPARATUS
8. PT1 DENOTES LEADS PART OF APPARATUS COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
9. P DENOTES PANEL.
10. ON THIS PIECE OF APPARATUS AN INSULATED SLEEVE 1/2 INCH LONG IS PROVIDED ON ALL WIRED TERMINALS.
11. WIRING NOT OTHERWISE SPECIFIED IS 20 GAGE.
12. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 600 VOLTS AC RMS AND 1,000 VOLTS DC.
13. CONTACT NUMBERS ARE ARBITRARILY ASSIGNED FOR REFERENCE PURPOSES ONLY.

IMPORTANT

SOME UNITS ARE DIFFERENT. SEE EQUIPMENT DIFFERENCES CHART

TM8-356-35-85

Figure 163. Power Supply PP-826/U bearing Order No. 14181-Phila-51, serial numbers 1,170 through 2,964, and Power Supply PP-826A/U, wiring diagram.

NOTES

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRE RUNS.
2. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 2500 VOLTS AC RMS AND 3500 VOLTS DC.
3. THIS WIRING HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 600 VOLTS AC RMS AND 850 VOLTS DC.
4. WIRING NOT OTHERWISE SPECIFIED IS 22 GAGE, AND HAS AN EXTRUDED NYLON JACKET AND INSULATION WHICH HAS A MAXIMUM RATED WORKING VOLTAGE OF 600 VOLTS AC RMS AND 850 VOLTS DC.
5. D3 WIRING IS DRESSED BACK TO THE CHASSIS AND RUN AT RIGHT ANGLES IN THE MOST CONVENIENT MANNER.
6. B5 DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING.
7. BSI DENOTES 20 GAGE TINNED, ANNEALED COPPER WIRING COVERED WITH SILICON IMPREGNATED FIBRE-GLASS SLEEVING.
8. PTI DENOTES LEADS THAT ARE PART OF APPARATUS AND ARE COVERED WITH SLEEVING.
9. WIRING NOT OTHERWISE SPECIFIED IS RUN IN A CABLE FORM.

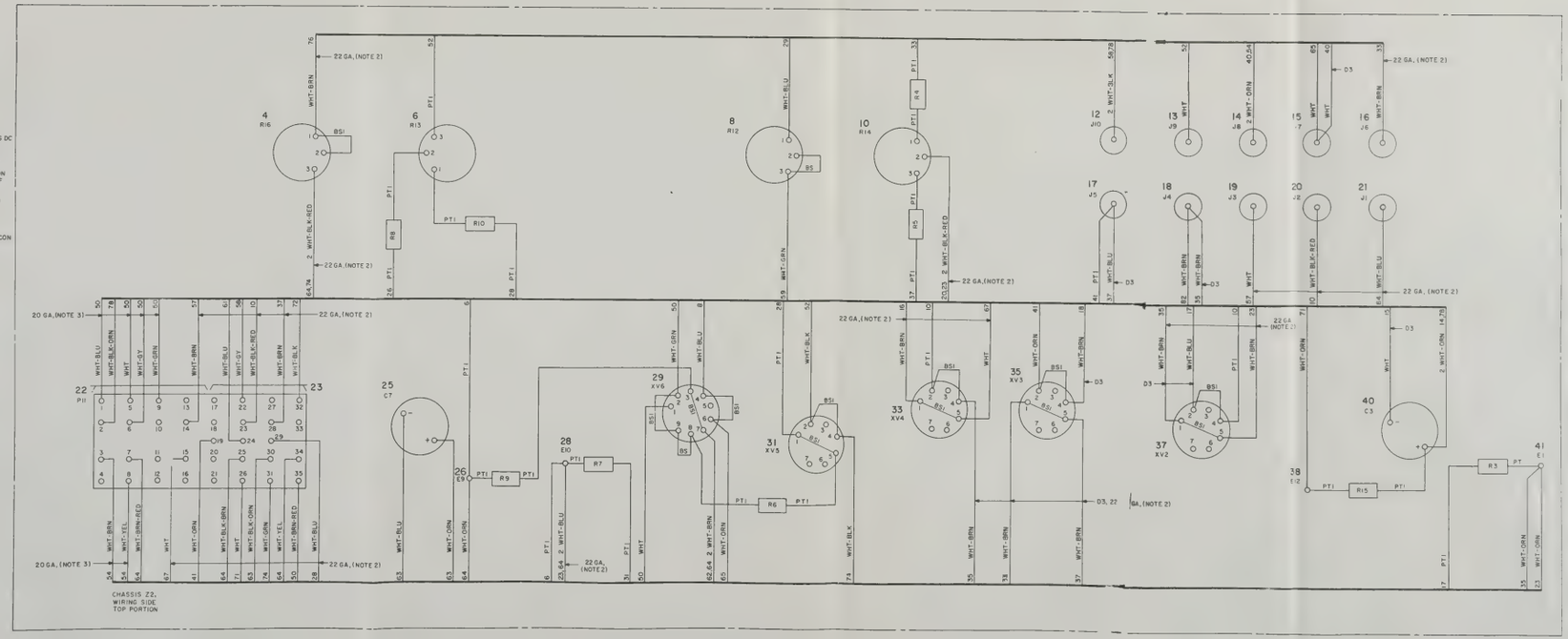
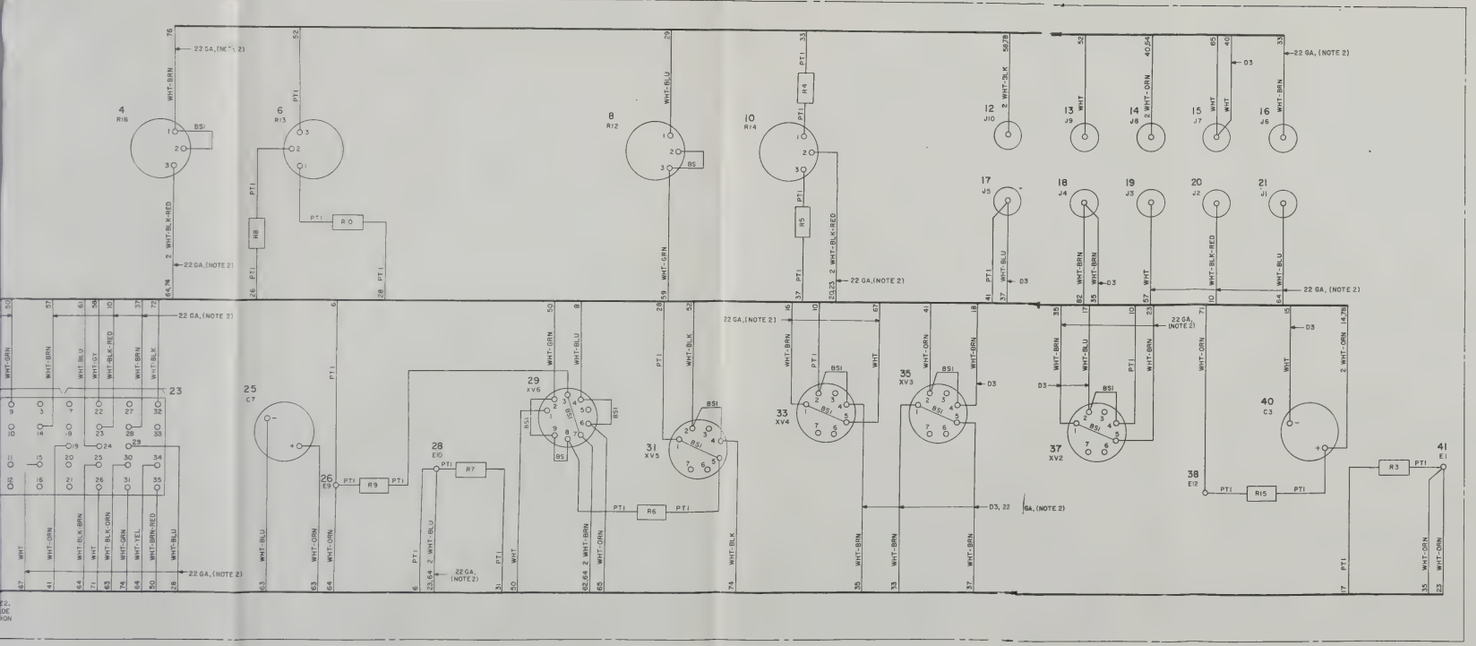
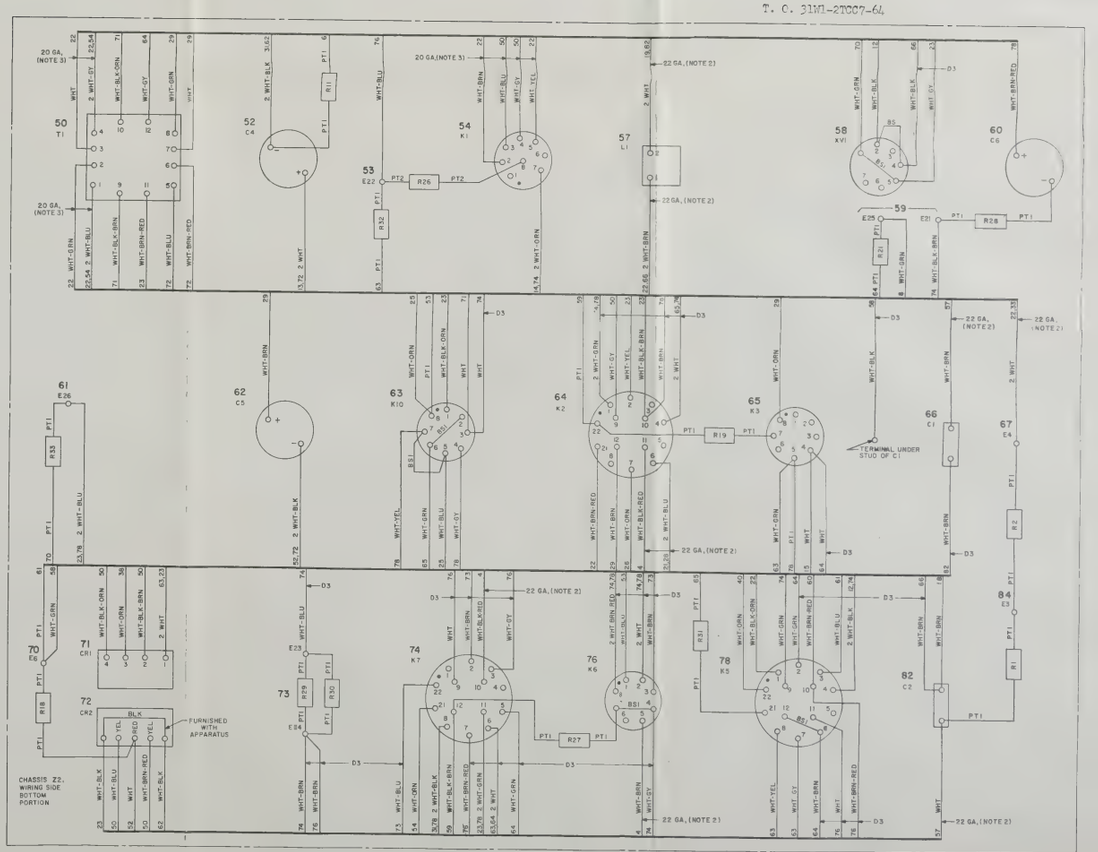


Figure 164. Low-Voltage rectifier and alarm unit Z2 (part of Power Supply PP-826A/U), wiring diagram.

Figure 164.

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TM2139-35-87

Figure 164. Low-Voltage rectifier and alarm unit Z2 (part of Power Supply PP-826A/U), wiring diagram.

T.O. 31W1-2TCC7-64

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-2139-35
TO 31W1-2TCC7-64
C 2

Field and Depot Maintenance Manual
TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

TM 11-2139-35
TO 31W1-2TCC7-64
CHANGES No. 2

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D. C., *23 July 1962*

TM 11-2139-35/TO 31W1-2TCC7-64, 14 November 1958, is changed as follows:

Change the title of the manual to: FIELD AND DEPOT MAINTENANCE MANUAL, TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50.

Note. The parenthetical reference to previous Changes (example: page 1 of C 1) indicates that pertinent material was published in those changes.

Page 2. Add the following note below the title of chapter 1:

Note. Terminal, Telephone AN/TCC-50 and Terminal, Telephone AN/TCC-7 are identical except that Power Supply PP-826(*)/U (600 VOLT POWER SUPPLY) is not provided as a component of the AN/TCC-50. Information in this manual that applies to the AN/TCC-7 also applies to the AN/TCC-50 except for information concerning those applications of the AN/TCC-7 which utilize the 600 VOLT POWER SUPPLY for unattended Repeaters, Telephone AN/TCC-11.

1. Scope

* * * * *

b. (Superseded) The complete technical instructions for this equipment include TM 11-2139-10 and TM 11-2139-20, TM 11-2139-20P, TM 11-2139-35P, TM 11-2150, TM 11-5805-224-20P, TM 11-5805-224-35P, TM 11-5805-245-20P, TM 11-5805-245-35P, TM 11-5805-248-20P, TM 11-5805-248-35P, TM 11-5805-317-20P, and TM 11-5805-317-35P. Refer to appendix I for other technical manuals applicable to the AN/TCC-7.

* * * * *

d. Make the following changes:

Line 3, change "Publications" to: Materiel Support, and after "Agency" add: ATTN: SIGMS-PA2d.

Page 3, paragraph 2, chart. In the "Differences" column, items 10*a*, 11*a*, and *c*, after "R15", add: on the main chassis. Add the following note below the chart.

Note. Low-voltage rectifier and alarm units Z1 and Z2 are *interchangeable* pluckout assemblies. Initially, Z1 is factory-installed in Power Supply PP-826/U and Z2 is factory-installed in Power Supply PP-826A/U. If maintenance personnel replace Z1 with Z2 (or visa versa), the nomenclature plate will not accurately indicate the model designation. Therefore if Z2 is installed in the PP-826/U, theory and maintenance instructions for the PP-826A/U are applicable; if Z1 is installed in the PP-826A/U, theory and maintenance instructions for the PP-826/U are applicable.

Page 9, figure 5 (contained in separate envelope). At winding 4-5 of transformer T18, change "13 Z" to: 135 Z.

Page 27, figure 18 (contained in separate envelope). On connector P103, make the following changes:

Change the terminal designated "E" to: R.
Change the terminal designated "R" to: E.

Page 31, figure 20 (contained in separate envelope). At switch S4, change "(NOTE 12)" to: (NOTE 8).

Page 87, chapter 3. Change the chapter title to: FIELD MAINTENANCE (THIRD AND FOURTH ECHELON).

Section I. After the warning notice, add:

***Caution:* When troubleshooting or making repairs in this equipment, be careful not to strike or damage the standoff terminals.**

Page 162, figure 78 (contained in separate envelope), power test cable assembly terminal board. Make the following changes:

Change the terminal designated "H" to: S.
Change the terminal designated "S" to: H.

Page 244, paragraph 159*a*(4), last line. Change "clockwise" to: counterclockwise.

Page 245, paragraph 159. Make the following changes:

Subparagraph *c*. Delete subparagraphs (1) and (2) and substitute:

(1) Connect the voltmeter ungrounded terminal to pin jack J1 on low-voltage rectifier and alarm unit Z1; connect the voltmeter grounded terminal to pin jack J10 on Z1. Subparagraph *f*(4), line 2, after "0 position," add: operate the RESTORE switch momentarily and release. When the indication on the CURRENT meter rises, adjust the LOAD CURRENT control.

CHAPTER 3.1 (Added)
FOURTH ECHELON TESTING PROCEDURES

Section I. INTRODUCTION

167.1. General

a. These testing procedures for the AN/TCC–7 and components of the AN/TCC–7 are prepared for use by Signal field maintenance shops and Signal service organizations responsible for fourth echelon maintenance of signal equipment to determine the acceptability of repaired signal equipment. They set forth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. These testing procedures may also be used as a guide for testing equipment repaired at third echelon if proper tools and test equipments are available.

b. Test equipment, tools, and material required to perform the testing procedures outlined in this chapter are in listed charts which precede each test and are authorized under TA 11–17, Signal Field Maintenance Shops, and TA 11–100 (11–17), Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States; or TOE 11–158D, Signal Depot Company, and TA 11–101 (11–158D), Allowances of Signal Corps Expendable Supplies for Signal Depot Company; or are repair part items for the AN/TCC–7 that are authorized for stockage at fourth echelon levels.

Note. Specific models and types of test equipment were used to establish the fourth echelon testing procedures outlined in this chapter. If these testing procedures are performed with other models or types of test equipment, make allowance for test connections and equipment control settings that may differ from those specified in this chapter.

167.2. General Test Procedures

Follow the instructions in *a*, *b*, and *c* below to test the equipments listed in *d* below.

a. Physical Tests and Inspections. Perform physical tests and inspections for *each* equipment to be tested (*d* below) as directed in paragraph 167.5.

b. Test and Performance Standards. Prepare a chart which will summarize the tests, performance standards, and test indications for *each* equipment to be tested. Typical charts are included in this chapter and are referenced in *d* below.

c. Test Procedures. Obtain the test equipment and materials required; comply with the requirements for test connections and conditions; then perform the test procedures for each equipment to be tested (*d* below). Follow in sequence the step-by-step instructions for each test procedure; *do not vary the sequence.* For each step, perform all actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each of the actions required in the *Test procedures* column and verify the results obtained; use the corresponding data in the *Performance standards* column as a standard. Record the test results in the *Test indication* column of the test and performance standards chart (*b* above).

d. Test References. Test procedures for each equipment to be tested are referenced in the following chart. Also referenced are applicable charts of tests and performance standards.

Equipment to be tested	Test procedure (par.)	Chart of tests and performance standards (par.)
200 VOLT POWER SUPPLY	167.6	162.7
600 VOLT POWER SUPPLY	167.8	167.9
TEST PANEL	167.10	162.11
CARRIER SUPPLY PANEL	167.12	167.13
CHAN MODEM	167.14	167.15
SUBGROUP PANEL	167.16	167.17
GROUP PANEL	167.18	167.19
ORDER WIRE PANEL	167.20	167.21
AN/TCC–7	167.22	162.23

167.3. Calibration of Test Equipment

Calibrate the test equipment (*a*, *b*, *c*, or *d* below) when required for the fourth echelon testing procedures of some panel and chassis assemblies of the AN/TCC–7. After the calibration procedures are

completed, do not remove the ac power from the equipment until the testing procedures are completed.

a. SG–15/PCM.

(1) Operate the ON-OFF switch to OFF and the PRIMARY VOLTAGE switch to the position that corresponds with the ac power source.

(2) Connect the GND terminal to an external ground.

(3) Connect the ac power cable to the ac power source.

(4) Set the FREQUENCY control to the 200-cps point as indicated on the KILOCYCLES dial. Set the COARSE DBM switch to ZERO OUTPUT.

(5) Operate the ON-OFF switch to ON. Allow the SG–15/PCM to warm up 10 to 15 minutes before proceeding.

(6) Set the FINE DBM control for a reading of approximately +6 on the OUTPUT LEVEL meter.

(7) Set the FREQUENCY control to 0 as indicated on the KILOCYCLES dial.

(8) Adjust the ZERO BEAT ADJ. control for a zero beat, indicated by no deflection on the OUTPUT LEVEL meter.

Note. As the FREQUENCY control is varied above and below 0 on the KILOCYCLES dial, observe that the *zero beat region* is about one-eighth inch wide. Set the ZERO BEAT ADJ. control so that zero frequency is in the center of this region.

b. ME–22/PCM.

(1) Operate the ON-OFF switch to OFF and the PRIMARY VOLTAGE switch to the position that corresponds to the ac power source.

(2) Connect the GND terminal to an external ground.

(3) Connect the SG–15/PCM (calibrated as given in *a* above) and the ME–22/PCM as shown in figure 128.1.

(4) Connect the ac power cable to the ac power source and operate the power ON-OFF switch to ON. Allow the ME–22/PCM to warm up for 5 to 10 minutes before proceeding.

(5) Operate the INPUT IMPEDANCE switch of the ME–22/PCM to 600 OHM. Operate the DBM switch to 0 on SCALE B.

(6) Adjust the FREQUENCY control of the SG–15/PCM for a 1,000-cps indication on the KILOCYCLES dial.

(7) Operate the COARSE DBM switch to 0.

(8) Operate the FINE DBM control for a 0-db indication on the OUTPUT LEVEL meter.

(9) Adjust the CAL ADJ control on the ME–22/PCM until the dbm meter indicates 0 on SCALE B.

(10) Set the DBM switch to 0 on SCALE A. The meter should read 0 db ±0.5 on SCALE A. If this indication is not obtained, repeat the procedures given in (8) and (9) above.

(11) Disconnect the hookup wires from the OUTPUT binding posts of the SG–15/PCM and the INPUT binding posts of the ME–22/PCM.

c. ME–71A/FCC.

(1) Connect the ac power cord to the ac power source and operate the AUD. GAIN control to midposition. Allow the ME–71A/FCC to warm up at least 20 minutes.

(2) Operate the METER switch to CAL. 1. The panel meter should indicate 0 db.

(3) Operate the METER switch to CAL. 2 (100 KC) and the ATTENUATOR DB switch to 0.

(4) Adjust the tuning dial at 100 kc for maximum meter indication.

(5) Adjust the CAL. 2 (I.F. GAIN) control until the panel meter indicates 0 db.

(6) Operate the METER switch to MEAS.

d. AN/TCC–7. An AN/TCC–7 is required as a test set for some fourth echelon tests of the panel and chassis assemblies of an AN/TCC–7. Before it can be used as a test set, test and adjust each panel and chassis assembly and subassembly of the AN/TCC–7; use the procedures given in chapter 4 then, perform the procedures given in paragraph 167.22*b* and *c* to calibrate the AN/TCC–7. *Do not change the settings of switches and controls used in paragraph 167.22b and c.*

167.4. Modification Work Orders

The performance standards for tests of the AN/TCC–7 or components of the AN/TCC–7 do not reflect any equipment modifications resulting from modification work orders (MWO's), since none exist for the AN/TCC–7 or components of the AN/TCC–7 as of the date of *these* changes publication. If the AN/TCC–7 or components of the

Figure 128.1. Calibration test setup for ME-22/PCM.

AN/TCC–7 are subsequently modified to reflect MWO's published after the date of *these* changes, take into account any test indications which may differ as a result of the equipment modification. A listing of the current MWO's will be found in DA Pamphlet 310–4.

167.5. Physical Tests and Inspection

a. Test Equipment. None required.

b. Conditions. Remove the panel and chassis assembly of the AN/TCC–7 from its case.

c. Procedure.

Test equipment control settings	Equipment under test control settings	Test and inspection procedures	Performance standards
N/A	Controls may be in any position.	*a.* Inspect front panel. Look for damaged, loose, or missing screws, knobs, or other parts.	*a.* No evidence of damaged, loose, or missing screws, knobs, or parts is found.
		b. Inspect front panel and chassis (top and bottom). Look for dirt, signs of excessive wear or damage, loose or missing components and hardware.	*b.* Front panel and chassis are clean. No evidence of excessive wear, damage, or loose or damaged components or hardware is found.
		c. Inspect condition of finish. Look for rust, corrosion, and spots where bare metal is exposed.	*c.* Painted surfaces do not show bare metal spots and no evidence of rust or corrosion is seen. *Note.* Touchup painting instead of refinishing is recommended whenever practicable. Do not polish with abrasives or paint screwheads, binding posts, and plated fasteners.
		d. Operate each switch and control on front panel and internal panels.	*d.* Switches and controls operate smoothly with positive action to indicated position.
		e. Inspect condition of all jacks and binding posts. Look for cracks and broken parts, and note condition of jack spring contacts.	*e.* No evidence of cracks or broken parts on jacks and binding posts. Jack contact springs are straight and show positive action in opening and closing.
		f. Inspect condition of all cables, cable connectors, and cable connector receptacles. Look for broken cable insulation, cracked connector and receptacle insulation, and missing or bent connector pins.	*f.* No evidence of broken cable insulation, cracked connector and receptacle insulation, or missing or bent connector pins.
		g. On PP–827/U and PP–826(*)/T, inspect fuseholders; look for burns, breaks, and insufficient spring tension. Check rating of each fuse.	*g.* Fuseholders show no sign of burning or being broken, and spring tension is strong. Refer to panel marking on equipment for proper fuse ratings.
		h. Inspect chassis; be sure tubes, tube shields, and clamps are in proper places.	*h.* Tubes, tube shields, and clamps are in proper place.
		i. Check equipment for applicable MWO (par. 167.4).	*i.* Equipment marked to indicate MWO, if applicable.

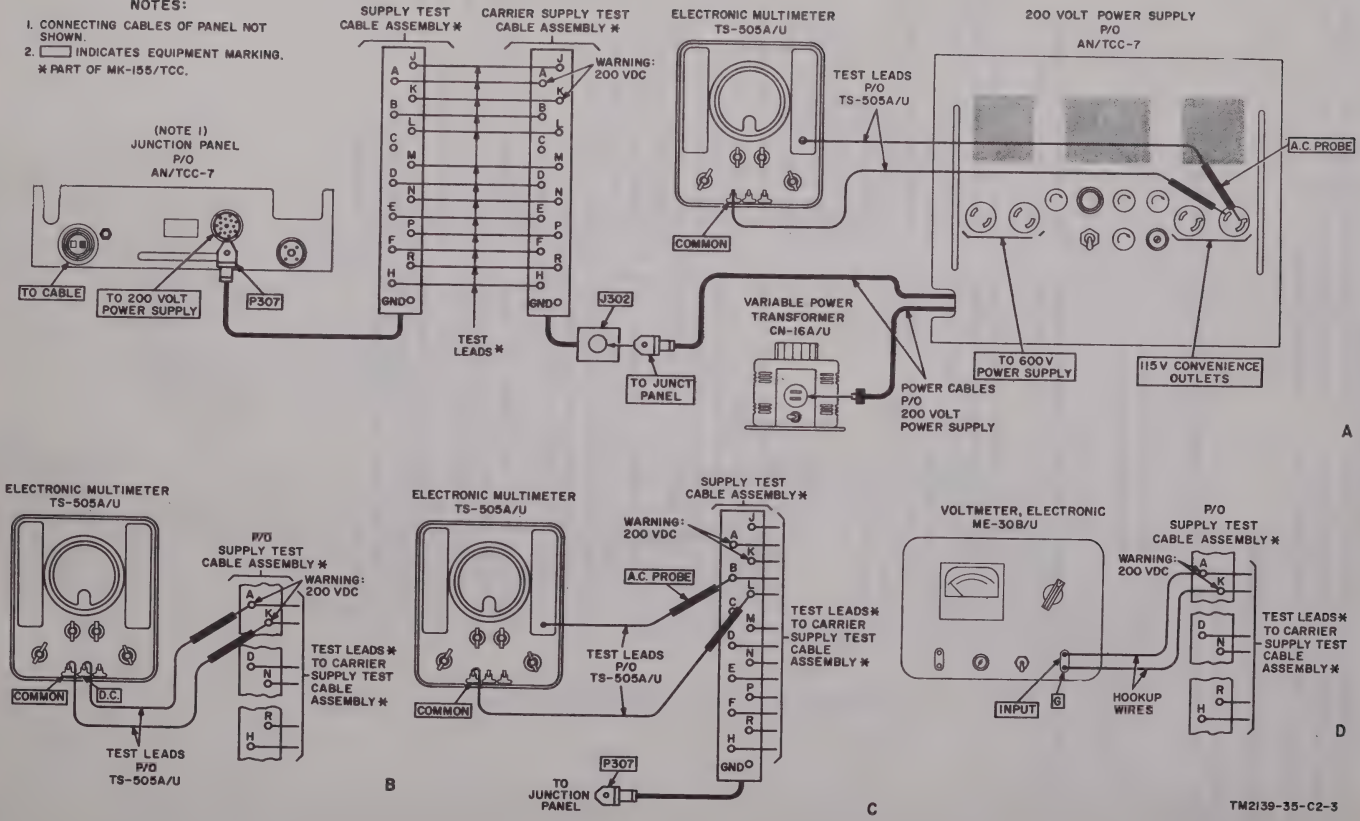


Figure 128.2 Test setups fourth echelon tests of 200 VOLT POWER SUPPLY.

167.7. Chart of Tests and Performance Standards, 200 VOLT POWER SUPPLY

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.6c.

Item	Test	Performance standard	Test indication
1	AC INPUT CIRCUITS:		
	AC POWER lamp	AC POWER lamp lights	
	115V CONVENIENCE OUTLETS	115 volts ac	
	115V–230V switch at 230V	0 volt	
	TO 600V POWER SUPPLY outlets indication	115 volts ac	
2	200-VOLTS DC OUTPUT:		
	200V ADJ control counterclockwise	Not more than 190 volts dc, and not less than 150 volts dc ±10	
	200V ADJ control clockwise	Not less than 210 volts dc, and not more than 260 volts dc ±10	
	200V ADJ control adjusted	200 volts dc	
	97 volts ac input	Between 197 and 200 volts dc	
	130 volts ac input	Between 200 and 203 volts dc	
	115V–230V switch at 230V	70 volts dc ±5	
3	−10 VOLTS DC OUTPUT:		
	Push-to-talk switch unoperated	11 volts dc ±1	
	Push-to-talk switch operated	8 volts dc ±1	
	115V–230V switch at 230V	4 volts dc ±0.5	
4	FILAMENT VOLTAGES OUTPUT:		
	At terminals B and L	6.2 volts ac ±0.2	
	At terminals E and J	6.2 volts ac ±0.2	
	At terminals F and P	6.2 volts ac ±0.2	
	At terminals M and N	6.2 volts ac ±0.2	
	At terminals M and N with 115V–230V switch at 230V	3 volts ac ±0.2	
5	AC OUTPUT RIPPLE VOLTAGES AND BLOWER OPERATION:		
	At terminals A and K	0.01 volt ac maximum	
	At terminals D and H:		
	Push-to-talk switch unoperated	*a.* 0.03 volt ac maximum	
	Push-to-talk switch operated	*b.* Same as indication obtained in *a* above	
	Blower operation	Blower is operating, forcing air out of front grill	

167.9. Chart of Tests and Performance Standards, 600 VOLT POWER SUPPLY

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.8*c*.

Item	Test	Performance standard	Test indication
1	NORMAL OUTPUT:		
	Current indication (starting)	80 ma ±15 within approximately 8 seconds	
	Alarm indications	Buzzer sounds and LOAD ALARM lamp lights; on PP-826A/U, LOW VOLTAGE lamp also lights.	
	Current indication (20 seconds)	100 ma	
	Alarm indications	Buzzer is silenced and LOAD ALARM lamp extinguished; on PP-826A/U, LOW VOLTAGE lamp is also extinguished.	
	I-199-A current indication	100 ma ±2	
	Terminals C and D indication	275 volts dc ±10	
2	LOW-OUTPUT VOLTAGE:		
	530-volt condition	LOAD ALARM and LOW VOLTAGE lamps extinguished and buzzer is silent.	
	Power cutoff condition	LOAD ALARM and LOW VOLTAGE lamps light and buzzer sounds. On PP-826/U, CURRENT meter indicates 0 ma; on PP-826A/U, CURRENT meter indicates 100 ma.	
	RESTORE switch operation	CURRENT meter indication rises to 100 ma	
	Normal condition	In approximately 20 seconds, LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent.	
3	HIGH-OUTPUT VOLTAGE:		
	670-volt condition	CURRENT meter indicates 100 ma; no alarm lamps light and buzzer is silent.	
	Power cutoff condition	LOAD ALARM and HIGH VOLTAGE lamps light and buzzer sounds; CURRENT meter indicates 0 ma.	
	RESTORE switch operation	In approximately 20 seconds, LOAD ALARM and LOW VOLTAGE lamps are extinguished and buzzer is silent. CURRENT meter indicates 100 ma.	
4	LOAD CURRENT CONTROL RANGE:		
	Full counterclockwise	85 ma ±5	
	Full clockwise	120 ma ±5	
5	600 V ADJ CONTROL RANGE	110 volts dc ±10	
6	AC LINE AND RIPPLE VOLTAGES, PP-826/U:		
	a. Ripple voltage at 115 vac	*a*. 0.02 volt ac, maximum	
	b. Indications at 100 vac	*b*. CURRENT meter indicates 100 ma; no alarms are obtained	
	c. Ripple voltage at 100 vac	*c*. Same as obtained in *a* above	
	d. Indications at 90 vac	*d*. LOAD ALARM lamp cycles on and off; and simultaneously, CURRENT meter cycles between 0 and 100 ma.	

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	e. Indications at 65 vac	*e.* LOAD ALARM lamp lights and CURRENT meter indicates 0 ma	
	f. Ac power restored	*f.* Same as *e* above	
	g. Indication at 130 vac	*g.* CURRENT meter indicates 100 ma +2	
	h. Ripple voltage	*h.* Same as obtained in *a* above	
7	AC LINE AND RIPPLE VOLTAGES, PP-826A/U:		
	a. Ripple voltage at 115 vac	*a.* 0.02 vac maximum	
	b. Indication at 90 vac	*b.* CURRENT meter indicates 100 ma	
	c. Ripple voltage at 90 vac	*c.* Same as obtained in *a* above	
	d. Ac power restored	*d.* In 2 to 3 seconds, CURRENT meter indicates 100 ma; LOAD CURRENT and LOW VOLTAGE lamps light. In 20 seconds (approx), lamps are extinguished.	
	e. Lowering ac voltage	*e.* At 80 vac ±5, LOAD ALARM and LOW VOLTAGE lamps light	
	f. Ac power restored	*f.* CURRENT meter indicates 0 ma and LOAD ALARM lamp lights	
	g. Indication at 130 vac	*g.* CURRENT meter indicates 100 ma +2	
	h. Ripple voltage	*h.* Same as obtained in *a* above	
8	LOW OUTPUT VOLTAGE, PP-826/U:		
	a. Ac power applied	*a.* CURRENT meter indicates 10 ma ±2 and LOAD ALARM lamp lights.	
	b. Load applied	*b.* Same as obtained in *a* above	
	c. Dc power applied	*c.* LOAD ALARM lamp lights and CURRENT meter indication slowly rises to 100 ma; OUTPUT meter on I–199–A indicates 480 vdc ±10. After approximately 20 seconds, LOAD ALARM lamp extinguishes. Immediately cutoff occurs: CURRENT meter indicates 0 ma and LOAD ALARM lamp lights.	
9	LOW OUTPUT VOLTAGE PP-826A/U:		
	a. Ac power applied	*a.* CURRENT meter indicates 0 ma and LOAD ALARM lamp lights.	
	b. Load applied	*b.* Same as *a* above	
10	REPEATER SWITCH POSITIONS AND BLOWER OPERATION:		
	a. Position 2 of REPEATER switch	*a.* CURRENT meter indicates 100 ma and no alarms are obtained. OUTPUT meter of I–199–A indicates 420 vdc ±20. TS–352/U meter indicates 600 vdc ±10.	
	b. Position 1 of REPEATER switch	*b.* CURRENT meter indicates 100 ma and TS–352/U meter indicates 600 vdc ±10. No alarms are obtained.	
	c. RESTORE switch operated	*c.* CURRENT meter indicates 100 ma and no alarms are obtained	
	d. TEST position of REPEATER switch	*d.* Same as *c* above	
	e. Blower operation	*e.* Blower is operating and forcing air *out* through front grill	

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167.11. Chart of Tests and Performance Standards, TEST PANEL

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.10c.

Item	Test	Performance standard	Test indication
1	200-VOLT MEASUREMENT:		
	TEST PANEL meter indication	0 db	
	TS-352/U meter indication	200 volts dc ±10	
2	600-VOLT MEASUREMENT:		
	TEST PANEL meter indication	0 db	
	TS-352/U meter indication	200 volts dc ±10	
3	1-KC CIRCUIT:		
	Frequency	1,000 cps ±20	
	1-KC control clockwise	+2.5 db or more	
	1-KC control counterclockwise	−2.5 db or less	
4	65-KC AND FAULT TEST FREQUENCIES:		
	SEND lamp	SEND lamp lights	
	65-kc output	65,000 cps ±150	
	REP 1 output	99,000 cps ±150	
	REP 2 output	91,000 cps ±150	
	REP 3 output	83,000 cps ±150	
5	METER CALIBRATION:		
	TEST PANEL meter indication	0 db ±0.5	
	2-db gain	+2 db ±0.5	
	5-db gain	+5 db ±0.5	
	Attenuator 5-db pushbutton	0 db ±0.5	
	7-db gain	+7 db ±0.5	
	Attenuator 10-db pushbutton	0 db ±0.5	
	Attenuator 20-db pushbutton	0 db ±0.5	
	3-db loss	−3 db ±0.5	
	5-db loss	−5 db ±0.5	
	7-db loss	−7 db ±0.5	
6	65-KC OSCILLATOR OUTPUT LEVEL:		
	HF control clockwise	+2.5 db or higher	
	HF control counterclockwise	−2.5 db or less	
	HF control adjusted	0 db	

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Item	Test	Performance standard	Test indication
7	65-KC GAIN ADJUSTMENT:		
	FINE TUNE control adjusted	Peak indication obtained	
	AMP GAIN control adjusted	0 db	
	GAIN control clockwise	Between ±1 and +1.5 db	
	GAIN control counterclockwise	Between −1.5 and −1 db	
	GAIN control adjusted	0 db	
8	ORDER WIRE TRANSMISSION	+2.5 db ±0.5	
9	ORDER WIRE RECEPTION	0 db ±0.5	
10	68-KC TRANSMISSION	0 db ±0.5	
11	SUBGROUP PANEL INPUT:		
	MOD IN 1	0 db ±3	
	MOD IN 2	0 db ±3	
	MOD IN 3	0 db ±3	
12	TRANSMISSION MODULATION	0 db ±2	
13	83-KC TRANSMISSION	0 db ±2	
14	99-KC TRANSMISSION	0 db ±1	
15	37-KC TRANSMISSION	0 db ±0.5	
16	12-KC TRANSMISSION:		
	TR AMP OUT	0 db ±0.5	
	REC AMP 2 OUT	0 db ±0.5	
17	28-KC TRANSMISSION:		
	TR AMP OUT	0 db ±0.5	
	REC AMP 2 OUT	0 db ±0.5	
18	GROUP PANEL DEMODULATOR OUTPUT	0 db ±0.5	
19	SUBGROUP PANEL OUTPUT:		
	DEM OUT 1	0 db ±0.5	
	DEM OUT 2	0 db ±0.5	
	DEM OUT 3	0 db ±0.5	
20	FAULT TEST LEVEL MEASUREMENT:		
	SEND lamp indication	SEND lamp lights	
	FAULT TEST-REP 1	0 db ±1	

	FAULT TEST-REP 2	0 db ±1	
	FAULT TEST-REP 3	0 db ±1	
21	65-KC TRANSMISSION:		
	65 KC TR OR FAULT TEST control clockwise	−23 db ±1	
	Counterclockwise	−32 db ±1	
	TEST PANEL meter indication	0 db ±1.5	
	Adjusted	0 db	
22	65-KC RECEPTION:		
	SEND lamp indication	SEND lamp lights	
	65 KC REC control clockwise	−25 db ±1	
	Counterclockwise	−60 db ±5	
	TEST PANEL meter indication	0 db +1.5	
	Adjusted	0 db	
23	62-KC TRANSMISSION	No meter indication, or peak indication at left of −5 db	
24	62-KC RECEPTION	No meter indication, or peak indication at left of −5 db	
25	CARRIER SUPPLY CIRCUIT	0 db ±3	
26	CHAN MODEM OUTPUT	0 db	
27	TO TS-712/TCC-11 TEST SET CONNECTOR MEASUREMENTS:		
	ME-30B/U meter indication	−22 db ±2	
	TS-352/U meter indications	680 ohms ±10 percent	

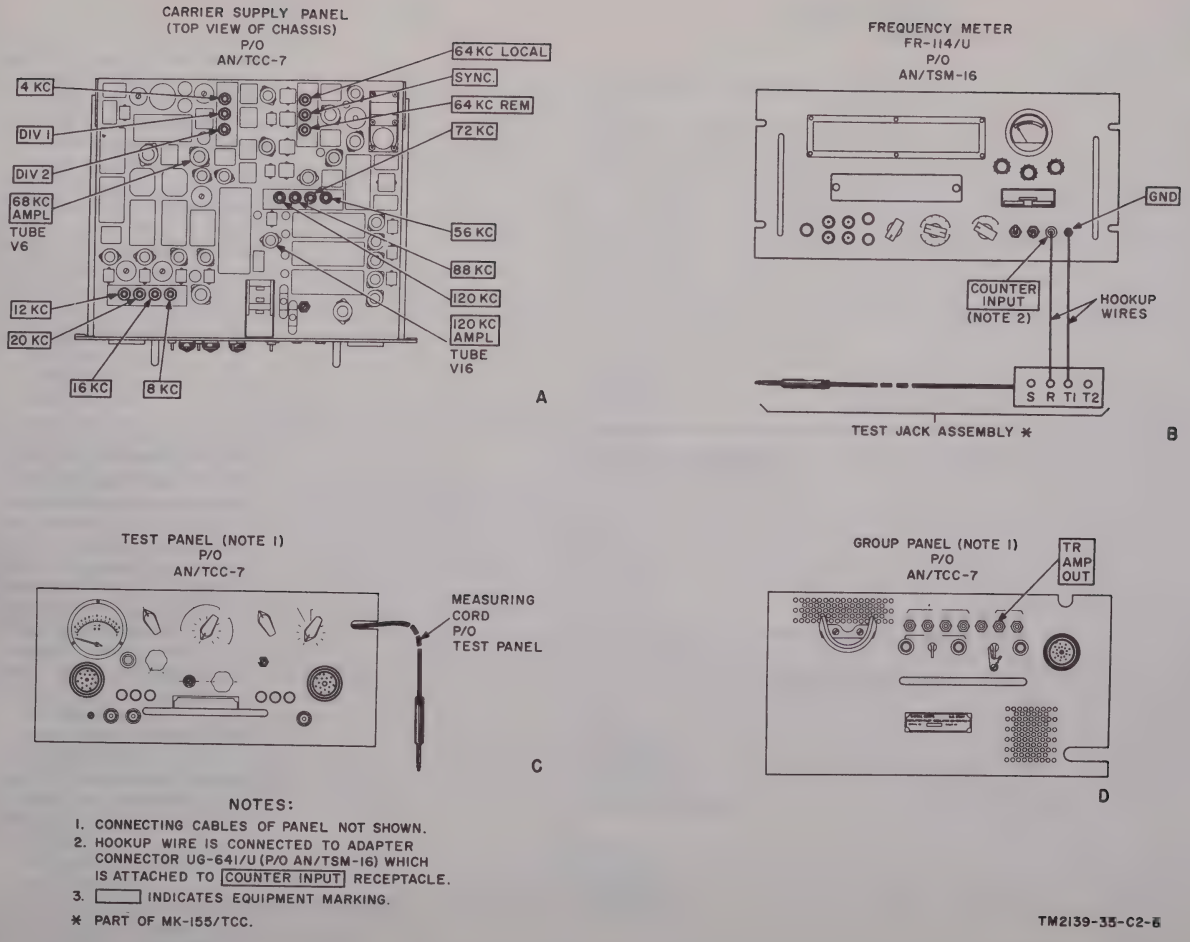


Figure 128.5 Test setups for fourth echelon tests of CARRIER SUPPLY PANEL.

167.13. Chart of Tests and Performance Standards, CARRIER SUPPLY PANEL

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.12c.

Item No.	Test	Performance standard	Test indication
1	DIVIDER CIRCUITS:		
	64KC LOCAL	0 db ±3	
	DIV 1	0 db ±3	
	DIV 2	0 db ±3	
	4KC	0 db ±3	
	8KC	0 db ±3	
	16 KC	0 db ±3	
	20KC	0 db ±3	
	12KC	0 db ±3	
	56KC	0 db ±3	
	72KC	0 db ±3	
	88KC	0 db ±3	
	120KC	0 db ±3	
2	REMOTE PILOT OPERATION:		
	4KC	0 db ±3	
	SYNC	0 db ±3	
	64KC REM	0 db ±3	
	64KC LOCAL	No indication	
3	FREQUENCY CHECK:		
	64KC LOCAL	64,000 cps ±2	
	4KC	4,000 cps ±1	
4	68-KC CIRCUIT:		
	68KC control counterclockwise	−2 db or less	
	68KC control clockwise	+2 db or more	
5	12-KC CIRCUIT:		
	12 & 28KC lamp	12 & 28KC lamp lights	
	12KC control counterclockwise	−3 db or less	
	12KC control clockwise	+3 db or more	
6	28-KC CIRCUIT:		
	28KC control counterclockwise	−2 db or less	
	28KC control clockwise	+2 db or more	
7	ALARM CIRCUITS:		
	Tube V16 removed	120KC ALARM lamp on CARRIER SUPPLY PANEL lights and buzzer in GROUP PANEL sounds.	
	120KC CUTOFF ALARM switch operated	120KC AAARM lamp remains lighted and buzzer is silenced.	
	Tube V16 replaced	120KC ALARM lamp is extinguished and buzzer sounds.	
	120KC CUTOFF ALARM switch operated	Buzzer is silenced	
	Tube V6 removed	68KC ALARM and 120 KC ALARM lamps light and buzzer sounds.	
	Tube V6 replaced	68KC ALARM and 120KC ALARM lamps are extinguished and buzzer is silenced.	

167.15. Chart of Tests and Performance Standards, CHAN MODEM

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.14c.

Item	Test	Performance standard	Test indication
1	TRANSMITTING BRANCH LOSS, CHANNELS 1, 2, 3, AND 4, CHAN MODEM 1:		
	Channel 1	−45.5 dbm ±1	
	Channel 2	Same	
	Channel 3	Same	
	Channel 4	Same	
2	TRANSMITTING BRANCH OVERLOAD LOSS, CHANNELS 1, 2, 3, AND 4, CHAN MODEM 1:		
	Channel 1	−27 dbm ±2	
	Channel 2	Same	
	Channel 3	Same	
	Channel 4	Same	
3	TRANSMITTING BRANCH, ORDER WIRE CIRCUIT, CHANNELS 1, 2, 3, AND 4, CHAN MODEM 1:		
	Channel 1	−45 dbm ±2	
	Channel 2	Same	
	Channel 3	Same	
	Channel 4	Same	
4	TRANSMITTING BRANCH, TEST FREQUENCY CIRCUIT, CHANNELS 1, 2, 3, AND 4, CHAN MODEM 1:		
	Channel 1	−45 dbm ±2	
	Channel 2	Same	
	Channel 3	Same	
	Channel 4	Same	
5	RECEIVING BRANCH, CHANNEL 1, GAIN CONTROL ADJUSTMENT, CHAN MODEM 1:		
	GAIN control clockwise	*a.* Between +3 and +8 dbm	
	GAIN control counterclockwise	*b.* 20 db less than indication obtained in *a* above	
	GAIN control adjusted	*c.* 0 dm	
6	RECEIVING BRANCH, CHANNEL 2, GAIN CONTROL ADJUSTMENT, CHAN MODEM 1:		
	GAIN control clockwise	*a.* Between +3 and +8 dbm	
	GAIN control counterclockwise	*b.* at least 20 db less than indication obtained in *a* above	
	GAIN control adjusted	*c.* 0 dbm	

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Item	Test	Performance standard	Test indication
7	RECEIVING BRANCH, CHANNEL 3, GAIN CONTROL ADJUSTMENT, CHAN MODEM 1:		
	GAIN control clockwise	*a.* Between +3 and +8 dbm	
	GAIN control counterclockwise	*b.* At least 20 db less than indication obtained in *a* above	
	GAIN control adjusted	*c.* 0 dbm	
8	RECEIVING BRANCH, CHANNEL 4, GAIN CONTROL ADJUSTMENT, CHAN MODEM 1:		
	GAIN control clockwise	*a.* Between +3 and +8 dbm	
	GAIN control counterclockwise	*b.* At least 20 db less than indication obtained in *a* above	
	GAIN control adjusted	*c.* 0 dbm	
9	RECEIVING BRANCH, CHANNEL 1, TEST FREQUENCY CIRCUIT, CHAN MODEM 1.	0 dbm ±0.5	
10	RECEIVING BRANCH, CHANNEL 2, TEST FREQUENCY CIRCUIT, CHAN MODEM 1.	0 dbm ±0.5	
11	RECEIVING BRANCH, CHANNEL 3, TEST FREQUENCY CIRCUIT, CHAN MODEM 1.	0 dbm ±0.5	
12	RECEIVING BRANCH, CHANNEL 4, TEST FREQUENCY CIRCUIT, CHAN MODEM 1.	0 dbm ±0.5	
13	RECEIVING BRANCH, CHANNEL 1, ORDER WIRE CIRCUIT, CHAN MODEM 1:		
	TALK switch operated	0 dbm ±0.5	
	MON switch operated	−21 dbm ±1	
14	RECEIVING BRANCH, CHANNEL 2, ORDER WIRE CIRCUIT, CHAN MODEM 1:		
	TALK switch operated	0 dbm ±0.5	
	MON switch operated	−21 dbm ±1	
15	RECEIVING BRANCH, CHANNEL 3, ORDER WIRE CIRCUIT, CHAN MODEM 1:		
	TALK switch operated	0 dbm ±0.5	
	MON switch operated	−21 dbm ±1	
16	RECEIVING BRANCH, CHANNEL 4, ORDER WIRE CIRCUIT, CHAN MODEM 1:		
	TALK switch operated	0 dbm ±0.5	
	MON switch operated	−21 dbm ±1	

17	HYBRID BALANCE, CHANNEL 1, CHAN MODEM 1	—40 dbm or less	
18	HYBRID BALANCE, CHANNEL 2, CHAN MODEM 1	—40 dbm or less	
19	HYBRID BALANCE, CHANNEL 3, CHAN MODEM 1	—40 dbm or less	
20	HYBRID BALANCE, CHANNEL 4, CHAN MODEM 1	—40 dbm or less	

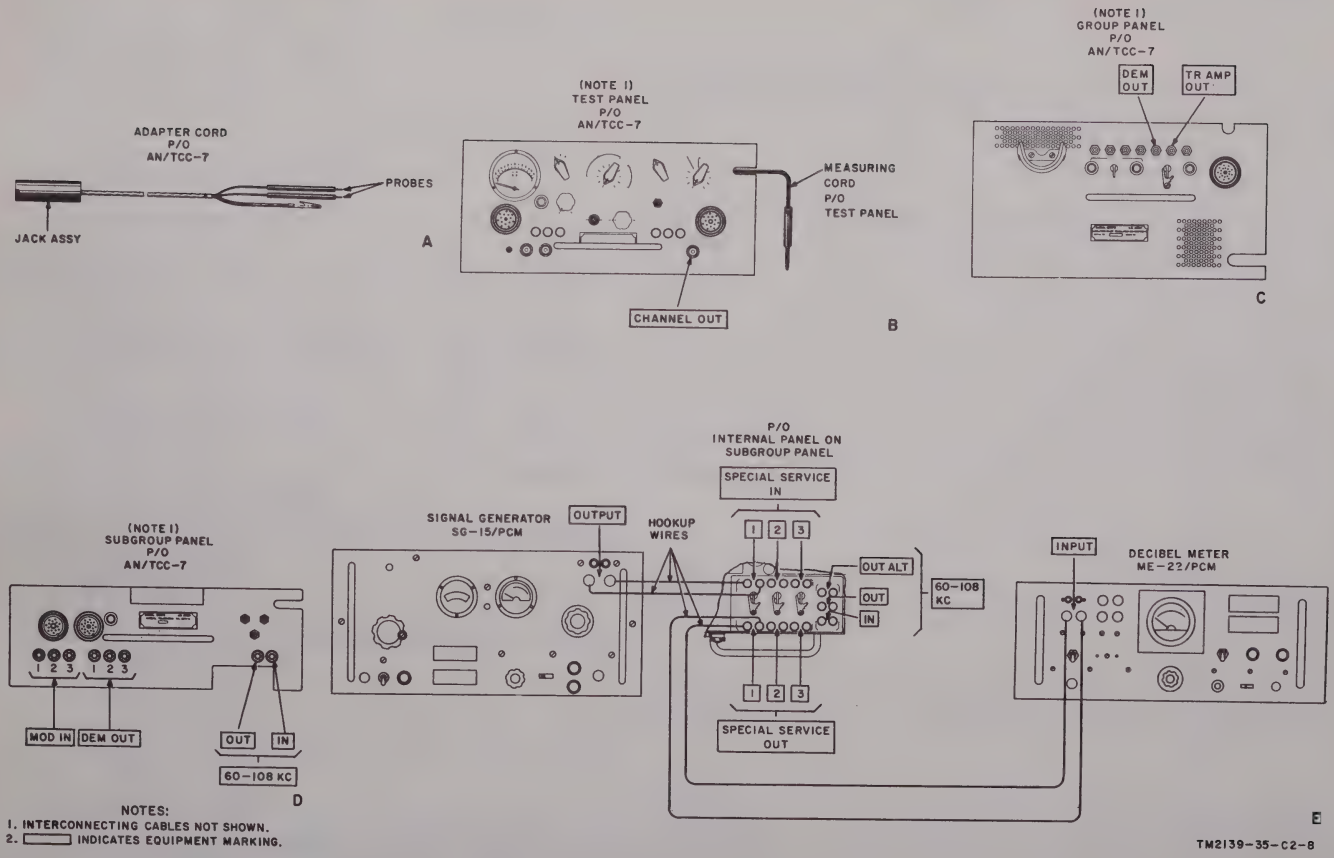


Figure 128.7. Test setups for fourth echelon tests of SUBGROUP PANEL.

167.17. Chart of Tests and Performance Standards, SUBGROUP PANEL

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.16c.

Item	Test	Performance standard	Test indication
1	TRANSMITTING CIRCUIT INPUT:		
	MOD IN 1 jack	0 db ±3	
	MOD IN 2 jack	0 db ±3	
	MOD IN 3 jack	0 db ±3	
2	83-KC TRANSMISSION:		
	60–108 KC OUT jack	*a.* +2 db ±1	
	TR AMP GAIN counterclockwise	*b.* 6 db ±1 less than indication obtained in *a* above	
	TR AMP GAIN adjusted	*c.* 0 db	
	60–108-KC binding posts	*d.* 0 db ±1	
	60–108-KC OUT ALT binding posts	*e.* 0 db ±1	
3	67-KC TRANSMISSION	0 db ±2	
4	99-KC TRANSMISSION	0 db ±2	
5	37-KC TRANSMISSION	0 db	
6	RECEIVING CIRCUIT, INPUT CHECK:		
	60–108 KC IN jack	0 db	
	60–108 KC IN binding posts	0 db	
7	RECEIVING CIRCUIT, OUTPUT OF SUBGROUP PANEL TO CHAN MODEM 1:		
	DEM 1 GAIN clockwise	*a.* Not less than +4 db	
	DEM 1 GAIN counterclockwise	*b.* At least 9 db less than indication obtained in *a* above	
	DEM 1 GAIN adjusted	*c.* 0 db	
8	RECEIVING CIRCUIT, OUTPUT OF SUBGROUP PANEL TO CHAN MODEM 2:		
	DEM 2 GAIN clockwise	*a.* Not less than +4 db	
	DEM 2 GAIN counterclockwise	*b.* At least 9 db less than indication obtained in *a* above	
	DEM 2 GAIN adjusted	*c.* 0 db	
9	RECEIVING CIRCUIT, OUTPUT OF SUBGROUP PANEL TO CHAN MODEM 3:		
	DEM 3 GAIN clockwise	*a.* Not less than +4 db	
	DEM 3 GAIN counterclockwise	*b.* At least 9 db less than indication obtained in *a* above	
	DEM 3 GAIN adjusted	*c.* 0 db	
10	RECEIVING CIRCUIT, OUTPUT OF SUBGROUP PANEL THROUGH CHAN MODEM 1.	0 db	

11	RECEIVING CIRCUIT, OUTPUT OF SUBGROUP PANEL THROUGH CHAN MODEM 2.	0 db	
12	RECEIVING CIRCUIT, OUTPUT OF SUBGROUP PANEL THROUGH CHAN MODEM 3.	0 db	
13	SPECIAL SERVICE CIRCUIT, CHANNEL 1 OF SUBGROUP PANEL: SPL SERV lamp Output level	 SPL SERV lamp is lighted 0 dbm ±1	
14	SPECIAL SERVICE CIRCUIT, CHANNEL 2 OF SUBGROUP PANEL: SPL SERV lamp Output level	 SPL SERV lamp is lighted 0 dbm ±1	
15	SPECIAL SERVICE CIRCUIT, CHANNEL 3 OF SUBGROUP PANEL: SPL SERV lamp Output level	 SPL SERV lamp is lighted 0 dbm ±1	

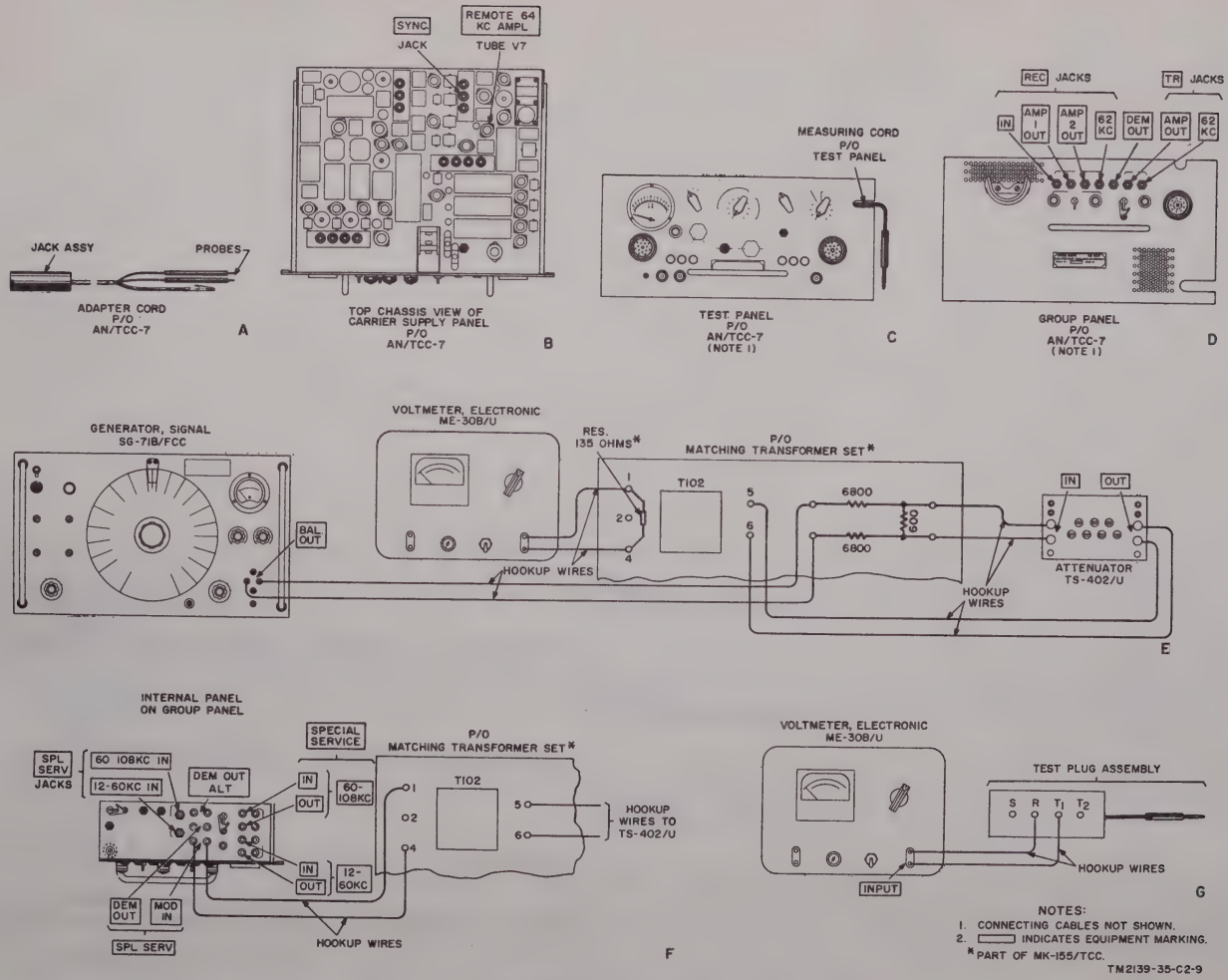


Figure 128.8. Test setups for fourth echelon tests of GROUP PANEL.

167.19. CHART OF TESTS AND PERFORMANCE STANDARDS, GROUP PANEL

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.18c.

Item	Test	Performance standard	Test indication
1	68-KC TRANSMISSION	0 db	
2	37-KC TRANSMISSION	0 db	
3	62-KC TRANSMISSION AND JACK CIRCUIT:		
	TR 62-KC jack circuit	0 db	
	62-KC output signal	No indication, or indication is to left of −5 db	
4	68-KC RECEPTION	+8 db ±1	
5	TR AND REC CABLE REELS TO FIRST AN/TCC-11 SWITCHES FUNCTION:		
	Normal signal level	0 db	
	At positions 5 and 20	0 db ±0.5	
	Other paired switch positions	0 db ±0.5	
6	68-KC RECEPTION, FLAT GAIN ADJUSTMENT:		
	FLAT ADJ 68KC control clockwise	+27 db ±2	
	FLAT ADJ 68KC control counterclockwise	−54 db ±2	
	FLAT ADJ 68KC control adjusted	0 db; obtained with control setting between 2 and 6	
7	68-KC RECEPTION AND ALARM ADJUSTMENTS:		
	MAN REG OUTPUT control clockwise	+12 db ±1	
	MAN REG OUTPUT control counterclockwise	−6 db ±1	
	MAN REG OUTPUT control adjusted	0 db	
	ADJ HIGH control adjustment:		
	ALARM TEST control operated	Buzzer sounds and HIGH ALARM lamp lights	
	ALARM TEST control released	Buzzer stops sounding and HIGH ALARM lamp is extinguished	
	ADJ LOW control adjustment:		
	ALARM TEST control operated	Buzzer sounds and LOW ALARM lamp lights	
	ALARM TEST control released	Buzzer stops sounding and LOW ALARM lamp is extinguished	
	AUTO REG OUTPUT control adjusted	0 db; no high- or low-alarm indications should occur	
	AUTO REG OUTPUT control range	9 db ±1	
	REC CABLE REELS TO FIRST AN/TCC-11 switch at 5:		
	First indication	Alarm buzzer sounds and LOW ALARM lamp lights	
	ALARM CUTOFF switch operated to LOW ALARM	On GROUP PANEL, alarm buzzer stops sounding and LOW ALARM lamp is lighted. TEST PANEL meter needle slowly returns toward 0 db. At 0-db ±0.5 indication, LOW ALARM lamp is extinguished and buzzer sounds.	
	ALARM CUTOFF switch operated to NORMAL	Buzzer is silenced	
	REC CABLE REELS TO FIRST AN/TCC-11 switch at 17:		
	First indication	Alarm buzzer sounds and HIGH ALARM lamp lights	

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Item	Test	Performance standard	Test indication
	ALARM CUTOFF switch operated to HIGH ALARM	On GROUP PANEL, alarm buzzer stops sounding and HIGH ALARM lamp is lighted. TEST PANEL meter needle slowly returns toward 0 db. At 0-db ±0.5 indication, HIGH ALARM lamp is extinguished and buzzer sounds.	
	ALARM CUTOFF switch operated to NORMAL	Buzzer is silenced	
	REC CABLE REELS TO FIRST AN/TCC-11 switch at 11	TEST PANEL meter indicates 0 db ±0.5; GROUP PANEL buzzer is silenced and LOW ALARM lamp is extinguished.	
8	SLOPE ADJ 12-KC CONTROL ADJUSTMENT:		
	Counterclockwise	1.25-db decrease from one position to next position	
	Clockwise	1.25 increase from one position to next position	
	Db difference between full counterclockwise and clockwise positions	Not less than 12 db nor more than 14 db	
9	BULGE ADJ 12KC CONTROL ADJUSTMENT:		
	Counterclockwise	0.75-db decrease from one position to next position	
	Clockwise	0.75-db increase from one position to next position	
	Db difference between full counterclockwise and clockwise positions	Not less than 6 db nor more than 8 db	
10	65-KC RECEPTION	0 db	
11	62-KC RECEPTION AND JACK CIRCUIT:		
	REC 62KC jack circuit	0 db	
	62-kc output signal	No indication, or indication is to left of −5	
12	DEMODULATION ADJUSTMENT:		
	DEM GAIN control counterclockwise	−4 db ±1	
	DEM GAIN control clockwise	+8 db ±1	
	DEM GAIN control adjusted	0 db	
	60-108 KC IN jack indication	0 db	
13	REMOTE 68-KC RECEPTION	0 db ±3	
14	EXTERNAL EQUIPMENT CIRCUITS:		
	DEM OUT jack	*a.* 0 db ±1	
	DEM OUT binding posts	*b.* Same as obtained in *a* above	
	DEM OUT ALT binding posts	*c.* Same as obtained in *a* above	
15	60–108 KC, SPECIAL SERVICE:		
	SPL SERV 1 amp indication	*a.* SPL SERV lamp is lighted	
	APL SERV 60-108KC IN jack	*b.* −4 db	
	DEM OUT jack	*c.* 0 db ±1	
	SPECIAL SERVICE 60–108KC OUT binding posts	*d.* Same as obtained in *c* above, ±1	
16	12-60 KC, SPECIAL SERVICE:		

SPL SERV lamp indication	SPL SERV lamp is lighted
SPL SERV 12-60KC IN jack	0 db
DEM OUT jack	0 db ±1
SPECIAL SERVICE 12-60KC OUT binding posts	0 db ±1

167.21. Chart of Tests and Performance Standards, ORDER WIRE PANEL

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.20c.

Item	Test	Performance standard	Test indication
1	TRANSMITTING BRANCH, SIGNAL TRANSMISSION:		
	Output level	+12.5 db ±2 (reference reading)	
	TR AMP OUT jack	Within 0.5 db of reference reading	
	TR GAIN control counterclockwise	−27 db ±2	
2	TRANSMITTING BRANCH, BANDPASS FILTER CHARACTERISTICS:		
	300-cps signal level	*a.* Within 1 db of reference reading (1 above)	
	1,700-cps signal level	*b.* Same indication as obtained in *a* above	
3	TRANSMITTING BRANCH, SWITCH OPERATION AND BANDPASS FILTER FREQUENCY CHARACTERISTICS:		
	Positions of switch	*a.* Within 1 db of reference reading (1 above). In 150–160 (HOT) position, 1.5 db ±0.5 higher than average indication.	
	300-cps signal level	*b.* 11 db ±1 less than indication obtained in *a* above	
	1,700-cps signal level	*c.* Within 2 db of indication obtained in *a* above	
4	TRANSMITTING BRANCH, HANDSET TRANSMISSION CIRCUIT:		
	For Handset H–60(*)	*a.* 7 db ±1 less than reference reading (1 above)	
	For Handset TS–9(*)	*b.* 1.5 db ±2 less than reference reading (1 above)	
	Terminals C and P	*c.* −22 db ±1.5	
	Terminals D and R	*d.* Same as obtained in *c* above	
	Handset transmission	*e.* ME–30B/U meter needle fluctuates with speech variations. Sidetone is heard in handset receiver.	
5	TRANSMITTING BRANCH, TEST AND RINGING FREQUENCIES TRANSMISSION:		
	Test frequency	4 db ±2 higher than reference reading (1 above)	
	Ringing frequency output level	+27 db ±1. CALL lamp lights and buzzer sounds	
	Ringing frequency count	1,600 cps ±4	
6	RECEIVING BRANCH, BANDPASS FILTER FREQUENCY CHARACTERISTICS:		
	1-kc signal level	*a.* −8 db ±3	
	300-cps signal level	*b.* Within 1 db of indication obtained in *a* above	
	1,700-cps signal level	*c.* Within 1 db of indication obtained in *b* above	
7	RECEIVING BRANCH, SWITCH IN RADIO POSITION	−15 db ±3	
8	RECEIVING BRANCH, RINGING SIGNAL RECEPTION:		

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SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD ECHELON	4TH ECHELON	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A1&2			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5910-376-9764		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 270,000 uuf ±10%; 100 vdcw; Sprague pt No. 81P274911F5			1	0.7	0.1	3.0		C1
P F	5910-543-0425		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw 680,000 uuf ±20%; Sprague pt No. 81P684Q3S5			1	0.7	0.1	3.0		C2
P F	5935-521-0083		CONNECTOR: 21 rd male cont (For authorized allowance see Amplifier Audio Freq AR101 Group)			1					P1
P O	5960-188-6584		ELECTRON TUBE: Glass envelope, reliable miniature twin triode, receiving; MIL E-1, type 5670			2	15.4	5.8	584.0		V1, V2
P F	5950-376-9713		REACTOR: filter choke 7.25 hy, 740 ohms 500 v, rms test; Sig dwg SC-C-62514			1	0.7	0.1	3.0		L1
P F	5945-259-1231		RELAY ARMATURE: cont arr 2 c, single break 26.5 vdcw, 115 v ac 4 amp; CP Clare Pt No. RP-3717-G2			1	0.7	0.1	3.0		K1
P F	5905-556-3344		RESISTOR, FIXED, FILM: 68.1 ohms ±1%; 1/2 w; MIL type RN70B68R1F			1	0.7	0.1	3.0		R13
P F	5905-279-2593		RESISTOR, FIXED, COMPOSITION: 240 ohms (For authorized allowance see Receiver Trans Group)			1					R5
P F	5905-646-5772		RESISTOR, FIXED, FILM: 604 ohms (For authorized allowance see Receiver Trans Group)			1					R12
P F	5905-190-8867		RESISTOR, FIXED, COMPOSITION: 5,100 ohms ±5%; 2 W; MIL type RC42GF512J			1	0.7	0.1	3.0		R10
P F	5905-556-5812		RESISTOR, FIXED, FILM: 68,100 ohms ±1%; 1/2 w; MIL type RN70B6812F			1	0.7	0.1	3.0		R11
P F	5905-195-6761		RESISTOR, FIXED, COMPOSITION: 100,000 ohms (For authorized allowance see Amplifier, AF AR101 Gr)			1					R3

	High signal level	*a.* CALL lamp lights and buzzer sounds	
	Low signal level	*b.* Same as *a* above	
9	RECEIVING BRANCH, RECEIVING JACKS CIRCUITS:		
	REC AMP IN jack	*a.* −26 db ±1	
	REC AMP OUT jack	*b.* Within 2 db of indication obtained in *a* above	
10	RECEIVING BRANCH, REC GAIN CONTROL RANGE	38 db ±3	
11	RECEIVING BRANCH, HANDSET RECEIVING CIRCUIT:		
	Terminals 3 and 5	*a.* −12 db ±3	
	Terminals 4 and 5	*b.* 7 db ±1 less than indication obtained in *a* above	
	Handset reception	*c.* Tone is heard in handset receiver	
12	RECEIVING BRANCH, CHANNEL CIRCUITS RECEPTION:		
	Terminals C and P	*a.* −12 db ±2	
	Terminals D and R	*b.* Same as obtained in *a* above	

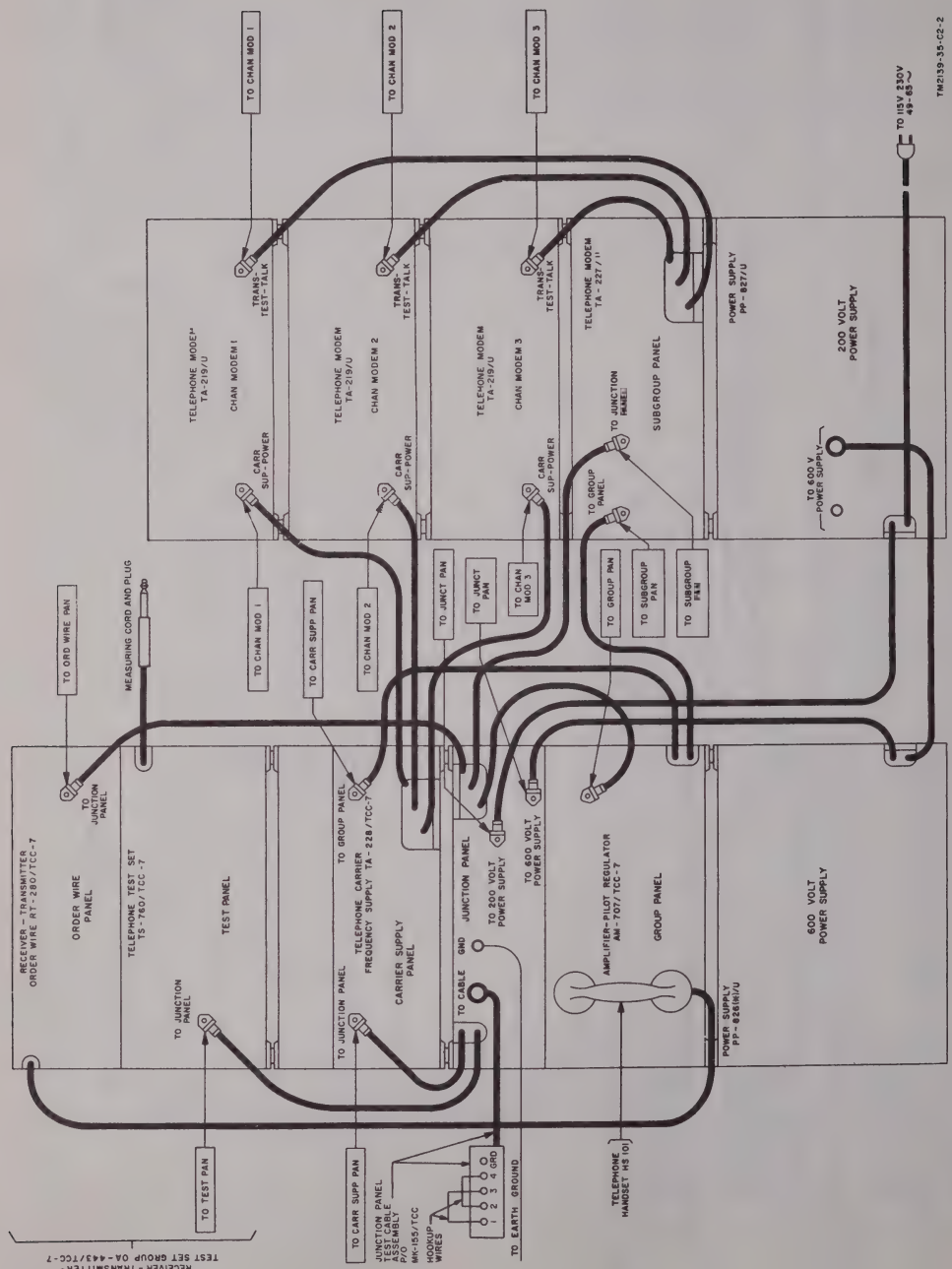


Figure 128.10. Terminal, Telephone AN/TCC-7, cabling diagram.

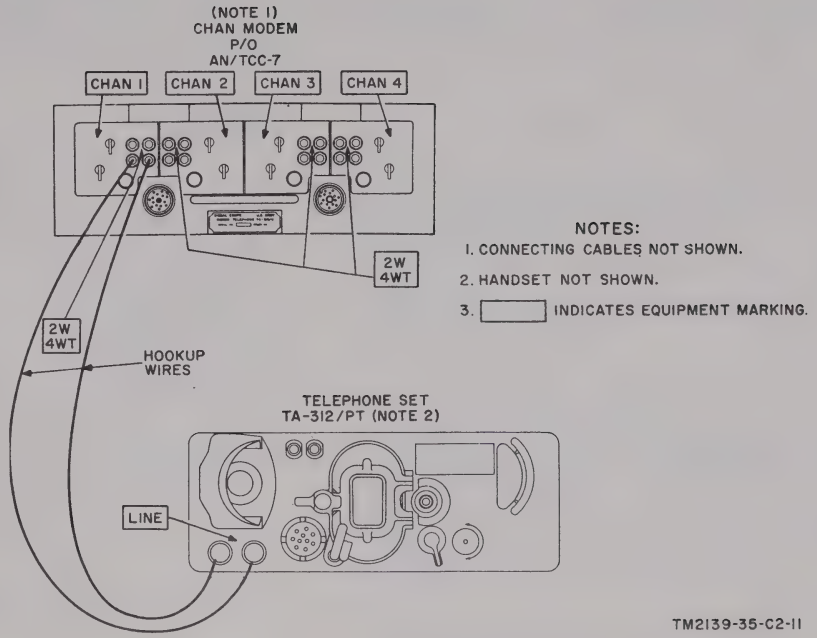


Figure 128.11. Test setups for fourth echelon tests of speech circuits of AN/TCC-7.

c. Testing AN/TCC–7 Speech Circuits. After the procedures in *b*(3) above are completed, perform the procedures in (1) through (3) below. Do not change any AN/TCC–7 switch settings or controls. Prepare a chart similar to that given in paragraph 167.23*b*. Use it to record the actual test indications obtained during the tests.

(1) *Test equipment and material.* Use Telephone Set TA–312/PT, or equivalent, and about 50 feet of hookup wire (Federal stock No. 6145–160–5300) or any hookup wire #16 to #20 AWG.

(2) *Test connections and conditions.*

(*a*) Two men are required; one to operate the AN/TCC–7, and another to operate the TA–312/PT (fig. 128.11). Locate the TA–312/PT far enough away from the AN/TCC–7 so that the speech of the testman who uses the ORDER WIRE PANEL handset cannot be easily heard by the testman listening at the TA–312/PT.

(*b*) Use the procedures given in (3) below and test the 12 channels (CHAN 1, CHAN 2, etc) of the AN/TCC–7. Start with CHAN 1 (channel) on CHAN MODEM 1 and test each CHAN of each CHAN MODEM, in turn.

(*c*) After all channels have been tested, remove the hookup wires of the TA–312/PT from the 4WR binding posts of the last channel Operate the AC POWER switch of the 200 VOLT POWER SUPPLY to OFF, and disconnect the junction panel test cable assembly from the spiral-four connector TO CABLE on the JUNCTION PANEL of the AN/TCC–7 (fig. 128.10)

(3) *Procedure.*

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standards
1	*TA–312/PT* CB–LB–CBS: LB	*CHAN of CHAN MODEM* (*under test*) 2W–4W (internal): 2W TALK-MON: vertical SEND-MEAS: SEND *ORDER WIRE PANEL* ORDER WIRE: TALK CHANNEL TALK: LINE	*Test Signal Transmission* *a.* Connect the hookup wires of the TA–312/PT to 2W–4WT binding posts of channel under test (fig. 128. 11). *b.* Listen on receiver of TA–312/PT and note indication. *c.* Operate SEND-MEAS switch on channel under test to vertical position.	*a.* None. *b.* 1,000-cps test tone should be heard clearly.
2	Unchanged.	Unchanged except: *CHAN MODEM* (*under test*) TALK-MON TALK	*Speech transmission* *a.* Operate push-to-talk switch on ORDER WIRE PANEL handset and speak into transmitter. Note indication obtained by TA–312/PT. Release push-to-talk switch. *b.* Operate push-to-talk switch on TA–312/PT handset and speak into transmitter. Note indication obtained by ORDER WIRE PANEL handset.	*a.* Speech is clear, loud, and undistorted. *b.* Speech is clear, loud, and undistorted.
3			Disconnect hookup wires of TA–312/PT from channel under test and test next channel; use procedures in steps No. 1 and 2.	Same as steps No. 1 and 2.

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167.23. Charts of Tests and Performance Standards, AN/TCC–7

a. AN/TCC–7 Signal Circuits. Use the following chart in conjunction with the test procedures given in paragraph 167.22*b*(3).

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.22*b*(3).

Item	Test	Performance standard	Test indication
1	200 VOLT POWER SUPPLY:		
	Ac power indication	AC POWER lamp lights	
	Indications in first 20 to 30 seconds	On ORDER WIRE PANEL, CALL lamp lights and buzzer sounds. On GROUP PANEL, HIGH ALARM and LOW ALARM lamps light. On CARRIER SUPPLY PANEL, 68KC ALARM and 120KC ALARM lamps light and buzzer sounds.	
	Indications after 20 to 30 seconds	On ORDER WIRE PANEL, CALL lamp is extinguished, and buzzer is silent. On GROUP PANEL, HIGH ALARM and LOW ALARM lamps are extinguished. On CARRIER SUPPLY PANEL, 68KC ALARM and 120KC ALARM lamps are extinguished and buzzer is silent.	
	200-volt output adjustment	0 db	
2	600 VOLT POWER SUPPLY:		
	AC POWER lamp	AC POWER lamp lights	
	Meter and alarm indications	Buzzer sounds. LOAD ALARM lamp lights (also LOW VOLTAGE lamp on PP–826A/U lights). CURRENT meter momentarily indicates approximately 8 to 12 ma; indication drops to 0 ma, and then slowly rises to 85 ma ±5. Approximately 20 seconds after ac power is applied, LOAD ALARM lamp (and LOW VOLTAGE lamp on PP–826A/U) is extinguished and buzzer is silent as soon as lamp is extinguished.	
	LOAD CURRENT control adjustment	100 ma	
	600-volt output adjustment	0 db	
3	CARRIER SUPPLY PANEL SIGNAL JACKS MEASUREMENTS:		
	64 KC LOCAL	0 db ±3	
	DIV 1	0 db ±3	
	DIV 2	0 db ±3	
	4 KC	0 db ±3	
	8 KC	0 db ±3	
	12 KC	0 db ±3	
	16 KC	0 db ±3	
	20 KC	0 db ±3	
	56 KC	0 db ±3	
	72 KC	0 db ±3	
	88 KC	0 db ±3	
	120 KC	0 db ±3	

4	1-KC AND HF MEASUREMENTS: 1 KC control HF control	 0 db 0 db	
5	HF TEST SIGNAL ADJUSTMENT: COARSE TUNE control GAIN control AMP GAIN control AMP GAIN control readjustment	 Near 0 db 0 db Near 0 db 0 db	
6	68-KC TRANSMISSION MEASUREMENT	0 db	
7	12-KC AND 28-KC TRANSMISSION MEASUREMENT: 12 & 28 KC lamp 12 KC control 28 KC control	 12 & 28 KC lamp lights 0 db 0 db	
8	CHAN MODEM 1 SIGNAL TRANSMISSION	0 db ±3	
9	CHAN MODEM 2 SIGNAL TRANSMISSION	0 db ±3	
10	CHAN MODEM 3 SIGNAL TRANSMISSION	0 db ±3	
11	67-KC SIGNAL MEASUREMENT	Peak indication at 0 db ±2	
12	83-KC SIGNAL MEASUREMENT	Peak indication at 0 db ±2	
13	99-KC SIGNAL MEASUREMENT	Peak indication at 0 db ±2	
14	37-KC SIGNAL MEASUREMENT	0 db	
15	65-KC SIGNAL TRANSMISSION MEASUREMENT: SEND LAMP indication 65 KC TR OR FAULT TEST control	 SEND lamp lights 0 db	
16	FAULT TEST FREQUENCIES MEASUREMENT: FAULT TEST REP 1 switch FAULT TEST REP 2 switch FAULT TEST REP 3 switch	 0 db ±1 0 db ±1 0 db ±1	
17	62-KC SIGNAL TRANSMISSION MEASUREMENT	No meter indication, or meter needle peaks to left of −5 db	
18	ORDER WIRE SIGNAL TRANSMISSION	+2.5 db	
19	68-KC RECEPTION MEASUREMENT	FLAT ADJ 68 KC control setting is between +2 and +6; meter indication is 0 db.	

Item	Test	Performance standard	Test indication
20	MANUAL REGULATION ADJUSTMENT	0 db	
21	AUTOMATIC REGULATION ADJUSTMENTS:		
	AUTO REG OUTPUT control	0 db	
	High-alarm adjustment indications	HIGH ALARM lamp lights and buzzer sounds	
	High-alarm release indications	HIGH ALARM lamp is extinguished and buzzer is silent	
	Low alarm adjustment indications	LOW ALARM lamp lights and buzzer sounds	
	Low alarm release indications	LOW ALARM lamp is extinguished and buzzer is silent	
22	12-KC AND 28-KC RECEPTION MEASUREMENT:		
	SLOPE ADJ 12 KC control	SLOPE ADJ 12 KC control setting is −1, 0, or +1. Meter indication is 0 db ±2.	
	BULGE ADJ 28 KC control	BULGE ADJ 28 KC control setting is −1, 0, or +1. Meter indication is 0 db ±2.	
23	65-KC RECEPTION MEASUREMENT:		
	SEND lamp	SEND lamp lights	
	65 KC REC control	0 db	
24	62-KC RECEPTION MEASUREMENT	No meter indication, or meter needle peaks at left of −5 db	
25	GROUP PANEL SIGNAL RECEPTION	0 db	
26	SUBGROUP PANEL SIGNAL RECEPTION:		
	DEM 1 GAIN	0 db	
	DEM 2 GAIN	0 db	
	DEM 3 GAIN	0 db	
27	CHAN MODEM 1 SIGNAL RECEPTION	0 db	
28	CHAN MODEM 2 SIGNAL RECEPTION	0 db	
29	CHAN MODEM 3 SIGNAL RECEPTION	0 db	
30	ORDER WIRE SIGNAL RECEPTION:		
	REC GAIN control	0 db	
	1,000-cps tone	1,000-cps tone is heard	
	Headset reception	Sidetone is heard and meter needle fluctuates with speech variations	
	RING switch	CALL lamp lights and meter needle fluctuates	

b. AN/TCC–7 Speech Circuits. Use the following chart in conjunction with the test procedures given in paragraph 167.22*c*(3).

Note. The *Item* numbers correspond with the *Step* numbers of the test procedures in paragraph 167.22*c*(3).

Item	Test	Performance standard	Test indication
1	TEST SIGNAL TRANSMISSION	1,000-cps test tone is heard clearly	
2	SPEECH TRANSMISSION:		
	CHAN MODEM 1:		
	CHAN 1	Speech is clear, loud, and undistorted	
	CHAN 2	Same	
	CHAN 3	Same	
	CHAN 4	Same	
	CHAN MODEM 2:		
	CHAN 1	Same	
	CHAN 2	Same	
	CHAN 3	Same	
	CHAN 4	Same	
	CHAN MODEM 3:		
	CHAN 1	Same	
	CHAN 2	Same	
	CHAN 3	Same	
	CHAN 4	Same	

Page 276, chapter 4. Change the title of chapter 4 to read: FINAL TESTS AND ADJUSTMENTS.

Page 277, paragraph 170. Make the following changes:

Subparagraph *b*(5), line 7. Change "−28.8 ±1 db" to: −45 db ±1.

Subparagraph *c*(4), line 4. Change "2 db" to: 18 db.

Page 279, paragraph 171*b*(1), last line. Change "60-ohm" to: 600-ohm.

Page 282, paragraph 172*b*(10), chart. In "Subgroup test cable assembly connection" column, change "(PL)" to: (P1).

Page 284, paragraph 173*b*(18), chart. In "Indication (db)" column, line 2, change "5.8 min." to: −5.8 min.

Page 301, paragraph 185*d*. Make the following changes:

Subparagraph (1), line 6, change "13.8 db" to: −13.8 db.

Subparagraph (3). Add the following: Operate TR GAIN control to clockwise position.

Page 302, paragraph 185. Make the following changes:

Subparagraph *d*(14), line 6. Delete the last sentence and substitute: The voltmeter indication should not be more than 11 db ±1 below the indication obtained in (4) above.

Subparagraph *e*(4), line 3. Change "TR101" to: TB101.

Page 303, paragraph 185*g*. Make the following changes:

Subparagraph (1). Add the following: Operate CABLE REELS TO NEXT AN/TCC-7 OR AN/TCC-8 switch to 0-11.

Subparagraph (4). Add the following after the first sentence: Operate REG GAIN control to clockwise position.

Subparagraph (5). Add the following after the first sentence: Set the attenuator for a 15-db loss.

Subparagraph (7). Add the following after the first sentence: Set the attenuator for a 0-db loss. In line 6, change "−21.3 ±1 db" to: −26 db ±1.

Subparagraph (8), line 3. Change "±1.5" to: +1.5.

Subparagraph (9). Delete the first sentence. Line 7, change "10.5" to: 20.

Subparagraph (10). Make the following changes:

Line 3. Change "1,700 cps" to: 1,000 cps.

Line 8. Change "2 ±5 db" to: 39 db ±5.

After the last sentence, add: Adjust the REC GAIN control to the extreme clockwise position.

Page 308, paragraph 191*c*, chart. In "Resistance" column, line 4 (opposite terminals "M" and "R"), change "Infinite" to: zero.

Page 309, paragraph 192*g*, Line 1 of note 6. Change "dc" to: ac.

Page 311, paragraph 194*a*. Make the following changes:

Chart (page 1 of C 1). Delete the test points and resistance (ohms) readings for terminals B, C, D, and A.

Delete the footnote at the end of the chart.

Add subparagraph (1.1) after subparagraph (1).

(1.1) Use Multimeter TS-352/U, TS-352A/U, or TS-352B/U. *Connect the red test lead to the −DC +AC OHMS pin jack* and *connect the black test lead to the OHMS pin jack*. Operate the 600V ADJ control of the power supply fully clockwise and the REPEATER switch (internal) to 3. Connect the test leads of the multimeter as indicated in the following chart.

Terminals of terminal board 1 or connector P3[a]				Resistance ±10 percent		
Red test lead	Black test lead	Red test lead	Black test lead	With Z1 installed	With Z2 installed	Without Z1 or Z2 installed
A	------	------	C	400K	36K	1.2 mego
	A	C	------	75K	36K	1.2 mego
D	------	------	C	440K	350K	580K
	D	C	------	375K	350K	580K
B	C	------	------	0 ohm	0 ohm	0 ohm

[a] Terminal C is chassis ground.

Subparagraph *a*(4), line 3. Change "LOW-VOLT ALARM" to: 600 V ADJ.

Page 312, paragraph 194. Make the following changes:

Subparagraph *a*(5), line 2 at top of page. Change "clockwise" to: counterclockwise.

Subparagraph *b*(6). Add subparagraph (7) after subparagraph (6):

(7) Adjust the multimeter to measure 1,000 volts dc and connect it to pin jacks J1 and J10 on low voltage rectifier and alarm unit Z1. Adjust the 600 V ADJ control until the multimeter indicates 600 volts dc. Remove the multimeter leads from pin jacks J1 and J10.

Subparagraph *c*(1). Delete the first two sentences and substitute:

Connect the voltmeter ungrounded terminal to terminal A on the 600 V power supply test cable assembly.

Page 317, paragraph 195. Make the following changes:

Subparagraphs *b*(2) and *c*(2). Add the following after the last sentences: The CURRENT meter should indicate 0 ma.

Subparagraph *d*(5). Add subparagraph (5.1) after subparagraph (5).

(5.1) Arrange the multimeter to measure 1,000 volts dc. Connect the ungrounded (+) terminal of the multimeter to the J1 pin jack on low-voltage rectifier and alarm unit Z2 and the ground (−) terminal to the J10 pin jack. Adjust the 600 V ADJ control until the multimeter indicates 600 volts dc.

Page 323, appendix. Make the following changes:

Change the title of TM 11–5088 to: Generators, Signal SG–71/FCC, SG–71A/FCC, and SG–71B/FCC.

Delete TM 11–5132.

Add the following to the appendix:

DA Pamphlet 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TA 11–17	Signal Field Maintenance Shops.
TA 11–100 (11–17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TA 11–101 (11–158)	Allowances of Signal Corps Expendable Supplies for Signal Depot Company.
TOE 11–158D	Signal Depot Company.
TM 11–5805–224–20P	Organizational Maintenance Repair Parts and Special Tools List, Modem Telephone TA–219/U.
TM 11–5805–224–35P	Field and Depot Maintenance Repair Parts and Special Tools List, Modem, Telephone TA–219/U.
TM 11–5805–240–12	Operator's and Organizational Maintenance Manual, Repeater, Telephone AN/TCC–11.
TM 11–5805–240–35	Field and Depot Maintenance Manual, Repeater, Telephone AN/TCC–11.
TM 11–5805–245–20P	Organizational Maintenance Repair Parts and Special Tools List, Power Supply PP–827/U.
TM 11–5805–245–35P	Field and Depot Maintenance Repair Parts and Special Tools List, Power Supply PP–827/U.
TM 11–5805–248–20P	Organizational Maintenance Repair Parts and Special Tools List, Power Supplies PP–826/U and PP–826A/U.
TM 11–5805–248–35P	Field and Depot Maintenance Repair Parts and Special Tools List, Power Supplies PP–826/U and PP–826A/U.
TM 11–5805–317–20P	Organizational Maintenance Repair Parts and Special Tools List, Terminal, Telephone AN/TCC–7.
TM 11–5805–317–35P	Field and Depot Maintenance Repair Parts and Special Tools List, Terminal, Telephone AN/TCC–7.
TM 11–5820–287–10	Operator's Manual, Radio Sets AN/TRC–24, AN/GRC–75, AN/GRC–78, and AN/GRC–81; Radio Terminal Sets AN/TRC–35, AN/GRC–76, AN/GRC–79, AN/GRC–82; Radio Relay Set AN/TRC–36; Radio Repeater Sets AN/GRC–77, AN/GRC–80, and AN/GRC–83; and Radio Set Group AN/TRA–25 and AN/TRA–25A.
TM 11–5820–287–20	Organizational Maintenance Manual, Radio Sets AN/TRC–24, AN/GRC–75, AN/GRC–78, and AN/GRC–81; Radio Terminal Sets AN/TRC–35, AN/GRC–76, AN/GRC–79, and AN/GRC–82; Radio Relay Set AN/TRC–36; Radio Repeater Sets AN/GRC–77, AN/GRC–80, and AN/GRC–83; and Radio Set Group AN/TRC–25 and AN/TRA–25A.
TM 11–6625–320–12	Operator's and Organizational Maintenance Manual, Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U and ME–30C/U.

TM 11-2139-35
T.O. 31W1-2TCC7-6
C 4

DS, GS, AND DEPOT MAINTENANCE MANUAL
TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

CHANGE
No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *18 November 1964*

TM 11-2139-35, 14 November 1958, is changed as follows:

Note. The parenthetical references to previous changes (example: page 1 of C 3) indicates that pertinent material was published in that change.

Delete "and final" in the following figure captions:

Page 102, figure 56 (in separate envelope).
Page 104, figure 57 (in separate envelope).
Page 144, figure 67.
Page 148, figure 71.
Page 162, figure 78 (in separate envelope).
Page 182, figure 86 (in separate envelope).
Page 196, figure 91 (in separate envelope).
Page 199, figure 94.
Page 208, figure 97.
Page 211, figure 100.
Page 215, figure 103 (in separate envelope).
Page 310, figure 134.

Delete "final" in the following captions:

Page 278, figure 129.
Page 280, figure 130.
Page 289, figure 131 (in separate envelope).
Page 291, figure 132.
Page 302, figure 133 (in separate envelope).
Page 316, figure 135.

(As changed by C 3, 24 Apr 64) make the following changes in the illustrations listed in the chart below:

Label each unmarked connector that is attached to the connector listed in the third column with the callout listed in the fourth column. For example: in figure 56, add P302 above the unmarked plug (on the power test cable assembly) attached to connector J9 on the SUBGROUP PANEL.

Page No.	Figure No.	Next to connector, plug, or jack—	Callout for connector on test cable assembly
90	49	Jack on test jack assembly	J306
		Plug on test plug assembly	P309
92	50	P3	J302
		P101, P201, P301, OR P401	P302
93	51	P101, P201, P301, OR P401	P302
		P3	J302
	56[a] and 57[a]	J9	P302
		J10	P310
		P1	J305
		P2	J305
		P3 (CHAN MODEM 1)	J305
		P3 (200 VOLT POWER SUPPLY)	J302
		Plug on test plug assembly	P309
	61[a]	P1	J305
		P2	J305

* This change supersedes C 3, 24 April 1964, and replaces the following Signal Corps Repaired Equipment Standards: REP-1191, Issue No. 1, 28 March 1957; REP-654, Issue No. 1, 10 January 1958; REP-1214, Issue No. 1, 13 March 1958; REP-1191, Issue No. 2, 2 June 1959; REP-1238, Issue No. 3, July 1961; and REP-1198, Issue No. 3, September 1961.

Page No.	Figure No.	Next to connector, plug, or jack—	Callout for connector on test cable assembly
		P3	J302
		J1	P302
		Plug on test plug assembly	P309
139	64	P3	J302
144	67	P1	P306
148	71	P1	J306
155	75	J103	J304
		P105	J303
		P101	J303
	78[a]	Jack on each test jack assembly (3 places)	J306
		Plug on test plug assembly	P309
		J5	P310
		J2	P302
		P3	J302
	86[a]	P1 (connected to extension test cable assembly)	P303
		J4 on test panel	P304
		J2 on test panel	P302
		P3 (2 places)	J302
		Connector on measuring set	J201
		Jack on test jack assembly	J306
		Plug on test plug assembly	P309
	90[a] and 91[a]	P3	J302
		J101	P302
		Plug on test plug assembly	P309
199	94	P3	J302
		P1	J306
208	97	P1	P306
		P3	J302
211	100	P1	P306
		P3	J302
	103[a]	J15	P310
		J16	P307
		P1, P2, and P3 (3 places)	J302
		Plug on test plug assembly	P309
		P3	J302
278	129	P3	J302
		J6	P307
		J5	P310
280	130	J6	P307
		P3	J302
		J5	P310
	131[a]	P3	J302
		P101	J303
		P102	J302
		P103	J302
		P104	J303
		J101	P307
		J103	J304
		P1	J305
		P2	J305
		Plug on test plug assembly	P309
291	132	P3	J302
		P1	P306
	133[a]	P3	J302
		J101	P302
		Plug on test plug assembly	P309
310	134	P3	J302
316	135	P3	J301

[a] Located in separate envelope.

Page 2, paragraph 1. Delete subparagraphs *c* and *d,* (as changed by C 3, 24 Apr 64), and substitute:

c. Refer to the latest issue of DA Pam 310–4 to determine whether there are new editions, changes, or additional publications pertaining to this equipment. DA Pam 310–4 is a current index of technical manuals, technical bulletins, supply manuals (types 4, 6, 7, 8, and 9), supply catalogs (type CL), supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (–10, –20, –35P, etc.) and the latest changes to and revisions of each equipment publication.

d. The direct reporting, by the individual user, of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed in triplicate by the use of pen, pencil, or typewriter. The original and one copy will be forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL–MR–MCA, Fort Monmouth, N. J. 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc.).

Page 3, paragraph 2, chart (as changed by C 3, 24 Apr 64).

Make the following changes:

Item No. 12*b*, Differences column, line 2. Change PP–286/U to PP–826/U.

Item No. 13, Equipment column, line 2. Change PP–286/U to PP–826/U.

Page 5, paragraph 4, heading (as changed by C 3, 24 Apr 64). Change Telephone TA–219/U to Telephone Modem TA–219/U.

Pages 92 and 93, figures 50 and 51 (as changed by C 3, 24 Apr 64).

Make the following changes:

Bracket and label the test cable assembly connected to the 200 VOLT POWER SUPPLY shown in figure 50 in the same manner as that shown in figure 51.

On both figures, below the cable of the modem and amplifier test cable assembly, delete P101, P201, P301, OR P401. Place this callout in the box of CHAN ASSEMBLY 1, 2, 3, OR 4, adjacent to the dashed symbol for a connector.

Page 276. Delete chapter 4 (as changed by C 3, 24 Apr 64) in its entirety, *except* for figures 129 through 131 and figures 133 through 135, and substitute:

CHAPTER 4

DEPOT INSPECTION STANDARDS

Section I. INTRODUCTION

168. General

This chapter covers depot inspection standards for Terminals, Telephone AN/TCC–7 and AN/TCC–50. It includes instructions for testing the individual components (paras. 173–182) and for testing the complete AN/TCC–7 and AN/TCC–50 (paras. 183–199). It also lists the test equipment and additional equipment required to perform the tests.

169. Applicability of Depot Inspection Standards

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

170. Applicable References

a. Repair Standards. Applicable procedures of the depot making these tests and general standards for repaired electronic equipment form a part of the requirements for testing this equipment.

b. Technical Publications. Technical publications applicable to the AN/TCC–7 and AN/TCC–50 are listed in the appendix.

c. Modification Work Orders. Perform all applicable modification work orders (MWO's) pertaining to any of the components before making the tests. DA Pam 310–4 lists all available MWO's.

171. Test Facilities, Test Equipment, and Additional Equipment

Dummy loads, a test signal source circuit, and metering circuits must be fabricated to perform some of the tests given in paragraphs 173 through 199. The test equipment required is listed in *a* below and the additional equipment in *b* below. The additional equipment, except for the two 8-μf capacitors are part of Test Facilities Kit, Telephone Carrier System MK–155/TCC. Instructions for the test setups and for fabricating the dummy loads are given in the test instructions for the specific test where their use is required.

a. Test Equipment.

Item	Federal stock No.	References
Meter, Audio Level ME–71(*)/FCC[a]	6625–669–0752	TM 11–2151
Attenuator TS–402(*)/U[b]	5905–230–5149	TM 11–2044
Digital Voltmeter AN/GSM–64	6625–870–2264	TM 11–6625–444–15
Multimeter, Electronic ME–26(*)/U[c]	6625–646–9409	TM 11–6625–200–12
Frequency Meter AN/TSM–16	6625–342–1666	TM 11–6625–218–12
Multimeter TS–352(*)/U[d]	6625–242–5023	TM 11–5527
Oscilloscope OS–8(*)/U[e]	6625–568–4898	TM 11–1214 or TM 11–1214A
Generator, Signal SG–71(*)/FCC[f]	6625–669–0255	TM 11–5088
Transmission Measuring Set TS/559(*)/FT[g]	6625–540–9051	TM 11–2094
Voltmeter, Meter ME–30(*)/U[h]	6625–669–0742	TM 11–6625–320–12
Watch, stop	6625–719–8670	

a Meter, Audio Level ME–71/FCC, ME–71A/FCC, or ME–71B/FCC.
b Attenuator TS–402/U or TS–402A/U.
c Multimeter, Electronic ME–26/U, ME–26A/U, ME–26B/U, or ME–26C/U.
d Multimeter TS–352/U, TS–352A/U, or TS–352B/U.
e Oscilloscope OS–8/U, OS–8A/U, or OS–8B/U.
f Generator, Signal SG–71/FCC, SG–71A/FCC, or SG–71B/FCC.
g Transmission Measuring Set TS–559/FT, TS–559A/FT, TS–559B/FT, TS–559C/FT, or TS–559D/FT.
h Voltmeter. Meter ME–30A/U or Voltmeters, Electronic ME–30B/U, or ME–30C/U.

b. Additional Equipment.

Item	Federal stock No.	Quantity Required
Capacitor, 0.5 μf, $\pm$20%, 600 vdcw	5910–112–7557	1
Capacitor, 1 μf, $\pm$10%, 100 vdcw	5910–557–6785	2
Capacitor, 2 μf, $\pm$20%, 600 vdcw	5910–170–4384	4
Capacitor, 8 μf, $\pm$20%, 600 vdcw	5910–112–7437	2
Carrier Supply Test Cable Assembly	5995–557–7313	2
Carrier Test Cable Assembly	5995–557–8669	1
Junction Panel Test Cable Assembly	5995–557–7315	1
Subgroup Test Cable Assembly	5995–557–7310	1
Supply Test Cable Assembly	5995–557–7312	1
Power Supply Test Cable Assembly, 600 V.	6625–603–5706	1
Power Test Cable Assembly	6625–603–5708	1
Test Jack Assembly	5995–557–7309	1
Test Plug Assembly	5995–557–7311	1
Transmission Test Cable Assembly	5995–557–7314	1
Transformer, Variable Power TF–171/USM	5950–503–0632	1
Transformer, AF (T101)	5950–646–3143	1
Transformer, AF (T107)	5950–648–2539	1
Transformer, AF (T108)	5950–645–4760	1
Transformer, AF (T109)	5950–64–6404	1
Resistor, 10 ohms, $\pm$1%, ½ watt	5950–552–2440	4
Resistor, 56.2 ohms $\pm$1%, ½ watt	5905–258–8686	1
Resistor, 60.4 ohms, $\pm$1%, ½ watt	5905–552–6140	4

Item	Federal stock No.	Quantity Required
Resistor, 67.3 ohms ±1%, ½ watt	5905–279–6979	1
Resistor, 75 ohms, ±1%, ½ watt	5905–556–3335	2
Resistor, 100 ohms, ±1%, ½ watt	5905–522–3893	2
Resistor, 121 ohms, ±1%, ½ watt	5905–542–8403	2
Resistor, 135 ohms, ±1%, ½ watt	5905–259–2776	4
Resistor, 160 ohms, ±5%, 2 watts	5905–279–1948	1
Resistor, 220 ohms, ±5%, ½ watt	5905–299–2053	2
Resistor, 301 ohms, ±1%, ½ watt	5905–542–9112	4
Resistor, 500 ohms, ±5%, 10 watts	5905–100–4969	2
Resistor, 511 ohms, ±1%, ½ watt	5905–542–9789	4
Resistor, 600 ohms, ±1%, ½ watt	5905–280–1143	7
Resistor, 630 ohms, ±5%, 78 watts	5905–556–7986	1
Resistor, 680 ohms, ±5%, ½ watt	5905–195–6791	1
Resistor, 866 ohms, ±1%, ½ watt	5905–271–7525	1
Resistor, 1,000 ohms, ±5%, 55 watts	5905–549–6965	1
Resistor, 1,000 ohms, ±5%, 2 watts	5905–256–3361	1
Resistor, 1,300 ohms, ±1%, ½ watt	5905–556–4620	1
Resistor, 1,600 ohms, ±5%, 37 watts	5905–264–9225	3
Resistor, 2,200 ohms, ±5%, ½ watt	5905–279–1876	2
Resistor, 6,800 ohms, ±1%, ½ watt	5905–117–4190	2
Resistor, 7,590 ohms, ±5%, ½ watt	5905–280–1637	2
Resistor, 10,000 ohms, ±1%, ½ watt	5905–542–8401	1
Resistor, 26,700 ohms, ±1%, ½ watt	5905–556–4628	1
Resistor, 68,100 ohms, ±1%, ½ watt	5905–201–8904	2
Resistor, 100,000 ohms, ±5%, ½ watt	5905–196–6760	1
Resistor, 1 megohm, ±5%, ½ watt	5905–192–0390	1
Resistor, variable, 1,500 ohms, ±10%, 50 watts	5905–158–5439	2
Switch, toggle, SPST	5930–646–4564	1

172. General Test Conditions

The tests will be conducted under the following conditions:

a. The equipment will be connected as directed in the appropriate test.

b. The input power source will be 115 volts, 50 to 60 cps.

c. The equipment will be allowed a 30-minute warmup period, unless otherwise specified before starting the tests.

d. The tests in each section will be performed in sequence.

e. Switch and control positions will not be changed for subsequent tests unless specifically directed.

f. The output frequency of the SG–71(*)/FCC is checked with the AN/TSM–16 for each frequency adjustment.

g. Unless otherwise specified, the output level of the SG–71(*)/FCC is checked with the ME–30(*)/U for each output level adjustment.

Section II. DEPOT INSPECTION STANDARDS FOR MAJOR COMPONENTS OF TERMINALS, TELEPHONE AN/TCC–7 AND AN/TCC–50

173. Telephone Modem TA–219/U

a. Preliminary Procedures.

(1) Connect the equipment, as shown in figure 129, by use of signal generator SG–71(*)/FCC No. 1 and SG–71(*)/FCC No. 2B.

(2) Connect 600-ohm resistors between terminals A and K, B and L, C and M, and E and P of the transmission test cable assembly.

(3) Operate the TALK-MON and SEND-MEAS switches of all channels to the vertical (nonoperate) position.

(4) Apply ac input power to the 200 VOLT POWER SUPPLY and the test equipment.

b. Channel Transmission Tests.

(1) Connect the SG–71(*)/FCC No. 1 (carrier supply) to terminals C and M of the supply test cable assembly. Adjust the output frequency for 8 kc at an output level of 0.82 volt.

(2) Operate the switches on the TS–402–(*)/U for 0-db attenuation. Connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109.

(3) Adjust the SG–71(*)/FCC No. 2 (modulation supply) output frequency for 1 kc at an output level of —13 db. Disconnect the ME–30(*)/U and the 600-ohm resistor from terminals 3 and 6 of transformer T109.

(4) Use jumper wires and connect terminals 3 and 6 of transformer T109 to the 2W 4WT binding posts of channel 1 (or the channel under test).

(5) Operate the 2W–4W lever switch of the channel under test to 2W. Use the ME–30(*)/U to measure and record the output level indication across terminals A and K of the transmission test cable assembly. The output level indication will be —48 db ±1.

(6) Disconnect the jumper wire from the 2W 4WT binding posts of channel 1.

(7) Repeat the procedures given in (1) through (6) above and adjust and connect SG–71(*)/FCC No. 1 as indicated in the chart below to test channels 2 through 4. The ME–30–(*)/U will indicate —48 db ±1 for each channel.

Channel under test	SG–71(*)/FCC No. 1	
	Frequency (kc)	Connections to supply test cable assembly
2	12	D and N
3	16	E and P
4	20	F and R

c. Transmitting Overload Loss Tests.

(1) Connect SG–71(*)/FCC No. 1 to terminals C and M of the supply test cable assembly. Adjust the output frequency for 8 kc at an output level of 0.82 volt.

(2) Fabricate the SG–71(*)/FCC No .2A circuit and connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109. Adjust the output frequency of SG–71(*)/FCC No. 2 for 1 kc at an output level of 15 db.

(3) Disconnect the ME–30(*)/U and the 600-ohm resistor from transformer T109 and connect terminals 3 and 6 of transformer T109 to the 2W 4WT binding posts of channel 1 (or the channel under test).

(4) Use the ME–30(*)/U to measure and record the output level across terminals A and K of the transmission test cable assembly. To calculate the transmitting overload loss, subtract the ME–30(*)/U indication noted in *b*(5) above from the overall loss obtained in this test. The difference will be 7 db or greater.

(5) Repeat the procedures given in (1) through (4) above and adjust and connect SG–71(*)/FCC No. 1 as indicated in the chart (*b*(7) above) to test channels 2, 3, and 4.

d. Receiving Tests.

(1) Connect the equipment as shown in figure 130.

(2) Connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109. Operate the switches on the TS–402(*)/U for 0-db attenuation.

(3) Adjust the SG–71(*)/FCC No. 2 output frequency for 7 kc at an output level of —5 db.

(4) Disconnect the ME–30(*)/U and the 600-ohm resistor from transformer T109 and connect terminals 3 and 6 of transformer T109 to terminals E and P of the transmission test cable assembly.

(5) Operate the 2W–4W lever switch of channel 1 (or the channel under test) to 4W and adjust the GAIN control completely clockwise.

(6) Use the ME–30(*)/U to measure and record the output level indication across the 4WR binding posts. The output level will be 2 db or greater.

(7) Adjust the GAIN control of the channel completely counterclockwise. The output level will be at least 20 db less than the indication obtained in (6) above.

(8) Repeat the procedures given in (2) through (7) above to adjust SG–71(*)/FCC No. 2 as indicated in the chart below and test channels 2, 3, and 4. The output levels will be 2 db or more for channels 2 and 3, and 1 db or greater for channel 4.

Channel under test	SG–71(*)/FCC No. 2	
	Output frequency (kc)	Output level (db)
2	11	—5
3	15	—5
4	19	—5

(9) Follow the procedures given in (2) through (8) above to adjust the SG–71(*)/FCC No. 2 to the required channel frequencies shown in the chart below at an output level of —5 db. The output level indication at the 4WR binding posts of each channel must not be greater than 2.4 db less than the indication noted in (6) above.

Channel	SG–71(*)/FCC No. 2 frequency (cps)
1	7,675
1	4,550
2	11,675
2	8,550
3	15,675
3	12,550
4	19,675
4	16,550

(10) Disconnect terminals 3 and 6 of transformer T109 from terminals E and P of the transmission test cable assembly.

e. Hybrid Balance Tests.

(1) Operate the TS–402(*)/U switches for 0-db attenuation. Connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109.

(2) Adjust the SG–71(*)/FCC No. 2 output frequency for 1 kc at an output level of —3 db. Disconnect the ME–30(*)/U and the 600-ohm resistor from transformer T109.

(3) Operate the CHAN MODEM switches as follows:

Switch	Position
2W–4W	2W
TALK-MON	TALK
SEND-MEAS	SEND

(4) Connect terminals 3 and 6 of transformer T109 to terminals C and M of the transmission test cable assembly. Connect a 600-ohm resistor between the 2W 4WT binding posts.

(5) Connect the ME–30(*)/U across terminals B and L of the transmission test cable assembly. The indication will be —40 db or a greater negative value.

(6) Repeat the procedures given in (1) through (5) above and test channels 2, 3, and 4.

174. Telephone Modem TA–227/U

a. Preliminary Procedures.

(1) Connect the equipment as shown in figure 56 with the following exception: Use transformer T109 (connected as shown in circuit 2B, fig. 129) in place of transformer T108 in the SG–71(*)/FCC No. 2 circuit. Connect the subgroup test cable assembly to CHAN MODEM 2 connector P2.

(2) Apply ac input power to the 200 VOLT POWER SUPPLY and the test equipment.

(3) Adjust the TR AMP GAIN control on the SUBGROUP PANEL completely clockwise.

(4) Connect the output of SG–71(*)/FCC No. 1 to terminals A and J of the transmission test cable assembly. Ad-

just the output frequency for 72 kc at an output level of 0 db.

(5) Connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109.

(6) Operate the TS–402(*)/U switches to provide 0-db attenuation.

(7) Adjust the SG–71(*)/FCC No. 2 output frequency for 11 kc at an output level of —4 db.

(8) Operate the TS–402(*)/U switches for 35-db attenuation.

(9) Disconnect the ME–30(*)/U and the 600-ohm resistor from transformer T109 and connect jumper wires between terminals 3 and 6 of transformer T109 and terminals A and K of the subgroup test cable assembly.

b. Transmission Tests.

(1) Use the ME–30(*)/U to measure and record the output level across terminals A and L of the power test cable assembly. The indication shall be between —48.4 and —49.6 db.

(2) Use the ME–30(*)/U to measure and record the output levels at the following points:

(*a*) Across terminals K and W of the power test cable assembly.

(*b*) Across the 60–108 KC OUT binding posts on the SUBGROUP PANEL chassis.

(*c*) Across the 60–108 KC OUT ALT binding posts of the SUBGROUP PANEL chassis.

(*d*) Across terminals T1 and R of the test plug assembly connected to the 60–108 KC OUT jack on the SUBGROUP PANEL.

(3) The ME–30(*)/U indications noted in (2)(*a*) through (*d*) above will be within ±1 db of the indication noted in (1) above.

(4) Connect the subgroup test cable assembly to CHAN MODEM 1 connector P3.

(5) Connect and adjust SG–71(*)/FCC No. 1 for the required frequency and output level of the subgroup channel under test as shown in the chart below. Test subgroup channels 1 and 3 as outlined in (1) above.

Subgroup channel under test	SG–71(*)/FCC No. 1		
	Transmission test cable assembly terminal connections	Frequency (kc)	Output level (db)
1	C and L	56	0
3	D and E	88	0

(6) Disconnect the jumper wires from transformer T109 and terminals A and K of the subgroup test cable assembly.

(7) Repeat the procedures given in *a*(5) through (9) above to adjust the SG–71(*)/FCC No. 2 output for a 4.5-kc signal.

(8) Connect the SG–71(*)/FCC No. 1 to terminals A and J of the transmission test cable assembly and adjust the output frequency for 72 kc at an output level of 0 db.

(9) Connect the ME–30(*)/U across terminals A and L of the power test cable assembly. The output level indication will be within —2 to +1.8 db of the indication noted in (1) above.

(10) Repeat the procedures given in (5) above and test subgroup channels 1 and 3. The ME–30(*)/U output level indications will be within —2 to +1.8 db of the indication noted in (1) above.

(11) Disconnect the jumper wires from terminals 3 and 6 of transformer T109 and the subgroup test cable assembly.

c. Special Service Transmission Tests.

(1) Connect the SG–71(*)/FCC No. 1 to terminals A and J of the transmission test cable assembly and adjust the output frequency for 72 kc at an output level of 0 db.

(2) Connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109.

(3) Adjust the TS–402(*)/U switches to provide 0-db attenuation.

(4) Adjust the SG–71(*)/FCC No. 2 output frequency for 11 kc at an output level of —4 db.

(5) Disconnect the ME–30(*)/U and the 600-ohm resistor from transformer T109 and connect jumper wires between terminals 3 and 6 of transformer T109 and the SPECIAL SERVICE 2 IN binding posts.

(6) Operate the SPECIAL SERVICE 2 switch to SPL SERV.

(7) Connect the ME–30(*)/U across terminals A and L of the power test cable assembly. The output level indication will be within ±2 db of that noted in *b*(1) above.

(8) Connect and adjust SG–71(*)/FCC No. 1 for the required frequency as shown in the chart below, at an output level of 0 db. Follow the procedures given in (1) through (7) above and test SPECIAL SERVICE subgroups 1 and 3.

Subgroup channel under test	SG–71(*)/FCC No. 1	
	Transmission test cable assembly terminal connections	Frequency (kc)
1	C and L	56
3	D and E	88

(9) Disconnect SG–71(*)/FCC No. 2 from the subgroup test cable assembly.

d. Transmission Carrier Leak Tests.

(1) Connect and adjust the SG–71(*)/FCC No. 1 to the required subgroup channel frequency as shown in the chart below at an output level of 0 db.

Subgroup channel under test	SG–71(*)/FCC No. 1	
	Transmission test cable assembly terminal connections	Frequency (kc)
1	C and L	56
2	A and J	72
3	D and E	88

(2) Connect Audio Level Meter ME–71(*)/FCC across terminals A and L of the power test cable assembly.

(3) Measure the carrier leak on each of the subgroup channels; use the SG–71(*)/FCC No. 1 subgroup channel frequency and terminal connections. The carrier leak level for each subgroup channel will not be greater than —85 db.

(4) Disconnect the ME–71(*)/FCC from the power test cable assembly.

e. Receiving Tests.

(1) Connect the equipment as shown in figure 57 with the subgroup test cable assembly connected to CHAN MODEM 2 connector P2.

(2) Connect the output of SG–71(*)/FCC No. 1 to terminals A and J of the transmission test cable assembly. Adjust the output frequency for 72 kc at an output level of 0 db.

(3) Connect the ME–30(*)/U and a 135-ohm resistor across terminals 1 and 2 of transformer T107. Operate the switches of the TS–402(*)/U for 0-db attenuation.

(4) Adjust the output frequency of SG–71(*)/FCC No. 2 for 83 kc at an output level of —7.8 db.

(5) Disconnect the ME–30(*)/U and the 135-ohm resistor from transformer T107 and connect terminals 1 and 2 of transformer T107 to terminals H and R of the transmission test cable assembly.

(6) Operate the TS–402(*)/U switches for 5-db attenuation and adjust the DEM 2 GAIN control on the SUBGROUP PANEL completely clockwise.

(7) Use the ME–30(*)/U to measure and record the output level across terminals E and P of the subgroup test cable assembly. The indication will be 5.2 db ±3.

(8) Adjust the DEM 2 GAIN control completely counterclockwise. The ME–30(*)/U will indicate —7 db ±3.

(9) Adjust the DEM 2 GAIN control completely clockwise, disconnect terminals 1 and 2 of transformer T107 from H and R of the transmission test cable assembly and reconnect terminals 1 and 2 to the 60–108 KC IN binding posts.

(10) Measure the output level across terminals E and P of the subgroup test cable assembly. The output level indication will be within ±0.6 db of the indication noted in (7) above.

(11) Disconnect terminals 1 and 2 of transformer T107 from the 60–108 KC IN binding posts and reconnect terminals 1 and 2 to terminals T1 and R of the test plug assembly. Connect the plug of the test plug assembly into the 60–108 KC IN jack on the SUBGROUP PANEL.

(12) Measure the output level across terminals E and P of the subgroup test cable assembly. The output level will be within ±0.6 db of the indication recorded in (7) above.

(13) Disconnect terminals 1 and 2 of transformer T107 from terminals T1 and R of the test plug assembly.

(14) Operate the TS–402(*)/U switches for 0-db attenuation and connect the ME–30(*)/U and a 135-ohm resistor across terminals 1 and 2 of transformer T107.

(15) Adjust the SG–71(*)/FCC No. 2 output frequency for 76.5 kc at an output level of —7.8 db.

(16) Disconnect the ME–30(*)/U and the 135-ohm resistor from transformer T107 and connect terminals 1 and 2 of transformer T107 to terminals H and R of the transmission test cable assembly.

(17) Operate the SPECIAL SERVICE 2 switch to SPL SERV and measure the output level across the SPECIAL SERVICE 2 OUT binding posts. The output level will be ±1.8 db of the indication noted in (7) above.

(18) Connect the plug of the test plug assembly to the DEM 2 OUT jack. Measure and record the output level across terminals T1 and R of test plug assembly. The output level will be ±1.8 db of the indication noted in (7) above.

(19) Connect the subgroup test cable assembly to CHAN MODEM 1 connector P3 and SG–71(*)/FCC No. 1 to terminals C and L of the transmission test cable assembly.

(20) Connect the SG–71(*)/FCC No. 1 to terminals C and L of the transmission test cable assembly and adjust the output frequency for 56 kc at an output level of 0 db.

(21) Perform the procedures given in (3) through (7) above; use the SG–71(*)/FCC No. 2 frequencies and DEM 1 GAIN control positions shown in the chart below to test subgroup channel 1.

Test No.	DEM 1 GAIN control position	SG–71(*)/FCC No. 2 frequency (kc)	ME–30(*)/U indication (db)
1	Clockwise	67	3.7 to 9.7
2	Counterclockwise	67	At least 9.5 db less than test No. 1 above.
3	Clockwise	60.5	4.9 to 8.5

(22) Repeat the procedures given in (17) and (18) above and test the SPECIAL SERVICE 1 OUT binding posts and the DEM 1 OUT jack.

(23) Connect the subgroup test cable assembly to CHAN MODEM 3 connector P1.

(24) Connect the output of the SG–71(*)/FCC No. 1 to terminals D and E of the transmission test cable assembly. Adjust the output frequency for 88 kc at an output level of 0 db.

(25) Perform the procedures given in (3) through (7) above; use the SG–71(*)/FCC No. 2 frequencies and DEM 3 GAIN control positions shown in the chart below to test subgroup channel 3.

Test No.	DEM 3 GAIN control position	SG–71(*)/FCC No. 2 frequency (kc)	ME–30(*)/U indication (db)
1	Clockwise	99	1.2 to 7.2
2	Counterclockwise	99	At least 9.5 db less than test 1 above.
3	Clockwise	92.5	2.4 to 6

(26) Repeat the procedures given in (17) and (18) above to test the SPECIAL SERVICE 3 OUT binding posts and the DEM 3 OUT jack.

175. Amplifier-Pilot Regulator AM–707/TCC–7

a. Preliminary Procedures.

(1) Interconnect the 200 VOLT POWER SUPPLY, the JUNCTION PANEL, the GROUP PANEL, and the signal generator circuits as shown in figure 131.

(2) Strap terminals J to P and E to F on the supply test cable assembly.

(3) Connect a carrier supply test cable assembly to connector P103 of the JUNCTION PANEL.

(4) Connect a carrier test cable assembly to connector P104 of the JUNCTION PANEL.

(5) Connect the junction panel test cable assembly with a 135-ohm resistor connected across terminals 1 and 2 to connector J103 of the JUNCTION PANEL.

(6) Apply ac input power to the 200 VOLT POWER SUPPLY and the test equipment.

(7) Operate the CABLE REELS TO FIRST AN/TCC–11 TR switch to 23.

(8) Connect the SG–71(*)/FCC No. 1 output to terminals H and R of the subgroup test cable assembly and adjust the output for 120 kc (carrier frequency) at an output level of 0 db.

(9) Operate the TS–402(*)/U switches for a 0-db attenuation.

(10) Connect a 135-ohm resistor between terminals 1 and 2 of transformer T107 and adjust the SG–71(*)/FCC No. 2 output for 60 kc at an output level of 8 db measured across the 135-ohm load.

(11) Disconnect the 135-ohm resistor from the output of transformer T107 and connect terminals 1 and 2 of transformer T107 to terminals A and L of the carrier test cable assembly connected to the TO SUBGROUP PANEL connector P104.

(12) Operate the TS–402(*)/U switches to provide 42-db attenuation.

b. Carrier Transmission, Transmitting Direction.

(1) Measure and record the output level across terminals 1 and 2 of the junction panel test cable assembly. The output level will be —8 db ±2.

(2) Disconnect terminals 1 and 2 of transformer T107 from terminal A and L of the carrier test cable assembly. Follow the procedures in *a*(9) through (12) above to adjust the output of the SG–71(*)/FCC for 108 kc then 83 kc. Measure the output level for each test frequency as indicated in (1) above.

(3) Connect the test plug assembly to the TR AMP OUT jack on the GROUP PANEL. The output level will be —40 db ±2. Disconnect the test plug assembly.

(4) Disconnect the output of transformer T107 from terminals A and L of the carrier test cable assembly and connect the output of transformer T107 to the SPECIAL SERVICE 60–108 KC IN binding posts on the GROUP PANEL chassis. Operate the SPL SERV 60–108 KC switch to SPL SERV.

(5) Operate the TS–402(*)/U switches to provide 0-db attenuation. Measure the

output level across terminals 1 and 2 of the junction panel test cable assembly. The output level will be —8 db ±2.

(6) Operate the SPL SERV 60–108 KC switch to REGULAR.

(7) Disconnect terminals 1 and 2 of transformer T107 from the SPECIAL SERVICE 60–108 KC IN binding posts and follow the procedures in *a* (9) and (10) above to adjust the output of the SG–71(*)/FCC No. 2 for 28 kc. Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107. Connect terminals 1 and 2 of transformer T107 to the SPECIAL SERVICE 12–60 KC IN binding posts on the SUBGROUP chassis.

(8) Operate the SPL SERV 12–60 KC switch on the panel to SPL SERV and measure the output level across terminals 1 and 2 of the junction panel test cable assembly. The output level will be —8 db ±2.

(9) Operate the SPL SERV 12–60 KC switch to REGULAR and follow the procedures given in *a*(9) and (10) above to adjust the output of the SG–71(*)/FCC No. 2 for 68 kc.

(10) Operate the TS–402(*)/U switches to provide 35-db attenuation and disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107.

(11) Connect terminals 1 and 2 of transformer T107 to terminals H and J of the carrier supply test cable assembly connected to the TO CARRIER SUPPLY PANEL connector P103.

(12) Measure the output level across terminals 1 and 2 of the junction panel test cable assembly. The output level will be —7.5 db ±1.5.

c. Order Wire Transmission Circuit Tests.

(1) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71(*)/FCC No. 2 output for 1 kc.

(2) Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T-107 and connect terminals 1 and 2 of transformer T107 to terminals 1 and 2 of the junction panel test cable assembly.

(3) Disconnect the carrier test cable assembly from connector P104 and connect it to connector P101 of the JUNCTION PANEL.

(4) Connect a 600-ohm resistor across terminals L and M of the carrier test cable assembly connected to connector P101. Measure the output level across the 600-ohm resistor. The output level will be —7.5 db ±1.5.

(5) Disconnect the 135-ohm resistor from terminals 1 and 2 of the junction panel test cable assembly and connect it between terminals 3 and 4 of the junction panel test cable assembly.

(6) Connect a 600-ohm resistor across terminals F and S of the carrier test cable assembly connected to connector P101 of the JUNCTION PANEL. Measure the output level across the 600-ohm resistor. The output level will be —10.5 db ±1.5.

d. Carrier Transmission, Receive Direction.

(1) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71-(*)/FCC No. 2 output frequency for 68 kc.

(2) Disconnect the 135-ohm resistors from terminals 1 and 2 of transformer T107 and terminals 3 and 4 of the junction panel test cable assembly.

(3) Connect terminals 1 and 2 of transformer T107 to terminals 3 and 4 of the junction panel test cable assembly.

(4) Operate the CABLE REELS TO FIRST AN/TCC–11 REC switch to 23 and the REGULAR switch to MAN.

(5) Adjust the BULGE ADJ 28 KC and the SLOPE ADJ 12 KC controls to 0.

(6) Connect a voltage divider network (fig. 131) consisting of a 10,000-ohm and a 135-ohm resistor connected in series (the 10,000-ohm resistor connects to terminal T1) between terminals T1 and R of the test plug assembly.

(7) Connect the plug of the test plug assembly to the REC IN jack on the GROUP PANEL. Measure the output level across the 135-ohm voltage divider resistor. The output level will be —47 db ±1.

(8) Disconnect the voltage divider resistors from the test plug assembly and connect the plug of the test plug assembly to the REC AMP 1 OUT jack on the GROUP PANEL.

(9) Adjust the FLAT ADJ 68 KC control completely clockwise. Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly and operate the TS–402(*)/U switches for an output level of —40 db.

(10) Adjust the FLAT ADJ 68 KC control completely counterclockwise. The output level will be —48 db or a greater negative value.

(11) Operate the TS–402(*)/U switches to provide 23-db attenuation and adjust the FLAT ADJ 68 KC control until an output level of —40 db is obtained on the ME–30(*)/U.

(12) Connect the plug of the test plug assembly to the REC AMP 2 OUT jack on the GROUP PANEL. Connect the ME–30(*)/U across terminals T1 and R of the test jack assembly. Adjust the MAN REG OUTPUT control for an output level of —40 db.

(13) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71(*)/FCC output frequency for 12 kc.

(14) Operate the TS–402(*)/U switches to provide 23-db attenuation. Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107 and connect terminls 1 and 2 of transformer T107 to terminals 3 and 4 of the junction panel test cable assembly.

(15) Connect the plug of the test plug assembly to the REC AMP 2 OUT jack of the GROUP PANEL. Measure the output level across terminals T1 and R of the test plug assembly. The output level will be —46.7 db ±3.

(16) Repeat the procedures given in (13) through (15) above; use a test frequency of 28 kc. The output level will be —45 db ±2.

(17) Repeat the procedures given in (13) through (15) above; use a test frequency of 60 kc. The output level will be —41 db ±2.

(18) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71(*)/FCC No. 2 output frequency for 12 kc.

(19) Operate the TS–402(*)/U switches to provide 23-db attenuation. Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107 and connect terminals 1 and 2 of the transformer to terminals 3 and 4 of the junction panel test cable assembly.

(20) Connect a subgroup test cable assembly to connector P1 of the GROUP PANEL. Connect a 135-ohm resistor between terminals H and R of the subgroup test cable assembly.

(21) Adjust the DEM GAIN control on the GROUP PANEL chassis completely clockwise. Measure and record the output level across terminals H and R of the subgroup test cable assembly. The output level will be —11.5 db ±2.5.

(22) Repeat the procedures given in (18) through (21) above; use a test frequency of 28 kc. The output level indication will be 1.9 db ±1.5 greater than the output level noted in (21) above.

(23) Connect the plug of the test plug assembly to the DEM OUT jack of the GROUP PANEL. The output level measured across terminals T1 and R of the test plug assembly will be the same as noted in (22) above.

(24) Disconnect the test plug assembly and measure the output level across the DEM OUT binding posts. The output level will be the same as that noted in (22) above.

(25) Repeat the procedures given in (18) through (21) above; use a test fre-

quency of 60 kc. The output level will be within 5.5 db ±2 of that noted in (21) above.

(26) Connect a carrier supply test cable assembly, with a 135-ohm resistor connected between terminals D and R to connector P102 of the JUNCTION PANEL.

(27) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71(*)/FCC No. 2 output frequency for 65 kc.

(28) Operate the TS–402(*)/U switches to provide 4-db attenuation. Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107 and connect terminals 1 and 2 of transformer T107 to terminals D and R of the carrier supply test cable assembly connected to connector P102 of the JUNCTION PANEL.

(29) Connect the plug of the test plug assembly to the REC AMP 1 OUT jack of the GROUP PANEL. Measure the output level across terminals T1 and R of the test plug assembly. The output level will be —42.3 db ±2.

(30) Disconnect the test plug assembly.

e. Carrier Transmission Looped Circuit Tests.

(1) Connect a carrier supply test cable assembly to connector P103 of the JUNCTION PANEL.

(2) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71(*)/FCC No. 2 output frequency for 68 kc at an output level of —8 db.

(3) Operate the TS–402(*)/U switches to provide 35-db attenuation. Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107 and connect terminals 1 and 2 of transformer T107 to terminals H and J of the carrier supply test cable assembly connected to connector P103 of the JUNCTION PANEL.

(4) Connect a strap between terminals 1 and 3 and between terminals 2 and 4 of the junction panel test cable assembly.

(5) Operate the CABLE REELS TO FIRST AN/TCC–11 TR and REC switches to 11.

(6) Connect the plug of the test plug assembly to the TR AMP OUT jack on the GROUP PANEL. Measure the output level across terminals T1 and R of the test plug assembly. The output level will be —40 db ±2.

(7) Connect the plug of the test plug assembly to the REC AMP 1 OUT jack of the GROUP PANEL. Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly. Adjust the FLAT ADJ 68 KC control of the GROUP PANEL chassis until an output level of —40 db is ±0.2 is obtained.

(8) Connect the plug of the test plug assembly to the REC AMP 2 OUT jack and operate the REGULATOR switch to AUTO. Adjust the AUTO REG OUTPUT control completely counterclockwise. The output level will be —48.5 db ±2.5.

(9) Adjust the AUTO REG OUTPUT control clockwise until an output level of —40 db ±0.2 is obtained.

(10) Connect the TS–352(*)/U across the REG VOLTS jacks J1 and J2 on the regulator and alarm Z6 subchassis. The TS–352(*)/U will indicate 3.5 volts dc ±0.5.

(11) Operate the ALARM TEST switch on the regulator and alarm Z6 subchassis to 2 LOW and the ALARM CUT OFF switch on the panel to NORMAL. Adjust the ADJ LOW control completely counterclockwise, then slowly clockwise until the audible alarm sounds and the LOW ALARM indicator lights.

(12) Operate the ALARM CUT OFF switch to LOW. The audible alarm will be silenced. Operate the ALARM TEST switch to NORMAL. The LOW ALARM indicator will extinguish and the audible alarm will sound. Operate the ALARM CUT OFF switch to NORMAL. The audible alarm will be silenced.

(13) Operate the ALARM TEST switch to 1 HIGH and adjust the ADJ HIGH control completely counterclockwise, then slowly clockwise until the audible alarm sounds and the HIGH ALARM indicator lights.

(14) Operate the ALARM CUT OFF switch to HIGH. The audible alarm will be silenced. Operate the ALARM TEST switch to NORMAL. The HIGH ALARM indicator will extinguish and the audible alarm will sound. Operate the ALARM CUT OFF switch to NORMAL. The audible alarm will be silenced.

(15) Connect a 10-ohm resistor between terminals F and P of the subgroup test cable connected to connector P2 of the GROUP PANEL. The output level measured across the 10-ohm resistor will be —0.5 db ±3.

(16) Operate the TS–402(*)/U switches to provide 30-db attenuation. Connect the plug of the test plug assembly to the REC AMP 2 OUT jack on the GROUP PANEL. The output level measured across terminals T1 and R of the test plug assembly will be —40 db ±1.4. Record this indication.

(17) Operate the TS–402(*)/U switches to provide 42-db attenuation. The output level across terminals T1 and R of the test plug assembly will not decrease more than 1.7 db from the output level obtained (16, above).

(18) Operate the TS–402(*)/U switches to provide 35-db attenuation. Operate the REGULATOR switch to MAN and connect the ME–30(*)/U across terminals T1 and R of the test plug assembly. Adjust the MAN REG OUTPUT control for an output level of —40 db ±0.2.

(19) Connect the plug of the test plug assembly to the TR 62 KC jack of the GROUP PANEL. Connect a 135-ohm resistor across terminals T1 and R of the test plug assembly and measure the output level across the resistor. The output level will be —29.6 db ±2.

(20) Connect the plug of the test plug assembly to the REC 62 KC jack of the GROUP PANEL. Measure the output level across terminals T1 and R of the test plug assembly. The output level will be —25.8 db ±2. Disconnect the 135-ohm resistor from terminals T1 and R of the test plug assembly.

(21) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71 (*) FCC No. 2 output frequency for 12 kc at an output level of —8 db.

(22) Operate the TS–402(*)/U switches to provide 30-db attenuation. Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107 and connect terminals 1 and 2 of transformer T107 to SPECIAL SERVICE 12–60 KC IN binding posts on the GROUP PANEL chassis.

(23) Connect a 135-ohm resistor across the SPECIAL SERVICE 12–60 KC OUT binding posts. Operate the SPL SERV 12–60 KC switch to SPL SERV.

(24) Operate the TS–402(*)/U switches to provide 0-db attenuation and measure the output level across terminals T1 and R of the test plug assembly. The output level will be —10.2 db ±2.5.

(25) Connect the plug of the test plug assembly to the SPL SERV 12–60 KC IN jack and measure the output level across terminals T1 and R of the test plug assembly. The output level will be —2 db ±1.

(26) Repeat the procedures given in (21) through (24) above; use a test frequency of 28 kc. The output level will be —9.8 db ±2.5.

(27) Repeat the procedures given in (21) through (24) above; use a test frequency of 60 kc. The output level will be —10.3 db ±3.

(28) Operate the SPL SERV 12–60 KC switch to REGULAR.

(29) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71 (*)/FCC No. 2 output frequency for 83 kc at an output level of —8 db.

(30) Disconnect the 135-ohm resistor from terminals 1 and 2 of transformer T107 and connect terminals 1 and 2 of transformer T107 to the SPECIAL SERVICE 60–108 KC IN binding posts. Operate the SPL SERV 60–108 KC switch to SPL SERV and connect the plug of the test plug assembly to the SPL SERV 60–108 KC IN jack. The output level measured across terminals T1 and R of the test plug assembly will be —13 db ±2.

(31) Connect the ME–30(*)/U and a 135-ohm resistor across terminals T1 and R of the test plug assembly. Connect the plug of the test plug assembly to the DEM OUT jack. Adjust the DEM GAIN control completely clockwise. The output level will be —3.7 db ±3. Record this indication.

(32) Connect the ME–30(*)/U and the 135-ohm resistor across the SPECIAL SERVICE 60–108 KC OUT binding posts. The output level will be within 0.3 db of the output level recorded in (31) above. Operate the DEM GAIN control completely counterclockwise. The output level will be reduced at least 10 db.

(33) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71 (*)/FCC No. 2 output frequency for 68 kc at an output level of —8 db.

(34) Operate the TS–402(*)/U switches to provide 35-db attenuation. Disconnect the 135-ohm resistor from transformer T107 and connect terminals 1 and 2 of transformer T107 to terminals H and J of the carrier supply test cable assembly connected to connector P103.

(35) Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly and connect the plug of the test plug assembly to the REC IN jack on the GROUP PANEL.

(36) Operate the CABLE REELS TO FIRST AN/TCC–11 TR and REC switches as follows: TR switch to 23 and REC switch to 2. Simultaneously operate both switches, one position at a time, throughout their numerical ranges and note the output level at each position. The output level will vary not more than 0.5 db for each switch position.

(37) Repeat the procedures given in *a*(9) and (10) above to adjust the SG–71 (*)/FCC No. 2 output frequency for 12 kc at an output level of —8 db.

(38) Operate the switches on the TS–402 (*)/U to provide 35-db attenuation. Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly and connect the plug of the test plug assembly to the REC AMP 1 OUT jack of the GROUP PANEL.

(39) Operate the CABLE REELS TO FIRST AN/TCC–11 TR and REC switches to 11. Adjust the SLOPE ADJ 12 KC and the BULGE ADJ 28 KC controls to —5. Operate the TS–402(*)/U switches for an output level of —44 db ±0.5. Adjust the SLOPE ADJ 12 KC control to +5. The output level will be —32 db or less negative value.

(40) Repeat the procedures given in (37) through (39) above with the following exceptions: The SG–71(*)/FCC No. 2 output frequency is adjusted for 28 kc and the BULGE ADJ 28 KC control is operated to +5 in place of the SLOPE ADJ 12 KC control. The 28-kc output level will increase to —38 db or a less negative value.

means of REC CABLE REELS TO FIRST AN/TCC–11 controls S5 to simulate the transmission loss through 0 to 21 reels of cable in steps of 3 cable reels. The network is used to build out the cable section to the first Telephone Repeater AN/TCC–11 to a total of 23 reels.

(2) *Flat network.* The flat network is arranged as a bridged-T pad. The FLAT ADJ 68 KC control is a double variable resistor, adjustable to provide a flat loss to the received signals.

(3) *Slope network Z4.* Slope network Z4 compensates for the slope variation (68-kc loss minus 12-kc loss) of the line. Figure 10 shows attenuation characteristics of slope network Z4 for various settings of the SLOPE ADJ 12 KC control.

(4) *Bulge network Z3.* Bulge network Z3 compensates for the bulge variation (68-kc loss minus 28-kc loss after the slope has been reduced to 0 db) of the line. Figure 11 shows the attenuation characteristics of bulge network Z3 for the various settings of the BULGE ADJ 28 KC control.

(5) *Delay equalizer EQ3.* Delay equalizer EQ3 improves the delay distortion in the frequency band from 15 to 45 kc in the 12- to 60-kc special service circuit (fig. 7). The delay equalizer corrects for the delay distortion of the high-pass sections of high-pass, low-pass filter FL102 in the JUNCTION PANEL (fig. 17).

(6) *Basic equalizer EQ2.* Basic equalizer EQ2 corrects for variations in attenuation through 5¾ miles of spiral-four cable. Figure 12 shows the frequency attenuation characteristic of the spiral-four cable end of basic equalizer EQ2. The two curves are complementary and add up to uniform attenuation at all frequencies. When the temperature is other than a mean temperature of 45° F., the cable attenuation characteristic and basic equalizer EQ2 no longer correct the

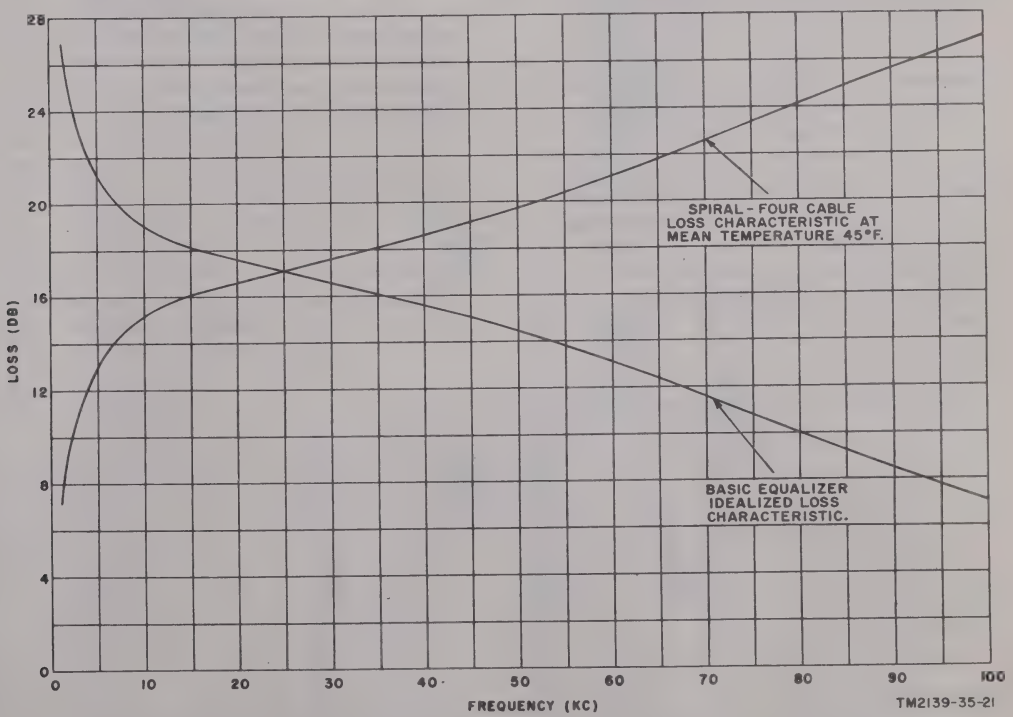


Figure 12. Spiral-four cable and equalizer EQ2, attenuation characteristics.

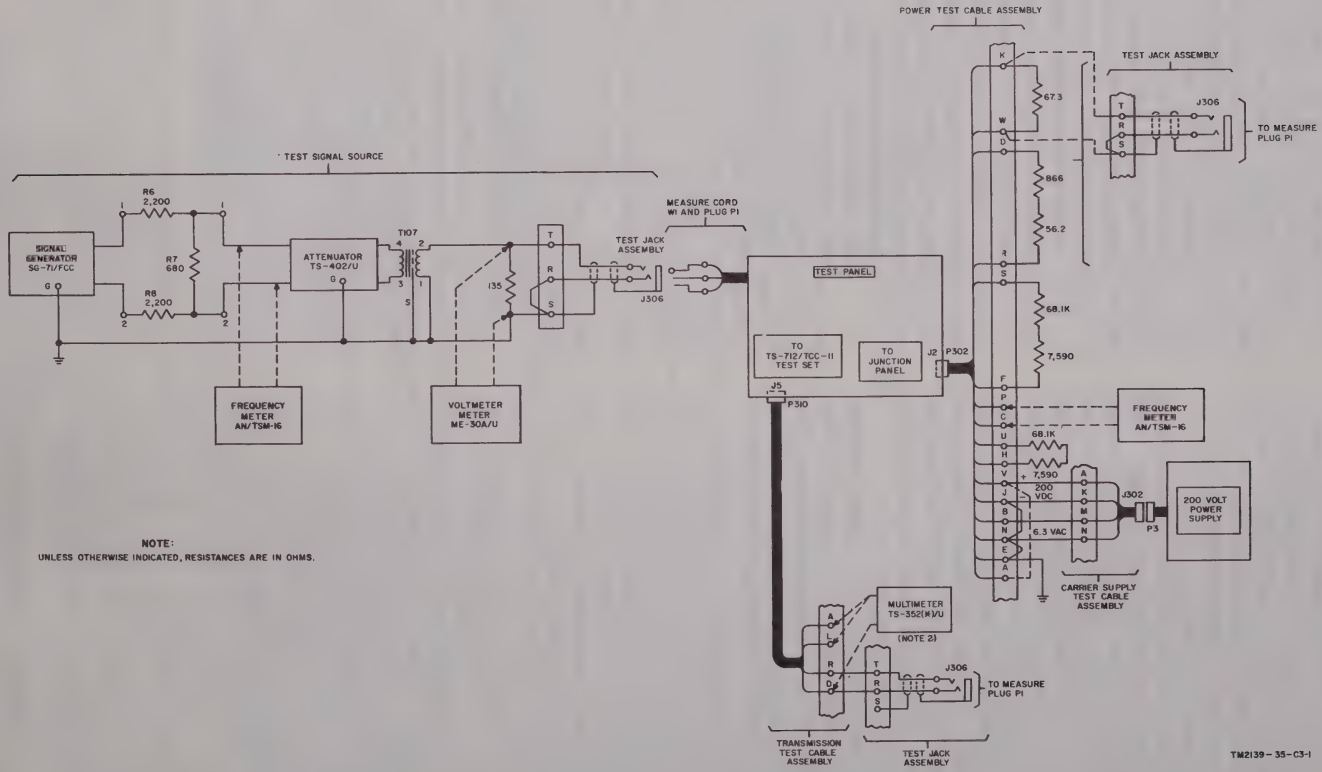


Figure 132.1. TEST PANEL test setup for depot inspection standards testing.

176. Telephone Test Set TS–760/TCC–7 (Part of Receiver-Transmitter Test Set Group OA–443/TCC–7)

a. Preliminary Procedures.

(1) Connect the equipment as shown in figure 132.1.

(2) Apply ac input power to the 200 VOLT POWER SUPPLY and the test equipment.

b. SEND Indicator Operation Tests.

(1) Operate the SEND switch on the TEST PANEL to 65 KC TR OR FAULT TEST, and then to 65 KC REC. The SEND indicator will light in both positions.

(2) Operate the SEND switch to CHECK GAIN CHECK HF. The SEND indicator will not light.

c. MEASURE Switch Operation Tests.

(1) Operate the MEASURE switch on the TEST PANEL to 200 VOLTS.

(2) Adjust the power supply 200V ADJ control for 0-db indication on the TEST PANEL meter.

(3) Use the TS–352(*)/U to measure the voltage across terminals V (+) and J (—) of the power test cable assembly. The TS–352(*)/U will indicate 200 volts dc ±7.

(4) Operate the MEASURE switch on the TEST PANEL to 600 VOLTS. No indication is obtained on the TEST PANEL meter.

(5) Operate the power supply AC POWER switch to OFF. Connect a jumper wire between terminals A and V of the power test cable assembly.

(6) Operate the power supply AC POWER switch to ON. The TEST PANEL meter will indicate 0 db.

d. Nonselective Measurement Tests.

(1) Operate the MEASURE switch on the TEST PANEL to TRANSMISSION and the MEASURE SELECTIVE switch to OFF.

(2) The test positions of the MEASURE NON-SELECTIVE switch are shown in the chart in (*e*) below (col. 1) for each test. Before performing the test for each position of the MEASURE NON-SELECTIVE switch, perform the following:

(*a*) Disconnect the TEST PANEL measure cord W1 and plug P1 from the test signal source circuit (fig. 132.1).

(*b*) Operate TS–402(*)/U switches for 0-db attenuation.

(*c*) Adjust the SG–71(*)/FCC output to indicate the required frequency (col. 2) and the output level (col. 3).

(*d*) Operate the TS–402(*)/U switches to provide the TS–402(*)/U attenuation (col. 4) required.

(*e*) Reconnect the TEST PANEL measure cord W1 and plug P1 to the test signal source circuit. The TEST PANEL meter indication for each test position of the MEASURE NON-SELECTIVE switch will be within the limits shown in column 5.

MEASURE NON-SELECTIVE switch position (1)	SG–71(*)/FCC		TS–402(*)/U attenuation (db) (4)	TEST PANEL meter indication (db) (5)
	Frequency (2)	Output level (volts) (3)		
CHECK 1 KC CHECK HF	68 kc ±100 cps	0.775	46	0 ±0.1
GRP DEM OUT	68 kc ±100 cps	0.731	11	0 ±0.5
SUBGRP DEM OUT	68 kc ±100 cps	0.775	0	0 ±0.5
CARR SUPPLY	68 kc ±100 cps	0.749	0	0 ±0.5
CHANNEL OUT	1 kc ±100 cps	0.870	0	0 ±0.5
OW TR AMP OUT	1 kc ±100 cps	0.699	13	0 ±0.5
OW REC AMP	1 kc ±100 cps	0.757	46	0 ±0.5
CARR SUPPLY	1 kc ±100 cps	0.731	0	0 ±0.5
SUB GRP MOD IN	7 kc ±100 cps	0.775	39	0 ±0.5
SUB GRP MOD IN	19 kc ±100 cps	0.775	39	0 ±0.5
FAULT TEST	83 kc ±100 cps	0.707	41	0 ±1.5
FAULT TEST	91 kc ±100 cps	0.707	41	0 ±1.5
FAULT TEST	99 kc ±100 cps	0.707	41	0 ±1.5
CARR SUPPLY	120 kc ±100 cps	0.749	0	0 ±0.5

e. Meter Scale Tests.

(1) Operate the MEASURE NON-SELECTIVE switch on the TEST PANEL to CHECK 1 KC CHECK HF.

(2) Operate the TS–402(*)/U switches for 46-db attenuation.

(3) Adjust the SG–71(*)/FCC output frequency for 68 kc at an output level of 0 db on the TEST PANEL meter.

(4) Operate the TS–402(*)/U switches in 1-db steps (as shown in the chart below) to provide attenuation losses from 39 to 53 db. At each setting (col. 1), the indication on the TEST PANEL meter will be within the limits shown in column 2 of the chart.

TS–402(*)/U attenuation (db)	TEST PANEL meter indication (db)
39	+7 ±0.3
40	+6 ±0.3
41	+5 ±0.3
42	+4 ±0.3
43	+3 ±0.3
44	+2 ±0.3
45	+1 ±0.3
46	0
47	−1 ±0.3
48	−2 ±0.3
49	−3 ±0.4
50	−4 ±0.5
51	−5 ±0.6
52	−6 ±0.7
53	−7 ±0.8

f. ATTENUATOR Switch Operation Tests.

(1) Operate the MEASURE NON-SELECTIVE switch on the TEST PANEL to CHECK 1 KC CHECK HF.

(2) Operate the TS–402(*)/U switches to provide 46-db attenuation.

(3) Adjust the SG–71(*)/FCC output frequency for 68 kc at an output level of 0 db on the TEST PANEL meter.

(4) Depress and hold the 5 db pushbutton of the ATTENUATOR switch on the TEST PANEL; then operate the TS–402(*)/U switches to provide 41 db attenuation. The TEST PANEL meter will indicate 0 db ±0.5.

(5) Operate the TS–402(*)/U switches to provide 46-db attenuation and release the 5 db pushbutton of the ATTENUATOR switch.

(6) Depress and hold the 10 db pushbutton of the ATTENUATOR switch; then operate the TS–402(*)/U switches to provide 36-db attenuation. The TEST PANEL meter will indicate 0 db ±0.5.

(7) Operate the TS–402(*)/U switches to provide 46-db attenuation, and release pushbutton of the ATTENUATOR switch.

(8) Depress and hold the 20 db pushbutton of the ATTENUATOR switch; then operate the TS–402(*)/U switches to provide 26-db attenuation. The TEST PANEL meter will indicate 0 db ±0.5.

(9) Operate the TS–402(*)/U switches to provide 46-db attenuation and release the pushbutton of the ATTENUATOR switch.

(10) Disconnect TEST PANEL measure cord W1 and plug P1 from the test signal source circuit and operate the TS–402(*)/U switches to provide 0-db attenuation.

g. FINE TUNE Control Range Tests.

(1) Operate the following switches and control of the TEST PANEL to the positions indicated below:

Switch	*Position*
MEASURE NON-SELECTIVE	OFF
MEASURE SELECTIVE	CHECK GAIN
FINE TUNE	Completely clockwise

(2) Adjust the SG–71(*)/FCC output frequency for 68 kc ±25 cps at an output level of 0.775 volt.

(3) Operate the TS–402(*)/U switches to provide 46-db attenuation, and reconnect TEST PANEL measure cord W1 and plug P1 to the signal source circuit.

(4) Adjust the COARSE TUNE control for maximum indication on the TEST PANEL meter.

(5) Operate the FINE TUNE control completely counterclockwise.

(6) Adjust the SG–71(*)/FCC frequency for maximum indication on the TEST PANEL meter. The output frequency will be between 70 and 71 kc.

(7) Adjust the FINE TUNE control on the TEST PANEL to midposition. Adjust the SG–71(*)/FCC output frequency for 68 kc ±25 cps at an output level of 0.775 volt.

(8) Adjust the COARSE TUNE control for maximum indication on the TEST PANEL meter.

h. GAIN Control Range Tests.

(1) Operate the TS–402(*)/U switches to provide 47-db attenuation and adjust the FINE TUNE control for maximum indication on the TEST PANEL meter.

(2) Adjust the GAIN control for a 0-db indication on the TEST PANEL meter.

(3) Operate the TS–402(*)/U switches to provide 45-db attenuation, and the GAIN control for an indication of 0-db on the TEST PANEL meter.

(4) Operate the TS–402(*)/U switches to provide 46-db attenuation, and adjust the FINE TUNE control for a maximum indication on the TEST PANEL meter.

(5) Operate the GAIN control for an indication of 0 db on the TEST PANEL meter.

i. Sensitivity of Circuit for Selective Measurement Tests. The test positions for the MEASURE SELECTIVE switch are shown in the chart in (6) below (col. 1) for each test to be performed. Before performing each MEASURE SELECTIVE switch position test, perform the following procedures:

(1) Disconnect TEST PANEL measure cord W1 and plug P1 from the test signal source circuit.

(2) Operate the TS–402(*)/U switches to provide 0-db attenuation.

(3) Adjust the SG–71(*)/FCC output to the required frequency (col. 2) at the correct output level (col. 3).

(4) Operate the TS–402(*)/U switches to provide the TS–402(*)/U attenuation (col. 4).

(5) Reconnect TEST PANEL measure cord W1 and P1 plug, to the test signal source circuit.

(6) Adjust the FINE TUNE control for a maximum indication on the TEST PANEL meter. The TEST PANEL meter indication for each test will be within the limits shown in column 5 below.

MEASURE SELECTIVE switch position (1)	Signal generator		TS–402(*)/U attenuation (db) (4)	TEST PANEL meter indication (db) (5)
	Frequency (kc ±100 cps) (2)	Output level (volts) (3)		
CHECK GAIN	68	0.775	46	0
12KC	12	0.731	48	0 ±0.5
28KC	28	0.731	48	0 ±0.5
68KC	68	0.731	38	0 ±0.5
65KC	65	0.731	38	0 ±0.5
37KC	37	0.731	38	0 ±0.5
67KC	67	0.731	48	0 ±0.5
83KC	83		48	0 ±0.5
99KC	99	0.731	48	0 ±0.5
GRP PANEL 62 KC[a]	62	0.775	70	0 ±0.7

a MEASURE NON-SELECTIVE switch must be operated to GRP PANEL.

j. HF Oscillator Frequency Tests.

(1) Disconnect TEST PANEL measure cord W1 and plug P1 from the test signal source circuit.

(2) Connect the AN/TSM–16 between terminal 6, section 1 of the SEND switch and chassis ground.

(3) Operate the HF (internal), 65 KC TR OR FAULT TEST (internal), and 65 KC REC controls of the TEST PANEL to their midpositions.

(4) Operate the SEND and FAULT TEST switches on the TEST PANEL as in-

dicated in the chart below (cols. 1 and 2). The AN/TSM–16 will indicate within the limits shown in the *Frequency* column of the chart.

SEND switch position (1)	Pushbutton of FAULT TEST switch operated (2)	Frequency (3)
CHECK GAIN CHECK HF	None	68 kc ±50 cps
65 KC REC	None	65 kc ±50 cps
65 KC TR OR FAULT TEST	REP–3	83 kc ±100 cps
65 KC TR OR FAULT TEST	REP–2	91 kc ±100 cps
65 KC TR OR FAULT TEST	REP–1	99 kc ±100 cps

k. HF Control Range Tests.

(1) Operate the following TEST PANEL switches to the positions indicated:

Switch	*Position*
MEASURE SELECTIVE	OFF
MEASURE NON-SELECTIVE	CHECK 1 KC CHECK HF
SEND	CHECK GAIN CHECK HF

(2) Connect TEST PANEL measure cord W1 and plug P1 to the CHECK HF jack on the TEST PANEL. Operate the HF control completely clockwise. The TEST PANEL meter will indicate 4 db or greater.

(3) Operate the HF control completely counterclockwise. The TEST PANEL meter will indicate —2.5 db or a greater negative value.

(4) Adjust the HF control for a 0-db indication on the TEST PANEL meter.

l. Check of TO 712/TCC–11 TEST Connector J5 Connections.

(1) Connect the test jack assembly to terminals D and R of the transmission test cable assembly. Depress and hold the 20 DB pushbutton ATTENUATOR switch on the TEST PANEL and connect TEST PANEL measure cord W1 and plug P1 to the test jack assembly. The TEST PANEL meter will indicate 3 db ±0.5. Disconnect TEST PANEL measure cord W1 and plug P1 and release the 20 DB pushbutton ATTENUATOR switch.

(2) Use the TS–352(*)/U to measure the resistance between terminals D and A and between terminals D and L of the transmission test cable assembly. The TS–352(*)/U will indicate 680 ohms ±68.

(3) Disconnect the test jack assembly from terminals D and R of the transmission test cable assembly.

m. 65 KC TR OR FAULT TEST Control Range Tests.

(1) Connect the test jack assembly to terminals K and W of the power test cable assembly.

(2) Operate the SEND switch to 65 KC TR OR FAULT TEST and adjust the 65 KC TR OR FAULT TEST (internal) control completely clockwise. Depress and hold the 5-db pushbutton ATTENUATOR switch on the TEST PANEL and connect TEST PANEL measure cord W1 and plug P1 to the test jack assembly. The TEST PANEL meter will indicate 3 db or greater.

(3) With the 5-db pushbutton ATTENUATOR depressed, operate the 65 KC TR OR FAULT TEST (internal) control completely counterclockwise. The TEST PANEL meter will indicate —3 db or a greater negative value.

(4) With the 5-db pushbutton ATTENUATOR switch depressed, operate the 65 KC TR OR FAULT TEST (internal) control for an indication of 0 db on the TEST PANEL meter. Release the 5-db pushbutton ATTENUATOR switch.

n. Fault Test Output Tests.

(1) Operate the MEASURE NON-SELECTIVE switch to FAULT TEST and depress the REP2 pushbutton

switch. The TEST PANEL meter will indicate —2.5 db ±0.3. Release the REP2 pushbutton switch.

(2) Depress the REP3 pushbutton switch. The TEST PANEL meter will indicate —2.5 db ±1. Release the REP3 pushbutton switch.

(3) Depress the REP1 pushbutton switch. The TEST PANEL meter will indicate —2.5 ±1. Release the REP1 pushbutton switch.

(4) Disconnect the test jack assembly from terminals K and W of the power test cable assembly.

o. 65 KC REC Control Range Tests.

(1) Connect the test jack assembly to terminals D and R of the power test cable assembly.

(2) Operate the following switches and control on the TEST PANEL to the positions indicated:

Switch or Control	*Position*
MEASURE NON-SELECTIVE	GRP DEM OUT
SEND	65 KC REC
65 KC REC	Completely clockwise

(3) Connect TEST PANEL measure cord W1 and plug P1 to the test jack assembly. The TEST PANEL meter will indicate between 4 and 6 db.

(4) The 65 KC REC control will be adjustable to obtain an indication of —5 db on the TEST PANEL meter. Readjust the 65 KC REC control for the indication noted in (3) above.

(5) Disconnect TEST PANEL cord W1 and plug P1 from the test jack assembly.

p. One-Kc Oscillator Output Tests.

(1) Operate the MEASURE NON-SELECTIVE switch to CHECK 1 KC CHECK HF and connect TEST PANEL measure cord W1 and plug P1 to the CHECK 1 KC jack. Adjust the 1 KC (internal) control completely clockwise. The TEST PANEL meter will indicate 3 db or greater.

(2) Adjust the 1KC (internal) control completely counterclockwise. The TEST PANEL meter will indicate —3 db or a greater negative value.

(3) Adjust the 1 KC (internal) control for an indication of 0 db on the TEST PANEL meter.

(4) Connect TEST PANEL measure cord W1 and plug P1 to the CHANNEL OUT jack. The TEST PANEL meter will indicate 0 db ±0.5.

(5) Check continuity between terminals C and S and between terminals F and P of the power test cable assembly. The TS–352(*)/U will indicate 0 ohm.

q. One-Kc Oscillator Frequency Tests. Connect the AN/TSM–16 to terminals C and P of the power test cable assembly. The AN/TSM–16 will indicate 1,000 cps ±20.

177. Order Wire Receiver-Transmitter RT–280/TCC–7

a. Preliminary Procedures.

(1) Connect the equipment as shown in figure 133; use SG–71/FCC circuit B. Connect the two 301-ohm resistors across terminals D and R and terminals C and P of the power test cable assembly when indicated in the tests.

(2) The telephone handset will be disconnected from terminal board TB101 of the ORDER WIRE PANEL unless otherwise indicated.

b. Lamp and Buzzer Test.

(1) Apply ac input power to the 200 VOLT POWER SUPPLY and the test equipment.

(2) The CALL indicator on the ORDER WIRE PANEL will light and the buzzer on the ringer-oscillator Y101 will sound. The CALL indicator will extinguish and the buzzer will silence within 30 seconds after power is applied.

c. Transmitting Circuit Tests With Test Signal Applied to 2W EXT Binding Posts.

(1) Operate the TS–402(*)/U switches to provide 0-db attenuation. Connect the ME–30(*)/U and a 600-ohm resistor across terminals 3 and 6 of transformer T109.

(2) Adjust the SG–71/FCC output signal for 1 kc at an output level of —13.5

db. Disconnect the ME–30(*)/U and the 600-ohm resistor from transformer T109.

(3) Use jumper wires and connect terminals 3 and 6 of transformer T109 to the 2W EXT binding posts of the ORDER WIRE PANEL.

(4) Adjust the TR GAIN control of the ORDER WIRE PANEL completely clockwise. Operate the ORDER WIRE, CHANNEL TALK, and SEND OW switches to vertical.

(5) Perform the tests as indicated in the chart below. The output levels measured with the ME–30(*)/U will be within the limits indicated in the ME–30(*)/U *Indications* (*db*) column of the chart.

Test No.	Operate CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to—	ME–30(*)/U	
		Test connections and conditions	Indications (db)
1	RADIO	Terminals L and M of power test cable assembly.	12 db ±2 (record this indication).
2	RADIO	Terminals T and R of test plug assembly connected to the TR AMP OUT jack.	Within ±0.5 db of the indication in test No. 1 above.
3	RADIO	Terminals L and M of power test cable assembly with the TR GAIN control operated completely counterclockwise.	−26 db ±5.
4	RADIO	Terminals L and M of power test cable assembly with the TR GAIN control operated completely clockwise and the SEND OW switch to ON.	−35 db or greater negative value.
5	From 0–11 to 150–160 one, position at a time with the SEND OW switch operated to vertical (nonoperated position).	Terminals L and M of power test cable assembly.	The indication at each switch position shall be within ±2 db of the indication obtained in test No. 1 above.
6	150–160 HOT	Terminals L and M of power test cable assembly.	Not more than 1 db greater than the indication obtained in test No. 1 above.

(6) Repeat the procedures given in (1) through (4) above for a test frequency of 300 cps. Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to RADIO. Measure and record the output level across terminals L and M of the power test cable assembly. The ME–30(*)/U indication will be not less than 0.7 db below the indication obtained in test No. 1 of the chart in (5) above.

(7) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 104–126 and measure the output level across terminals L and M of the power test cable assembly. The indication on the ME–30(*)/U will be not more than 8.5 db below the indication noted in (6) above.

(8) Repeat the procedures given in (1) through (4) above for a test frequency of 1,700 cps. Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to RADIO. Measure and record the output level across terminals L and M of the power test cable assembly. The ME–30(*)/U will indicate within 1.5 db of the indication obtained in test No. 1 of the chart in (5) above.

(9) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 104–126 and measure the output level across terminals L and M of the power test cable assembly. The ME–30(*)/U indication will be not more than 1.5 db above the indication noted in (8) above.

d. Transmitting Circuit Tests With Test Signal Applied to TB101.

(1) Connect the SG–71(*)/FCC circuit C (fig. 133) for the signal source.

(2) Operate TS–402(*)/U switches to provide 0-db attenuation. Connect a 301-ohm resistor and two 100-ohm resistors in parallel across terminals 1 and 4 of transformer T101.

(3) Adjust the SG–71(*)/FCC output signal for 1 kc at an output level of —13.5 db. Disconnect the two 100-ohm resistors from terminals 1 and 4 of transformer T101.

(4) Disconnect the 10-volt dc power supply from terminals A and T of the power test cable assembly and strap terminals A and T.

(5) Use jumper wires and connect terminals 1 and 4 of transformer T101 to terminals 2 and 3 of TB101 on the ORDER WIRE PANEL.

(6) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch to 0–11 and measure the output level across terminals L and M of the power test cable assembly. The ME–30(*)/U will indicate —17.5 db or a greater negative value.

(7) Operate the ORDER WIRE switch of the ORDER WIRE PANEL to TALK and measure the output level across terminals L and M of the power test cable assembly. The ME–30(*)/U will indicate 4 db ±2.

(8) Move the jumper wire from terminal 2 to terminal 1 on TB101.

(9) Operate the CHANNEL TALK switch of the ORDER WIRE PANEL to LINE and the ORDER WIRE switch to TALK. Connect a 301-ohm resistor across terminals C and P of the power test cable assembly.

(10) Measure the output level across terminals C and P of the power test cable assembly. The ME–30(*)/U will indicate between —21 and —24 db.

(11) Operate the CHANNEL TALK switch to TEST BD. Connect a 301-ohm resistor across terminals D and R of the power test cable assembly.

(12) Measure the output level across terminals D and R of the power test cable assembly. The ME–30(*)/U will indicate between —21 and —24 db.

e. Transmitting Tests From Test Signal Connection.

(1) Connect the SG–71(*)/FCC circuit A (fig. 133). Operate the TS–402(*)/U switches to provide 0-db attenuation.

(2) Adjust the output frequency of the SG–71(*)/FCC for 1 kc at an output level of —7.5 db measured across the 10-ohm resistor.

(3) Use jumper wires and connect terminals 3 and 6 of transformer T109 to terminals K and W of the power test cable assembly.

(4) Operate the ORDER WIRE PANEL switches as follows: CHANNEL TALK to TEST BD, ORDER WIRE to TALK, and Cable REELS TO NEXT AN/TCC–7 OR AN/TCC–8 to RADIO.

(5) Use the ME–30(*)/U and measure the output level across terminals L and M of the power test cable assembly. The output level will be —17.5 db or a greater negative value.

(6) Operate the SEND OW switch of the ORDER WIRE PANEL to ON and measure the output level across terminals L and M of the power test cable assembly. The ME–30(*)/U will indicate between 2.5 and 5.5 db greater than the indication obtained in test No. 1 of the chart in *c*(5) above.

f. Receive Tests From Line.

(1) Connect the equipment as shown in figure 91; use the top SG–71/FCC circuit.

(2) Operate the TS–402(*)/U switches to provide 0-db attenuation.

(3) Operate the following ORDER WIRE PANEL control and switches to the positions indicated.

Control or switch	Position
REC GAIN	Completely clockwise
CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8	0–11
CHANNEL TALK	Nonoperated (vertical)
ORDER WIRE	Nonoperated (vertical)
SEND OW	Nonoperated (vertical)

(4) Connect a 1,300-ohm resistor and a 301-ohm resistor in series across the test leads of the ME–30(*)/U and terminals 3 and 6 of transformer T109. Adjust the output signal of the SG–71(*)/FCC for 1 kc at an output level of —16 db.

(5) Disconnect the resistors and the ME–30(*)/U from terminals 3 and 6 of transformer T109. Operate the TS–402(*)/U switches to provide 25-db attenuation and connect terminals 3 and 6 of transformer T109 to terminals F and S of the power test cable assembly.

(6) Measure and record the output level across the 2W EXT binding posts of the ORDER WIRE PANEL. The ME–30(*)/U will indicate —7.5 db ±2.

(7) Repeat the procedures given in (1) through (5) above; use a test frequency of 300 cps. The output level measured across the 2W EXT binding posts will be 0.5 db ±1 greater than the indication noted in (6) above.

(8) Repeat the procedures given in (1) through (5) above; use a test frequency of 1,700 cps. The output level measured across the 2W EXT binding posts will be within ±1 db of the indication noted in (6) above.

(9) Repeat the procedures given in (1) through (5) above for a test frequency of 1 kc.

(10) Connect the plug of the test plug assembly to the REC AMP IN jack of the ORDER WIRE PANEL. Measure and record the output level across terminals T1 and R of the test plug assembly. The ME–30(*)/U will indicate —40.5 db ±1.

(11) Connect the plug of the test plug assembly to the REC AMP OUT jack of the ORDER WIRE PANEL. Measure the output level across terminals T1 and R of the test plug assembly. The ME–30(*)/U will indicate within ±1 db of the indication noted in (10) above.

(12) Operate the TS–402(*)/U switches to provide 15-db attenuation. Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch of the ORDER WIRE PANEL to RADIO.

(13) Connect the plug of the test plug assembly to the REC AMP IN jack of the ORDER WIRE PANEL and measure the output level across terminals T1 and R of the test plug assembly. The ME–30(*)/U shall indicate 11 db ±2 greater negative value than the indication noted in (10) above.

(14) Repeat the procedures given in (1) through (5) above with the following exceptions: Use a test frequency of 1,700 cps and adjust the REC GAIN control of the ORDER WIRE PANEL completely counterclockwise.

(15) Connect the plug of the test plug assembly to the REC AMP IN jack of the ORDER WIRE PANEL and measure the output level across terminals T1 and R of the test plug assembly. The ME–30(*)/U will indicate —37 db ±25.

(16) Disconnect the strap between terminals A and T on the power test cable assembly and reconnect the 10-volt dc supply to terminals A and T. Operate the REC GAIN control of the ORDER WIRE PANEL completely clockwise.

(17) Repeat the procedures given in (1) through (4) above for a test frequency of 1,600 cps.

(18) Disconnect the 1,300-ohm resistor, the 301-ohm resistor, and the ME–30(*)/U from terminals 3 and 6 of transformer T109 and connect terminals 3 and 6 of the transformer to terminals F and S of the power test cable assembly.

(19) Operate the TS–402(*)/U switches to provide 15-db attenuation, then 39-db attenuation. At both attenuator positions, the CALL indicator will light and the buzzer will sound on the ORDER WIRE PANEL.

Note. If the input circuit is broken at the 39-db attenuator position, the CALL indicator will be extinguished and the buzzer will silence. The attenuation must be reduced to energize them again.

(20) Repeat the procedures given in (1) through (4) above. Disconnect the resistors and the ME–30(*)/U from terminals 3 and 6 of transformer T109. Connect terminals 3 and 6 of the transformer to terminals F and S of the power test cable assembly.

(21) Operate the TS–402(*)/U switches to provide 15-db attenuation. Connect two 121-ohm resistors in series between terminals 3 and 5 of TB101 of the ORDER WIRE PANEL.

(22) Connect the ground test lead of the ME–30(*)/U to terminal 3 of TB101 and the INPUT test lead to terminal 5 of TB101. The output level indication will be —50 db or a greater negative value.

(23) Operate the TS–402(*)/U switches to provide 20-db attenuation. Operate the ORDER WIRE switch of the ORDER WIRE PANEL to TALK and measure the output level across terminals 3 and 5 of TB101. The ME–30(*)/U will indicate —4.5 db ±2.

(24) Disconnect the two 121-ohm resistors from terminals 3 and 5 of TB101. Connect two 75-ohm resistors in series between terminals 3 and 4 of TB101 and measure the output level across terminals 3 and 4 of TB101. The ME–30(*)/U will indicate —11.5 db ±2. Disconnect the two 75-ohm resistors connected to terminals 3 and 4 of TB101.

g. Receiving Tests From Message Channels.

(1) Connect the lower signal generator circuit shown in figure 91. Connect a 600-ohm and a 301-ohm resistor in parallel between terminals 3 and 6 of transformer T109. Operate switches on the TS–402(*)/U to provide 0-db attenuation and adjust the SG–71(*)/FCC output signal for 1 kc at an output level of —10 db.

(2) Disconnect the 301-ohm resistor from terminals 3 and 6 of transformer T109. Connect terminals 3 and 6 of transformer T109 to terminals D and R of the power test cable assembly.

(3) Operate the CHANNEL TALK switch of the ORDER WIRE PANEL to LINE and the ORDER WIRE switch to nonoperate (vertical) position. Connect two 121-ohm resistors in series across terminals 3 and 5 of TB101 of the ORDER WIRE PANEL.

(4) Connect the ground test lead of the ME–30(*)/U to terminal 3 and the INPUT test lead to terminal 5 of TB101. The output level will be —23.5 db ±2.

(5) Connect the SG–71(*)/FCC circuit output to terminals C and P of the power test cable assembly. Operate the CHANNEL TALK switch of the ORDER WIRE PANEL to TEST BD. Measure the output level across terminals 3 and 5 of TB101. The ME–30(*)/U will indicate within 0.5 db of the indication noted in (4) above.

(6) Connect handset HS–101 to TB101 of the ORDER WIRE PANEL. A 1-kc tone will be audible.

178. Telephone Carrier Frequency Supply TA–228/TCC–7

a. Preliminary Procedures.

(1) Connect the equipment as shown in figure 103.

(2) Apply ac input power to the 200 VOLT POWER SUPPLY and the test equipment.

b. 64–Kc Oscillator Tests.

(1) Disconnect frequency stabilizer network Z1 (fig. 20) from standoff terminals E61 and E62 and connect a 100,000-ohm resistor between terminals E61 and E62.

(2) Connect the plug of the test plug assembly to the 64KC LOCAL jack on

the CARRIER SUPPLY PANEL chassis. Use the AN/TSM–16 to measure across terminals T1 and R of the test plug assembly. The frequency will be 64 kc ±100 cps.

(3) Disconnect the 100,000-ohm resistor and reconnect frequency stabilizer network Z1 to standoff terminals E61 and E62.

(4) Allow a 20-minute warmup period before continuing the tests.

(5) Measure the frequency across terminals T1 and R of the test plug assembly. The AN/TSM–16 will indicate 64 kc ±2 cps. Disconnect the test plug assembly from the 64 KC LOCAL jack.

(6) Connect the vertical input leads of the OS–8(*)/U between terminal 1 of inductor L3 (fig. 20) and chassis ground of the CARRIER SUPPLY PANEL. Adjust the sweep controls of the OS–8(*)/U for a trace pattern of 2 to 3 cycles. The wave shape pattern will be a steady sine wave.

c. Channel Carrier Output Tests.

(1) Connect the carrier supply test cable assembly to each of the CHAN MOD connectors in turn and use the ME–30(*)/U to measure the voltage across each of the 60.4-ohm resistors. The ME–30(*)/U will indicate between 0.69 and 0.98 volt across each resistor.

(2) Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly and connect the plug of the test plug assembly to the following jacks in turn; 12KC, 20KC, 16KC, and 8KC. The indication on the ME–30 (*)/U at each jack will be between 0.77 and 0.585 volt.

d. Group and Subgroup Carrier Tests.

(1) Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly and connect the plug of the test plug assembly to the following jacks in turn: 120KC, 88KC, 72KC, and 56KC. The indication on the ME–30(*)/U at each jack will be between 0.63 and 0.89 volt.

(2) Use the ME–30(*)/U to measure across each of the four 10-ohm resistors connected to terminals of the transmission test cable assembly. The ME–30(*)/U indication across each resistor will be between 0.63 and 0.89 volt.

e. Continuity and Voltage Tests.

(1) Connect the carrier supply test cable assembly to CHAN MOD 1 connector P3. Use the ME–30(*)/U to perform the following tests on the transmission test cable assembly:

(*a*) Measure the resistance between terminal K and chassis ground. The indication will be 0 ohms.

(*b*) Measure the ac voltage between terminals B and L. The indication will be 6.3 volts ac.

(*c*) Measure the dc voltage between terminals A and K. The indication will be 200 volts dc.

(2) Connect the carrier supply test cable assembly to CHAN MOD 2 connector P2 and repeat the tests given in (1) above.

(3) Connect the carrier supply test cable assembly to CHAN MOD 3 connector P1 and repeat the tests given in (1) above.

f. Pilot and Test Frequency Tests.

(1) Calibrate and connect the ME–71(*)/FCC across the 135-ohm resistor connected between terminals H and J of the supply test cable assembly.

(2) Tune the ME–71(*)/FCC to 68 kc and adjust the 68KC control on the CARRIER SUPPLY PANEL chassis completely clockwise. The ME–71(*)/FCC will indicate an output level of —33.5 db or a less negative value.

(3) Operate the 68KC control completely counterclockwise. The ME–71(*)/FCC will indicate an output level of —37.5 db or a greater negative value.

(4) Operate the 12 & 28 KC switch on the CARRIER SUPPLY PANEL to ON. The 12 & 28 KC indicator will light.

(5) Ground terminal 3 of filters FL–4 and FL–5 and adjust the 12KC control completely counterclockwise.

(6) Connect the ME–30(*)/U between terminal E37 and chassis ground. The output level indication on the ME–30(*)/U will be —29 db or a greater negative value.

(7) Adjust the 12KC control completely clockwise. The ME–30(*)/U will indicate an output level of —25 db or a less negative value.

(8) Disconnect the ME–30(*)/U and the ground from terminal 3 of filters FL–4 and FL–5.

(9) Adjust the ME–71(*)/FCC for an input impedance of 135 ohms. Operate the ATTENUATOR DB control —40 and connect the input leads to terminals H and J of the supply test cable assembly.

(10) Adjust the 28KC control completely counterclockwise and note the 28-kc output level on the ME–71(*)/FCC. The output level will be —47 db or a greater negative value.

(11) Operate the 28KC control completely clockwise. The ME–71(*)/FCC will indicate an output level of —43 db or a more negative value.

(12) Operate the 12 & 28 KC switch on the panel to OFF. The 12 & 28 KC indicator will extinguish.

g. 68KC and 120KC ALARM Tests.

(1) Connect the ME–26(*)/U and a 600-ohm resistor between terminals B and E of the supply test cable assembly.

(2) Connect terminal 1 of frequency stabilizer network Z1 to ground. The 68KC and the 120KC ALARM indicators will light and the ME–26(*)/U will indicate 6.3 volts ac.

(3) Operate the 68 KC ALARM CUTOFF and the 120 KC ALARM CUTOFF switches. The 68KC and the 120KC ALARM indicators remain lighted and the ME–26(*)/U will indicate 0 volt.

(4) Connect the ME–30(*)/U to terminals T1 and R of the test plug assembly. Connect the plug of the test plug assembly to the DIV 2 jack. The ME–30(*)/U will indicate 0.1 volt or less.

(5) Disconnect the test plug assembly, the ME–30(*)/U, and the ground connection from terminal 1 of frequency stabilizer network Z1. Operate the 68 KC and the 120 KC ALARM CUTOFF switches to normal.

h. Test Jack Output Tests. Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly. Connect the plug of the test plug assembly in turn to the following jacks and note the output level indications on the ME–30(*)/U: 64KC LOCAL, DIV 1, DIV 2, and 4KC. The ME–30(*)/U indications will be between 0.525 and 1.025 volt at the 64KC LOCAL, DIV 1, and DIV 2 jacks, and between 0.525 and 1.2 volt at the 4KC jack.

i. Remote Operation Tests.

(1) Connect the SG–71(*)/FCC to terminals F and P of the transmission test cable assembly and adjust the output signal for an indication of 68 kc ±100 cps on the AN/TSM–16 and adjust the output level for 0.75 volt on the ME–30(*)/U.

(2) Operate the CARR SYNC switch to REMOTE and readjust the output level of the SG–71(*)/FCC for an indication of 0.75 volt on the ME–30(*)/U.

(3) Connect the ME–30(*)/U across terminals T1 and R of the test plug assembly. Connect the plug of the test plug assembly to the SYNC jack and note the meter indication; then connect it to the 64KC REM jack. The ME–30(*)/U indication will be as follows: at the SYNC jack, between 0.53 and 1.06 volt, and at the 64KC REM jack, between 0.53 and 1.18 volt.

(4) Connect the plug of the test plug assembly to the 64KC LOCAL jack. The ME–30(*)/U will indicate 0.2 volt or less and the 68KC and 120KC ALARM lamps will not be lighted.

179. Power Supply PP–827/U

a. Preliminary Procedures.

(1) Remove the power supply from the transit case.

(2) No connections are made to connectors P2 and P3 when the resistance tests in *b* below are performed.

(3) Operate the power supply 115V–230V switch to 115V and the AC POWER switch to ON.

b. Resistance Tests.

(1) Use the TS–352(*)/U and perform the resistance test indicated in the chart below.

Test No.	TS–352(*)/U	
	Test leads connected across terminals of connector P3	Required indication (ohms)
1	R and chassis ground	0
2	A and R	Infinity
3	B and R	Infinity
4	D and R	Infinity
5	J and R	Infinity
6	M and R	0
7	P and R	Infinity
8	A and K	32K to 40K

(2) Connect one test lead of the TS–352 (*)/U across both contact blades of connector P2 and the other test lead to terminal R of connector P3. Operate the 115V–230V to 230V, then to 115V. The indication on the TS–352 (*)/U for each switch position will be infinity.

c. Output Voltage Tests.

(1) Connect the equipment as shown in figure 134 with connector P2 connected to the output of Transformer, Variable Power TF–171/USM.

(2) Use the TS–352(*)/U in place of Multimeter AN/URM–105.

(3) Connect the terminating resistors on the carrier test cable assembly as indicated in the chart (cols 2 and 3) in (5) below.

(4) Apply ac input power to TF–171/USM and operate the power supply AC POWER switch to ON. The AC POWER lamp will light. Adjust the output of the TF–171/USM for an indication of 115 volts on the TS–352 (*)/U and allow the equipment to warm up for 15 minutes before continuing the tests.

(5) Perform the tests listed in the chart below; use the instructions in the notes following the chart to complete the tests. The output voltage indications on the TS–352(*)/U (dc volts) and the ME–30(*)/U (ac ripple volts) will be within the limits indicated in columns 6 through 9 of the chart. When performing the ripple voltage tests, note the average indication value. Ignore momentary peaks.

Test No. (1)	Resistance termination across terminals of carrier test cable assembly		See notes—(4)	Ac input volts (output of TF–171/USM) (5)	TS–352(*)/U indication connected across terminals of carrier supply test cable assembly		Maximum ripple voltage indication on the ME–30(*)/U connected across terminals of carrier supply test cable assembly	
	Terminals A and K (ohms) (2)	Terminals D and H (ohms) (3)			Terminals A and K (dc volts) (6)	Terminals D and H (dc volts) (7)	Terminals A and K (ac volts) (8)	Terminals D and H (ac volts) (9)
1	740	1,000	1, 2, 7	115.0	200	No connection	0.01	No connection
2	740	1,000	3, 7	97.5	197 to 200	No connection	0.01	No connection
3	800	1,000	3, 8	115.0	200 to 202	No connection	0.01	No connection
4	800	1,000	1, 2, 8	115.0	200	No connection	0.01	No connection
5	800	1,000	3, 8	130.0	200 to 203	No connection	0.02	No connection
6	387	1,000	4, 9	115.0	190 to 210	No connection	No connection	No connection
7	387	1,000	9	115.0	200	12 ±1	No connection	0.03
8	387	138	9, 10	115.0	200	9 ±1	No connection	0.03
9	387	138	5, 9, 10	115.0	200	9 ±1	No connection	No connection
10	800	1,000	6, 8	115.0	No connection	No connection	No connection	No connection
11	800	1,000	8, 11	230.0	No connection	12 ±1	No connection	No connection

NOTES

1. Adjust the power supply 200V ADJ control to obtain the voltage given in test No. 1.
2. The equipment will be allowed to operate for a minimum of 5 minutes under the conditions of test No. 1 before proceeding to the next test. Do not turn off the ac input power during tests No. 1 through 4. *Two hundred volts dc exists across terminals A and K of the carrier supply test cable assembly.*
3. Do not adjust the 200V ADJ control of the power supply.
4. Adjust the 200V ADJ control of the power supply from the counterclockwise stop position to the clockwise stop position. The indications of the TS–353(*)/U will be equal to the indication in column 6 of the chart. After completion of test 5, adjust the 200V ADJ control to indicate 200 volts dc across terminals A and K of the carrier supply test cable assembly. Tighten the locknut.
5. By use of the TS–352(*)/U, measure the ac voltage across terminals B and L, J and E, P and F, and M and N of the carrier supply test cable assembly. The TS–352(*)/U indication across each pair of terminals will be 7.2 volts ±1.
6. By use of the TS–352(*)/U, measure the ac output at the TO 600V POWER SUPPLY outlets J2 and J3, and the 115 V CONVENIENCE OUTLETS J4 and J5. The TS–352(*)/U indication at each outlet will be 115 volts ±1.
7. The 740-ohm resistor is formed by connection of 2 variable 1,500-ohm, 25-watt resistors in parallel and adjustment of them to obtain an indication of 740 ohms on the TS–352(*)/U.
8. The 800-ohm resistor is formed by connection of 2 1,000-ohm, 37-watt resistors in parallel.
9. The 387-ohm resistor is formed by connection of a 1,000-ohm, 55-watt resistor and a 630-ohm, 78-watt resistor in parallel.
10. The 138-ohm resistor is formed by connection of a 1,000-ohm, 2-watt resistor and a 160-ohm, 2-watt resistor in parallel.
11. Before performing test No. 11, operate the AC POWER switch on the power supply to OFF. Operate the 115V–230V switch to 230V and adjust the TF–171/USM to indicate 230 volts on the TS–352(*)/U. Operate the AC POWER switch of the power supply to ON. Repeat the procedures in note 5 after the chart in *c* above and perform test No. 11.

d. Blower Operation.

(1) Replace the power supply in the transit case without the cover in place.

(2) Apply 115-volt ac input power to the power supply and operate the AC POWER switch to ON. Thermostat S2 will operate in approximately 20 minutes to start the blower motor and force air through the front panel grill.

180. Power Supply PP–826/U and PP–826A/U Resistance Tests

a. Preliminary Procedures.

(1) The test will be performed at an ambient temperature from 60° to 90° Fahrenheit.

(2) Remove the power supply from the transit case.

(3) No connections are made to connectors P1 and P3 when the resistance tests in *b* below are performed.

(4) Operate the AC POWER switch to ON and the 115V–230V switch to 115V.

b. Resistance Tests.

(1) Use the TS–352(*)/U and measure the resistance between the test points indicated in the chart below. The *Required indication (ohms)* column, gives the required TS–352(*)/U indication.

Test No.	TS–352(*)/U		
	Test lead connected to terminal of terminal board TB1—	Test lead connected to test point	Required indication (ohms)
1[a]	A	Ground	180 to 540K
2[b]	A	Ground	19 to 23K
3	B	Ground	0
4	C	Ground	0
5	D	Ground	180 to 540K
6	E	Ground	Infinity
7	F	Ground	Infinity
8	E	Terminal 9 of transformer T1 (low voltage rectifier and alarm Z1).	Infinity
9	E	Terminal 11 of transformer T1 (low voltage rectifier and alarm Z1).	Infinity
10	E	Terminal 1 of transformer T1 (main chassis).	Infinity

a Operate the REPEATER switch to 3.
b Applies to PP–826A/U only. Adjust the 600V ADJ control completely clockwise.

(2) Use the TS–352(*)/U and measure the resistance between the test points indicated in the chart below. The indication on the TS–352(*)/U will be as indicated in the *Required indication (ohms)* column of the chart.

Test No.	TS–352(*)/U		
	Test lead to—	Test lead to—	Required indication (ohms)
1	Terminal 1 of transformer T1 (main chassis).	Ground	Infinity
2	Terminal 9 of transformer T1 (low voltage rectifier and alarm Z1).	Ground	Infinity
3	Terminal 11 of transformer T1 (low voltage rectifier and alarm Z1).	Ground	Infinity

(3) Use the TS–352(*)/U and measure the resistors between the REPEATER switch contacts. The chart below indicates the switch and control positions, the test points, and the required TS–352(*)/U indications for each test.

Test No.	REPEATER switch position	600V ADJ control position	Resistor being measured	TS–352(*)/U	
				Test points	Required indication (ohms) ±20%
1	3	Completely clockwise	R7	J1 to J3	7,100
2	3	Completely clockwise	R6, R12	J3 to J4	2,000
3	3	Completely counterclockwise.	R6	J3 to J4	500
4	2	Completely counterclockwise.	R6, R13	J3 to J4	2,300
5	1	Completely counterclockwise.	R6, R13, R14, R15	J3 to J4	4,100
6	0	Completely counterclockwise.	R6, R13, R14, R15	J3 to J4	5,700
7	TEST	Completely counterclockwise.	None	J4 to ground	0

181. Power Supply PP–826/U Operating Tests

a. Preliminary Procedures.

(1) Connect the equipment as shown in figure 135 with connector P1 of the power supply cable connected to the output of the TF–171/USM.

(2) Use the TS–352(*)/U in place of Multimeter AN/URM–105.

(3) Apply ac input power to the TF–171/USM and operate the power supply AC POWER switch to ON. Adjust the output of the TF–171/USM for an indication of 115 volts on the TS–352(*)/U.

(4) After the required warmup period, operate the power supply AC POWER switch to OFF.

(5) Operate the REPEATER switch to 3. Adjust the LOAD CURRENT, the LOW-VOLT ALARM, and the HIGH-VOLT ALARM controls completely counterclockwise. Adjust variable resistors R16 and R20 (on the bottom of the low voltage rectifier alarm unit Z1 chassis) completely clockwise.

(6) Connect the TS–352(*)/U across terminals A and B of the 600 v power supply test cable assembly and adjust the 1,500-ohm variable load resistor for an indication of 4,000 ohms on the TS–352(*)/U. Disconnect the TS–352(*)/U.

(7) Operate the power supply AC POWER switch to ON. The power supply CURRENT meter will indicate between 10 and 17 milliamperes.

(8) Adjust variable resistor R16 slowly counterclockwise until relay K5 releases. When relay K5 releases, relays K1, K8, and K9 will operate. The indication on the CURRENT meter will drop to zero, then rapidly rise between 60 and 90 milliamperes.

b. Normal Output Voltage Tests.

(1) Operate the power supply AC POWER switch to OFF. Connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly and adjust the 1,500-ohm variable load resistor for a 6,000-ohm indication on the TS–352(*)/U.

(2) Connect the AN/GSM–64 across terminals A and B of the 600 V power supply test cable assembly. Operate the power supply AC POWER switch to ON. The CURRENT meter will increase between 65 and 95 milliamperes within 8 seconds, as timed with the

stopwatch. The AN/GSM–64 will indicate 600 volts dc. Recheck the output of the TF–171/USM and if necessary readjust for an indication of 115 volts on the TS–352(*)/U. The LOAD ALARM indicator will light and the buzzer will sound. Operate the ALARM CUTOFF switch to horizontal and the buzzer will be silenced. Proceed to the next test within 8 seconds as timed with the stopwatch.

(3) Adjust the LOAD CURRENT control on the Z1 chassis clockwise until the CURRENT meter indicates precisely 100 milliamperes. The LOAD ALARM indicator will extinguish. Operate the ALARM CUTOFF switch to normal. The buzzer will silence.

(4) Use the AN/GSM–64 and measure the dc voltage across terminals B and D of the 600 V power supply test cable assembly. The indication will be between 268 and 285 volts.

c. Output Ripple Voltage Tests.

(1) Connect the ME–30(*)/U, a 0.5-μf capacitor, and a 1-megohm resistor as shown in figure 135.

(2) Connect the ME–30(*)/U test setup to terminals A and B of the 600 V power supply test cable assembly. The ripple voltage must not exceed 0.2 volt.

d. Voltage Regulation Tests.

(1) Recheck the output voltage of TF–171/USM and, if necessary, readjust the output for an indication of 115 volts on the TS–352(*)/U.

(2) Note and record the CURRENT meter indication. Adjust the output voltage of the TF–171/USM for an indication of 132.5 volts on the TS–352(*)/U. The CURRENT meter indication will not have increased more than 1 milliampere. Use the ME–30(*)/U and measure the ripple voltage across terminals A and B of the 600 V power supply test cable assembly. The ripple voltage must not exceed 0.2 volt.

(3) Adjust the output of the TF–171/USM for an indication of 115 volts on the TS–352(*)/U.

(4) Note and record the CURRENT meter indication. Adjust the output of the TF–171/USM for an indication of 97.5 volts on the TS–352(*)/U. The CURRENT meter indication will not decrease more than 1 milliampere.

(5) Use the ME–30(*)/U and measure the ripple voltage across terminals A and B of the 600 V power supply test cable assembly. The ripple voltage must not exceed 0.2 volt.

(6) Readjust the output of the TF–171/USM for an indication of 115 volts on the TS–352(*)/U.

e. Low Output Voltage Cutoff Tests.

(1) Connect the AN/GSM–64 across terminals A and B of the 600 V power supply test cable assembly. Slowly reduce the output voltage by means of the variable load resistor until cutoff occurs. The AN/GSM–64 will indicate between 450 and 510 volts at the time cutoff occurs. The LOAD ALARM and LOW VOLTAGE indicators will light and the buzzer will sound.

Note. If cutoff cannot be reached, adjust the variable load resistor for an approximate indication of 450 volts on the AN/GSM–64 and adjust the LOW-VOLT ALARM control until cutoff occurs between 450 and 510 volts.

(2) Operate the power supply AC POWER switch to OFF and connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly. Adjust the variable load resistor for 6,000 ohms and disconnect the TS–352(*)/U.

(3) Operate the power supply AC POWER switch to ON and the ALARM CUTOFF switch to vertical. After the time delay, the LOAD ALARM indicator will extinguish and the buzzer will silence.

(4) Connect the AN/GSM–64 across terminals A and B of the 600 V power supply test cable assembly and adjust the variable load resistor for 680 volts. Operate the LOW-VOLT ALARM control completely clockwise. Slowly reduce the output voltage by means of the variable load resistor

until cutoff occurs. The AN/GSM–64 will indicate a minimum of 570 volts at the time of cutoff.

(5) Restore normal operation by adjusting the LOW-VOLT ALARM control completely counterclockwise and repeat the procedures given in (2) and (3) above.

(6) Adjust the variable load resistor for an indication of 532 volts on the AN/GSM–64. Slowly adjust the LOW-VOLT ALARM control until cutoff occurs. This is the normal adjustment position for the LOW-VOLT ALARM control. When the power supply stabilizes, hand tighten the locking nut of the LOW-VOLT ALARM control.

(7) Test the low voltage cutoff adjustment as follows: Repeat the procedures in (2) and (3) above. Decrease the output voltage by means of the variable load resistor until cutoff occurs. The AN/GSM–64 will indicate between 530 and 535 volts at the time of cutoff. The LOW VOLTAGE and LOAD ALARM indicators will light and the buzzer will sound at the time of cutoff. Restore the power supply to normal by repeating the procedures given in (2) and (3) above.

f. High Voltage Cutoff Range Tests.

(1) Connect the AN/GSM–64 across terminals A and B of the 600 V power supply test cable assembly. Increases the output voltage by means of the variable load resistor until cutoff occurs. The LOAD ALARM and HIGH VOLTAGE indicators will light and the buzzer will sound. The AN/GSM–64 will indicate a minimum of 750 volts at cutoff.

Note. If cutoff does not occur, adjust the HIGH-VOLT ALARM control until cutoff occurs.

(2) Operate the AC POWER switch of the power supply to OFF. Connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly and adjust the variable load resistor for 6,000 ohms. Disconnect the TS–352(*)/U.

(3) Adjust the power supply 600V ADJ control completely counterclockwise and operate the AC POWER switch to ON. The dc power will be restored immediately, the LOAD ALARM and HIGH VOLTAGE indicators are extinguished, and the buzzer is silenced.

(4) Connect the AN/GSM–64 across terminals A and B of the 600 V power supply test cable assembly and adjust the variable load resistor for an indication of 570 volts. Adjust the HIGH-VOLT ALARM control completely clockwise and slowly increase the output voltage by means of the variable load resistor until cutoff occurs. The AN/GSM–64 will indicate 660 volts or less at cutoff.

(5) Operate the HIGH-VOLT ALARM control completely counterclockwise and repeat the procedures given in (2) and (3) above.

(6) Adjust the variable load resistor for an indication of 672 volts on the AN/GSM–64. Slowly adjust the HIGH-VOLT ALARM control until cutoff occurs. The control will remain in this position. When the power supply stabilizes, hand tighten the locking nut on the HIGH-VOLT ALARM control.

(7) Restore the power supply to normal by repeating the procedures given in (2) and (3) above.

(8) Increase the output voltage by adjusting the variable load resistor until cutoff occurs. The HIGH VOLTAGE and LOAD ALARM indicators will light and the buzzer will sound. The AN/GSM–64 will indicate between 670 and 675 volts at the time cutoff occurs. Readjust the HIGH-VOLT ALARM control ((6) above) if necessary.

(9) Restore the power supply to normal by repeating the procedures given in (2) and (3) above.

g. Low Voltage Alarm Tests.

(1) Operate the power supply AC POWER switch to OFF and the 600V ADJ

control to midposition. Connect the TS–352(*)/U to test jacks J1 and J10 on low voltage rectifier and alarm unit Z1. Adjust the variable load resistor for an indication of 6,000 ohms on the TS–352(*)/U. Disconnect the TS–352(*)/U and connect the AN/GSM–64 to jacks J1 and J10.

(2) Operate the power supply AC POWER switch to ON and adjust the 600V ADJ control for an indication of 600 volts on the AN/GSM–64. Adjust the LOAD CURRENT control for an indication of 100 milliamperes on the power supply CURRENT meter. Adjust the variable load resistor for a 510-volt indication on the AN/GSM–64. A low-voltage cutoff will occur.

(3) Operate the RESTORE switch. The dc output will be restored; then a low voltage cutoff will occur after 20 seconds. Adjust the variable load resistor for an indication of 600 volts on the AN/GSM–64.

h. Load Current Range Tests.

(1) Slowly operate the LOAD CURRENT control completely counterclockwise while simultaneously operating the variable load resistor to maintain an indication on the AN/GSM–64 between 535 and 670 volts. The LOAD CURRENT control range will be between 90 and 115 milliamperes indicated on the CURRENT meter.

(2) Recheck the ac input to the power supply and if required, readjust to indicate 115 volts on the TS–352(*)/U.

(3) Adjust the LOAD CURRENT control for an indication of 100 milliamperes on the CURRENT meter and the variable load resistor for an indication of 600 volts on the AN/GSM–64. Hand tighten the locking nut of the LOAD CURRENT control.

i. Load Detecting Circuit Tests.

(1) Adjust the output voltage to indicate 480 volts on the AN/GSM–64. A low voltage cutoff will occur and it will be necessary to depress and release the RESTORE switch to adjust to 480 volts. After a 20-second time delay, another low voltage cutoff will occur and the alarm will sound.

(2) Operate the power supply AC POWER switch to OFF and adjust variable resistor R16 (on bottom of low voltage rectifier and alarm unit Z1) completely clockwise.

(3) Operate the AC POWER switch to ON. The AN/GSM–64 will indicate no dc output and the CURRENT meter will indicate between 8 and 15 milliamperes.

(4) Adjust variable resistor R16 slowly counterclockwise until relay K6 releases. The current indication on the CURRENT meter will drop to zero and then increase to 100 milliampers. Quickly adjust the variable load resistor for an indication of 400 volts on the AN/GSM–64. The low voltage cutoff will not occur if the adjustment is completed within the 20-second time delay period.

(5) Operate the AC POWER switch to OFF; then to ON. The dc output will not come on and the LOAD ALARM indicator will remain lighted.

(6) Hand tighten the locking nut on the shaft of variable resistor R16.

(7) Recheck the correct positioning of variable resistor R16 by slowly adjusting the variable load resistor until relay K6 operates and normal dc power comes on. When the CURRENT meter indication reaches 100 milliamperes, the AN/GSM–64 will indicate 480 volts ± 10. If necessary, readjust variable resistor R16 until the above indications are obtained. These indications make possible the detection of a missing repeater in the load.

(8) Operate the AC POWER switch to OFF and adjust the 600V ADJ control completely counterclockwise.

(9) Connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly. Adjust the variable load resistor for an indication of 4,000 ohms and disconnect the TS–352(*)/U.

(10) Operate the AC POWER switch to ON. The dc power will not go on and the CURRENT meter will indicate between 8 and 15 milliamperes.

(11) Adjust the variable load resistor to increase the load resistance until the dc power goes on. The current indication on the CURRENT meter will drop to zero and rapidly rise to 100 milliamperes. The AN/GSM–64 will indicate 480 volts ±10.

j. Low Line Voltage Cutoff Protection Tests.

(1) Check the ac input voltage to the power supply and if necessary adjust the TF–171/USM output to indicate 115 volts on the TS–352(*)/U.

(2) Adjust the 600V ADJ control on the power supply for an indication of 600 volts on the AN/GSM–64 and the LOAD CURRENT control for 100 milliamperes on the CURRENT meter.

(3) Adjust the TF–171/USM to provide 93-volt ac input to the power supply.

(4) Adjust variable resistor R20 (on bottom of low voltage rectifier and alarm unit Z1) slowly counterclockwise until relay K9 releases. When relay K9 releases the dc output will decrease, the buzzer will sound, the LOAD ALARM indicator will light, and the power supply will cycle off and on but will not cutoff. Hand tighten the locking nut on the shaft of variable resistor R20.

(5) Adjust the output of TF–171/USM to indicate 97 volts on the TS–352(*)/U. The power supply will stop cycling and the CURRENT meter will indicate 100 milliamperes ±1. If the power supply continues to recycle, readjust variable resistor R20 for continuous operation.

(6) Rapidly adjust the TF–171/USM to provide 60-volt ac input to the power supply. Cutoff will occur. Readjust the ac input to 115 volts. Normal operation will be restored immediately and automatically.

(7) Interrupt the 115-volt ac input for 2 seconds ±0.5. Normal operation will be restored automatically after the interruption.

k. Blower Operation Tests.

(1) Install the power supply in the transit case.

(2) Operate the AC POWER switch to ON. The blower will operate within approximately 20 minutes and force air out the front panel grill.

182. Power Supply PP–826A/U

a. Preliminary Procedures.

(1) Connect the equipment as shown in figure 135, with connector P1 of the power supply connected to the output of TF–171/USM.

(2) Use the TS–352(*)/U in place of Multimeter AN/URM–105 to perform the tests.

(3) Disconnect resistor R32 (on low voltage rectifier and alarm unit Z2) from standoff terminal E22.

(4) Operate the REPEATER switch to 3 and the following controls of the power supply completely counterclockwise: LOAD CURRENT, LOW-VOLT ALARM, and HIGH-VOLT ALARM.

(5) Adjust variable resistor R16 (on low voltage rectifier and alarm unit Z2) completely clockwise.

(6) Connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly and adjust the variable load resistor for an indication of 3,000 ohms on the TS–352(*)/U. Disconnect the TS–352(*)/U.

(7) Apply ac input power to TF–171/USM. Operate the AC POWER switch of the power supply to ON and adjust the output of TF–171/USM for an indication of 115 volts on the TS–352(*)/U. The CURRENT meter of the power supply will indicate between 16 and 23 milliamperes.

(8) Adjust variable resistor R16 of the power supply slowly counterclockwise until K6 releases and relay K1 operates. The indication on the CUR-

RENT meter will fall to zero, then rapidly rise to between 70 and 110 milliamperes.

(9) Operate the power supply AC POWER switch to OFF and reconnect resistor R32 to standoff terminal E22.

b. Open Line Tests.

(1) Adjust the output of TF–171/USM for an indication of 132.5 volts on the TS–352(*)/U.

(2) Operate the power supply AC POWER switch to ON. The LOAD ALARM indicator will light and the buzzer will sound within 2 seconds. Operate the ALARM CUTOFF. The buzzer will silence.

(3) Operate and hold the power supply RESTORE switch until the LOAD ALARM indicator is extinguished. Release the RESTORE switch. The LOAD ALARM indicator will light within 2 seconds. Operate the power supply AC POWER switch to OFF and the ALARM CUTOFF switch to vertical.

c. Low Resistance Tests.

(1) Short the 2-μf capacitor connected at the junction of the 1,500-ohm variable resistor and the 500-ohm resistor in the RC network to provide a 2,600-ohm test load.

(2) Adjust TF–171/USM for an indication of 115 volts on the TS–352(*)/U.

(3) Operate the power supply AC POWER switch to ON. The LOAD ALARM and LOW VOLTAGE indicators will light and the buzzer will sound. Within 2 seconds, the LOW VOLTAGE indicator will extinguish and the LOAD ALARM indicator and the buzzer will remain operated. Operate the ALARM CUTOFF switch. The buzzer will silence. Operate the power supply AC POWER switch to OFF and the ALARM CUTOFF switch to vertical; disconnect the strap from the capacitor in the RC network.

d. Normal Operating Condition Tests.

(1) Disconnect the test load from the power supply at connector P3. Connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly. Adjust the variable load resistor for an indication of 6,000 ohms on the TS–352(*)/U. Disconnect the TS–353(*)/U.

(2) Reconnect the load to connector P3 of the power supply. Operate the power supply AC POWER switch to ON. The indication on the CURRENT meter of the power supply will increase between 65 and 95 milliamperes within 8 seconds as timed with the stopwatch. If necessary, adjust the output of TF–171/GSM for an indication of 115 volts on the TS–352(*)/U. The LOAD ALARM and LOW VOLTAGE indicators will light and the buzzer will sound. Operate the ALARM CUTOFF switch; the buzzer will silence.

(3) Adjust the LOAD CURRENT control clockwise until the CURRENT meter indicates precisely 100 milliamperes. The buzzer will sound and the LOAD ALARM and LOW VOLTAGE indicators will extinguish. Operate the ALARM CUTOFF to vertical; the buzzer will be silenced.

(4) Connect the AN/GSM–64 across terminals B and D of the 600 V power supply test cable assembly. The AN/GSM–64 will indicate between 265 and 285 volts dc. Operate the power supply AC POWER switch to OFF and disconnect the AN/GSM–64.

e. Starting Into Low Resistance With High Ac Input.

(1) Connect the TS–352(*)/U between jacks J1 and J10 of low voltage rectifier and alarm unit Z2. Adjust the variable load resistor for an indication of 4,500 ohms on the TS–352(*)/U. Disconnect the TS–352(*)/U.

(2) Adjust the output of TF–171/USM for an indication of 132.5 volts on the TS–352(*)/U and operate the power supply AC POWER switch to ON. The LOAD ALARM and LOW VOLTAGE indicators will light and the buzzer will sound. The power supply

CURRENT meter indication will increase to between 99 and 101 milliamperes within 10 seconds as timed with the stopwatch. Continue to the next test immediately.

(3) Operate and hold the power supply RESTORE switch operated. The indication on the CURRENT meter will decrease to between 10 and 20 milliamperes. The LOAD ALARM and LOW VOLTAGE indicators will extinguish and the buzzer will be silenced.

(4) Release the RESTORE switch. The indication on the CURRENT meter will drop and then rapidly increase toward 100 milliamperes. The LOAD ALARM and LOW VOLTAGE indicators will light and the buzzer will sound. The LOAD ALARM and LOW VOLTAGE indicators will extinguish and the buzzer will silence within 20 seconds as timed with the stopwatch. Operate the power supply AC POWER switch to OFF.

f. Low Voltage Alarm Range and Requirement Tests.

(1) Disconnect the test load from the power supply at connector P3. Connect the TS–352(*)/U across terminals A and B of the 600 V power supply test cable assembly and adjust the variable load resistor for an indication of 6,000 ohms on the TS–352(*)/U. Disconnect the TS–352(*)/U.

(2) Reconnect the test load to connector P3 of the power supply. Adjust the output of TF–171/USM for an indication of 115 volts on the TS–352(*)/U. Connect the AN/GSM–64 across terminals A and B of the power supply test cable assembly.

(3) Operate the power supply AC POWER switch to ON. Adjust the variable load resistor for an indication of 530 volts on the AN/GSM–64.

(4) Adjust the power supply 600V ADJ control completely counterclockwise. Slowly adjust the LOW-VOLT ALARM control clockwise until the LOAD ALARM and LOW VOLTAGE indicators light and the buzzer sounds. Hand tighten the locking nut on the LOW-VOLT ALARM control.

(5) Adjust the variable load resistor for an indication of 600 volts on the AN/GSM–64. After approximately 30 seconds, the LOAD ALARM and LOW VOLTAGE indicators will extinguish and the buzzer will silence.

g. High Voltage Cutoff Tests.

(1) Adjust the variable load resistor for an indication of 672 volts on the AN/GSM–64. Adjust the HIGH-VOLT ALARM control until cutoff occurs. This is the normal position for the HIGH-VOLT ALARM control. When the power supply becomes stable, hand tighten the locking nut on the HIGH-VOLT ALARM control.

(2) Operate the power supply RESTORE switch and adjust the variable load resistor for the normal output indication of 600 volts on the AN/GSM–64; then adjust the variable load resistor to increase the output voltage until cutoff occurs. The HIGH VOLTAGE and LOAD ALARM indicators will light and the buzzer will sound. The AN/GSM–64 will indicate between 670 and 675 volts at the time cutoff occurs.

(3) Operate and release the RESTORE switch. The power supply will start with the indication on the CURRENT meter increasing toward 100 milliamperes. The LOAD ALARM and LOW VOLTAGE indicators will light and the buzzer will sound. Quickly adjust the variable load resistor for an indication of 600 volts on the AN/GSM–64. After approximately 30 seconds the LOAD ALARM and the LOW VOLTAGE indicators will extinguish and the buzzer will silence.

Note. If cutoff occurs before the output voltage is reduced to 600 volts, repeat the procedures given in (3) above.

h. Output Ripple Voltage Tests.

(1) Connect the ME–30(*)/U, a 1-megohm resistor, and a 0.5-μf capacitor as shown in figure 135.

(2) Connect the ME–30(*)/U test setup across terminals A and B of the 600 V power supply test cable assembly. The ME–30(*)/U will indicate 0.2 volt ac or less.

i. Voltage Regulation Tests.

(1) Recheck the output of TF–171/USM and if necessary adjust the output for an indication of 115 volts on the TS–352(*)/U.

(2) Note the indication on the CURRENT meter of the power supply. Adjust the output of TF–171/USM for an indication of 132.5 volts on the TS–352(*)/U. The indication on the CURRENT meter will not increase more than 1 milliampere and the ripple voltage will be 0.2 volts or less, indicated on the ME–30(*)/U.

(3) Adjust TF–171/USM for an indication of 115 volts on the TS–352(*)/U.

(4) Note the indication on the CURRENT meter of the power supply, and adjust TF–171/USM for an indication of 97.5 volts on the TS–352(*)/U. The indication on the CURRENT meter will not decrease more than 1 milliampere. The ripple voltage as indicated on the ME–30(*)/U will be 0.2 volt ac or less.

(5) Readjust the output of TF–171/USM for an indication of 115 volts on the TS–352(*)/U.

j. Blower Operation Tests.

(1) Install the power supply in the transit case.

(2) Operate the power supply AC POWER to ON. The blower will operate in approximately 20 minutes and force air out the front panel grill.

Section III. DEPOT INSPECTION STANDARDS FOR TERMINALS, TELEPHONE AN/TCC–7 AND AN/TCC–50

183. Test Conditions

The tests provided in paragraphs 184 through 199 will be conducted under the general test conditions (para. 172) and the conditions listed below.

a. The terminal equipment is connected for operation as shown in TM 11–2139–10. Connect a junction panel test cable assembly to the TO CABLE connector on the JUNCTION PANEL. Use jumper wires and strap terminals 1 and 3 and terminals 2 and 4 on the junction panel test cable assembly.

b. A test signal source circuit will be fabricated as shown in figure 132.1.

c. The 200 VOLT POWER SUPPLY will be turned on during all the tests, and the 600 VOLT POWER SUPPLY will be turned on when directed in the tests.

184. TEST PANEL Meter Calibration

a. Operate the TS–402(*)/U switches in the test signal source circuit to provide 0-db attenuation. Adjust the SG–71(*)/FCC output frequency for 68 kc ±100 cps at an output level of 0.775 volt.

b. Operate the following switches of the TEST PANEL to the positions indicated below:

Switch	Position
MEASURE	TRANSMISSION
MEASURE SELECTIVE	OFF
MEASURE NON-SELECTIVE.	CHECK 1 KC CHECK HF.

c. Operate the TS–402(*)/U switches to provide 46-db attenuation and connect TEST PANEL measure cord W1 and plug P1 to the test jack assembly of the test signal source circuit. The TEST PANEL meter will indicate 0 db ±0.5. Disconnect TEST PANEL measure cord W1 and plug P1 from the test signal source circuit.

185. TEST PANEL Calibration

a. 1-Kc Oscillator Output Adjustment.

(1) Operate the SEND switch of the TEST PANEL to CHECK GAIN CHECK HF.

(2) Connect TEST PANEL measure cord W1 and plug P1 to the CHECK 1 KC jack on the TEST PANEL.

(3) The TEST PANEL meter indication will be adjustable to 0 db with the 1KC screwdriver control on the TEST PANEL chassis.

b. HF Oscillator Output Adjustment.

(1) Connect TEST PANEL measure cord W1 and plug P1 to the CHECK HF jack on the TEST PANEL.

(2) The indication on the TEST PANEL meter will be adjustable to 0 db with the HF screwdriver control on the front panel.

c. Carrier Oscillator Tuning.

(1) Operate the TEST PANEL switches as follows: MEASURE SELECTIVE to CHECK GAIN and MEASURE NON-SELECTIVE to OFF.

(2) Connect TEST PANEL measure cord W1 and plug P1 to the CHECK HF jack of the TEST PANEL.

(3) The TEST PANEL meter will indicate maximum when the FINE TUNE control is adjusted near the mid-position of its range.

d. Selective Circuit Gain Adjustment.

(1) TEST PANEL measure cord W1 and plug P1 remains connected to the HF jack of the TEST PANEL.

(2) The TEST PANEL meter indicates 0 db with the GAIN control of the TEST PANEL adjusted near the mid-position of its range.

186. Power Supply PP–827/U Tests

a. Operate the MEASURE switch of the TEST PANEL to 200 VOLTS.

b. The TEST PANEL meter will be adjustable to 0 db by means of the power supply 200V ADJ control.

c. The internal blower inside the 200 VOLT POWER SUPPLY will operate approximately 20 minutes after ac input power was applied.

187. Power Supply PP–826/U and PP–826A/U

a. Operate the REPEATER switch on the chassis of the power supply to 0.

b. Operate the power supply AC POWER switch to ON. The LOAD ALARM indicator will light and the buzzer will sound for approximately 30 seconds until the power supply has warmed.

c. Operate the MEASURE switch of the TEST PANEL to 600 VOLTS. The TEST PANEL meter indication will be adjustable to 0 db by means of the power supply 600V ADJ control.

d. Operate the REPEATER switch on the power supply chassis to TEST. The indication on the power supply CURRENT meter will be adjustable to 100 milliamperes by means of the LOAD CURRENT control on the power supply chassis.

e. The internal blower inside the power supply will begin operation approximately 20 minutes after ac input power has been applied. Operate the power supply AC POWER switch to OFF.

188. ORDER WIRE PANEL Tests and Adjustments

a. Transmitting and Receiving Amplifier Adjustment.

(1) Operate the CABLE REELS TO NEXT AN/TCC–7 OR AN/TCC–8 switch on the ORDER WIRE PANEL to 0–11.

(2) Operate the TEST PANEL switches as follows: MEASURE to TRANSMISSION, SEND to CHECK GAIN CHECK HF, MEASURE SELECTIVE to OFF, and MEASURE NON-SELECTIVE to OW TR AMP OUT.

(3) Connect TEST PANEL measure cord W1 and plug P1 to the TR AMP OUT jack on the ORDER WIRE PANEL.

(4) Operate the SEND OW switch of the ORDER WIRE PANEL to ON. The

indication on the TEST PANEL meter will be adjustable to +2.5 db by means of the TR GAIN control on the ORDER WIRE PANEL chassis.

(5) Connect TEST PANEL measure cord W1 and plug P1 to the REC AMP IN jack on the ORDER WIRE PANEL and operate the MEASURE NON-SELECTIVE switch on the TEST PANEL to OW REC AMP. The indication on the TEST PANEL meter will be adjustable to 0 db by means of the REC GAIN control on the ORDER WIRE PANEL.

(6) Connect TEST PANEL measure cord W1 and plug P1 to the REC AMP OUT jack on the ORDER WIRE PANEL. The TEST PANEL meter will indicate 0 db ±1.

(7) Operate the ORDER WIRE switch on the ORDER WIRE PANEL to TALK. A 1,000-cycle tone will be audible in the handset. Restore the SEND OW switch on the ORDER WIRE PANEL to vertical and the MEASURE NON-SELECTIVE switch on the TEST PANEL to OW TR AMP OUT.

b. Signaling Tests.

(1) Connect TEST PANEL measure cord W1 and plug P1 to the TR AMP OUT jack of the ORDER WIRE PANEL.

(2) Operate the ORDER WIRE switch on the ORDER WIRE PANEL to RING. The CALL indicator on the ORDER WIRE PANEL will light, the buzzer will sound, and the TEST PANEL meter will indicate approximately 0 db.

c. Talking Tests.

(1) Operate the ORDER WIRE switch of the ORDER WIRE PANEL to TALK.

(2) Connect TEST PANEL measure cord W1 and plug P1 to the TR AMP OUT jack on the ORDER WIRE PANEL.

(3) Speak a test message into the telephone handset. Note the deflections of the TEST PANEL meter pointer while speaking.

(4) Operate the ORDER WIRE switch on the ORDER WIRE PANEL to vertical.

d. Noise Tests.

(1) Calibrate the Transmission Measuring Set TS–559(*)/FT for 144 weighting with the following exceptions: Operate switch S4 to FIA and the decibel dial to 35. The dba readings are taken direct with no correction factor.

(2) Connect the LINE jacks of the TS–559(*)/FT to the 2W EXT binding posts on the ORDER WIRE PANEL.

(3) The noise indication on the TS–559-(*)/FT meter will not exceed ±10 dba.

(4) Disconnect the TS–559(*)/FT.

189. Test Frequency Adjustments

a. Operate the 12 & 28 KC switch on the CARRIER SUPPLY PANEL to ON. The 12 & 28 KC indicator will light

b. Operate the CABLE REELS TO FIRST AN/TCC–11 TR switch on the GROUP PANEL chassis to 11.

c. Operate the TEST PANEL switches as follows: SEND to CHECK GAIN CHECK HF, MEASURE to TRANSMISSION, and MEASURE NON-SELECTIVE to OFF.

d. Connect TEST PANEL measure cord W1 and plug P1 to the TR AMP OUT jack of the GROUP PANEL.

Note. Adjust the FINE TUNE control of the TEST PANEL for maximum meter indications before performing the control adjustments in *e* through *g* below.

e. Operate the MEASURE SELECTIVE switch of the TEST PANEL to 12KC. The indication on the TEST PANEL meter is adjustable to 0 db by means of the 12KC control on the CARRIER SUPPLY PANEL.

f. Operate the MEASURE SELECTIVE switch of the TEST PANEL to 28KC. The indication on the TEST PANEL meter is adjustable to 0 db by means of the 28 KC control on the CARRIER SUPPLY PANEL.

g. Operate the 12 & 28 KC switch of the CARRIER SUPPLY PANEL to OFF and the MEASURE SELECTIVE switch of the TEST PANEL to 68KC. The indication on the TEST PANEL meter is adjustable to 0 db by means of the 68KC control on the CARRIER SUPPLY PANEL chassis.

190. Transmitting Gain Adjustments

a. Operate the SEND-MEAS switches on CHAN 2 of all three CHAN MODEMS to SEND.

b. Use the TEST PANEL and perform the tests given in the chart below.

Test No. (1)	TEST PANEL measure cord W1 and plug connected to—		MEASURE SELECTIVE switch position (4)	Notes (5)	Required TEST PANEL meter indication (6)
	Jack (2)	Panel (3)			
1	TR AMP OUT	GROUP	37KC	1 and 2	0 db
2	60–108 KC OUT	SUBGROUP	83KC	1	0 db ±1.5
3	60–108 KC OUT	SUBGROUP	67KC	1	0 db ±2
4	60–108 KC OUT	SUBGROUP	99KC	1	0 db ±2

Note 1. Adjust the FINE TUNE control on the TEST PANEL for maximum meter indication before performing the final measurement (col. 6).

Note 2. The TEST PANEL meter indication (col. 6) will be obtained by adjusting the TR AMP GAIN control on the SUBGROUP PANEL chassis.

c. Operate the SEND-MEAS switches on CHAN 2 of all three CHAN MODEMS to the vertical (normal) position.

191. Pilot Regulator-Amplifier Adjustments

a. Operate the CABLE REEL TO FIRST AN/TCC–11 REC switch on the GROUP PANEL to 11 and the REGULATOR switch to MAN.

b. Perform the tests listed in the chart below by following the procedures given in *c* through *i* below. To obtain the required TEST PANEL meter indications (col. 4), adjust the control indicated in column 5 of the chart.

Test No. (1)	TEST PANEL measure W1 and plug P1 connected to GROUP PANEL jack— (2)	MEASURE SELECTIVE switch position (3)	Notes (4)	Required TEST PANEL METER meter indication (5)	Control on GROUP PANEL to be adjusted (6)
1	REC AMP 1 OUT	68KC	1 and 2	0 db	FLAT ADJ 68 KC
2	REC AMP 2 OUT	68KC	1 and 3	0 db	AUTO REG OUTPUT
3	REC AMP 2 OUT	12KC	1 and 4	0 db, ±1.5	SLOPE ADJ 12 KC
4	REC AMP 2 OUT	28KC	1 and 5	0 db, ±1.5	BUIGE ADJ 28 KC
5	REC AMP 2 OUT	37KC		0 db, ±1	

Note 1. Adjust the FINE TUNE control on the TEST PANEL for maximum meter indication before performing the adjustments in column 6 of the chart.

Note 2. The indications in *Required TEST PANEL meter indication* (col. 5) will be obtained with the FLAT ADJ 68 KC control (col. 6) between positions 2 and 5.

Note 3. Allow sufficient time for the TEST PANEL meter to stabilize.

Note 4. The SLOPE ADJ 12 KC control (col. 6) will be in position 0 ±1.

Note 5. The indication in the *Required TEST PANEL meter indication* (col. 5) will be obtained with the BULGE ADJ 28 KC control (col. 6) at 0.

c. Perform test No. 1 in the chart.

d. Connect TEST PANEL measure cord W1 and plug P1 of the REC AMP 2 OUT jack on the GROUP PANEL and adjust the MAN REG OUTPUT control slowly clockwise until the alarm buzzer sounds. Record the TEST PANEL meter indication. Adjust the MAN REG OUTPUT control slowly counterclockwise until the buzzer sounds. Record the TEST PANEL meter indication. Adjust the MAN REG OUTPUT control clockwise for an indication of 0 db on the TEST PANEL meter. The indication on the TEST PANEL meter when the buzzer sounds will be between —1 and —3 db on the low side and between +1 and +3 on the high side.

e. Operate the REGULATOR switch on the GROUP PANEL chassis to AUTO and perform test No. 2 in the chart.

f. Operate the 12 & 28 KC switch on the CARRIER SUPPLY PANEL to ON and perform tests No. 3 and No. 4 in the chart.

g. Operate the 12 & 28 KC switch on the CARRIER SUPPLY PANEL to OFF.

h. Operate the SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to SEND and perform test No. 5 in the chart.

i. Restore the SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to the vertical (normal) position.

192. Demodulator Gain Adjustment

a. Operate the MEASURE SELECTIVE switch on the TEST PANEL to OFF.

b. Operate the SEND-MEAS switch on CHAN 2 of CHAN MODEM 2 to SEND.

c. Operate the 2W–4W switch on each of the 12 channels to 4W and the GAIN controls completely counterclockwise.

d. Perform test No. 1 in the chart below. The indications in the *Required TEST PANEL meter indication* column will be obtained by means of the controls in the *Control to be adjusted* column.

Test No.	TEST PANEL measure cord W1 and Plug P1 connected to—		MEASURE NON-SELECTIVE switch position	Required TEST PANEL meter indication	Control to be adjusted
	Jack	Panel			
1	DEM OUT_____	GROUP_____	GRP DEM OUT_____	0 db	DEM GAIN on GROUP PANEL.
2	DEM OUT 1____	SUBGROUP____	SUB GRP DEM OUT__	0 db	DEM 1 GAIN on SUB-GROUP PANEL.
3	DEM OUT 2____	SUBGROUP____	SUB GRP DEM OUT__	0 db	DEM 2 GAIN on SUB-GROUP PANEL.
4	DEM OUT 3____	SUBGROUP____	SUB GRP DEM OUT__	0 db	DEM 3 GAIN on SUB-GROUP PANEL.

e. Operate the SEND-MEAS switches on CHAN 2 of CHAN MODEM 1 and CHAN MODEM 3 to SEND.

f. Perform tests Nos. 2, 3, and 4 in the chart in *d* above.

g. Operate the SEND-MEAS switches on CHAN 2 of CHAN MODEM 1, CHAN MODEM 3 to vertical position.

193. Receiving Channel Gain Adjustment

a. Connect terminals T and R of the test jack assembly and a 600-ohm resistor across the 4WR binding posts on CHAN 1 of CHAN MODEM 1.

b. Operate the MEASURE NON-SELECTIVE switch of the TEST PANEL to CHAN OUT.

c. Connect TEST PANEL measure cord W1 and plug P1 to the test jack assembly.

d. Operate the SEND-MEAS switch on CHAN 1 of CHAN MODEM 1 to SEND. The indication on the TEST PANEL meter will be adjustable to 0 db by means of the GAIN control on CHAN 1 of CHAN MODEM 1.

e. Restore the SEND-MEAS switch on CHAN 1 of CHAN MODEM 1 to vertical.

f. Repeat the procedures given in *a* through *e* above and test each of the remaining channels. The indication on the TEST PANEL meter is adjusted for each channel by means of the associated GAIN control.

g. Disconnect the test jack assembly and the 600-ohm resistor.

194. Subgroup Carrier Leak Tests

a. Operate the MEASURE NON-SELECTIVE switch on the TEST PANEL to SUB GRP MOD IN.

b. Connect a 600-ohm resistor across each set of SPECIAL SERVICE binding posts on the SUBGROUP PANEL chassis.

c. Operate the SPECIAL SERVICE 1, 2, and 3 switches on the SUBGROUP PANEL chassis to SPL SERV.

d. Connect TEST PANEL measure cord W1 and plug P1 to the DEM OUT 1 jack on the SUBGROUP PANEL. Note and record the TEST PANEL meter indication. The TEST PANEL meter will indicate —5 db or a greater negative value.

e. Connect TEST PANEL measure cord W1 and plug P1 to the DEM OUT 2 jack, then to the DEM OUT 3 jack on the SUBGROUP PANEL. The TEST PANEL meter indication for each test will be the same as the indication noted in *d* above.

f. Operate the SPECIAL SERVICE 1, 2, and 3 switches to CHAN MODEM. Disconnect the 600-ohm resistors from the SPECIAL SERVICE binding posts.

195. Carrier Transmission Channel Noise Tests

a. Calibrate the TS–559(*)/FT for 144 weighting with the following exceptions: operate switch S4 to FIA and the decibel dial to 35. The dba readings are taken direct with no correction factor required.

b. Connect from the LINE jacks of the TS–559(*)/FT to the 4WR binding posts on CHAN 1 of CHAN MODEM 1.

c. The noise indication on the TS–559(*)/FT meter will not be more than +20 dba.

d. Repeat the procedures given in *a* and *b* above and test the remaining channels. Each channel will meet the requirements given in *c* above. Disconnect the TS–559(*)/FT.

196. Transmission Tests Through Channel TALK-MON Switches

a. Operate the CHANNEL TALK switch on the ORDER WIRE PANEL to LINE.

b. On CHAN 1 of CHAN MODEM, operate the TALK-MON switch to TALK and the SEND-MEAS switch to SEND.

c. The 1,000-cycle tone will be audible in the handset of the ORDER WIRE PANEL.

d. Operate the TALK-MON switch on CHAN 1 of CHAN MODEM 1 to MON.

e. The 1,000-cycle tone will be audible at a noticeably lower level than indicated in *c* above.

f. Operate the TALK-MON and SEND-MEAS switches on CHAN 1 of CHAN MODEM 1 to vertical.

g. Repeat the procedures given in *b* through *f* above on each of the remaining channels.

197. Crosstalk Tests

a. Calibrate the TS–559(*)/FT for 144 weighting, with the following exceptions: Operate switch S4 to FIA and the decibel dial to 35. The dba readings are taken direct with no correction factor required.

b. Connect the LINE jacks of the TS–559(*)/FT and a 600-ohm resistor to the 4WR binding posts of the channel indicated in the *Measure* column of the chart in *d* below.

c. Operate the SEND-MEAS switches, one at a time, to SEND on the channels indicated in the *Send* column of the chart.

d. The TS–559(*)/FT meter indication for each test will not exceed 27 dba.

e. The crosstalk tests are given below.

Measure		Send	
CHAN	CHAN MODEM	CHAN	CHAN MODEM
1	1	2	1
2	1	1	1
2	1	3	1
3	1	2	1
3	1	4	1
4	1	3	1
4	1	1	2
1	2	4	1
1	2	2	2
2	2	1	2
2	2	3	2
3	2	2	2
3	2	4	2
4	2	3	2
4	2	1	3
1	3	4	2
1	3	2	3
2	3	1	3
2	3	3	3
3	3	2	3
3	3	4	3
4	3	3	3

f. Repeat the procedures given in *b* and *c* above to check the crosstalk between the channels listed in the chart below. The TS–559(*)/FT meter indication will not exceed 22 dba.

Send		Measure	
CHAN	CHAN MODEM	CHAN	CHAN MODEM
3	1	1	1
3	1	1	2
3	1	3	2
3	1	3	3
3	3	3	1
3	3	3	2
1	3	2	1
2	2	1	3
1	1	3	1
1	3	2	2
4	2	4	1
4	2	4	3
(See note below.)	(See note below.)	4	3

Note. Operate the ORDER WIRE switch on the ORDER WIRE PANEL to RING.

198. 65-Kc and Faulty Frequency Tests

a. Operate the following TEST PANEL switches to the positions indicated:

Switch	Position
SEND	65 KC TR OR FAULT TEST.
MEASURE	TRANSMISSION
MEASURE SELECTIVE	65KC
MEASURE NON-SELECTIVE.	OFF

b. Connect TEST PANEL measure cord W1 and plug P1 to the TR AMP OUT jack on the GROUP PANEL.

c. Adjust the FINE TUNE control on the TEST PANEL for maximum meter indication.

d. Adjust the 65 KC TR OR FAULT TEST control on the TEST PANEL chassis for a 0-db indication on the meter.

e. On the TEST PANEL, operate the MEASURE SELECTIVE switch to OFF and the MEASURE NON-SELECTIVE switch to FAULT TEST.

f. On the TEST PANEL, depress and release, one at a time, the FAULT TEST REP 1, REP 2, and REP 3 switches. The TEST PANEL meter indication for each switch will be between —1db and +1 db.

g. Connect TEST PANEL measure cord W1 and plug P1 to the REC AMP OUT 2 jack on the GROUP PANEL.

h. Operate the following TEST PANEL switches to the positions indicated.

Switch	Position
SEND	65KC REC
MEASURE SELECTIVE	65KC
MEASURE NON-SELECTIVE.	OFF

i. The SEND lamp on the TEST PANEL will light.

j. Adjust the FINE TUNE control on the TEST PANEL for a maximum meter indication.

k. The TEST PANEL meter indication will be adjustable to 0 db by means of the 65 KC REC control.

199. Unwanted Modulation Tests

a. Operate the SEND switch on the TEST PANEL to 65 KC TR OR FAULT TEST.

b. Connect the TEST PANEL measure cord W1 and plug P1 to the TR AMP OUT jack on the GROUP PANEL.

c. Adjust the FINE TUNE control on the TEST PANEL for a maximum meter indication.

d. The TEST PANEL meter indication will be adjustable to 0 db by means of the 65 KC TR OR FAULT TEST control on the TEST PANEL chassis.

e. Operate the MEASURE SELECTIVE and MEASURE NON-SELECTIVE switches on the TEST PANEL to GRP PANEL 62KC.

f. Connect TEST PANEL measure cord W1 and plug P1 to the REC 62 KC jack on the GROUP PANEL.

g. Adjust the FINE TUNE control on the TEST PANEL for a maximum indication on the meter.

h. The TEST PANEL meter will indicate less than 0 db.

i. Operate the REGULATOR switch on the GROUP PANEL chassis to MAN and the AC POWER switch on the 200 VOLT POWER SUPPLY to OFF.

Figure 18 (in separate envelope) (as changed by C 3, 24 Apr 64).

Make the following changes to connector P103:

Change E to R.

Change R to E.

Figure 103 (in separate envelope) (as changed by C 3, 24 Apr 64).

Make the following changes:

Delete (NOTE 5).

Delete note 5.

Figure 131 (in separate envelope). Make the following changes:

On SUPPLY TEST CABLE ASSEMBLY connected to connector J101 of the JUNCTION PANEL, change the strap from "J to F" to: J to P; change the strap from "E to P" to: E to F.

Delete note 5 and add new note 5:

(5) TWO CARRIER SUPPLY TEST CABLE ASSEMBLIES ARE REQUIRED BY TESTS USING THIS TEST SETUP.

Page 316, figure 135 (as changed by C 3, 24 Apr 64). Make the following changes:

In the left-hand section of the RC network, delete 1,800 in two places and substitute 1,600.

Delete J301 added to the connector adjacent to connector P3.

Delete (NOTE 4) added below the 1,500-ohm variable resistor. Delete note (4).

Page 323, appendix (page 61 of C 2). Delete the references as added by C 3, 24 April 1964 and substitute:

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, 8, and 9), Supply Catalogs (type CL), Supply Bulletins, Lubrication Orders, and Modification Work Orders
TB SIG 355–1	Depot Inspection Standard for Repaired Signal Equipment
TB SIG 355–2	Depot Inspection Standard for Refinishing Repaired Signal Equipment
TM 9–213	Painting Instructions for Field Use
TM 11–5527	Multimeters TS–352/U, TS–352A/U, and TS–352B/U
TM 11–6625–200–12	Operator and Organizational Maintenance Manual: Multimeters ME–26A/U and ME–26B/U
TM 11–6625–218–12	Operation and Organizational Maintenance: Frequency Meter AN/TSM–16
TM 6625–444–15	Operator, Organizational, Field and Depot Maintenance Manual: Digital Voltmeters AN/GSM–64 and V–34A
TM 38–750	Army Equipment Record Procedures.

Changes in force: C 2, C 4, and C 5

TM 11-2139-35/T. O. 31W1-2TCC7-64

***C 5**

DS, GS, and Depot Maintenance Manual, Including Repair Parts and Special Tool Lists TERMINALS, TELEPHONE, AN/TCC–7 AND AN/TCC–50

CHANGE
No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *30 November 1965*

TM 11–2139–34, 14 November 1958, is changed as follows:

Title of the manual is changed as shown above.

Note. The parenthetical reference to previous changes (example 1 of C 2) indicates that pertinent material was published in those changes.

Page 2, paragraph 1 (page 1 of C 2). Delete subparagraph *b* and substitute:

b. Refer to appendix I for technical manuals applicable to the AN/TCC–7 and AN/TCC–50.

Paragraph 1, (page 3 of C 4). Delete subparagraph *d* and substitute:

d. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA Publications) will be used for reporting these improvements. This form will be completed using pencil, pen, or typewriter and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL–MR–(NMP)–MA, Fort Monmouth, N.J., 07703.

Page 323, appendix (page 47 of C 4.) Designate "APPENDIX" as APPENDIX I.

Delete TM 11–2139–10 and TM 11–2139–20 in their entirety and substitute:

TM 11–2139–10	Operator's Manual: Terminals Telephone AN/TCC–7 and AN/TCC–50.
TM–11–2139–20	Organizational Maintenance Manual: Terminals, Telephone AN/TCC–7 and AN/TCC–50.
TM 11–2150	Telephone Carrier Systems using Terminals, Telephone AN/TCC–7 and AN/TCC–50, Repeater, Telephone AN/TCC–8 (AN/TCC–21), Repeater, Telephone AN/TCC–11, and Telephone Test Set TS–712/TCC–11.
TM 11–5965–216–15P	Operator's, Organizational, Field and Depot Maintenance Repair Parts and Special Tool Lists and Maintenance Allocation Chart: Hand set TS–9–F.

Add appendix II after appendix I.

This change supersedes TM 11–5805–317–35P, 2 December 1964.

APPENDIX II

DIRECT AND GENERAL SUPPORT, AND DEPOT REPAIR PARTS LIST

Section I. INTRODUCTION

1. General

a. This manual lists the quantities of repair parts for direct support, general support and depot field maintenance and is a basis for requisitioning authorized parts. It is also a guide for depot maintenance in establishing initial levels of spare parts.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.* Source, maintenance, and recoverability codes indicate the commodity command responsible for supply, the maintenance category at which an item is stocked, categories at which an item is installed or repaired, and whether an item is repairable or salvageable. The source code column is divided into four parts.

(*a*) *Column A.* This column indicates the materiel code and designates the area of responsibility for supply. AR 310–1 defines the basic numbers used to identify the materiel code. If the part is Signal materiel responsibility, the column is left blank.

(*b*) *Column B.* This column indicates the point within the maintenance system where the part is available. "P" indicates that the repair part is a high mortality part; procured by Commodity Command, stocked in and supplied from the supply depot system, and authorized for use at indicated maintenance categories.

(*c*) *Column C.* This column indicates the lowest maintenance categories authorized to install the part.

"O"—Organizational maintenance (operator and organizational).
"F"—Direct support maintenance.
"H"—General support maintenance.

(*d*) *Column D.* The symbols in this column indicate whether the item is repairable or salvageable, as follows:

"R"—indicates that the part or assembly is economically repairable and is supplied, when available, on an exchange basis.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number.

(3) *Designation by model.* Not used.

(4) *Description.* Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

(5) *Unit of issue.* The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

(6) *Expendability.* Nonexpendable items are indicated by NX. Expendable items are not annotated.

(7) *Quantity incorporated in unit.* This column lists the quantity of each part found in a given assembly, component, or equipment.

(8) *Direct support.* This column indicates quantities of repair parts authorized for initial stockage for use in the direct support maintenance and in supply support to organization. The quantities are based on 100 equipments to be maintained for a 15-day period.

(9) *General support.* The numbers in this column indicate quantities of repair parts authorized for initial stockage for use in general support maintenance. The quantities are based on 100 equipments to be maintained for a 15-day period.

(10) *Depot.* The numbers in this column indicate quantities of repair parts author-

ized for depot maintenance and for initial stockage for maintenance, and for supply support to lower categories. The entries are based on the quantity required for rebuild of 100 equipments.

(11) *Illustration.* The "Item No." column lists the reference symbols used for identification of the items in the illustration or text of the manual.

2. Parts for Maintenance

When this equipment is used by signal service organizations organic to theater headquarters or communication zones to provide theater communications, those repair parts authorized up to and including general support are authorized for stockage by the organization operating this equipment.

3. Arrangement of Groups

This list is arranged in the following Group order:

Telephone, Terminal AN/TCC–7 and Telephone, Terminal AN/TCC–50

Group I—Amplifier-Pilot Regulator AM–707/TCC–6

Group Ia—Amplifier Audio Frequency Subassembly AR1, AR2, AR3 (FSN 5805–503–3365) (Quantity in use reflects 3 each Line Amplifiers)

Group Ib—Amplifier Audio Frequency Subassembly AR4 (FSN 5805–378–4760)

Group Ic—Amplifier-Pilot Regulator Subassembly 26 (FSN 5805–392–7626)

Group II—Modem Telephone TA–227/U

Group III—Receiver-Transmitter Test OA–443/TCC–7

Group IIIa—Receiver-Transmitter Order Wire RT–280/TCC–7

Group IIIa (1)—Amplifier Audio Frequency AR101 (FSN 5805–503–3360)

Group IIIa (2)—Amplifier Audio Frequency AR102 (FSN 5805–503–0920)

Group IIIa (3)—Ringer-Oscillator Assembly Y101 (FSN 5805–356–2898)

Group IIIb—Test Set, Telephone TS–760/TCC–7

Group IV—Telephone Carrier Frequency TA–228/TCC–7

4. Additional Repair Parts Authorization

An asterisk (*) indicates that an item is not authorized for stockage but if required, may be requisitioned for immediate use only.

5. Electron Tubes

The consumption rates given for tubes are conservative theoretical estimates and are provided for use only when more complete information, such as data based on operating experience, is not available. These figures are based on levels and requirements for equipment actually in use, not on authorizations or equipment stored in depots.

6. Requisitioning Information

a. The allowance factors are based on 100 equipments. In order to determine the number of parts authorized for initial stockage for the specific number of equipments supported, the following formula will be used and carried out to two decimal places.

$$\text{Specific number of equipments supported} \times \frac{\text{allowance factor}}{100} =$$

number of parts authorized for initial stockage.

b. Fractional values obtained from above computation will be rounded to whole numbers as follows:

(1) When the total number of parts authorized is less than 0.5, the quantity authorized will be zero.

(2) When the total number of parts authorized is between 0.5 and 1.0, the quantity authorized will be one.

(3) For all values above one, fractional values below 0.5 will revert to the next lower whole number and fractional value 0.5 and above will advance to the next higher whole number.

(4) A parenthesis after the allowance factor listed in the direct support column indicates that the item is combat essential and that a minimum quantity of one is authorized for initial stockage even though the computed quantity is less than 0.5.

c. The quantities determined in accordance with the above computation represent the initial stockage for a 15-day period.

SECTION II. FUNCTIONAL PARTS LIST

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						TELEPHONE, TERMINAL AN/TCC-7 AND TELEPHONE, TERMINAL AN/TCC-50								
				5805-503-1228		TELEPHONE, TERMINAL AN/TCC-7: 12 channels, 4 transmission line; 12 to 60 kc, 1000 cyc ringing; MIL Spec-C-10623; Sig Corps dwg SC-D-63099		NX						
				5805-752-5588		TELEPHONE, TERMINAL AN/TCC-50: 12 channels, 4 transmission lines; 12 to 60 kc, 100 cps ringing; (Less Power Supply PP-826/U; PP-826A/U)		NX						
		O		5975-224-5260		ROD, GROUND, MX-148/G: glav steel; 6 ft lg x 2-3/4 in w x 1-1/4 in thk o/a; Sig dwg SC-D-14158-D			1	0.5	0.1	2.0		
						GROUP 1 AMPLIFIER-PILOT REGULATOR AM-707/TCC-7								
		O		5805-503-3365		AMPLIFIER, AUDIO FREQUENCY - RADIO FREQUENCY: 12 kc to 68 kc freq range, output 2.2 w, 600 ohms, input 2.2 w 6.3 vac, 60 cyc, single phase, 200 vac, Sig dwg No. SC-D-63308		NX	3	1.3	0.3	9.0		AR1, AR2 AR3
		O		5805-378-4760		AMPLIFIER, AUDIO FREQUENCY - RADIO FREQUENCY: 12 to 60 kc and 60 to 108 kc, freq range, 7-3/4 in lg x 4-5/16 in w x 3-15/16 in h o/a; Sig dwg No. SC-D-63287		NX	1	0.7	0.1	3.0		AR4
		O		5805-392-7626		AMPLIFIER, PILOT REGULATOR, SUB-ASSEMBLY: c/o cap, 37 res, 5 vacuum tubes, 1 ea trans chassis assembly and filter; Sig dwg No. SC-D-63280		NX	1	0.7	0.1	3.0		Z6
		O		5920-092-8729		ARRESTOR, LIGHTNING: carbon block type, 500 v peak brkdn; 350 v, rms, line to gnd, 2/32 in lg x 23/32 in dia; Sig dwg SC-B-63334			2	1.2	0.2	8.0		E101, E102

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD FIELD	4TH FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
O	5920-049-7835		ARRESTOR, LIGHTNING: carbon block type, 800 v pk, brkdn, voltage 565 v line to gnd, 21/32 in lg x 23/32 in dia; Sig dwg SC-B-63335			1	0.8	0.1	4.0		E103
F	5905-589-9972		ATTENUATOR, VARIABLE: panel mounted 2-5/16 in x 1 7/8 in x 1 15/16 in; 11 steps, Sig dwg SC-C-67305-2			1	0.7	0.1	3.0		R34
F	5905-440-6385		ATTENUATOR, VARIABLE: 7,780 ohms, manual dr, 11 steps 2 5/16 in lg x 1 7/8 in dia x 1 15/16 in h; Sig dwg SC-C-67305-1			1	0.7	0.1	3.0		R35
F	5940-553-2581		BINDING POST, U-106/U: 0.785 in x 0.583 in dia x 10-32 thd; Sig dwg SC-C-16495			16	3.1	1.0	32.0		E1 thru E15 E104
F	6350-269-7977		BUZZER: 6.3 vac, 60 cyc; 2 5/8 in lg x 1 21/32 in w x 3/4 in deep; Edwards type No. MD6531-2			1	0.7	0.1	3.0		I1
F	6145-283-9456		CABLE, SPECIAL PURPOSE, ELECTRICAL: 3 No. 16 AWG stranded copper cond and 14 No. 22 AWG; stranded copper cond; Sig dwg SC-C-64033 (Authorized quantity will be a minimum or a multiple of ft in use)	ft		14	*	*	42.0		
F	6145-283-9457		CABLE, SPECIAL PURPOSE, ELECTRICAL: 8 No. 16 AWG stranded copper cond and 4 No. 22 AWG; stranded copper cond; Sig C dwg No. SC-C-63338 (Authorized quantity will be a minimum or a multiple of ft in use)	ft		5	*	*	15.0		
F	6145-283-9448		CABLE, SPECIAL PURPOSE, ELECTRICAL: 10 conductors No. 22 AWG; 0.660 in dia o/a; Sig dwg SC-D-63266 (Authorized quantity will be a minimum or a multiple of ft in use)	ft		10	*	*	30.0		
F	6145-547-0920		CABLE, SPECIAL PURPOSE, ELECTRICAL: 6 No. 16 AWG stranded 12 No. 22 AWG cond; Sig dwg No. SC-C-63337 (AUthorized quantity will be a minimum or a multiple of ft in use)	ft		5	*	*	15.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (continued)								
	P	F		5910-183-9260		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 1300 uuf ±2%; 500 vdcw; MIL type CM30E132G			1	0.7	0.1	3.0		C14
	P	F		5910-184-4513		CAPACITOR, FIXED, MICA DIELECTRIC: 5,100 uuf ±2%; 500 vdcw, MIL type CM35E512G			1	0.7	0.1	3.0		C6
	P	F		5910-101-4063		CAPACITOR, FIXED, MICA DIELECTRIC: 10,000 uuf ±2%; 300 vdcw, MIL type CM35E103G			2	1.0	0.2	6.0		C3,C13
	P	F		5910-235-8664		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 100,000 uuf ±20% - 10%; 600 vdcw, Sprague p/n 91P104D1T6 (Authorized allowances based on a total of 2 per equipment)			1	1.0	0.2	6.0		C12
	P	F		5910-306-5456		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 470,000 uuf ±20%; 300 vdcw; Sprague pt No. 81P47403T5 (Authorized allowances based on a total of 11 per equipment)			1	3.5	0.8	33.0		C4
	P	F		5910-280-7350		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 1 uf ±10%; 200 vdcw, 900,000 to 1.1 uf cap range, Sprague pt No. 91P10592T6			5	1.9	0.4	15.0		C5,C7,C8, C9,C10
	P	F		5910-280-8259		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 1 uf ±10%; 900,000 to 1.1 uf cap, range, 200 vdcw, Sprague pt No. 81P10592T5			1	0.7	0.1	3.0		C11
	P	O		6805-306-2310		CASE, STANDARDIZED, COMPONENTS, ELECTRICAL: 20-5/8 in lg x 17-1/16 in w x 17-5/16 in h o/a; WECo dwg SO-D-62844 (less Sig dwg SC-C-62846 cover assy)		NX	1	0.7	0.1	3.0		
	P	F		5340-498-9412		CATCH, LUGGAGE: 2-1/16 in lg x 1-15/32 in w x 15/32 in h o/a; Sig dwg SC-D-20648			10	1.4	0.3	10.0		
	P	F		5935-201-3998		CONNECTOR, RECEPTACLE, ELECTRICAL: 4 rd male cont, 35 amp, 1250 vdcw, 900 vac rms, 1-3/16 in lg x 1-15/32 in dia type No. CS-2020(1)(P)			1	0.7	0.1	3.0		J102

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
P	F			5935-539-0898		CONNECTOR, RECEPTACLE, ELECTRICAL: 4 cont, 1 conn, mating end, Polarized Inc, cap and chain 1 1/4 in lg x 21/32 in dia, type U-122G			1	0.7	0.1	3.0		J103
P	F			5935-542-9927		CONNECTOR, PLUG, ELECTRICAL: 1 conn, mating end, 14 rd male cont, 20 amp 1250 vdcw, 900 vac, 3 7/16 in lg x 2 13/16 in w x 1 7/8 in h o/a; type CS-1326(1)(P) 0.718			2	1.0	0.2	6.0		P1, P2
P	F			5935-542-9925		CONNECTOR, PLUG, ELECTRICAL: 14 cont, female rd, 20 amp, 1250 vdcw, 900 vac 3 7/16 in lg, 2 13/16 in w x 1 7/8 in h o/a; type CS-132(1)(S)0.690			1	0.7	0.1	3.0		P103
P	F			5935-201-3996		CONNECTOR, RECEPTACLE, ELECTRICAL: 14 cont, male, rd 20 amp, 1250 vdcw 900 vac rms, 1 3/16 in lg x 1 27/32 in dia, type CS-2026(1)(P)			1	0.7	0.1	3.0		J101
P	F			5935-552-7032		CONNECTOR, RECEPTACLE, ELECTRICAL: 1 conn mating end, 19 male cont, 20 amp, 700 vdcw, 500 vac, 1 3/16 in lg x 1 27/32 in dia o/a; MIL-C-12520A, type CS2026-(3)(P)			1	0.7	0.1	3.0		J1
P	F			5935-542-9928		CONNECTOR, PLUG, ELECTRICAL: 1 conn mating end, 19 female rd cont, 20 amp, 700 vdcw, 500 vac 3 7/16 in lg x 2 13/16 in w x 1-7/8 in h o/a; MIL-C-12520A, type CS-1326F027			1	0.7	0.1	3.0		P105
P	F			5935-542-9926		CONNECTOR, PLUG, ELECTRICAL: 1 conn mating end, rd female cont, 20 amp, 700 vdcw, 500 vac 3 7/16 in lg x 2/13/16 in w x 1 7/8 in h; MIL-C-12520A, type CS-1326FD25			3	1.3	0.3	9.0		P101 P104 P102
P	F			5935-258-9963		CONNECTOR, RECEPTACLE, ELECTRICAL: 21 rd female cont, 2 3/32 in lg x 12/16 in w x 23/32 in h o/a; Garde Mfg Co No. R-6601-21			5	1.9	0.4	15.0		J2, J3, J4, J5, J6
P	O			5805-392-5692		COVER: Carrying case; 20-9/16 in lg x 16-5/8 in w x 2-1/2 in h; Sig dwg SO-C-62846			1	0.7	0.1	3.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D															FIGURE NO.	ITEM NO.
											AN/TCC-7 AND AN/TCC-50 (Continued)								
	P			5960-262-1357							ELECTRON TUBE: Pentode, glass envelope, SPEC MIL-E-1, type 5654/6AK5W; (Authorized allowances based on a total of 10 per equipment)			1	146.0	46.0	876.0		V1
	P	F		5805-503-2726							EQUALIZER, TELEPHONE LINE: bridged "T" type 12 to 68 kc freq range 1 7/16 in lg x 2 1/32 in w x 39/64 in h o/a; Sig dwg SC-C-64011			1	0.7	0.1	3.0		EQ3
	P	F		5805-503-2718							EQUALIZER, TELEPHONE LINE: bridged "T" type 12 to 68 kc freq range; 1 7/16 in lg, 2 19/32 in w x 3 1/2 in h o/a; Sig dwg SC-C-63262			1	0.7	0.1	3.0		EQ2
	P	F		5805-503-2725							EQUALIZER, LINE TELEPHONE: bridged "T" type 12 to 68 kc freq range; 1-7/16 in lg x 2 17/32 in w x 39/64 h o/a; Sig dwg SC-C-64009			1	0.7	0.1	3.0		Z3
	P	F		5805-503-2724							EQUALIZER, LINE TELEPHONE: bridged "T" type 12 to 68 kc, 1-7/16 in lg x 2 17/32 in w x 3 9/64 in h o/a; Sig dwg SC-C 64008			1	0.7	0.1	3.0		Z4
	P	F		5915-501-4145							FILTER, BAND PASS: 68 kc, 1 23/32 in lg x 1-23/32 in w x 3-9/16 in h SC-C-63626			1	0.7	0.1	3.0		FL2
	P	F		5915-392-7497							FILTER, HIGH-PASS: 0-1.7 kc, low pass 12-100 kc high pass, 4 29/32 in x 2 7/16 in x 3 9/16 in h o/a; Sig dwg SC-C-64013			2	1.0	0.2	6.0		FL101 FL102
	P	F		5915-501-4049							FILTER, LOW PASS: 60 kc, cut off freq, 600 ohms input 600 ohms output, 3 29/32 in lg x 2-19/32 in w x 1 7/16 in h; Sig dwg 63261			1	0.7	0.1	3.0		FL3
	P	F		5915-281-0297							FILTER, LOW PASS: 60 kc cut off freq, 600 ohms input and output; 3 29/32 in lg x 1 7/16 in w x 3 5/32 in h; Sig dwg SC-C-63265			1	0.7	0.1	3.0		FL1
	P	F		5920-030-0330							HOLDER, LIGHTNING ARRESTOR: plug type, accom 1 bayonet base plug; 21/32 in lg x 23/32 in dia o/a; WECo pt No. GA51574; (3 ea holds spare arrestor)			6	2.3	0.5	18.0		XE101 XE102

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5935-192-4729		JACK, TELEPHONE: accom 3 cont; plug; Shank 0.026 dia x 1.093 lg; arr J2, type No. JJ033			9	2.3	0.5	27.0		J7 thru J15
P O	5355-284-5616		KNOB: rd alum; 0.257 in dia shaft; 9/16 in dia x 1/4 in thk; Sig dwg SC-B-63251			5	1.4	0.3	10.0		
5 F	6210-299-6636		LIGHT, INDICATOR: supplied w/o lens, accom len, 1/2 in dia and 1 amp 1-3/4 in lg x 13/16 in dia; Dialco Part No. 922210-1			3	1.3	0.3	9.0		X12,X13, X14
5 F	6250-586-7769		LAMPHOLDER: accom 1 miniature bayonet base lamp, 7/16 in lg x 1-11/16 in w x 1-1/16 in h w/mtg. bkt; Drake Part No. 167C			2	1.0	0.2	6.0		
5 O	6240-155-8706		LAMP, INCANDESCENT: 6 to 8 V, 0.15 amp; Min bayonet based, T-3-1/4 bulb, clear finish, 3000 hr rated life; MIL-MS15571-2, type TB-14; GE No. 47			3	3.1	0.7	30.0		I1,I2,I3
5 O	6210-643-2059		LENS, INDICATOR LIGHT: lens 1/2 in glass, red; smooth face and frosted back, 3/4 in lg x 13/16 in dia; Dial Light Co No. 92-111			2	1.0	0.2	6.0		
5 O	6210-299-3928		LENS, INDICATOR LIGHT: 1/2in glass, colorless, smooth face, 3/4 in lg x 13/16 in dia Dialco 92-117			1	0.7	0.1	3.0		X14
P F	5905-393-1850		NETWORK, LINE BUILDING OUT: 9 soldered term on top c/o 3 toroidal inductors, 4 mica capacitors and 12 carbon resistors; 3-29/32 in lg x 1-17/16 in w x 3-9/64 in h o/a; Sig dwg SC-C-64010			2	1.0	0.2	6.0		Z1,Z5
P F	5915-392-7640		NETWORK, TEMPERATURE; COMPENSATING: compensates for drift, due to variation temp; 4 soldered lug term; c/o 5 resistors 2 cap and 2 toroidal inductors; Sig dwg SC-C-64007			1	0.7	0.1	3.0		Z2
P F	5330-292-3895		PACKING, PREFORMED: cork, neoprene comp, 13/32 in h o/a; Armstrong Cork No. NC-755; (Authorized quantity will be a minimum or a multiple of ft in use)	ft		7	*	*	21.0		

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (continued)								
	P	F		5905-190-8883		RESISTOR, FIXED, COMPOSITION: 100 ohms ±5%; 1/2 w; MIL type RC20GF100J (AUthorized allowances based on a total of 4 per equipment)			1	1.9	0.4	12.0		R26
	P	F		5905-552-7203		RESISTOR, FIXED, FILM: 26.1 ohm ±1%; 1/2 w; MIL type RN70B26R1F			1	0.7	0.1	3.0		R27
	P	F		5905-552-5696		RESISTOR, FIXED, FILM: 56.2 ohms ±1%; 1/2 w; MIL type RN70B56R2F			1	0.7	0.1	3.0		R24
	P	F		5905-552-6140		RESISTOR, FIXED, FILM: 60.4 ohm ±1%; 1/2 w; MIL type RN70B60R4F			1	0.7	0.1	3.0		R2
	P	F		5905-556-3739		RESISTOR, FIXED, FILM: 76.8 ohms ±1%; 1/2 w; MIL type RN70B76R8F			1	0.7	0.1	3.0		R3
	P	F		5905-552-7207		RESISTOR, FIXED, FILM: 86.6 ohms ±1%; 1/2 w; MIL type RN70B86R6F			1	0.7	0.1	3.0		R14
	P	F		5905-190-8889		RESISTOR, FIXED, COMPOSITION: 100 ohms ±5%; 1/2 w; MIL type RC20GF101J			1	0.7	0.1	3.0		R31
	P	F		5905-556-3749		RESISTOR, FIXED, FILM: 115ohms ±1%; 1/2 w; MIL type RN70B1150F			1	0.7	0.1	3.0		R15
	P	F		5905-556-3109		RESISTOR, FIXED, FILM: 135 ohms ±1%; 1/2 w; Sig dwg SC-C-62507-12, fig B			5	1.9	0.4	15.0		R1, R18, R22, R29 R101
	P	F		5905-556-3743		RESISTOR, FIXED, FILM: 137 ohms ±1%; 1/2 w; MIL type RN70B1370F			1	0.7	0.1	3.0		R5
	P	F		5905-556-3765		RESISTOR, FIXED, FILM: 196 ohms ±1%; 1/2 w; MIL type RN70B1960F			1	0.7	0.1	3.0		R46
	P	F		5905-702-5154		RESISTOR, FIXED, FILM: 252 ohms ±1%; 1/2 w; Sig dwg No. SC-C-62507-98			2	1.0	0.2	6.0		R47,
	P	F		5905-556-3760		RESISTOR, FIXED, FILM: 287 ohms ±1%; 1/2 w; MIL type RN70B2870F			1	0.7	0.1	3.0		R12
	P	F		5905-192-3971		RESISTOR, FIXED, COMPOSITION: 330 ohms ±5%; 1/2 w; MIL type RC20GF331J			1	0.7	0.1	3.0		R41

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL						DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D															FIGURE NO.	ITEM NO.
											AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-581-1005							RESISTOR, FIXED, FILM: 464 ohm 1w, ±1%; MIL type RN75B464F			1	0.7	0.1	3.0		R25
	P	F		5905-556-3766							RESISTOR, FIXED, FILM: 536 ohms ±1%; 1/2 w; MIL type RN70B5360F			1	0.7	0.1	3.0		R51
	P	F		5905-195-6800							RESISTOR, FIXED, COMPOSITION: 560 ohms ±5%; 1/2 w; MIL type RC20GF561J			1	0.7	0.1	3.0		R103
	P	F		5905-646-5772							RESISTOR, FIXED, FILM: 604 ohms ±1%; 1/2 w; MIL type RN70B6040F			2	1.0	0.2	6.0		R9, R10
	P	F		5905-556-3348							RESISTOR, FIXED, FILM: 619 ohms ±1%; 1/2 w; mil type RN70B6190F			2	1.0	0.2	6.0		R36, R37
	P	F		5905-552-7206							RESISTOR, FIXED, FILM: 825 ohms ±1%; 1/2 w; MIL type RN70B8250F			1	0.7	0.1	3.0		R16
	P	F		5905-552-7204							RESISTOR, FIXED, FILM: 887 ohms ±1%; 1/2 w; MIL type RN70B8870F			1	0.7	0.1	3.0		R19
	P	F		5905-542-9109							RESISTOR, FIXED, FILM: 953 ohms ±1%; 1/2 w; MIL type RN70B953DF			1	0.7	0.1	3.0		R33
	P	F		5905-542-9473							RESISTOR, FIXED, FILM: 1.150 ohms ±1%; 1/2 w; MIL type RN70B1151F			2	1.0	0.2	6.0		R45 R50
	P	F		5905-542-9948							RESISTOR, FIXED, FILM: 1.910 ohms ±1%; 1/2 w; MIL type RN70B1911F			1	0.7	0.1	3.0		R30
	P	F		5905-553-2178							RESISTOR, FIXED, FILM: 2,670 ohms ±1%; 1/2 w; MIL type RN70B2671F			2	1.0	0.2	6.0		R11, R13
	P	F		5905-279-3506							RESISTOR, FIXED, COMPOSITION: 3,300 ohms ±5%; 1/2 w; MIL type RC20GF332J			3	1.3	0.3	9.0		R19, R20 R54
	P	F		5905-542-9469							RESISTOR, FIXED, FILM: 3,480 ohms ±1%; 1/2 w; MIL type RN70B3481F			1	0.7	0.1	3.0		R23
	P	F		5905-556-3762							RESISTOR, FIXED, FILM: 3830 ohms ±1%; 1/2 w; MIL type RN70B3831F (Authorized allowances based on a total of 3 per equipment)			1	1.3	0.3	9.0		R17
	P	F		5905-553-2205							RESISTOR, FIXED, FILM: 4220 ohms ±1%; 1/2 w; MIL type RN70B4221F			2	1.0	0.2	6.0		R4, R6,

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-556-3737		RESISTOR, FIXED, FILM: 7,500 ohms ±1%; 1/2 w; MIL type RN70B7501F			1	0.7	0.1	3.0		R52
	P	F		5905-552-7208		RESISTOR, FIXED, FILM: 8,250 ohms ±1%; 1/2 w; MIL type RN70B8251F			1	0.7	0.1	3.0		R39
	P	F		5905-185-8510		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 1/2 w; MIL type RC20GF103J (Authorized allowances based on a total of 6 per equipment)			2	2.3	0.5	18.0		R102 R104
	P	F		5905-185-8516		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 2W; MIL type RC42GF103J			1	0.7	0.1	3.0		R43
	P	F		5905-542-9315		RESISTOR, FIXED, FILM: 24,000 ohms ±1%; 1/2 w; Sig dwg SC-C-62507-209			1	0.7	0.1	3.0		R40
	P	F		5905-556-3763		RESISTOR, FIXED, FILM: 26,100 ohms ±1%; 1/2 w; MIL type RN70B2612F			1	0.7	0.1	3.0		R32
	P	F		5905-556-3738		RESISTOR, FIXED, FILM: 20,500 ohms ±1%; 1/2 w; MIL type RN70B2052F			1	0.7	0.1	3.0		R53
	P	F		5905-556-3735		RESISTOR, FIXED, FILM: 46,400 ohms ±1%; 1/2 w; MIL type RN70B4642F			1	0.7	0.1	3.0		R21
	P	F		5905-556-3744		RESISTOR, FIXED, FILM: 64,900 ohms ±1%; 1/2 w; MIL type RN70B6492F			1	0.7	0.1	3.0		R8
	P	F		5905-552-3547		RESISTOR, FIXED, FILM: 100,000 ohms ±1%; 1/2 w; MIL type RN70B1003F (Authorized allowances based on a total of 4 per equipment			1	1.9	0.4	12.0		R42
	P	F		5905-257-6545		RESISTOR, THERMAL: 110 ohms at 0.02 amp, 2600 ohms at 0.001 amp, 4000 Ohms at 0.001 amp, Sig dwg No. SC-C-67301			1	0.7	0.1	3.0		RT1
	P	F		5905-284-3430		RESISTOR, VARIABLE: 20,000 ohms ±20%; 1/2 w; Sig dwg SC-C-62818-2			1	0.7	0.1	3.0		R44
	P	F		5905-226-9462		RESISTOR, VARIABLE: 200 ohms ±10%; Sig dwg SC-D-62818-9			1	0.7	0.1	3.0		R7
	P	F		5905-299-2097		RESISTOR, VARIABLE: 5,000 ohms ±10%; 2 w; Sig dwg SC-C-62816-6			1	0.7	0.1	3.0		R28

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC 7 AND AN/TCC-50 (Continued)								
	P	F		5905-283-6445		RESISTOR, VARIABLE: comp, 2 sect; front sect; 6000 ohms ±10%; rear sect, 5,500 ohms ±20%; 2 w; AB No. JJ2-B6021-A5522			1	0.7	0.1	3.0		R38
	P	F		5340-355-9839		RETAINER, CATCH: Used as catch on case, 1-3/8 in lg x 3/4 in w x 11/32 in h o/a; Sig dwg No. SC-B-62557			10	1.4	0.3	10.0		
	P	O		5305-206-5544		SCREW, EXTERNALLY, RELIEVED BODY: secures panel to frame; fil hd; 10-32NF; Sig dwg No. SO-B-62467			8	1.9	0.4	15.0		
	P	O		5305-558-3180		SCREW, EXTERNALLY RELIEVED BODY: 10-32 thd; 1-1/2 lg Sig dwg SC-B-62664-2			12	2.7	0.6	24.0		
	P	O		5305-558-3181		SCREW, EXTERNALLY RELIEVED BODY: Fil hd; slot drive 6-32 thd, 5/8 in lg Sig dwg SC-B-62716-9			15	3.1	0.7	30.0		
	P	O		5960-262-0015		SHIELD, ELECTRON TUBE: 1-3/8 in lg x 0.813 id; JAN type TS102U01 (Authorized allowances based on a total of 13 per equipment) (Includes 3 spares)			1	2.7	0.6	25.0		
	P	F		5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont; miniature; JAN type TS-102P01 (Authorized allowances based on a total of 13 per equipment			4	2.7	0.6	25.0		V1
	P	H		5930-614-8621		SPRING: Helical torsion, actuates lvr for 1 way sw; bronze wire; Beamco No. 101-53			1		0.1	3.0		
	P	F		5805-392-6423		SPRING ASSEMBLY: used to secure frame in case c/o 1 plate, 1 spg, and 2 fingers, steel; Sig dwg No. SC-B-62552			4	1.9	0.4	16.0		
	P	O		5340-276-7585		STRAP, CARRYING: Cotton webbing 27 7/8 in lg x 1 in w; Sig dwg No. SC-C-62849			2	1.0	0.2	6.0		

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5930-173-8362		SWITCH, LEVER, PILE-UP: 2 locking lvr pos; Sig dwg SC-C-62539			2	1.0	0.2	6.0		S1, S2
P F	5930-548-6908		SWITCH, LEVER, PILE-UP: 2 locking lvr pos; Sig dwg SC-C-64016			1	0.7	0.1	3.0		S4
P F	5930-201-3617		SWITCH, LEVER, PILE-UP: 3 locking lever positions; Sig dwg SC-C-64015			1	0.7	0.1	3.0		S3
P F	5930-568-9824		SWITCH, ROTARY: 4 8 positions 2 sect; Sig dwg SC-C-67302			2	1.0	0.2	6.0		S5, S6
P F	5940-542-8157		TERMINAL STUD; 0.187 lg x 0.076 w x 0.052 h o/a; Whitso Inc pt No. 1M16-A4 Item Nos. E26, E27, E28, E29, E30, E48, E21			7	1.9	0.4	15.0		SEE DESC COLUMN
P F	5940-542-8114		TERMINAL STUD: 7/8 in lg x 1/4 in across flats; Whitso pt No. 2H-35-A4 (Authorized allowances based on a total of 89 per equipment) Item Nos. E31 thru E47 E50 thru E69, R71, E106, E107, E108 E105			47	12.9	3.2	180.0		SEE DESC COLUMN
P F	5940-642-3963		TERMINAL STUD: 7/8 in lg x 11/32 in w x 5/16 in h o/a; Winchester Elect pt No. FT5 (Authorized allowances based on a total of 3 per equipment)			1	1.0	0.2	6.0		E49
P F	5950-645-5205		TRANSFORMER, AUDIO FREQUENCY: plate coupling type, 25,000 ohm pri 12 ohms secd; Sig dwg SC-C-63435			1	0.7	0.1	3.0		E49
P F	5950-648-2539		TRANSFORMER, AUDIO FREQUENCY: line type, pri, 132 ohms, secd; 600 ohms 500 V rms test; Sig dwg SC-C-63221			2	1.0	0.2	6.0		T1, T2
P F	5950-569-0183		TRANSFORMER, AUDIO FREQUENCY: line type, pri, 135 ohms secd; 600 ohms 500 v and 2000 v, rms test; Sig dwg SC-C-67303			2	1.0	0.2	6.0		T101 T102
P F	5950-648-2267		TRANSFORMER, AUDIO FREQUENCY: line type 600 ohms secd; Sig dwg SC-C-67304			1	0.7	0.1	3.0		T3

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
			GROUP Ia AMPLIFIER AUDIOFREQUENCY SUB-ASSEMBLY AR1, AR2, AR3 (FSN 5805-503-3365) (Quantity in use reflects 3 each Line Amplifiers)								
P F	5910-101-5599		CAPACITOR, FIXED, MICA DIELECTRIC: 15 uuf ±10%; 500 vdcw MIL type CM20B150K			3	1.4	0.3	9.0		C4
P F	5910-101-5616		CAPACITOR, FIXED, MICA DIELECTRIC: 100 uff ±5%; 500 vdcw, MIL type CM20C101J			3	1.4	0.3	9.0		C9
P F	5910-101-5585		CAPACITOR, FIXED, MICA DIELECTRIC: 150 uuf ±2%; 500 vdcw, MIL type CM20C151G			3	1.4	0.3	9.0		C11
P F	5910-170-8707		CAPACITOR, FIXED, MICA DIELECTRIC: 510 uuf ±2%; 500 vdcw, MIL type CM20D511G			3	1.4	0.3	9.0		C13
P F	5910-666-8354		CAPACITOR, FIXED, PAPER DIELECTRIC: 1,500 uuf ±20%; 600 vdcw; Sprague No. 91P1520634			3	1.4	0.3	9.0		C12
P F	5910-280-7150		CAPACITOR, FIXED, PAPER DIELECTRIC: 10,000 uuf ±20%; 400 vdcw, Sprague No. 91P1030434 (Authorized allowances based on a total of 15 per equipment)			3	4.6	1.0	45.0		C3
P F	5910-666-7362		CAPACITOR, FIXED, PAPER DIELECTRIC: 100,000 uuf ±20%; 300 vdcw; Sprague No. 81P1040375			3	1.4	0.3	9.0		C10
P F	5910-306-5456		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf (For authorized allowances see Amplifier, pilot Regulator GR)			6					C2, C8
P F	6910-280-7326		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 uf ±20%; 300 vdcw, Sprague No. 81P1050375			12	3.9	0.8	36.0		C1, C5, C6, C7

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5950-219-6713		COIL, RADIO FREQUENCY: coil, RF, 200 uh at 564 KC, 3.62 ohms dc, 7 strands No. 41 AWG cond QLCpt No. L-187-290D			3	1.4	0.3	9.0		L1
	P	F		5935-521-0083		CONNECTOR, PLUG, ELECTRICAL: 21 rd make cont, 5 amp, 600 v, 2 3/32 in lg x 3/4 in w x 29/32 in h o/a; WECo part G-20513-2 (Authorized allowances based on a total of 5 per equipment)			3	2.3	0.5	15.0		P1
	P	O		5960-262-1357		ELECTRON TUBE: (For authorized allowances see Amplifier, Pilot-Regulator Gr)			6					V1, V2
	P	F		5915-392-7638		NETWORK, IMPEDANCE MATCHING: interstage network, 4 term, 2 tor ind, 1 aircore ind, 5 mica cap and 4 comp res, 1 21/32 in lg x 1 1/2 in w x 3 13/32 in d o/a; Sig dwg SC-C-63258			3	1.4	0.3	9.0		Z1
	P	F		5905-192-4490		RESISTOR, FIXED, COMPOSITION: 33 ohm ±5%; 1/2 w; MIL type RC20GF330J (Authorized allowances based on a total of 12 per equipment)			6	3.9	0.8	36.0		R7, R10
	P	F		5905-190-8883		RESISTOR, FIXED, COMPOSITION: 100 ohms (For authorized allowances see Amplifier, Pilot-Regulator Gr)			3					R8
	P	F		5905-542-8405		RESISTOR, FIXED, FILM: 147 ohms ±1%; 1/2 w; MIL type RN70B1470F (Authorized allowances based on a total of 4 per equipment)			3	1.4	0.3	12.0		R18
	P	F		5905-542-9111		RESISTOR, FIXED, FILM: 215 ohms ±1%; 1/2 w; MIL type RN70B2150F			3	1.4	0.3	9.0		R16
	P	F		5905-539-3523		RESISTOR, FIXED, FILM: 316 ohms ±1%; 1/2 w; MIL type RN70B3160F (Authorized allowances based on a total of 4 per equipment)			3	1.9	0.4	15.0		R13
	P	F		5905-192-3973		RESISTOR, FIXED, COMPOSITION: 470 ohms ±5%; 1/2 w; MIL type RC20GF471J			9	2.7	0.6	25.0		R12, R17 R19

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D											
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-542-8406		RESISTOR, FIXED, FILM: 1,780 ohms ±1%; 1/2 w; MIL type RN70B1781F			6	2.3	0.5	18.0		R11, R14
P F	5905-256-8358		RESISTOR, FIXED, COMPOSITION: 2,400 ohms ±5%; 2 w; MIL type RC42GF242J			3	1.3	0.3	9.0		R1
P F	5905-542-8408		RESISTOR, FIXED, FILM: 3,160 ohms ±1%; 1/2 w; MIL type RN70B3161F			3	1.3	0.3	9.0		R6
P F	5905-279-3503		RESISTOR, FIXED. COMPOSITION: 6,800 ohms ±5%; 1/2 w; MIL type RC20GF682J (Authorized allowances based on a total of 4 per equipment)			3	1.4	0.3	12.0		R9
P F	5905-185-8510		RESISTOR, FIXED, COMPOSITION: 10,000 ohms (For authorized allowances see Amplifier, Pilot-Regualtor GR)			3					R15
P F	5905-589-1279		RESISTOR, FIXED, FILM: 16,000 ohms ±1%; 1/2 w; Sig dwg No. SC-C-62507-76 (Authorized allowances based on a total of 4 per equipment)			3	1.4	0.3	12.0		R2
P F	5905-556-3740		RESISTOR, FIXED, FILM: 38,300 ohms ±1%; 1/2 w; MIL type RN70B3832F			3	1.3	0.3	9.0		R5
P F	5905-646-5635		RESISTOR, FIXED, FILM: 130,000 ohms ±1%; 1/2 w; MIL type RN70B1303F (Authorized allowances based on a total of 4 per equipment)			3	1.4	0.3	12.0		R3
P F	5905-539-4565		RESISTOR FIXED, FILM: 1 meg ±1%; 1/2 w; MIL type RN70B1004F (Authorized allowances based on a total of 4 per equipment)			3	1.4	0.3	12.0		R4
P D	5960-262-0015		SHIELD, ELECTRON TUBE: (For authorized allowances see Amplifier Pilot Regulator Gr)			6					
F	5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont (For authorized allowances see Amplifier Pilot-Regulator Gr)			6					XV1 XV2
P F	5940-542-8114		TERMINAL STUD: (For authorized allowances see Amplifier-Pilot Regulator Gr) Item Nos. E1 E2, E3, E4, E5, E6, R7			21					SEE DESC Column

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5950-645-4759		TRANSFORMER, AUDIO FREQUENCY: pri wnd 600 ohms, tapped at 120 ohms secd wnd, 600 ohms, 1-3/8 in lg x 29/32 in wd x 2 in h; Sig dwg SC-C 64250			3	1.3	0.3	9.0		T1
P F	5950-569-0168		TRANSFORMER, AUDIO FREQUENCY: plate comp, pri wnd 6,000 ohms at 25 ma, secd, 785 ohms, 1-13/16 in lg x 1-7/16 in wd x 2-15/16 in d; Sig SC-C-64251			3	1.3	0.3	9.0		T2
			GROUP Ib AMPLIFIER AUDIO FREQUENCY SUB-ASSEMBLY AR4 (FSN 5805-378-4760)								
P F	5910-117-4723		CAPACITOR, FIXED, MICA DIELECTRIC: 5 uuf ±1%; 500 vdcw; MIL type CM20B050M			1	0.7	0.1	3.0		C9
P F	5910-101-4030		CAPACITOR, FIXED, MICA DIELECTRIC: 820 uuf ±2%; 500 vdcw MIL type CM25E821G			1	0.7	0.1	3.0		C8
P F	5910-161-4491		CAPACITOR, FIXED, MICA DIELECTRIC: 3,000 uuf ±2%; 500 vdcw MIL type CM30E302G			1	0.7	0.1	3.0		C10
P F	5910-235-8664		CAPACITOR, FIXED, PAPER DIELECTRIC: 100,000 uuf (For authorized allowances see Amplifier Pilot Gr)			1					(AR4) C7
P F	5910-280-7344		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf ±20%; 300 vdcw; Sprague No. 91P47403T6			2	1.0	0.2	6.0		C4,C6
P F	5910-306-5456		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf (For authorized allowances see Amplifier-Pilot Regulator Gr)			3					C1,C2,C5
P F	5910-262-8525		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf ±20%; 100 vdcw; Sprague No. 81P47401T5 (Authorized allowances based on a total of 2 per equipment)			1	1.0	0.2	6.0		C3

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5950-219-6714		COIL, RADIO FREQUENCY: duo lateral wnd, 245 turns No. 34 AWG, 250 mh at 505 kc, 4.8 ohms res QLC part L-187-250D			1	0.7	0.1	3.0		L1
	P	F		5935-521-0083		CONNECTOR, PLUG, ELECTRICAL: 21 rd male cont; (For authorized allowances see Amp-AF-AR1, AR2, AR3, Group)			1					P1
	P	O		5960-262-1357		ELECTRON TUBE: (For authorized allowances see Amp Pilot-Regulator Group)			2					V1 V2
	P	F		5915-281-0304		FILTER, LOW PASS: 108kc cut off freq 240 ohms input 240 ohms output, 6-1/32 in lb x 1 7/16 in w x 3 9/64 in; Sig dwg SC-C-63260			1	0.7	0.1			FL1
	P	F		5915-392-7637		NETWORK, IMPEDANCE MATCHING: interstage network c/o duolateral inductor, 1 mica cap or carbon 1 19/32 in lg x 1 1/2 in w x 3 15/32 in h; Sig dwg SC-C-63259			1	0.7	0.1	3.0		Z1
	P	F		6130-356-1702		RECEIFIER, METALLIC; input 4.5 v rms, single phase, output 3 vdc, 15 ma max cur full wave; Sig dwg SC-C-62504			2	1.0	0.2	6.0		CR1 CR2
	P	F		5905-192-4490		RESISTOR, FIXED, COMPOSITION: 33 ohms (For authorized allowances see Amp AF AR1, AR2, AR3 Group)			2					R18, R19
	P	F		5905-252-4018		RESISTOR, FIXED, COMPOSITION: 47 ohms ±5%; 1/2 w; type RC20GF470J			1	0.7	0.1	3.0		R11
	P	F		5905-702-5155		RESISTOR, FIXED, FILM: 67.3 ohms ±1%; 1/2 w; Sig dwg SC-C-62507-156			1	0.7	0.1	3.0		R1
	P	F		5905-556-3742		RESISTOR, FIXED, FILM: 105 ohms, ±1%; 1/2 w; MIL type SC-C-62507-154			1	0.7	0.1	3.0		R14
	P	F		5905-252-5436		RESISTOR, FIXED, COMPOSITION: 130 ohms ±5%; 1/2 w; MIL type RC20GF131J			1	0.7	0.1	3.0		R10
	P	F		5905-279-2674		RESISTOR, FIXED, COMPOSITION: 200 ohms ±5%; 1/2 w; MIL type RC20GF201J			1	0.7	0.1	3.0		R6

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-589-1282		RESISTOR, FIXED, FILM: 626 ohms ±1%; 1/2 w; Sig dwg SC-C-62507-154			2	1.0	0.2	6.0		R15 R16
P F	5905-542-9115		RESISTOR, FIXED, FILM: 634 ohms ±1%; 1/2 w; MIL type RN70B6340F			1	0.7	0.1	3.0		R13
P F	5905-190-8880		RESISTOR, FIXED, COMPOSITION: 1200 ohms ±5%; 1/2 w; MIL type RC20GF122J			1	0.7	0.1	3.0		R4
P F	5905-552-3521		RESISTOR, FIXED, FILM: 2,000 ohms ±1%; 1/2 w; MIL type RN70B2001F			1	0.7	0.1	3.0		R3
P F	5905-101-9927		RESISTOR, FIXED, COMPOSITION: 3,300 ohms ±5%; 1 w; MIL type RC32GF332J			1	0.7	0.1	3.0		R7
P F	5905-279-1719		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 1 MIL type RC32GF103J			1	0.7	0.1	3.0		R8
P F	5905-589-1283		RESISTOR, FIXED, FILM: 15,200 ohms ±1%; 1/2 w; Sig dwg No. SC-C-62507-153			1	0.7	0.1	3.0		R17
P F	5905-279-3500		RESISTOR, FIXED, COMPOSITION: 18,000 ohm ±5%; 1/2 w; MIL type RC20GF183J			1	0.7	0.1	3.0		R12
P F	5905-299-2021		RESISTOR, FIXED, COMPOSITION: 20,000 ohms ±5%; 1 w; MIL type RC32GF203J			1	0.7	0.1	3.0		R5
P F	5905-299-2017		RESISTOR, FIXED, COMPOSITION: 30,000 ohms ±5%; 1 w; MIL type RC32GF303J			1	0.7	0.1	3.0		R9
P F	5905-542-9113		RESISTOR, FIXED, FILM: 51,000 ±1%; 1/2 w; MIL type RN70B5112F			1	0.7	0.1	3.0		R2
P O	5960-262-0015		SHIELD, ELECTRON TUBE: (For authorized allowances see Amplifier, Pilot Regulator Gr)			2					
P F	5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont (For authorized allowance see Amplifier, Pilot Regulator Gr)			2					XV1 XV2
P F	5940-542-8158		TERMINAL STUD: forked type conn 7/8 in lg across flats; 9,500 v rms bkdn; 4-40 thd 1/4 in lg; Kellogg pt No. EPS-263			4	1.4	0.3	12.0		E2, E5, E6, E7

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (CONTINUED)								
P F	5940-642-3963		TERMINAL STUD: 7/8 in lg (For authorized allowance see Amplifier, Pilot-Regulator Gr)			2					E1 E4
P F	5950-645-4723		TRANSFORMER, AUDIO FREQUENCY: linetype 280 ohms pri, 135 ohms secd, 60 to 108,000 cyc 2 in h x 1 3/8 in 10 x 19/32 in w; Sig dwg SC-C-67308			1	0.7	0.1	3.0		T3
P F	5950-645-4760		TRANSFORMER, AUDIO FREQUENCY: 120 ohms pri 240 ohms seed, 2 in h x 1 3/8 in lg x 29/32 in w; Sig dwg No. SC-C-67307			1	0.7	0.1	3.0		T5
P F	5960-645-6324		TRANSFORMER, AUDIO FREQUENCY: line type, pri wnd 20,000 ohms, tapped at 135 ohms, 1 3/8 in lg x 29/32 in w x 2 in h; Sig dwg SC-C-64151			2	1.0	0.2	6.0		T1, T2
P F	5950-645-5226		TRANSFORMER, AUDIO FREQUENCY: line type 280 and 140 ohms pri, 600 ohms secd, 2 in h x 1 3/8 in lg x 29/32 in w; Sig dwg SC-C-67306			2	1.0	0.2	6.0		T4 T6
			GROUP Ic AMPLIFIER-PILOT REGULATOR SUB-ASSEMBLY Z6 (FSN 5805-392-7626)								
P F	5910-280-7150		CAPACITOR, FIXED, PAPER DIELECTRIC: 10,000 uuf (For authorized allowances see Amp, A1f, AR1, AR2, AR3 Group) Item Nos. C2, C3, C4, C5, C7, C15, C8, C9, C10, C11, C14 C16			12					SEE DESC COLUMN
P F	5910-262-8526		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf ±20%; 100 vdcw; Sprague No. 91P47401T6			2	1.0	0.2	6.0		C6, C12
P F	5910-262-8525		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf (For authorized allowances see Amp, AF, AR4 Group)			1					C13
P F	5910-306-5456		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 uuf (For authorized allowance see Amp Pilot-Regulator Group)			1					C1

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD FIELD	4TH FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5950-645-4435		COIL, TELEPHONE RETARDATION: 1 wnd, 21 ohms dc 19/32 in lg x 21/32 in w x 2 in h; Sig dwg No. SC-C-63292			1	0.7	0.1	3.0		L1
	P	F		5935-521-0083		CONNECTOR, PLUG, ELECTRICAL: 21 rd male cont (For authorized allowance see Amp AF AR1, AR2, AR3 Group)			1					P1
	P	O		5960-188-6584		ELECTRON TUBE: glass envelope, miniature twin triode, receiving MIL type 5670			4	30.8	11.6	576.0		V2, V3, V4, V5
	P	O		5960-262-1357		ELECTRON TUBE: (For authorized allowance see Amplifier-Pilot Regulator)			1					V1
	P	F		5915-501-4146		FILTER, BAND PASS: 68 kc, 2 kc band width, 66,000 ohms imput, 10,000 output, 3-13/32 in lg x 1-7/16in w x 3 9/64 in hg; Sig dwg SC-C-64012			1	0.7	0.1	3.0		FL1
	P	F		5935-259-0015		JACK, TIP: std phone tip comp ins, plastic red, single thru hole mtg, 1/4 in -32thd; Sig dwg No. SM-B-289931-2			1	0.7	0.1	3.0		J1
	P	F		5935-201-9490		JACK, TIP: std phone tip cont, comp, ins plastic black, single thru hole mtg, 1/4 in -32thd, Sig dwg No. SM-B-289931-3			1	0.7	0.1	3.0		J2
	P	F		5945-259-1231		RELAY, ARMATURE: cont arr, 2 c single brk, 26.5 vdc, or 115 v ac, 4 amp, 3 1/16 in lg x 1 5/8 in w x 1 7/16 in d; CP Clare pt No. RP-3717-02			2	1.0	0.2	6.0		K1 K2
	P	F		5905-192-4490		RESISTOR, FIXED, COMPOSITION: 33 ohms (For authorized allowance see Amp AF AR1, AR2, AR3, Group)			4					R10, R11 R3, R38
	P	F		5905-542-8405		RESISTOR, FIXED, FILM: 147 ohms (For authorized allowance see Amp AF, AR1, AR2, AR3 Group)			1					R1
	P	F		5905-539-3523		RESISTOR, FIXED, FILM: 316 ohms (For authorized allowancesee Amp Aif, AR2, AR3 Gropp)			1/					R5

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-556-3337		RESISTOR, FIXED, FILM: 562 ohms ±5%; 1/2 w; MIL type RN70B562OF			1	0.7	0.1	3.0		R13

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-279-1757		RESISTOR, FIXED, COMPOSITION: 1,500 ohms ±5%; 1/2 w; MIL type RC20GF152J			1	0.7	0.1	3.0		R24
P F	5905-556-3762		RESISTOR, FIXED, FILM: 3,830 ohms (For authorized allowances see Amplifier, Pilot-Regulator Gr)			2					R6, R21
P F	5905-279-3503		RESISTOR, FIXED, COMPOSITION: 6,800 ohms (For authorized allowance see Amp AF AR1, AR2, AR3 Group)			1					R17
P F	5905-279-7232		RESISTOR, FIXED, FILM: 8,250 ohms ±5%; 2 w; Sig dwg No. SC-C-63921-5			2	1.0	0.2	6.0		R12, R34
P F	5905-542-8401		RESISTOR, FIXED, FILM: 10,000 ohms ±1%; 1/2 w; MIL type RN70B1002F			1	0.7	0.1	3.0		R20
P F	5905-185-8516		RESISTOR, FIXED COMPOSITION: 10,000 ohms (For authorized allowances see Amplifier Pilot Reg Gr)			1					R7
P F	5905-185-8510		RESISTOR, FIXED, COMPOSITION: 10,000 ohms (For authorized allowances see Amplifier Pilot Reg Gr)			1					R36
P F	5905-589-1279		RESISTOR, FIXED, FILM: 16,000 ohms (For authorized allowances see Amp AF AR1, AR2, AR3, Gr)			1					R33
P F	5905-354-1777		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 2W; MIL type RC42GF273J			1	0.7	0.1	3.0		R19
P F	5905-279-2675		RESISTOR, FIXED, COMPOSITION; 33,000 ohms ±5%; 2 w; MIL type RC42GF333J			3	1.3	0.3	9.0		R29, R30, R31
P F	5905-254-7708		RESISTOR, FIXED, COMPOSITION: 51,000 ohms ±5%; 2 w; MIL type RC42GF513J			1	0.7	0.1	3.0		R25
P F	5905-553-2197		RESISTOR, FIXED, FILM: 56,200 ohms ±1%; 1/2 w; MIL type RN70B5622F			1	0.7	0.1	3.0		R4
P F	5905-552-3547		RESISTOR, FIXED, FILM: 100,000 ohms (For authorized allowance see Amplifier Pilot-Regulator Gr)			3					R15 R16 R37
P F	5905-195-6761		RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±5%; 1/2 w; MIL type RC20GF104J			1	0.7	0.1	3.0		R23

SOURCE CC E				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5960-646-5635		RESISTOR, FIXED, FILM: 130,000 ohms (For authorized allowance see Amp AF AR1, AR2, AR3 Group)			1					R32
	P	F		5905-539-2033		RESISTOR, FIXED, FILM: 316,000 ohms ±1%; 1/2 w; MIL type RN70B3163F			4	1.4	0.3	12.0		R2, R8, R9, R22
	P	F		5905-539-3810		RESISTOR, FIXED, FILM: 909,000 ohms ±1%; 1/2 w; MIL type RN70B9093F			1	0.7	0.1	3.0		R14
	P	F		5905-539-4565		RESISTOR, FIXED, FILM: 1 meg ohm (For authorized allowance see Amp AF AR1, AR2, AR3 Group)			1					R35
	P	F		5905-190-8885		RESISTOR, FIXED, COMPOSITION: 2.2 meg ohm ±5%; 1/2 w; MIL type RC20GF225J			2	1.0	0.2	6.0		R26, R27
	P	F		5905-591-8941		RESISTOR, VARIABLE: 1,000 ohms ±10%; 2 w; Sig dwg SC-D-62818-11			1	0.7	0.1	3.0		R28
	P	F		5905-226-9455		RESISTOR, VARIABLE: 10,000 ohms ±10%; 2 w; SIG dwg No. SC-D-62818-3			1	0.7	0.1	3.0		R18
	P	O		5960-262-0015		SHIELD, ELECTRON TUBE: (For authorized allowance see Amplifier, Pilot-Regulator Gr)			1					
	P	O		5960-262-0345		SHIELD, ELECTRON TUBE: accom, Retma tube envelope T-6-1/2(6-1) straight cyl; 1 1/2 in lg x 1.062 dia o/a; MIL TS-103U01 (Authorized allowances based on a total of 6 per equipment includes 2 ea for spares)			4	2.3	0.5	18.0		
	P	F		5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont, miniature (For authorized allowance see Amplifier Pilot-Regulator Gr)			1					XV1
	P	F		5935-160-1365		SOCKET, ELECTRON TUBE: type "E" Noval pin contact configuration 1 13/32 in lg x 1 3/16 in h x 1.035 in w; MIL type TS103P01 Item Nos. XV2, XV3, XV5, XV-4			4	1.4	0.3	12.0		SEE DESC COLUMN

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
P	F			5930-636-1479		SWITCH, LEVER, PILE UP: 3 lever positions 2 in lg x 1-3/8 in w x 1-3/32 in h; Sig dwg SM-C-429727			1	0.7	0.1	3.0		S1
P	F			5940-542-8114		TERMINAL STUD: (For authorized allowance see Amplifier Pilot-Regulator Gr)			16					E1 thru E16
P	F			5950-645-6371		TRANSFORMER, AUDIO FREQUENCY: pri 300 ohms secd 20,000 ohms 500 v test; 27/32 in lg x 9/16 in w x 1-9/32 h 4,000 to 64,000 cyc, Sig dwg SC-D-62806			1	0.7	0.1	3.0		T1
						GROUP II MODEM TELEPHONE TA-227/U								
P	F			5940-553-2581		BINDING POST: Marked No. U-106/U; Sig dwg No. SC-C-16495 (Item Nos. E3 thru E6,E18 thru E21,E33 thru E36,E52 thru E55,E62,E63)			18	3.5	0.8	36.0		SEE DESC COLUMN
P	F			6145-589-1250		CABLE, SPECIAL PURPOSE, ELECTRICAL: 13 conductor, 3 No. 16, 2 No. 22, 8 No. 22 AWG; cross sect rd, 0.675 dia SC-C-62838 (Authorized quantity will be a minimum of ft in use)	ft		16	*	*	48.0		
P	F			5910-101-5639		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 v dc 39 uuf ±5%; Spec MIL type No. CM20C390J			3	1.3	0.3	9.0		C8,C19, C20
P	F			5910-101-5616		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 v dc 100 uuf; ±5%; Spec No. MIL type CM20C101J			1	0.7	0.1	3.0		C35
P	F			5910-101-5585		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 vdc, 150 uuf ±2%; Spec No. MIL type CM20C151G			3	1.3	0.3	9.0		C1,C12, C23
P	F			5910-538-1324		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 v dc cap 910 uuf ±5%; MIL type No. CM25E911J			3	1.3	0.3	9.0		C4,C15,

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5910-171-3231		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 v dc 3300 uuf ±2%; Spec No. MIL type No. CM30E332G			3	1.3	0.3	9.0		C34,C41, C42
	P	F		5910-101-3842		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 v dcw, cap 4700 uuf ±2%; Spec MIL type No. CM35E472G			1	0.7	0.1	3.0		C39
	P	F		5910-399-7598		CAPACITOR, FIXED, PAPER DIELECTRIC: 33,000 uuf ±20%; 300 vdcw; Sprague Pt No. 181P3330T5			3	1.3	0.3	9.0		C2,C13, C24
	P	F		5910-284-4089		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 200 vdcw; cap 100,000 uuf ±20%; Sprague Elec Pt No. 181P10402T5			1	0.7	0.1	3.0		C36
	P	F		5910-667-5309		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 300 vdcw; 100,000 uuf ±20%; Sprague Pt No. 191P10403T6			6	2.3	0.5	18.0		C5,C6, C16,C17, C27,C28
	P	F		5910-666-8226		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 300 vdcw 220,000 uuf ±20%; Sprague Pt. No. 181P22403T5			3	1.3	0.3	9.0		C9,C20, C31
	P	F		5910-668-3611		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 470,000 uuf ±10%; 100 vdcw; Sprague pt No. 191P47491T6			3	1.3	0.3	9.0		C11,C12, C33
	P	F		5910-667-5137		CAPACITOR, FIXED, PAPER DIELECTRIC: 300 vdcw, 470,000 uuf ±20%; Sprague pt No. 181P47403T5			4	1.4	0.3	12.0		C3,C14, C25,C40
	P	F		5910-284-5071		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 300 vdcw; 470,000 uuf ±20%; Sprague type No. 191P47403T6			7	2.3	0.5	21.0		C7,C10, C18,C21, C29,C32, C37
	P	F		5805-306-2309		CASE, STANDARDIZED, COMPONENTS, ELECTRICAL: olive drab aluminum, approx 16-7/8 lg x 20-5/8 wd x 9-1/2 h o/a, WECo part/spec No. CS-55101; S'g dwg No. SC-D-62548, less SC-D-62550		NX	1	0.7	0.1	33.0		

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5340-498-9412		CATCH, LUGGAGE: secures cover; Sig dwg SC-C-63046			8	2.7	0.6	25.0		
P F	5950-645-4431		COIL, TELEPHONE RETARDATION: 1 wnd, 295 ohms dc res; WECo pt spec No. GA-50289; Sig dwg SC-C-63168			3	1.3	0.3	9.0		L1,L2,L3
P F	5935-542-9927		CONNECTOR, PLUG, ELECTRICAL: 14 male cont; polarized angle type, MIL type CS-1326-(1)(P), Amphenol pt No. 164-202-5P(23) MIL type CX-1326(1)(P); (0-590)			3	1.3	0.3	9.0		P1,P2,P3
P F	5935-201-3999		CONNECTOR, RECEPTACLE, ELECTRICAL: (to Group panel) 14 rd female cont; polarized straight type; MIL type CS-2026-(1)(S)			1	0.7	0.1	3.0		J10
P F	5935-552-7032		CONNECTOR, RECEPTACLE, ELECTRICAL: 19 male contact, straight type polarized; MIL type CS-2026-(3)(P)			1	0.7	0.1	3.0		J9
P O	5805-392-5687		COVER: carrying case cover; rectangular; 20-9/16 in lg x 11/16 in x 2-5/16 in thk o/a; Sig dwg SC-C-62550			1	0.7	0.1	3.0		
P O	5960-262-1357		ELECTRON TUBE: pentode, glass envelope, Spec MIL-E-1, type 5654/6AK5W			7	102.2	32.2	876.0		V1 thru V7
P F	5915-281-0268		FILTER, BAND PASS: 68 kc oper freq, 60.4 to 75.8 kc band w, 135 ohms output; WECo Spec No. GA-50210, Sig dwg SC-C-63169			2	1.0	0.2	6.0		FL8,FL9
P F	5915-281-0265		FILTER, BAND PASS: 84 kc oper freq, 76.4 to 91.8 kc band w, 135 ohms input, WECo pt/spec No. GA-50211; Sig dwg SC-C-63170			2	1.0	0.2	6.0		FL6,FL7
P F	5915-281-0262		FILTER, BAND PASS: 100 kc freq 92.4 to 107.8 kc bandw, 135 ohms input, Sig dwg SC-C-63181			2	1.0	0.2	6.0		FL4,FL5
P F	5915-281-0296		FILTER, LOW PASS: 20 kc cut off freq, 13,000 ohms input, 13,000 ohms output, Sig dwg No. SC-C-63664			3	1.3	0.3	9.0		FL1,FL2, FL3

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5935-192-4729		JACK, TELEPHONE: 3 cont, MIL type JJ-033			8	2.7	0.6	24.0		J1 thru J8
5 F	6250-586-7769		LAMPHOLDER: (retains spare lamp) miniature bayonet base; 7/16 in lg x 1-11/16 in w x 1-1/16 in h o/a; Drake Mfg Co part No. 167C			1	0.7	0.1	3.0		
5 O	6240-155-8706		LAMP, INCANDESCENT: 6 to 8v 0.15 amp, bayonet base, MIL-MS-15571-2 type TB-12			1	0.7	0.1	3.0		I2
5 F	6210-299-6636		LIGHT, INDICATOR: accom lens 1/2 in dia 1-3/4 in lg x 13/16 in dia; Dialco pt No. 922210-1			1	0.7	0.1	3.0		XDS1
5 O	6210-299-3928		LENS, INDICATOR LIGHT: clear 1/2 in dia Dialco pt No. 92-117			1	0.7	0.1	3.0		
P F	5330-292-3895		PACKING PREFORMED: synthetic rubber and cork comp; 13/32 in nom size; Armstrong Cork type No. NC-755	ft		5	*	*	15.0		
P F	6130-356-1702		RECTIFIER, METALLIC: input 4.5v rms, single phase, output 3 vdc 15 ma max cur, full wave; Sig dwg SC-C-62504			6	2.3	0.5	18.0		CR1 thru CR6
P F	5905-552-7201		RESISTOR, FIXED, FILM: 15.4 ohms ±1%; 1/2 w; MIL type No. RN70B15R4F			6	2.3	0.5	18.0		R15,R16, R49,R50, R83,R84
P F	5905-556-3755		RESISTOR, FIXED, FILM: 16.9 ohms ±1%; 1/2w; MIL type No. RN70B16R9F			3	1.3	0.3	9.0		R14,R48, R82
P F	5905-192-4490		RESISTOR, FIXED, COMPOSITION: 33 ohm ±5%; 1/2 w; MIL type No. RC20GF330J			7	2.3	0.5	21.0		R121 thru R127
P F	5905-556-3753		RESISTOR, FIXED, FILM: 34 ohms ±1%; 1/2w; MIL type No. RN70B34R0F			3	1.3	0.3	9.0		R41,R44, R78
P F	5905-552-5696		RESISTOR, FIXED, FILM: 56.2 ohms ±1%; MIL type No. RN70B56R2F			3	1.3	0.3	9.0		R11,R45, R79
P F	5905-556-3732		RESISTOR, FIXED, FILM: 63.4 ohms ±1%; MIL type No. RN70B63R4F			1	0.7	0.1	3.0		R103

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-552-7134		RESISTOR, FIXED, FILM: 64.9 ohms ±1%; MIL type No. RN70B64R9F			1	0.7	0.1	3.0		R116
	P	F		5905-702-5155		RESISTOR, FIXED, FILM: 67.3 ohms ±1%; 1/2 w; Sig dwg No. SC-C-62507-156, Fig B			1	0.7	0.1	3.0		R115
	P	F		5905-556-3344		RESISTOR, FIXED, FILM: 68.1 ohms ±1%; 1/2 w; MIL type No. RN70B68R1F			3	1.3	0.3	9.0		R8, R42 R76
	P	F		5905-279-1758		RESISTOR, FIXED, COMPOSITION: 75 ohm ±5%; 1/2 MIL type RC20GF750J			3	1.3	0.3	9.0		R29, R63 R97
	P	F		5905-552-3893		RESISTOR, FIXED, FILM: 100 ohms ±1%; 1/2 w; MIL type No. RN70B1000F			3	1.3	0.3	9.0		R32, R66
	P	F		5905-556-3742		RESISTOR, FIXED, FILM: 1 05 ohms ±1%; 1/2 w; MIL type RN70B1050F			3	1.3	0.3	9.0		R12 R46 R80
	P	F		5905-646-5768		RESISTOR, FIXED, FILM: 110 ohms ±1%; 1/2 w; MIL type No. RN70B1100F			3	1.3	0.3	9.0		R9, R43 R77
	P	F		5905-542-9092		RESISTOR, FIXED, FILM: 182 ohms ±1%; 1/2 w; MIL type RN70B1820F			2	1.0	0.2	6.0		R117 R120
	P	F		5905- 556-3733		RESISTOR, FIXED, FILM: 191 ohms ±1%; 1/2 w; MIL type RN70B1910F			2	1.0	0.2	6.0		R118 R119
	P	F		5905-279-2674		RESISTOR, FIXED, COMPOSITION: 200 ohms ±5%; 1/2 w; MIL type RC20GF201J			3	1.3	0.3	9.0		R23, R57 R91
	P	F		5905-279-3513		RESISTOR, FIXED, COMPOSITION: 220 ±5%; 1/2 w; MIL type RC20GF221J			1	0.7	0.1	3.0		R108
	P	F		5905-583-2032		RESISTOR, FIXED, FILM: 280 ohms ±1%; 1/2 w; MIL type RN70B2800F			3	1.3	0.3	9.0		R13, R47, R87
	P	F		5905-556-3760		RESISTOR, FIXED, FILM: 287 ohms ±1%; 1/2 w; MIL type RN70B2870F			3	1.3	0.3	9.0		R3 R37 R71
	P	F		5905-583-2039		RESISTOR, FIXED, FILM: 412 ohms ±1%; 1/2 w; MIL type RN70B4120F Item Nos. R33, R34, R67, R68, R101, R102			6	2.3	0.5	18.0		SEE DESC COLUMN
	P	F		5905-542-9114		RESISTOR, FIXED, FILM: 576 ohms ±1%; 1/2 w; MIL type No. RN70B5760F			3	1.3	0.3	9.0		R17 R51 R85

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued).								
P F	5905-646-5772		RESISTOR, FIXED, FILM: 604 ohms ±1%; 1/2 w; MIL type No. RN70B6040F			6	2.3	0.5	18.0		R4,R7, R38,R41, R72,R75
P F	5905-190-8881		RESISTOR, FIXED, COMPOSITION: 1800 ohms ±5%; 1/2 w; MIL type RC20GF182J			1	0.7	0.1	3.0		R105
P F	5905-190-8887		RESISTOR, FIXED, COMPOSITION: 2000 ohms ±5%; 1/2 w; MIL type RC20GF202J			3	1.3	0.3	9.0		R28,R62, R96
P F	5905-279-1723		RESISTOR, FIXED, COMPOSITION: 2,200 ohms ±5%; 1 w; MIL type RC32GF222J			3	1.3	0.3	9.0		R22,R56, R90
P F	5905-552-6141		RESISTOR, FIXED, FILM: 2260 ohms ±1% 1/2 w; MIL type No. RN70B2261G			1	0.7	0.1	3.0		R113
P F	5905-553-2178		RESISTOR, FIXED, FILM: 2,670 ohms ±1%; 1/2 w; MIL type RN70C2671F			6	2.3	0.5	18.0		R1,R2, R35,R36, R69,R70
P F	5905-556-3758		RESISTOR, FIXED, FILM: 3,400 ohms ±1%; MIL type RN70B3401F			3	1.3	0.3	9.0		R20,R54, R88
P F	5905-291-2903		RESISTOR, FIXED, COMPOSITION: 3,600 ohms ±5%; 1 w; MIL type RC32GF362J			3	1.3	0.3	9.0		R19,R53, R87
P F	5905-556-3757		RESISTOR, FIXED, FILM: 4,420 ohms ±1%; 1/2 w; MIL type No. RN70B4421F			3	1.3	0.3	9.0		R18,R52, R86
P F	5905-542-8410		RESISTOR, FIXED, FILM: 4,460 ohms ±1%; 1/2 w; MIL type No. RN70B4641F			1	0.7	0.1	3.0		R112
P F	5905-299-2040		RESISTOR, FIXED, COMPOSITION: 4,700 ohms ±5%; 1w; MIL type RC32GF472J			1	0.7	0.1	3.0		R114
P F	5905-185-8510		RESISTOR, FIXED, COMPOSITION: 10,000 ohms 5%; 1/2 w; MIL type RC20GF103J			1	0.7	0.1	3.0		R110
P F	5905-279-2669		RESISTOR, FIXED, COMPOSITION: 13,000 ohms ±5%; 1/2 w; MIL type RC20GF133J			3	1.3	0.3	9.0		R31,R65, R99
P F	5905-279-2549		RESISTOR, FIXED, COMPOSITION: 13,000 ohms ±5%; 1 w; MIL type RC32GF133J			3	1.3	0.3	9.0		R27,R61, R95

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-556-3756		RESISTOR, FIXED, FILM: 13,700 ohms ±1%; 1/2 w; MIL type No. RN70B1372F Item Nos. R5, R6, R39, R40, R73 R74			6	2.3	0.5	18.0		SEE DESC COLUMN
	P	F		5905-556-3736		RESISTOR, FIXED, FILM: 21,500 ohms ±1%; 1/2 w; MIL type No. RN70B2152F			1	0.7	0.1	3.0		R104
	P	F		5905-299-2020		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 1 w; MIL type No. RC32GF273J			3	1.3	0.3	9.0		R21,R55 R89
	P	F		5905-556-3735		RESISTOR, FIXED, FILM: 46,400 ohms ±1%; 1/2 w; MIL type RN70B4642F			1	0.7	0.1	3.0		R111
	P	F		5905-299-2009		RESISTOR, FIXED, COMPOSITION: 62,000 ohms ±5%; 1 w; MIL type RC32GF623J			3	1.3	0.3	9.0		R25, R93
	P	F		5905-299-2003		RESISTOR, FIXED, COMPOSITION: 62,000 ohms ±5%; 1 w; MIL type RC32GF104J			3	1.3	0.3	9.0		R26, R60 R94
	P	F		5905-279-2519		RESISTOR, FIXED, COMPOSITION: 330,000 ohms ±5%; 1/2 w; MIL type No. RC20GF334J			1	0.7	0.1	3.0		R109
	P	F		5905-279-2516		RESISTOR, FIXED, COMPOSITION: 510,000 ohms ±5%; 1/2 w; MIL type RC20GF514J			3	1.3	0.3	9.0		R24,R58 R92
	P	F		5905-192-0390		RESISTOR, FIXED, COMPOSITION: 1 meg ±5%; 1/2 w; MIL type RC20GF105J			1	0.7	0.1	3.0		R107
	P	F		5905-226-9462		RESISTOR, VARIABLE: 200 ohms ±10%; 2 w; WECo Spec No. GA-51018L9, dwg No. SC-D-62818-9			3	1.3	0.3	9.0		R30,R64 R98
	P	F		5905-299-2098		RESISTOR, VARIABLE: 6,000 ohms ±10%; 2 w; WECo pt No. GA-51018L4, dwg No. SC-D-62818-4			1	0.7	0.1	3.0		R106
	P	F		5340-355-9839		RETAINER, CATCH: (used as latch on case) Sig dwg SC-B-62577			8	1.2	0.2	8.0		
	P	F		5305-206-5544		SCREW, EXTERNALLY RELIEVED BODY: secures panel to frame; Sig dwg SC-B-62467			2	1.0	0.2	6.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	O		5305-558-3180		SCREW, EXTERNALLY RELIEVED BODY: 10-32 thd; 5/8 lg; 1-1/2 o/a length Sig dwg SC-B-62664-2			4	1.4	0.3	12.0		
	P	O		5960-262-0015		SHIELD, ELECTRON TUBE: 1-3/8 in lg x 810 inside JAN type TS102U01; (based on 7 in use, 2 reg for spare tubes)			9	3.1	0.7	27.0		
10		O		8465-275-5755		SLING, CARRYING BAG AND CASE: cotton webbing, olive drab, 19-3/4 in lg x 1-1/8 in wd; Sig dwg SC-C-63052			2	1.0	0.2	6.0		
	P	F		5035-260-0516		SOCKET, ELECTRON TUBE: 1-1/8 in lg x 0.900 w x 25/32 in h, type TS102P01			9	3.1	0.7	27.0		XV1 thru XV7
	P	F		5805-392-6423		SPRING, ASSEMBLY: (used to secure frame in case) Sig dwg SC-B-62552			4	1.9	0.4	12.0		
	P	F		5905-173-8362		SWITCH, LEVER, PILE UP: 3 lever pos tel Modem No. TA-219/U; Sig dwg No. SC-C-62539			3	1.3	0.3	9.0		S1 thru S3
	P	F		5940-642-3963		TERMINAL STUD: 7/8 in lg x 11/32 in w x 5/16 in h o/a; Winchester part No. FT-5 (Item Nos. E10,E13,E25, E28,E40,E43,E48)			7	2.3	0.5	21.0		SEE DESC COLUMN
	P	F		5940-542-8159		TERMINAL STUD: 0.187 in lg x 0.076 in w x 0.052 in h o/a; 4-40 thd; Whitso Inc pt No. 1M16-A4			4	1.4	0.3	12.0		E58,E59, E61,E60
	P	F		5940-542-8155		TERMINAL STUD: 2-3/32 in lg x 1/4 in dia, 1/4 in across flats, 4-40 thd; Whitso Inc pt No. 15M16-A4			2	1.0	0.2	6.0		E64,E65
	P	F		5940-542-8158		TERMINAL, STUD: 1-3/32 in lg 1/4 in across flats 4-40 x 7/32 in thd; Kellogg Co dwg No. DPS-263			3	1.3	0.3	9.0		E1,E16, E31
	P	F		5940-542-8114		TERMINAL, STUD: 7/8 in lg, 1/4 in across hex flats 4-40 thd x 1/4 in lg; Whitso part 2H-35-A4 (Item Nos. E7,E27,E8,E9,E11,E12,E14,E15,E22, E23,E24,E26,E29,E30,E37,E38,E39, E41,E42,E44,E45,E47,E49,E50,E51,E56, E57)			28	4.9	1.1	56.0		SEE DESC COLUMN
	P	F		5950-645-4723		TRANSFORMER, AUDIO FREQUENCY: 60-108 cc, 20 dbm, type dc sig nation TF1A16YY; Sig dwg SC-D-67308			1	0.7	0.1	3.0		T18

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5950-648-2281		TRANSFORMER, AUDIO FREQUENCY: pri wnd 365 ohms ct sect 600 ohms, 500 v test, WECo pt/Spec No. GA51118, Sig dwg SC-C-67309			3	1.3	0.3	9.0		T1, T6, T11
P F	5950-648-2269		TRANSFORMER, AUDIO FREQUENCY: pri wnd 135 ohms, secd 415 ohms ct, 500 v, test MIL-T-27A grade, class R, Sig dwg SC-C-63432			6	2.3	0.5	18.0		T2, T5, T7, T10, T12, T15
P F	5950-646-4398		TRANSFORMER, AUDIO FREQUENCY: pri 365 ohms, tapped 182.5 ohms, secd 13,000 ohms 500 v test; WECo Spec No. GA-51120; Sig dwg SC-C-63172			3	1.3	0.3	9.0		T4, T9, T14
P F	5950-645-6324		TRANSFORMER, AUDIO FREQUENCY: pri wnd 20,000 ohms tapped at 135 ohms, 500 and 700 v test; Sig dwg No. SC-C-64151			2	1.0	0.2	6.0		T16, T17
P F	5950-645-6403		TRANSFORMER, AUDIO FREQUENCY: pri 25,200 ohms, tapped 4200 ohms secd; 600 ohms 500 v and 200 v test, 0.2kc to 20 kc, freq; WECo Spec No. GA-61122; Sig dwg SC-C-63173			3	1.3	0.3	9.0		T3, T8, T13
			GROUP III RECEIVER-TRANSMITTER TEST OA-443/TTC-7								
P F	5895-306-2310		CASE, STANDARDIZED, COMPONENTS, ELECTRICAL: olive drab alum approx 20-5/8 in lg x 17-1/16 in w x 17 5/16 h; o/a; dwg No. SC-D-62844; less SC-C-62846, (cover assy)		NX	1	0.7	0.1	3.0		
P F	5340-498-9412		CATCH, LUGGAGE: loop locking type, approx 2.185 in lg x 1.357 in w x 0.479 in h o/a; Sig dwg No. SC-D-20648			10	1.4	0.3	10.0		
P O	5805-392-5692		COVER, CARRYING CASE: olive drab metal 20-9/16 in lg x 16-5/8 in w x 2-1/2 in thk o/a; Sig dwg SC-C 62846			1	0.7	0.1	3.0		

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD FIELD	4TH FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P H	5330-292-3895		PACKING, PREFORMED: syn rubber and cork comp; 13/32 in nom size; Armstrong Cork type No. NC-755 (Authorized quantity will be minimum or a multiple of ft in use)	ft		6	*	*	18.0		
5 P F	5805-503-0864		RECEIVER, TRANSMITTER, ORDER WIRE RT-280/TCC-7 : 300 to 2000 cyc; trans freq range; 300 to 2000 cyc; rec freq range, p/o Jcens Transmitter-Test Set Group type No. OA-443/TCC-7; Spec MIL-C-10623, Sig dwg No. SC-D-63497		NX	1	0.7	0.1	3.0		
5 P F	5340-355-9839		RETAINER, CATCH: (used as latch on case, Sig dwg SC-B-62557			10	1.4	0.3	10.0		
O	5340-276-7585		STRAP, CARRYING: cotton webbing; 27-7/8 in lg x 1 in w o/a; Sig dwg No. SC-C- 62849			2	1.0	0.2	6.0		
P F	5805-392-6423		SPRING ASSEMBLY: (used to secure frame in case; 7 in lg x 3/4 in w x 9/16 in thk; Sig dwg No. SC-B-62552			4	1.4	0.3	12.0		
P O R	6625-669-0271		TEST SET, TELEPHONE TS-760/TCC-7; test oscillator supplies frequencies of 1 kc and 65 kc, w/o carrying case; 13-3/4 in lg x 18 1/16 in w x 7 in h; MIL Spec No. MIL-C-10623, Sig dwg SC-D-63569		NX	1	0.7	0.1	3.0		
			GROUP IIIa RECEIVER-TRANSMITTER ORDER WIRE RT-280/TCC-7								
P O	5805-503-3360		AMPLIFIER, AUDIO FREQUENCY: 0.5 w power output, oper power ac 6.3 vac, 60 cyc single phase 200 vdc; WECo No. GS-55135, Sig C dwg SC-D-63539		NX	1	0.7	0.1	3.0		AR101
P O	5805-503-0920		AMPLIFIER, AUDIO FREQUENCY: 0.25 w power output, oper power 6.3 vac, 60 cyc, single phase 200 vdc, WECo No. GS-55136, Sig dwg SC-D-63554		NX	1	0.7	0.1	3.0		AR102

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5940-553-2581		BINDING POST U-106/U: 31/32 in o/a h, 1/2 in dia, 10-32 thd; 7/8 in lg; Term type, No. TH-3/TC; Kellogg No. G-C-19-2, Sig dwg No. SC-C-16495			2	1.0	0.2	6.0		E101,E102
	P	F		5910-667-5210		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 470,000 uuf ±10%; 200 vdcw; Sprague pt No. 191P47492T13			1	0.7	0.1	3.0		C101
	P	F		5910-284-4002		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 100 vdcw, 820,000 uuf ±10%; Sprague pt No. 191P82491T13			1	0.7	0.1	3.0		C104
	P	F		5910-284-4006		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 200 vdcw 10 uf ±10%; Sprague pt No. 191P10592T13			1	0.7	0.1	3.0		C102
	P	F		5910-284-4010		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 100 vdcw, 1.0 uf ±10%; Sprague pt No. 191P510591T13			1	0.7	0.1	3.0		C103
	P	F		5935-552-7032		CONNECTOR, RECEPTACLE, ELECTRICAL: 1 conn, mating end 19 rd male cont; 20 amp, 700 v dc 500 v ac; MIL C-12520A, type No. CS2026-(3)(P)			1	0.7	0.1	3.0		J101
	P	F		5935-258-9963		CONNECTOR, RECEPTACLE, ELECTRICAL: 21 rd female contacts, polarized straight type, Cinch part No. 47A16987			3	1.3	0.3	9.0		J102, J104, J106
	P	F		5805-510 4738		EQUALIZER, TELEPHONE LINE: series type, 0.3 to 1/65 kc freq range, Sig dwg SC-C-63521			1	0.7	0.1	3.0		EQ101
	P	F		5915-281-0303		FILTER, LOW PASS: 2 kc cut-off freq, 1 mp, 1500 ohms, input, 1500 ohms output, Sig dwg No. SC-C 63520			1	0.7	0.1	3.0		FL101

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	O		5965-170-6473		HANDSET: 256 ohms 1 amp no dc res; carbon element telephone, 25 ohms 1 amp no dc res; 0.125 amp oper cur; Sig Tel Set type No. EE-8; MIL-H 13253A, type TS-9-F		NX	1	0.7	0.1	3.0		HS101
	P	F		5805-590-6453		HOLDER, HANDSET: (retains handset in storage) 2-1/316 in lg, 1-1/2 in w x 4-7/32 in h o/a; Sig dwg No. SC-C-63510			1	0.7	0.1	3.0		
	P	F		5935-192-4729		JACK, TELEPHONE: accom 3 cond plug, Shank 0.2065 dia x 1.093 lg; JAN type JJ-033			3	1.3	0.3	9.0		J103, J105, J107
	P	O		5355-558-2395		KNOB: (control knob for S103) MIL type MS90120-2801			1	0.7	0.1	3.0		
5		O		6240-155-8706		LAMP, INCANDESCENT: 6 to 8 v; 0.15 amp, 3000 hrs rated life; MIL type MS15571, type TB-14, GE No. 47			1	0.7	0.1	3.0		I101
5		O		6250-586-7769		LAMPHOLDER: (hold spare lamp); accom 1 min base lamp; o/a dia inc bracket 7/16 in lg x 1-11/16 in w x 1-1/16 in h; Drake Mfg Co pt No. 167C			1	0.7	0.1	3.0		
5		O		6210-643-2059		LENS, INDICATOR LIGHT: (lens for indicator light) 1/2 in dia glass, red; smooth face, frosted back; Dialco pt No. 92-111			1	0.7	0.1	3.0		
5		F		6210-299-6636		LIGHT, INDICATOR: supplied w/o lens, 1/2 in dia, 1-3/4 in lg x 13/16 in dia; Dialco No. 922210-1			1	0.7	0.1	3.0		X1101

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-552-7194		RESISTOR, FIXED, FILM: 64,9 ohms ±1%; 1/2 W; MIL type No. RN70B64R9F			1	0.7	0.1	3.0		R168
	P	F		5905-279-1758		RESISTOR, FIXED, COMPOSITION: 75 ohms ±5%; 1/2 w; MIL type No. RC20GF750J			1	0.7	0.1	3.0		R133
	P	F		5905-279-2654		RESISTOR, FIXED, COMPOSITION: 82 ohms ±5%; 1 W; MIL type RC32GF820J			1	0.7	0.1	3.0		R102
	P	F		5905-279-1726		RESISTOR, FIXED, COMPOSITION: 120 ohms ±5%; 1 W; MIL type RC32GF121J			1	0.7	0.1	3.0		R101
	P	F		5905-752-3352		RESISTOR, FIXED, FILM: 133 ohms ±1%; 1/2 W; MIL type RN70B1330F			1	0.7	0.1	3.0		R112
	P	F		5905-279-2593		RESISTOR, FIXED, COMPOSITION: 240 ohms ±5%; 1/2 W; MIL type No. RC20GF241J (Authorized allowances based on a total of 2 per equipment)			1	1.3	0.2	6.0		R103
	P	F		5905-556-3343		RESISTOR, FIXED, FILM: 267 ohms ±1%; 1/2 w; MIL type RN70B2670F			1	0.7	0.1	3.0		R165
	P	F		5905-299-1965		RESISTOR, FIXED, COMPOSITION: 300 ohms ±5%; 1/2 w; MIL type RC20GF301J Item Nos. R104, R106, R107, R108, R109			5	1.9	0.4	15.0		See desc Column
	P	F		5905-539-3531		RESISTOR, FIXED, FILM: 402 ohms ±1%; 1/2 w; MIL type RN70B4020F			1	0.7	0.1	3.0		R117
	P	F		5905-542-9106		RESISTOR, FIXED, FILM: 453 ohms ±1%; 1/2 w; MIL type RN70B4530F			1	0.7	0.1	3.0		R167
	P	F		5905-552-7198		RESISTOR, FIXED, FILM: 475 ohms ±1%; 1/2 W; MIL type RN70B4750F			1	0.7	0.1	3.0		R166
	P	F		5905-542-9114		RESISTOR, FIXED, FILM: 576 ohms ±1%; 1/2 W; MIL type RN70B5760F			1	0.7	0.1	3.0		R163
	P	F		5905-646-5772		RESISTOR, FIXED, FILM: 604 ohms ±1%; MIL type RN70B6040F (Authorized allowances based on a total of 2 per equipment)			1	1.3	0.2	6.0		R122
	P	F		5905-171-1999		RESISTOR, FIXED, COMPOSITION: 820 ohms ±5%; 1/2 W; MIL type RC20GF821J			1	0.7	0.1	3.0		R119
	P	F		5905-542-9108		RESISTOR, FIXED, FILM: 866 ohms ±1%; 1/2 w; MIL type RN70B8660F			1	0.7	0.1	3.0		R164

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-195-6806		RESISTOR, FIXED, COMPOSITION: 1000 ohms ±5%; 1/2 w; MIL type RC20GF102J (Authorized allowances based on a total of 3 per equipment)			1	1.3	0.3	9.0		R120

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-190-8880		RESISTOR, FIXED, COMPOSITION: 1200 ohms ±5%; 1/2 w; MIL type RC20GF122J			2	1.0	0.2	5.0		R174 R105
	P	F		5905-279-3507		RESISTOR, FIXED, COMPOSITION: 1600 ohms ±5%; 1/2 w; MIL type RC20GF162J Item Nos. R111, R115, R116, R125, R126			5	1.9	0.4	15.0		SEE DESC COLUMN
	P	F		5905-190-8881		RESISTOR, FIXED, COMPOSITION: 1800 ohms ±5%; 1/2 w; MIL type RC20GF182J			1	0.7	0.1	3.0		R118
	P	F		5905-279-1876		RESISTOR, FIXED, COMPOSITION: 2,200 ohms ±5%; 1/2 w; MIL type RC20GF222J			1	0.7	0.1	3.0		R110
	P	F		5905-552-6141		RESISTOR, FIXED, COMPOSITION: 2260 ohms ±1%; 1/2 w; MIL type RN70B2261F			1	0.7	0.1	3.0		R175
	P	F		5905-279-1751		RESISTOR, FIXED, COMPOSITION: 3,000 ohms ±5%; 1/2 w; MIL type RC20GF302J			1	0.7	0.1	3.0		R121
	P	F		5905-552-7199		RESISTOR, FIXED, FILM: 4020 ohms ±1%; 1/2 w; MIL type RN70B4021F			1	0.7	0.1	3.0		R176
	P	F		5905-556-3338		RESISTOR, FIXED, FILM: 5110 ohms ±1%; 1/2 w; MIL type RN70B5111F			1	0.7	0.1	3.0		R169
	P	F		5905-556-3336		RESISTOR, FIXED, FILM: 6,190 ohms ±5%; 1/2 w; MIL type RN70B6191J			1	0.7	0.1	3.0		R177
	P	F		5905-552-3245		RESISTOR, FIXED, FILM: 9090 ohms ±1%; 1/2 w; MIL type RN70B9091F			1	0.7	0.1	3.0		R178
	P	F		5905-542-8401		RESISTOR, FIXED, FILM: 10,000 ohms ±1%; 1/2 w; MIL type No. RN70B1002F			1	0.7	0.1	3.0		R170
	P	F		5905-552-6143		RESISTOR, FIXED, FILM: 13,300 ohms ±1%; 1/2 w; MIL type RN70B1332F			1	0.7	0.1	3.0		R179
	P	F		5905-552-3524		RESISTOR, FIXED, FILM: 16,200 ohms ±1%; 1/2 w; MIL type RN70B1622F			1	0.7	0.1	3.0		R171
	P	F		5905-552-7195		RESISTOR, FIXED, FILM: 23,700 ohms ±1%; 1/2 3; MIL type RN70B2372F			1	0.7	0.1	3.0		R172

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-552-7193		RESISTOR, FIXED, FILM: 35,700 ohms ±1%; 1/2 w; MIL type RN70B3572F			1	0.7	0.1	3.0		R173
	P	F		5905-552-3522		RESISTOR, FIXED, FILM: 182,000 ohms ±1%; 1/2 w; MIL type RN70B1823F			1	0.7	0.1	3.0		R123
	P	F		5905-284-3449		RESISTOR, VARIABLE: 1,600 ohms ±20%; 2 w; Sig dwg SC-D-63519			2	1.0	0.2	6.0		R114,R124
	P	O		5805-356-2898		RINGER, OSCILLATOR ASSEMBLY Y101: incl; Relay Buzzer, 3 trans, 2 electron tubes and 21 pin conn; 6 in lg x 4-1/8 in w x 4-9/16 in high; (provides Audible and visual signal between term; Sig dwg SC-D-62633		NX	1	0.7	0.1	3.0		Y101
	P	O		5305-356-4309		SCREW, EXTERNALLY RELEIVED BODY: (secures panel to frame); 10-32 x 1-7/8 in lg; Sig dwg SC-B-62664-1			2	1.0	0.2	6.0		
	P	O		5305-208-4455		SCREW, EXTERNALLY RELIEVED BODY: 10-32 thd; RH 2-1/8 in lg ; Sig dwg No. SC-B-63502			4	1.4	0.3	12.0		
	P	O		5305-206-5544		SCREW, EXTERNALLY RELIEVED BODY: Fil H slot drive; 10-32 NF-2 thd; 9/32 in min, 0.625 in nom lgth; Sig dwg SC-B-62467			4	1.4	0.3	12.0		
	P	O		5305-206-7214		SCREW, SHOULDER: steel, cadmium plated; rd Hd, slot drive 4-40 x 0.343 thd; Sig dwg No. SC-B-62661-7			4	1.4	0.3	12.0		
	P	O		5305-257-9102		SCREW, SHOULDER: 4-40 thd; steel, cad plated rd hd 0.208 dia x 0.065 h; Sig dwg No. SC-B-62661-1			2	1.0	0.2	6.0		
	P	O		5305-573-3037		SCREW, SHOULDER: 4-40 steel No. QQ-S-632, rd hd, slot dr; Sig dwg No. SC-B-62661-3			6	2.3	0.5	18.0		
	P	O		5960-262-0015		SHIELD, ELECTRON TUBE: 1 3/8 lg x 0.958 dia inc spring; Spec JAN-S-28, type TS102U01; (4 ea hold spare tubes)			8	2.7	0.6	24.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	O		5960-262-0345		SHIELD, ELECTRON TUBE: 1 1/2 in lg x 1.065 in dia o/a; MIL Spec TS-103U01 (2 ea holds spare tubes)			3	1.3	0.3	9.0		
	P	F		5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont; miniature, 1 pc saddle mtg; JAN type TS102P01 (Authorized allowances based on a total of 12 per equipment)			8	2.7	0.6	24.0		XV1 XV2 (spares)
	P	F		5935-160-1365		SOCKET, ELECTRON TUBE: type E noval pin contact config dwg No. 203, JAN type TS103P01 (Authorized allowances based on a total of 3 per equipment)			1	1.3	0.3	9.0		
	P	H		5930-614-8621		SPRING, HELICAL, TORSION: (activates switch lvr for one way switch) bronze wire 1.062 in lg x 0.8125 in w x 0.234 in thk; Beamco Inc dwg No. 101-53			1		0.1	3.0		
	P	F		5930-351-7304		SWITCH, LEVER: pile up type, 2 locking lvr pos; cont arrang 4c, 1 amp at 50 v dc, Sig dwg SC-C-62827			1	0.7	0.1	3.0		S101
	P	F		5930-548-3494		SWITCH, LEVER: pile up type, 3 lever pos, 2 locking and 1 momentary, 1 amp at 50 v dc, Sig dwg SC-C-62826			1	0.7	0.1	3.0		S104
	P	F		5930-201-3597		SWITCH, LEVER: 2 locking pos, cont arrang, 2 c, 50 v dc, 1 amp; Sig dwg SC-C-63523			1	0.7	0.1	3.0		S102
	P	H		5930-642-9350		SWITCH, ROTARY: 4 sect, 10 max switch pos, 30° pos increments, cont arrang non pile up type; Sig dwg SC-D-64060-1			1		0.1	3.0		S103
	P	F		5950646-3143		TRANSFORMER, AUDIO FREQUENCY: line type, 120 ohms pri 600 ohms secd 50 ma secd sig dwg SC-C-62800			2	1.0	0.2	6.0		T101 T102
	P	F		5950-645-6404		TRANSFORMER, AUDIO FREQUENCY: line type 600 ohm pri 2 secd 600 ohms, 500 v ac test; Sig dwg SC-D-62524			2	1.0	0.2	6.0		T103 T105

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5950-545-7792		TRANSFORMER, AUDIO FREQUENCY: line type, 2 pri 600 ohms 4 seed; 700 ohms Sig dwg SC-D-62528			1	0.7	0.1	3.0		T104
			GROUP III a(1) AMPLIFIER AUDIO FREQUENCY AR101 (FSN 5805-503-3360)								
P F	5910-191-9340		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw, 680 uuf MIL type CM30E681G			1	0.7	0.1	3.0		C3
P F	5910-376-9768		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw; 100,000 uuf ±20%; Sprague pt No. 181P10403T5 (Authorized allowances based total of 3 per equipment)			1	1.3	0.3	9.0		C1
P F	5910-667-5379		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 680,000 uuf ±20%; 300 vdcw; Sprague pt No. 181P68403T5 (Authorized allowances based on a total of 2 per equipment)			1	1.0	0.2	6.0		C2
P F	5935-521-0083		CONNECTOR, PLUG, ELECTRICAL: 21 rd male cont; 5 amp, 600 v 1 conn mating end; straight type, 2 3/4 in lg x 3/4 in w x 29/32 h o/a; Garde Mfg co No. PL6601-21 (Authorized allowances based on a total of 3 per equipment)			1	1.3	0.3	9.0		P1
P O	5960-262-1357		ELECTRON TUBE: JAN type 5654/6AK5W (Authorized allowances based on a total of 4 per equipment)			2	58.4	18.4	876.0		V1 V2
P F	5905-279-1894		RESISTOR, FIXED, COMPOSITION: 82 ohms ±5%; 1/2 w; MIL type RC20GF820J			1	0.7	0.1	3.0		R12
P F	5905-256-0415		RESISTOR, FIXED, COMPOSITION: 160 ohms ±5%; 1/2 w; MIL type RC20GF161J (Authorized allowances based on a total of 2 per equipment)			1	1.0	0.2	6.0		R7

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-279-3509		RESISTOR, FIXED, COMPOSITION: 910 ohms ±5%; 1/2 w; MIL type RC20GF911J			2	1.0	0.2	6.0		R2, R3
	P	F		5905-195-6806		RESISTOR, FIXED, COMPOSITION: 1000 ohms (For authorized allowance see Receiver-Trans Order Gr)			2					R5, R9
	P	F		5905-299-2041		RESISTOR, FIXED, COMPOSITION: 3000 ohms ±5%; 1 w; MIL type RC32GF302J			1	0.7	0.1	3.0		R11
	P	F		5905-279-3506		RESISTOR, FIXED, COMPOSITION: 3,300 ohms ±5%; 1/2 w; MIL type RC20GF332J			2	1.0	0.2	6.0		R6, R8
	P	F		5905-279-2669		RESISTOR, FIXED, COMPOSITION: 13,000 ohms ±5%; 1/2 w; MIL type RC20GF133J			1	0.7	0.1	3.0		R10
	P	F		5905-195-6761		RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±5%; 1/2 w; MIL type RC20GF104J (Authorized allowances based on a total of 3 per equipment)			2	1.3	0.3	9.0		R1, R4
	P	F		5960-262-0015		SHIELD, ELECTRON TUBE: (For authorized allowance see Receiver Trans Group)			2					
	P	F		5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont (For authorized allowances see Receiver Trans Group)			2					XV1, XV2
	P	F		5940-542-8158		TERMINAL STUD: 1 3/32 in lg x 1/4 in across flats, 4.6 kv rms breakdown, 4-40 thd, Whitso Inc part No. 2L35-A4, Kellogg dwg No. EPS-263 (Authorized allowances based on a total of 16 per equipment)			5	3.1	0.7	30.0		E1, E2, E3 :E5
	P	F		5950-645-6373		TRANSFORMER, AUDIO FREQUENCY: wnd (1-3) No. 42 AWG 100 ohms dc res; wnd (4-6) No. 46 AWG 4,300 ohms dc res; 300-2800 cps freq, 3.6 volts rms; Sig dwg No. SC-C-63036 (Authorized allowances based on a total of 3 per equipment)			1	1.3	0.3	9.0		T1

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5950-569-0163		TRANSFORMER, AUDIO FREQUENCY: pri wnd 80,000 ohms imp 7 ma, tapped at 40,000 ohms secd wnd, 1600 ohms tapped at 800 ohms; secd 1000 v test 8 solder lug terms; Sig dwg No. SC-C-62505 (Authorized allowances based on a total of 3 per equipment)			1	1.3	0.3	9.0		(AR101) T2
						GROUP III a(2) AMPLIFIER AUDIO FREQUENCY AR102 (FSN 5805-503-0920)								
	P	F		5910-101-5585		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 150 uuf ±2%; 500 vdcw; MIL type CM20C151G			1	0.7	0.1	3.0		C1
	P	F		5910-101-4713		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 240 uuf ±2%; 500 vdcw; MIL type CM20D241G			1	0.7	0.1	3.0		C3
	P	F		5910-667-5397		CAPACITOR, FIXED, PAPER DIELECTRIC: (For authorized allowances see Amplifier AF AR101, Group)			1					C5
	P	F		5910-376-9768		CAPACITOR, FIXED, PAPER DIELECTRIC: (For authorized allowance see Amplifier AF AR101 Group)			2					C2 C4
	P	F		5935-521-0083		CONNECTOR, PLUG, ELECTRICAL: 21 rd male cont (For authorized allowance see Amplifier, AF AR101 Group)			1					P1
	P	O		5960-262-1357		ELECTRON TUBE: (For authorized allowances see Amp AF, AR101 Group)			2					V1 V2
	P	F		5905-256-0415		RESISTOR, FIXED, COMPOSITION: 160 ohms (For authorized allowance see Amp Rec Gr, AR101)			1					R3
	P	F		5905-279-1761		RESISTOR, FIXED, COMPOSITION: 620 ohms ±5%; 1/2 w; MIL type RC20GF621J			1	0.7	0.1	3.0		R9
	P	F		5905-185-6935		RESISTOR, FIXED, COMPOSITION: 3,000 ohms ±5%; 2 w; MIL type RC42GF302J			1	0.7	0.1	3.0		R8

SOURCE CODE A B C D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-279-3505		RESISTOR, FIXED, COMPOSITION: 3,900 ohms ±5%; 1/2 w; MIL type RC20GF392J			1	0.7	0.1	3.0		R2
P F	5905-257-0935		RESISTOR, FIXED, COMPOSITION: 4,300 ohms ±5%; 1/2 w; MIL type RC20GF432J			1	0.7	0.1	3.0		R5
P F	5905-279-3499		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 1/2 w; MIL type RC20GF273J			1	0.7	0.1	3.0		R11
P F	5905-279-2522		RESISTOR, FIXED, COMPOSITION: 150,000 ohms ±5%; 1/2 w; MIL type RC20GF154J			1	0.7	0.1	3.0		R10
P F	5905-171-2003		RESISTOR, FIXED, COMPOSITION: 200,000 ohms ±5%; 1/2 w; MIL type RC20GF204J			1	0.7	0.1	3.0		R1
P F	5905-279-2515		RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±5%; 1/2 w; MIL type RC20GF474J (Authorized allowances based on a total of 2 per equipment)			1	1.0	0.2	6.0		R6
P F	5905-279-1868		RESISTOR, FIXED, COMPOSITION: 1.1 meg ±5%; 1/2 w; MIL type RC20GF115J			1	0.7	0.1	3.0		R7
P F	5905-190-8874		RESISTOR, FIXED, COMPOSITION: 1.2 meg ±5%; 1/2 w; MIL type RC20GF125J			1	0.7	0.1	3.0		R4
O	5960-262-0015		SHIELD, ELECTRON TUBE: 7 cont (For authorized allowance see Receiver Tran Group)			2					
F	5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont (For authorized allowance see Receiver Tran Group)								XV1, XV2
P F	5940-542-8158		TERMINAL STUD: (For authorized allowance see Amp AF Group AR101)			2					E1, E2
P F	5950-645-6373		TRANSFORMER, AUDIO FREQUENCY: 115 ohms (For authorized allowance see Amp Audio Freq Gr AR101)			1					T1

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5950-569-0163		TRANSFORMER, AUDIO FREQUENCY: 80,000 ohms (For authorized allowance see Amp AF Gr AR101)			1					T2
			GROUP III a (3) RINGER-OSCILLATOR ASSEMBLY Y101 (FSN 5805-356-2898)								
F	6350-269-7977		BUZZER: 6.3 v ac, 60 cyc, 2 5/8 in lg x 1 21/32 in w x 3/4 in d o/a; Edwards type No. MD 6531-2			1	0.7	0.1	3.0		I1
P F	5910-668-4594		CAPACITOR, VARAIBLE, CERAMIC DIELECTRIC: rotary type, 1 sect; 20 uff min, 125 uuf max; 500 vdcw; Centralab No. 823-AN			1	0.7	0.1	3.0		C5
P F	5910-101-5653		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 62 uuf ±2%; MIL type CM20C620G			1	0.7	0.1	3.0		C4
P F	5910-101-5661		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw, 91 uuf ±2%; MIL type CM20C910G			1	0.7	0.1	3.0		C7
P F	5910-101-5579		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 vdcw, 180 uuf ±2%; MIL type CM20C181G			1	0.7	0.1	3.0		C8
P F	5910-101-5634		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 vdcw; 330 uuf ±2%; MIL type CM20D331G			1	0.7	0.1	3.0		C9
P F	5905-101-4013		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 10,000 uuf ±2%; MIL type CM30E102G			1	0.7	0.1	3.0		C13
P F	5910-183-9260		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw, 1300 uuf ±2%; MIL type CM30E132G			2	1.0	0.2	6.0		C12 C3
P F	5910-276-6860		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw, 3,300 uuf ±2%; MIL type CM35E392G			1	0.7	0.1	3.0		C6
P F	5910-284-4024		CAPACITOR, FIXED, MICA DIELECTRIC: 300 vdcw; 10,000 uuf ±5%; MIL type CM35E103G			2	1.0	0.2	6.0		C10, C11

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5910-376-9764		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 270,000 uuf ±10%; 100 vdcw; Sprague pt No. 81P27491T5			1	0.7	0.1	3.0		C1
	P	F		5910-543-0925		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw 680,000 uuf ±20%; Sprague pt No. 81P6840385			1	0.7	0.1	3.0		C2
	P	F		5935-521-0083		CONNECTOR: 21 rd male cont (For authorized allowance see Amplifier Audio Freq AR101 Group)			1					P1
	P	O		5960-188-6584		ELECTRON TUBE: Glass envelope, reliable miniature twin triode, receiving; MIL E-1, type 5670			2	15.4	5.8	584.0		V1,V2
	P	F		5950-376-9713		REACTOR: filter choke 7.25 hy, 740 ohms 500 v, rms test; Sig dwg SC-C-62514			1	0.7	0.1	3.0		L1
	P	F		5945-259-1231		RELAY ARMATURE: cont arr 2 c, single break 26.5 vdcw, 115 v ac 4 amp; CP Clare Pt No. RP-3717-G2			1	0.7	0.1	3.0		K1
	P	F		5905-556-3344		RESISTOR, FIXED, FILM: 68.1 ohms ±1%; 1/2 w; MIL type RN70B68R1F			1	0.7	0.1	3.0		R13
	P	F		5905-279-2593		RESISTOR, FIXED, COMPOSITION: 240 ohms (For authorized allowance see Receiver Trans Group)			1					R5
	P	F		5905-646-5772		RESISTOR, FIXED, FILM: 604 ohms (For authorized allowance see Receiver Trans Group)			1					R12
	P	F		5905-190-8867		RESISTOR, FIXED, COMPOSITION: 5,100 ohms ±5%; 2 W; MIL type RC42GF512J			1	0.7	0.1	3.0		R10
	P	F		5905-556-5812		RESISTOR, FIXED, FILM: 68,100 ohms ±1%; 1/2 w; MIL type RN70B6812F			1	0.7	0.1	3.0		R11
	P	F		5905-195-6761		RESISTOR, FIXED, COMPOSITION: 100,000 ohms (For authorized allowance see Amplifier, AF AR101 Gr)			1					R3

SOURCE CODE A	SOURCE CODE B	SOURCE CODE C	SOURCE CODE D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
P	F			5905-192-0667		RESISTOR, FIXED, COMPOSITION: 220,000 ohms ±5%; 1/2 w; MIL type RC20GF224J			1	0.7	0.1	3.0		R17
P	F			5905-279-2520		RESISTOR, FIXED, COMPOSITION: 360,000 ohms ±5%; 1/2 w; MIL type RC20GF364J			1	0.7	0.1	3.0		R14
P	F			5905-279-2515		RESISTOR, FIXED, COMPOSITION: 470,000 ohms (For authorized allowance see Amp AF AF102)			1					R15
P	F			5905-279-2516		RESISTOR, FIXED, COMPOSITION: 510,000 ohms ±5%; 1/2 w; MIL type RC20GF514J			1	0.7	0.1	3.0		R1
P	F			5905-279-2514		RESISTOR, FIXED, COMPOSITION: 560,000 ohms ±5%; 1/2 w; MIL type RC20GF564J			1	0.7	0.1	3.0		(Y101) R8
P	F			5905-192-0390		RESISTOR, FIXED, COMPOSITION: 1 meg ±5%; 1/2 w; MIL type RC20GF105J			1	0.7	0.1	3.0		R2
P	F			5960-557-5032		SEMI-CONDUCTOR DEVICE, DIODE: Germanimum xtal, 1/2 in lg x 0.250 dia; excl term mtd, 2 stud w/wire lead; MIL type 1N70A			2	1.0	0.2	6.0		CR3 CR4
P	O			5960-262-0345		SHIELD, ELECTRON TUBE: 1-1/2 in lg x 1.065 dia o/a; MIL type TS103U01			2	1.0	0.2	6.0		XV1 XV2
P	F			5935-160 -1365		SOCKET, ELECTRON TUBE: (For authorized allowance see Receiver Transmitter Gr)			2					
P	F			5940-542-8114		TERMINAL STUD: forked type conn 7/8 in lg x 1/4 in across flats, 9,500 vrsm, breakdn 4-40 thd, 1/4 in lg; Whitso pt No. 2H35-A4			7	2.3	0.5	20.0		E1 thru E6, E15
P	F			5940-542-8158		TERMINAL STUD: (For authorized allowance see Amp AF Group AR101)			8					E7 thru E14
P	F			5950-569-0159		TRANSFORMER, AUDIO FREQUENCY: pri 30 ohms, 10 ma, sec, 355 ohms tapped at 116 ohms, 1,600 cyc freq 5 lug term; Sig dwg SC-C-63038			1	0.7	0.1	3.0		T3

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5950-645-6373		TRANSFORMER, AUDIO FREQUENCY: (For authorized allowance see Amp AF AR101 Group)			1					T1
P F	5950-569-0163		TRANSFORMER, AUDIO FREQUENCY: (For authorized allowance see Amplifier AF AR101 Gr) GROUP III b			1					T2
			TEST SET, TELEPHONE TS-760/TCC-7								
P F	6145-283-9655		CABLE, SPECIAL PURPOSE, ELECTRICAL: 2 cond, 300 v max vdcw; 0.260 in max dia; SIG dwg SC-C-67311 (MWC-20 (7) JSJ-9) (Authorized qty will be a min or multiple of ft in use)	ft		5	*	*	15.0		C23
P F	5910-543-1191		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 56 uuf ±2%; 500 vdcw; MIL type CM25E560G			1	0.7	0.1	3.0		C52
P F	5910-190-7143		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 82 uuf ±2%; 500 vdcw; MIL type CM25E820G			1	0.7	0.1	3.0		C58
P F	5910-101-5665		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 100 uuf ±2%; 500 vdcw; MIL type CM25E101G			1	0.7	0.1	3.0		C29 C35 C44
P F	5910-114-2408		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 110 uuf ±2%; 500 vdcw; MIL type CM25E111G			3	1.3	0.3	9.0		C35 C42
P F	5910-190 -8925		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 120 uuf ±2%; 500 vdcw; MIL type CM25E121G			2	1.0	0.2	6.0		C41
P F	5910-114-2410		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 130 uuf ±2%; 500 vdcw; MIL type CM25E131G			1	0.7	0.1	3.0		C7 C11
P F	5910-190-8232		CAPACITOR, FIXED, MICA DIELECTRIC: 150 uuf ±2%; 500 vdcw; MIL type CM25E151G			2	1.0	0.2	6.0		C33
P F	5910-114-2416		CAPACITOR, FIXED, MICA DIELECTRIC: 160 uuf ±2%; 500 vdcw; MIL type CM25E161G			1	0.7	0.1	3.0		

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SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5910-190-9412		CAPACITOR, FIXED, MICA DIELECTRIC: 200 uuf ±2%; 500 vdcw; MIL type CM25E201G			1	0.7	0.1	3.0		C54
	P	F		5910-184 5055		CAPACITOR, FIXED, MICA DIELECTRIC: 270 uuf ±2%; 500 vdcw; MIL type CM25E271G			1	0.7	0.1	3.0		C26
	P	F		5910 191-0916		CAPACITOR, FIXED, MICA DIELECTRIC: 300 uuf ±2%; 500 vdcw; MIL type CM25E301G			3	1.3	0.3	9.0		C38,C39, C48
	P	F		5910-191-5876		CAPACITOR, FIXED, MICA DIELECTRIC: 360 uuf ±2%; 500 vdcw; MIL type CM25E361G			2	1.0	0.2	6.0		C24,C56
	P	F		5910-170-8707		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 510 uuf ±2%; 500 vdcw; MIL type CM20D511G			1	0.7	0.1	3.0		C13
	P	F		5910-195 0916		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 260 uuf ±2%; 500 vdcw; MIL type CM25E561G			2	1.0	0.2	6.0		C10,C32
	P	F		5910-191-6984		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 750 uuf ±2%; 500 vdcw; MIL type CM25E751G			1	0.7	0.1	3.0		C49
	P	F		5910-101-4030		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 820 uuf ±2%; 500 vdcw; MIL type CM25E821G			1	0.7	0.1	3.0		C28
	P	F		5910-112 8171		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 1000 uuf ±2%; 500 vdcw; MIL type CM25E102G			1	0.7	0.1	3.0		C25
	P	F		5910-101-5783		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 2000 uuf ±5%; 500 vdcw; MIL type CM30E202J			2	1.0	0.2	6.0		(AR1)C4 (AR2)C4
	P	F		5910-171 3231		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 3,300 uuf ±2%; 500 vdcw; MIL type CM30E332G			1	0.7	0.1	3.0		C3
	P	F		5910-184-5996		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 10,000 uuf ±2%; 300 vdcw; MIL type CM35D103G			3	1.3	0.3	9.0		(AR1)C8 (AR2)C8 C14

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5910-191-5422		CAPACITOR, FIXED, MICA DIELECTRIC: 22,000 uuf ±2%; 600 vdcw; MIL type CM50B223G			1	0.7	0.1	3.0		C2
	P	F		5910-642-6275		CAPACITOR, FIXED, PAPER DIELECTRIC: 22,000 uuf ±20%; 100 vdcw; Sprague No. 191P2230154			1	0.7	0.1	3.0		C1
	P	F		5910-666-8227		CAPACITOR, FIXED, PAPER DIELECTRIC: 120,000 uuf ±10%; 300 vdcw; Sprague No. 81P12493S5			2	1.0	0.2	6.0		(AR1) C2 (AR2) C2
	P	F		5910-561-8218		CAPACITOR, FIXED, PAPER DIELECTRIC: 200,000 uuf ±20%; 600 vdcw; Cornell-Dubilier part No. NFTW-6P22L4			1	0.7	0.1	3.0		C20
	P	F		5910-284-5275		CAPACITOR, FIXED, PAPER DIELECTRIC: 270,000 uuf ±10%; 300 vdcw; Sprague No. 181P27493S5			2	1.0	0.2	6.0		(AR1)C6 (AR2)C6
	P	F		5910-284-5063		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 330,000 uuf ±20%; 200 vdcw; Sprague pt No. 191P33402S6			1	0.7	0.1	3.0		C18
	P	F		5910-284-5071		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 470,000 uuf ±20%; 300 vdcw; Sprague pt No. 191P47403T6 (Item Nos. (AR1) C11 (AR2) C11 (AR2) C12 (AR1) C12)			4	1.4	0.3	12.0		See desc Column
	P	F		5910-356-0136		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 470,000 uuf ±20%; 100 vdcw; Sprague pt No. 181P47401T5			1	0.7	0.1	3.0		C19
	P	F		5910-643-9072		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 470,000 uuf ±20%; 400 vdcw; San Fernando EC Co No. West-Cap 25M447AAA			3	1.3	0.3	9.0		C16 C17 C22
	P	F		5910-667-5137		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 470,000 uuf ±20%; 300 vdcw; Sprague pt No. 181P47403T5 Item Nos. (AR1)C3 (AR2)C3 (AR1)C7 (AR2)C7			4	1.4	0.3	12.0		SEE DESC COLUMN
	P	F		5910-667-5379		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 680,000 uuf ±20%; 300 vdcw; Sprague pt No. 181P68403T5			2	1.0	0.2	6.0		C4, C5

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5910-667-5376		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect; 1.0 uuf ±20%; 300 vdcw; Sprague pt No. 181P10501S5			2	1.0	0.2	6.0		(AR1)C5 (AR2)C5
	P	F		5910-666-8310		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 1.0 uuf ±20%; 100 vdcw; Sprague pt No. 191P10501T6 Item Nos. (AR1)C1 (AR1)C10 (AR2)C1 (AR2)C10			4	1.4	0.3	12.0		See desc Column
	P	F		5910-280-7358		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect; 1.0 uuf ±20%; 100 vdcw; Sprague pt No. 191P10501S6			2	1.0	0.2	6.0		(AR1)C9 (AR2)C9
	P	F		5910-280-7326		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect; 1.0 uf ±20%; 300 vdcw; Sprague part No. 81P10503T5			1	0.7	0.1	3.0		C21
	P	F		5910-537-5219		CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type 1 sect; 33 uuf SLC tuning 1400 v ac, Sig dwg SC-C-64153			1	0.7	0.1	3.0		C8
	P	F		5910-578-1623		CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: Rotary type, 1 sect, 7 uuf to 45 uuf; 500 vdcw; MIL type No. CV11C450			1	0.7	0.1	3.0		C59
	P	F		5910-669-0798		CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type, 1 sect; 9 uuf to 97.5 uuf, 14.0 vac, Sig dwg No. SC-C-63629			1	0.7	0.1	3.0		C9
	P	F		5910-126-1583		CAPACITOR, VARIABLE, AIR DIELECTRIC: 1 sect, 7.5 uf to 99 uuf, SLC tuning MIL type CT1B100			1	0.7	0.1	3.0		C51
	P	F		5910-668-4594		CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 20 uuf to 125 uuf; 500 vdcw; Centralab No. 823-AN Item Nos. C12, C27, C30, C31, C34, C37, C40, C42, C45, C46, C47, C50, C55, C57, C53			15	4.2	0.9	45.0		See desc Column
	P	F		5950-645-4514		COIL, TELEPHONE RETARDATION: 1 wnd 3/4 in lg x 7/32 in w x 5/16 in h; WECo No. 302AF			2	1.0	0.2	6.0		(AR1)L1 (AR2)L1

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5935-202-0945		CONNECTOR, PLUG, ELECTRICAL: 4 rd male cont; pol, str type M4P-LS Winchester Elec part M4P-LS			2	1.0	0.2	6.0		P2,P3
P F	5935-257-7060		CONNECTOR, RECEPTACLE, ELECTRICAL: 4 female rd cont; 11/32 in lg x 19/32 in w x 5/8 in h; Winchester El type M4SLRN			2	1.0	0.2	6.0		(AR1)J1 (AR2)J1
P F	5935-552-7032		CONNECTOR, RECEPTACLE, ELECTRICAL: 19 rd male cont; 1-3/16 in lg x 1 27/32 in dia; type CS2026-(3)(P)			1	0.7	0.1	3.0		J2
P F	5935-257-7206		CONNECTOR, RECEPTACLE, ELECTRICAL: 7 rd female cont; 1-5/8 in lg x 5/16 in h; Sig dwg SM-C 169654-1			3	1.3	0.3	9.0		J3,J4, (W2) P2
P F	5935-201-3999		CONNECTOR, RECEPTACLE, ELECTRICAL: 14 cont rd female 20 amp, 1250 v dc 1-3/16 in lg x 1-27/32 in dia; MIL-C 12520A, type No. CS-2026(1) (S)			1	0.7	0.1	3.0		J5
P F	5935 199-3260		CONNECTOR, RECEPTACLE, ELECTRICAL: 7 rd male cont; 10 amp; 1-5/8 in lg x 5/16 in h; Sig dwg No. SM-C-169654-2 (Item nos. (AR1)P1, (W2)P1, (AR2)P1)			3	1.3	0.3	9.0		See desc column
P O	5960-262-1357		ELECTRON TUBE: Pentode, glass envelope, Spec MIL-E-1; type No. 5654/6AK5W (Spare tubes located in RT280/TCC-7) (Item Nos. V1,V2,V4, (AR1)V1,(AR2)V1,(AR1)V2,(AR1)V3, (AR2)V3,(AR2)V2)			9	69.3	26.1	584.0		See desc column
P O	5960-188-6584		ELECTRON TUBE: glass envelope, miniature twin triode MIL-E-1, type No. 5670 (spare tubes located in RT-280/TCC-7)			1	7.7	2.9	194.0		V3
P F	5915-280-0287		FILTER, BAND PASS: 62 KC freq; 13,300 ohms input 20,000 ohms output, 4-29/32 in x 2-7/16 in w x 3 in h; Sig dwg No. SC-C-64147			1	0.7	0.1	3.0		FL1
P F	5915-281-0263		FILTER, BAND PASS: 90 kc freq; 200 ohms input, 27,000 ohms output, 2 1/32 in lg, 1-7/16 in w x 3-5/32 in h; Sig dwg No. SC-C-64145			1	0.7	0.1	3.0		FL5

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5915-523-1879		FILTER, BAND PASS: 194 kc freq; 75 ohms, input, 27,100 output 4 in lg x 1 3/4 in w x 4 15/16 in h; Sig dwg No. SC-C-63627			1	0.7	0.1	3.0		FL2
	P	F		5915-281-0261		FILTER, BAND PASS: 194 kc freq, 27,000 ohms input and output 4 23/32 in lg x 2 7/16 in w x 3 9/16 in h; Sig dwg No. SC-C-64146			1	0.7	0.1	3.0		FL3
	P	F		5915-281-0296		FILTER, LOW, PASS: 20 kc, cut-off freq; 13,000 ohms input and output; 3 1/32 in lg x 1 7/16 in w x 3 5/32 in h; Sig dwg No. SC-C-63664			1	0.7	0.1	3.0		FL4
	P	F		5935-192-4729		JACK, TELEPHONE: accom 3 Cond; plug shak 0.206 dia x 1.093 lg Spec JAN-J-641, type JJ-033			4	1.4	0.3	12.0		J1, J6, J7 XP1
	P	O		5355-667-9003		KNOB: setscrew type, octagon shape, 1 1/8 in od x 7/8 in thk o/a; Sig dwg No. SC-B-62904			2	1.0	0.2	6.0		
		O		5355-558-2395		KNOB: setscrew type, bar w/single pointer shape, 1 15/32 in lg x 21/32 in w x 21/32 in thk; MIL-K-3926, type MS90120-2B01			4	1.4	0.3	12.0		
5		O		6240-155-8706		LAMP, INCANDESCENT: 6 to 8 v, 0.15 amp, miniature bayonet base T-3-1/4 bulb; 3000 hr rated life, MIL MS-15571-2, type TB-14; GE No. 47			1	1.4	0.3	10.0		I1
5		O		6210-299-3928		LENS, INDICATOR LIGHT: 1/2 dia, glass colorless; Dialco pt No. 92-117			1	0.7	0.1	3.0		
5		F		6210-299-6636		LIGHT, INDICATOR: supplied w/o lens, accom lens 1/2 in dia lamp accom 1 min bayonet base, T-3-1/4 bulb, 1 3/4 in lg x 13/16 in dia; Dialco pt No. 922210			1	0.7	0.1	3.0		X11
	P	F		6625-519-2411		METER, AUDIO LEVEL: -7 to +7 db scale cw; metal case, panel type, Sig dwg No. SC-D-63625			1	0.7	0.1	3.0		M1

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH-DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	O		5935-187-4561		PLUG, TELEPHONE: 3 cond, Single shank, red plastic shell 0.206 dia x 1.093 lg PJ309 stamped on shell, JAN-P-642, type PJ-309			1	0.7	0.1	3.0		P1
	P	O		5355-644-1420		PUSH BUTTON: (cover for elect switch) rd blk bakelite; 7/16 in dia x 5/8 in thk; Kurz-Kasch pt No. S-343-30AA			3	1.3	0.3	9.0		
	P	O		5355-667-5966		PUSH BUTTON: round shape, plain gripping surface; red plastic body; 7/16 in od x 5/8 in thk; Friedman Pt No. S-343-30			3	1.3	0.3	9.0		
	P	F		6130-356-1702		RECTIFIER, METALLIC: copper oxide, input 4.5 v rms, single phase, output 3 vdc 15 ma, full wave, 1 11/16 in h x 15/16 in lg x 7/8 in w o/a; Sig dwg SC-C-62504			1	0.7	0.1	3.0		CR1
	P	F		5905-542-9570		RESISTOR, FIXED, FILM: 5.11 ohms ±1%; 1/2 w; MIL type RN70B5R11F			1	0.7	0.1	3.0		(AR1)R21
	P	F		5905-752-3354		RESISTOR, FIXED, FILM: 6.04 ohms ±1%; 1/2 w; MIL type RN70C6R04F			2	1.0	0.2	6.0		R7, R75
	P	F		5905-552-2440		RESISTOR, FIXED, FILM: 10 ohms ±1%; 1/2 w; MIL type RN70B10R0F Item Nos. (AR1)R4 (AR1)R6 (AR2)R4 (AR2)R21 R9			6	2.3		18.0		See desc Column
	P	F		5905-190-8883		RESISTOR, FIXED, COMPOSITION: 10 ohms ±5%; 1/2 w; MIL type RC20GF100J			2	1.0	0.2	6.0		R82, R83
	P	F		5905-542-9517		RESISTOR, FIXED, FILM: 32.8 ohms ±1%; 1/2 w; MIL type RN70B32R8F			1	0.7	0.1	3.0		R80
	P	F		5905-542-9571		RESISTOR, FIXED, FILM: 38.3 ohms ±1%; 1/2 w; MIL type RN70B38R3F			2	1.0	0.2	6.0		(AR1)R5 (AR2)R5
	P	F		5905-556-3344		RESISTOR, FIXED, FILM: 68.1 ohms ±1%; 1/2 w; MIL type RN70B68R1F			1	0.7	0.1	3.0		R49
	P	F		5905-556-3335		RESISTOR, FIXED, FILM: 75 ohms ±1%; 1/2 w; MIL type RN70B75R0F			1	0.7	0.1	3.0		R47
	P	F		5905-279-1758		RESISTOR, FIXED, COMPOSITION: 75 ohms 1/2 w; MIL type RC20GF750J			2	1.0	0.2	6.0		(AR1)R22 (AR2)R22

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-542-9518		RESISTOR, FIXED, FILM: 92 ohms ±1%; 1/2 w; MIL type RN70B92R0F			1	0.7	0.1	3.0		R54
	P	F		5905-556-4629		RESISTOR, FIXED, FILM: 118 ohm ±1%; 1/2 w; MIL type RN70B118OF			1	0.7	0.1	3.0		R59
	P	F		5905-556-3109		RESISTOR, FIXED, FILM: 135 ohms ±1%; 1/2 w; MIL type Sig dwg SC-C-62507-12			1	0.7	0.1	3.0		R86
	P	F		5905-552-5700		RESISTOR, FIXED, FILM: 140 ohms ±1%; 1/2 w; MIL type RN70B140OF			1	0.7	0.1	3.0		R68
	P	F		5905-279-3514		RESISTOR, FIXED, COMPOSITION: 180 ohms ±5%; 1/2 w; MIL type RC20GF181J			1	0.7	0.1	3.0		R2
	P	F		5905-556-3733		RESISTOR, FIXED, FILM: 191 ohms ±1%; 1/2 w; MIL type RN70B191OF			1	0.7	0.1	3.0		R81
	P	F		5905-279-3513		RESISTOR, FIXED, COMPOSITION: 220 ohms ±5%; 1/2 w; MIL type RC20GF221J			2	1.0	0.2	6.0		(AR1)R16 (AR2)R16
	P	F		5905-702-5154		RESISTOR, FIXED, FILM: 252 ohms ±1%; 1/2 w; MIL type Sig dwg SC-C-62507-98			1	0.7	0.1	3.0		R39
	P	F		5905-542-9112		RESISTOR, FIXED, FILM: 301 ohms ±1%; 1/2 w; MIL type RN70B301OF			1	0.7	0.1	3.0		R79
	P	F		5905-192-3971		RESISTOR, FIXED, COMPOSITION: 330 ohms ±5%; 1/2 w; MIL type RC20GF331J Item Nos. (AR1)R3, (AR2)R3, (AR1)R11, (AR2)R11, R22			5	1.9	0.4	15.0		See desc Column
	P	F		5905-542-9572		RESISTOR, FIXED, FILM: 432 ohms ±1%; 1/2 w; MIL type RN70B432OF			2	1.0	0.2	6.0		R52, R53
	P	F		5905-542-9531		RESISTOR, FIXED, FILM: 470 ohms ±1%; 1/2 w; MIL type RN70B470OF			1	0.7	0.1	3.0		R50
	P	F		5905-542-9789		RESISTOR, FIXED, FILM: 511 ohms ±1%; 1/2 w; MIL type RN70B511OF			1	0.7	0.1	3.0		R64
	P	F		5905-542-9573		RESISTOR, FIXED, FILM: 590 ohms±1%; 1/2 w; MIL type RN70B590OF			1	0.7	0.1	3.0		R46

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-646-5772		RESISTOR, FIXED, FILM: 600 ohms ±1%; 1/2 w; MIL type RN70B6000F			1	0.7	0.1	3.0		R73
	P	F		5905-542-9533		RESISTOR, FIXED, FILM: 673 ohms ±1%; 1/2 w; MIL type RN70B6730F			1	0.7	0.1	3.0		R66
	P	F		5905-195-6791		RESISTOR, FIXED, COMPOSITION: 680 ohms ±5%; 1/2 w; MIL type RC20GF681J			1	0.7	0.1	3.0		R24
	P	F		5905-542-9520		RESISTOR, FIXED, FILM: 1200 ohms ±1%; 1/2 w; MIL type RN70B1201F			2	0.7	0.2	6.0		R8, R10
	P	F		5905-556-4620		RESISTOR, FIXED, FILM: 1300 ohms ±1%; 1/2 w; MIL type RN70B1301F			1	0.7	0.1	3.0		R61
	P	F		5905-552-3521		RESISTOR, FIXED, FILM: 2,000 ohms ±1%; 1/2 w; MIL type RN70B2001F			1	0.2	0.1	3.0		R51
	P	F		5905-279-1876		RESISTOR, FIXED, COMPOSITION: 2,200 ohms ±5%; 1/2 w; MIL type RC20GF222J			2	1.0	0.2	6.0		(AR1)R19 (AR2)R19
	P	F		5905-279-1877		RESISTOR, FIXED, COMPOSITION: 2,400 ohms ±5%; 1/2 w; MIL type RC20GF242J			2	1.0	0.2	6.0		(AR1)R13 (AR2)R13
	P	F		5905-279-1880		RESISTOR, FIXED, COMPOSITION: 2,700 ohms ±5%; 1/2 w; MIL type RC20GF272J			2	1.0	0.2	6.0		(AR1)R8 (AR2)R8
	P	F		5905-556-4632		RESISTOR, FIXED, FILM: 2,800 ohms ±1%; 1/2 w; MIL type RN70B2801F			2	1.0	0.2	6.0		R34, R36
	P	F		5905-542-9574		RESISTOR, FIXED, FILM: 4,530 ohms ±1%; 1/2 w; MIL type RN70B4531F			2	1.0	0.2	6.0		R13, R15
	P	F		5905-553-2196		RESISTOR, FIXED, FILM: 5,490 ohms ±1%; 1/2 w; MIL type RN70B5491F			1	0.7	0.1	3.0		R32
	P	F		5905-542-9534		RESISTOR, FIXED, FILM: 7,590 ohms ±1%; 1/2 w; MIL type RN70B7591F			4	1.4	0.3	12.0		R18, R20, R25, R27
	P	F		5905-556-4623		RESISTOR, FIXED, FILM: 7,870 ohms ±1%; 1/2 w; MIL type RN70B7871F			1	0.7	0.1	3.0		R72
	P	F		5905-299-1971		RESISTOR, FIXED, COMPOSITION: 8200 ohms ±5%; 1/2 w; MIL type RC20GF822J			1	0.7	0.1	3.0		R3

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-192-4504		RESISTOR, FIXED, COMPOSITION: 8200 ohms ±5%; 2 w; MIL type RC42GF822J			1	0.7	0.1	3.0		R21
P F	5905-542-9535		RESISTOR, FIXED, FILM: 9,650 ohms ±1%; 1/2 w; MIL type RN70B9651F			1	0.7	0.1	3.0		R40
P F	5905-185-8516		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 2 w; MIL type RC42GF103J			3	1.3	0.3	9.0		(AR1)R18 (AR2)R18 R57
P F	5905-542-9519		RESISTOR, FIXED, FILM: 10,400 ohms ±1%; 1/2 w; MIL type RN70B1042F			1	0.7	0.1	3.0		R42
P F	5905-552-4832		RESISTOR, FIXED, FILM: 12,000 ohms ±1%; 1/2 w; MIL type RN70B1202F			1	0.7	0.1	3.0		R70
P F	5905-542-9522		RESISTOR, FIXED, FILM: 12,600 ohms ±1%; 1/2 w; MIL type RN70B1262F			1	0.7	0.1	3.0		R17
P F	5905-646-5769		RESISTOR, FIXED, FILM: 13,000 ohms ±1%; 1/2 W; MIL type RN70B1302F			1	0.7	0.1	3.0		R60
P F	5905-542-9104		RESISTOR, FIXED, FILM: 14,000 ohms ±1%; 1/2 w; MIL type RN70B1402F			3	1.3	0.3	9.0		R28, R30, R41
P F	5905-542-9524		RESISTOR, FIXED, FILM: 14,500 ohms ±1%; 1/2 w; MIL type RN70B1452F			1	0.7	0.1	3.0		R77
P F	5905-279-2616		RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±5%; 1/2 w; MIL type RC20GF153J			1	0.7	0.1	3.0		R4
P F	5905-556-4622		RESISTOR, FIXED, FILM: 16,500 ohms ±1%; 1/2 w; MIL type RN70B1652F			1	0.7	0.1	3.0		R69
P F	5905-542-9525		RESISTOR, FIXED, FILM: 18,900 ohms ±1%; 1/2 w; MIL type RN70B1892F			1	0.7	0.1	3.0		R29
P F	5905-556-4527		RESISTOR, FIXED, FILM: 20,000 ohms ±1%; 1/2 w; MIL type RN70B2002F			1	0.7	0.1	3.0		R45
P F	5905-556-3738		RESISTOR, FIXED, FILM: 20,500 ohms ±1%; 1/2 w; MIL type RN70B2052F			1	0.7	0.1	3.0		R62
P F	5905-556-3333		RESISTOR, FIXED, FILM: 22,100 ohms ±1%; 1/2 w; MIL type RN70B2212F			2	1.0	0.2	6.0		R31, R33
P F	5905-542-9527		RESISTOR, FIXED, FILM: 26,400 ohms ±1%; 1/2 w; MIL type RN70B2642F			3	1.3	0.3	9.0		R43, R63 R65

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD FIELD	4TH FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-556-4628		RESISTOR, FIXED, FILM: 26,700 ohms ±1%;1/2 w; MIL type RN70B2672F			3	1.3	0.3			R58, R67, R85
P F	5905-279-3499		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 1/2 w; MIL type RC20GF273J Item Nos. (AR1)R9, (AR2)R9,(AR1)R14, (AR2)R14, (AR2)R20 (AR1)R20)			6	2.3	0.5	18.0		See desc Column
P F	5905-254-1777		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 2W; RC42GF273J Item Nos. (AR1)R7, (AR2)R7, (AR1)R12, (AR2)R12			4	1.4	0.3	12.0		See desc Column
P F	5905-542-9528		RESISTOR, FIXED, FILM: 27,100 ohms ±1%; 1/2 w; MIL type RN70B2712F			2	1.2	0.2	6.0		(AR1)R2 (AR2)R2
P F	5905-171-1998		RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±5%; 1/2 w; MIL type RC20GF333J			1	0.7	0.1	3.0		R6
P F	5905-542-9529		RESISTOR, FIXED, FILM: 41,700 ohms ±1%; 1/2 w; MIL type RN70B4172F			1	0.7	0.1	3.0		R14
P F	5905-542-9530		RESISTOR, FIXED, FILM: 44,800 ohms ±1%; 1/2 w; MIL type RN70B4482F			2	1.0	0.2	6.0		R19, R26
P F	5905-553-2198		RESISTOR, FIXED, FILM: 53,600 ohms ±1%; 1/2 w; MIL type RN70B5362F			1	0.7	0.1	3.0		R78
P F	5905-171-1986		RESISTOR, FIXED, COMPOSITION: 56,000 ohms ±5%; 1/2 w; MIL type RC20GF563J			1	0.7	0.1	3.0		(AR2)R1
P F	5905-556-3528		RESISTOR, FIXED, FILM: 69,800 ohms ±1%; 1/2 w; MIL type RN70B6982F			1	0.7	0.1	3.0		R35
P F	5905-279-2639		RESISTOR, FIXED, COMPOSITION: 91,000 ±5%; 1 w; MIL type RC32GF913J			1	0.7	0.1	3.0		R23
P F	5905-195-6761		RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±5%; 1/2 w; MIL type RC20GF104J			1	0.7	0.1	3.0		R84
P F	5905-192-0667		RESISTOR, FIXED, COMPOSITION: 220,000 ohms ±5%; 1/2 w; MIL type RC20GF224J			1	0.7	0.1	3.0		R16
P F	5905-259-5219		RESISTOR, FIXED, WIRE WOUND: 446,000 ohms ±5%; 1/2 w; MIL type RB18BE44602D			2	1.0	0.2	6.0		R11, R12

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-279-2515		RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±5%; 1/2 w; MIL type RC20GF474J Item Nos. R1, R74 (AR1) R10, (AR2)R10, (AR1)15, (AR2)R15			6	2.3	0.5	18.0		See desc Column
P F	5905-171-2000		RESISTOR, FIXED, COMPOSITION: 690,000 ohms ±5%; 1/2 w; MIL type RC20GF684J			1	0.7	0.1	3.0		R56
P F	5905-557-9241		RESISTOR, VARIABLE: 1 sect, 50 ohms ±10%; 2 w; Sig dwg No. SC-D-62818-10			2	1.0	0.2	6.0		(AR1)R17 (AR2)R17
P F	5905-226-9481		RESISTOR, VARIABLE: 200 ohms ±10%; 2 w; Sig dwg No. SC-D-62818-17			1	0.7	0.1	3.0		R48
P F	5905-591-8939		RESISTOR, VARIABLE: 1 sect 500 ohms ±10%; 2 w; Sig dwg No. SC-D-62818-15			1	0.7	0.1	3.0		R55
P F	5905-556-4743		RESISTOR, VARIABLE: 1 sect; 750 ohms ±10%; 2 w; Sig dwg No. SC-D-62818-20			1	0.7	0.1	3.0		R37
P F	5905-591-8941		RESISTOR, VARIABLE: 1 sect; 1000ohms ±10%; 2 w; Sig dwg No. SC-D-62818-11			2	1.0	0.2	6.0		R38, R44
P F	5905-556-4740		RESISTOR, VARIABLE: 1 sect; 25,000 ohms ±10%; 2 w; Sig dwg No. SC-D-62818-13			1	0.7	0.1	3.0		R71
P F	5905-226-9450		RESISTOR, VARIABLE: 50,000 ohms ±10%; 2 w; Sig dwg No. SC-D-62818-16			1	0.7	0.1	3.0		R5
P O	5305-206-5533		SCREW, EXTERNALLY RELEIVED BODY: slot drive; bind Hd; 0.138 in od, 32 thds; 1-3/4 in nom legth; Sig dwg No. SC-B-62716-1			4	1.9	0.4	12.0		
P O	5305-206-5532		SCREW, EXTERNALLY RELIEVED BODY: slot dr, bind hd; 0.138 in nom OD, 32 threads; 3/4 in nom lg Sig dwg No. SC-B-62716-2			4	1.9	0.4	12.0		
P O	5305-206-1181		SCREW, EXTERNALLY RELIEVED BODY: slot drive; bind H; 0.138 in od, 32 threads; 1-7/16 in nom lg; Sig dwg No. SC-B-62716-3			4	1.9	0.4	12.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	O		5305-206-1184		SCREW, EXTERNALLY RELIEVED BODY: slot drive; bind H; 0.138 in od, 32 threads, 1-17/32 in nom length; Sig dwg No. SC-B-62716-4			6	2.3	0.5	18.0		
	P	O		5305-206-5544		SCREW, EXTERNALLY RELIEVED BODY: Fil II slot drive; No. 10-32 NF-2, 9/32 in thd lgth; 0.625 in nom lg Sig dwg No. SC-B-62467			4	1.4	0.3	12.0		
	P	O		5960-262-0015		SHIELD, ELECTRON TUBE: accom Retma style No. T-5-1/2-(6-1) tube envelope, 1-3/8 in lg x 0.930 in dia; MIL type TS102U01			9	2.7	0.6	27.0		
	P	F		5960-262-0345		SHIELD, ELECTRON TUBE: accom Retma tube, envelope style, T6-(6-1), 1-1/2 lg x 1.062 in dia o/a; JAN type TS103U01			1	0.7	0.1	3.0		
	P	F		5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont, miniature, 1-1/8 in lg x 0.900 wd x 25/32 in h; JAN type TS102P01 (Item Nos XV1,XV2,XV4,(AR1)XV1, (AR2)XV3,(AR1)XV2,(AR2)XV2,(AR1)XV3 (AR2)XV1)			9	2.7	0.6	27.0		See desc column
	P	F		5935-160-1365		SOCKET, ELECTRON TUBE: 9 cont; 1 3/16 in h x 1.035 in w x 1-13/32 in lg; JAN type TS103P01			1	0.7	0.1	3.0		XV3
	P	F		5930-301-5853		SWITCH, PUSH: 3 units DPDT, 3-11/32 in lg x 2-47/64 in w x 15/16 in h; Sig dwg No. SC-C-63603-1			1	0.7	0.1	3.0		S6
	P	F		5930-301-5836		SWITCH, PUSH: 3 units, DPDT, 3-13/32 in lg x 2-47/64 in w x 15/16 in h; Sig dwg SC-C-63602-1			1	0.7	0.1	3.0		S2
	P	F		5930-590-7990		SWITCH, ROTARY: 2 sect, 3 pos, 2 poles, 3 throws, 1-17/32 in h x 1-7/16 in lg x 13/32 in w; Oak Mfg Co part No. 154703-K2			1	0.7	0.1	3.0		S1
	P	F		5930-548-8216		SWITCH, ROTARY: 3 sect; 12 max, switching pos, non pile-up type, 3 poles, 11 throws, 2-5/8 in h x 5 5/16 in lg x 2-7/8 in w; Sig dwg SC-D-63660-1			1	0.7	0.1	3.0		S3

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5930-548-6862		SWITCH, ROTARY: 3 sect, 12 max switching pos, non pile-up type, 3 poles, 11 throws 3 in h x 4-5/8 in lg x 3-1/2 w; WECo part G 650181			1	0.7	0.1	3.0		S 4
	P	F		5930-333-9788		SWITCH, ROTARY: 1-11/16 in lg x 1 3/16 in w x 13/16 in h o/a; 33 amp, 125v 2 sect, 3 poles, 3 throw, 3 sw pos, Sig dwg SC-D-63599-1			1	0.7	0.1	3.0		S5
	P	F		5940-542-8114		TERMINAL, STUD: forked type conn 7/8 in lg x 1/4 in across hex flats; 9.500 vrms brkdn; Whitso Inc pt No. 2 H35-A4 (Item Nos. E1, E2, E5, E6, E7, E10, E13, E14, E15, E33, E37, E38, E39, E40, E41, E42, (AR1)E3, (AR1)E4, (AR2)E4, (AR2)E3)			20	5.3	1.2	60.0		See desc Column
	P	F		5940-642-3963		TERMINAL, STUD: 7/8 in lg x 11/32 in w x 5/16 in h o/a; 4.5K vrms brkdn; Winchester pt No. FT-5 Item Nos. (AR1)E1, (AR2)E1, (AR1)E5, (AR2)E5, (AR1)E6, (AR2)E6			6	2.3	0.5	18.0		See desc Column
	P	F		5940-542-8158		TERMINAL, STUD: 1-3/32 in lg 1/4 in across hexflats, 4.6 kv, rms brkdn; 4-40 thd, 7/32 in lg; Whitso Inc. No. 2L35-A4			7	2.3	0.5	21.0		E3, E4, E8, E9, E11, E12, E44
	P	F		5940-542-8159		TERMINAL STUD: 0.187 in lg x 0.076 in w x 0.052 h o/a; 1/4 in across flats Whitso Inc pt No. 1M16-A4 Item Nos. (AR1)E7, (AR2)E7, (AR1)E9, (AR2)E9			4	1.4	0.3	12.0		See desc Column
	P	O		6625-392-6926		TEST, SET, SUB-ASSEMBLY: c/o 12 capacitors, 2 connectors, 3 electron tubes, 1 inductor and 21 resistors, 4-1/8 in lg x 4-3/16 in w x 3-9/16 in h; Sig dwg SC-D-63648		NX	1	0.7	0.1	3.0		AR1
	P	O		6625-765-5416		TEST SET, SUB-ASSEMBLY: c/o 12 capacitors, 2 connectors 3 electron tubes, 1 inductor and 22 resistors 4-1/8 in lg x 4-3/16 in w; 3-9/16 in h; Sig dwg No. SC-D-63652		NX	1	0.7	0.1	3.0		AR2

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A B C D										FIGURE NO.	ITEM NO.
			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5950-648-2276		TRANSFORMER, AUDIO FREQUENCY: plate coupling type, 73000/10000 ohms, pri 100/6 ohms secd, 1 kc freq, 2 in h x 1-3/8 in lg x 29/32 in w; Sig dwg SC-D-63040			1	0.7	0.1	3.0		T1
P F	5950-569-0167		TRANSFORMER, AUDIO FREQUENCY: plate coupling type, 2 pri wnd, 7,500 ohms ea secd, 18 ohms 500 v test Sig dwg SC-C-64152			1	0.7	0.1	3.0		T4
P F	5950-645-6324		TRANSFORMER, AUDIO FREQUENCY: line type, pri 20,000 ohms secd 270 ohms ct, 135 ohms ct, 2 in h x 1-3/8 in lg x 19/32 w o/a; Sig dwg SC-C-64151			1	0.7	0.1	3.0		T3
P F	5950-645-7676		TRANSFORMER, AUDIO FREQUENCY: line type, 2 pri wnd ea 13,000 ohms secd 26,000 ohms; 1-25/32 in lg x 1-13/32 in w x 2-15/16 in h; Sig dwg SC-C-64150			1	0.7	0.1	3.0		T2
P F	5950-219-6438		TRANSFORMER, AUDIO FREQUENCY: pri wnd 10 ohms dc res; secd 0.3 ohms dc res; 2 in dia x 2-9/16 in lg; 8 solder lug term; Sig dwg SC-C-64149			1	0.7	0.1	3.0		T5
			GROUP IV TELEPHONE CARRIER FREQUENCY TA-228/TCC-7								
F	6145-283-9655		CABLE, SPECIAL PURPOSE, ELECTRICAL: No. 20 AWG; 7 strand and No. 28 AWG; 1 white and 1 boack or other dist color, 300 vdcw; 0.260 dia; Sig dwg No. SC-C-67311; (Authorized Qty will be a minimum or a multiple of ft in use)	ft		2	*	*	6.0		(W5)W1
P F	6145-589-1250		CABLE, SPECIAL PURPOSE, ELECTRICAL: 10 cond No. 22 AWG; 3 cond No.. 16 AWG; stranded copper wire, 300 vrms 0/675 dia; WECo part/spec No. GA-51039 (Authorized qty will be a minimum or a multiple of ft in use)	ft		11	*	*	33.0		

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	6145-568-5801		CABLE, SPECIAL PURPOSE, ELECTRICAL: No. 22 AWG; No. 30 AWG, syn rubber color coded, 22 conductor, 300 vdcw 0.750 dia; WECo No. GA-51796 (Authorized quantity will be minimum or a multiple of ft in use)	ft		2	*	*	6.0		
P F	5910-101-4708		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 24 uuf ±5%; MIL type CM20C240J			1	0.7	0.1	3.0		C23
P F	5910-101-5655		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 68 uuf ±2%; MIL type CM20C680G			3	1.3	0.3	9.0		C7, C19, C21
P F	5910-101-5614		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 100 uuf ±2%; MIL type CM20C101G			1	0.7	0.1	3.0		C5
P F	5910-191-0910		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 300 uuf ±2%; MIL type CM20D301G (NOTE: C11 will be either CM20D301G or CM20D391G chosen to give max output)			2	1.0	0.2	6.0		C11 C50
			OR								
P F	5910-112-7710		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 390 uuf ±2%; MIL type CM20D391G			1	0.7	0.1	3.0		C11
P F	5910-191-0910		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 300 uuf ±2%; MIL type CM20D301G (NOTE: C10 will be either CM20D301G or CM20D361G chosen to give max output)			1	0.7	0.1	3.0		C10
			or								
P F	5910-160-5324		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 360 uuf ±2%; MIL type CM20D361F			1	0.7	0.1	3.0		C10
P F	5910-170-4376		CAPCITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 470 uuf ±2%; MIL type CM20D471G			1	0.7	0.1	3.0		C4

SOURCE CODE			FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C D										FIGURE NO.	ITEM NO.
					AN/TCC-7 AND AN/TCC-50 (Continued)								
P	F		5910-112-8171		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 1,000 uuf ±2%; MIL type CM25E102G Item Nos. C9, C24, C25, C28, C30, C31, C35, C40, C41, C42, C43			1	3.5	0.8	33.0		See desc Column
P	F		5910-183-8462		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect 500 vdcw; 1200 uuf ±2%; MIL type CM20E122G			3	1.3	0.3	9.0		C13, C15, C17
P	F		5910-101-4044		CAPACITOR, FIXED, MICA DIELECTRIC: 1 sect, 500 vdcw; 1800 uuf ±2%; MIL type CM20D182G			1	0.7	0.1	3.0		C12
P	F		5910-667-5047		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw 10,000 uuf ±20%; Sprague pt No. 191P10303S4			2	1.0	0.2	6.0		C2, C3
P	F		5910-667-5298		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 100 vdcw; 10,000 uuf ±20%; Sprague pt No. 191P10301S2			3	1.3	0.2	9.0		C1, C26, C48
P	F		5910-667-5353		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw; 10,000 uuf ±20%; Sprague pt No. 181P10303S2			4	1.4	0.3	12.0		C34, C36 C37, C38
P	F		5910-284-5075		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw; 10,000 uuf ±20%; Sprague pt No. 191P10303S2			1	0.7	0.1	3.0		C6
	F		5910-809-8654		CAPACITOR, FIXED, PAPER DIELECTRIC: 16,000 uuf ±2%; 600 vdcw; MIL type CM50B163G			1	0.7	0.1	3.0		C29
P	F		5910-284-4056		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect 200 vdcw 20,000 uuf ±5%; Sprague No. 181P20353S3			1	0.7	0.1	3.0		C33
P	F		5910-537-5337		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 600 vdcw; 56,000 uuf ±10%; Sprague pt No. 191P56396T4			1	0.7	0.1	3.0		(W5)C1
P	F		5910-667-5007		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 100 vdcw; 56,000 uuf ±10%; Sprague pt No. 191P56391S4			1	0.7	0.1	3.0		C14
P	F		5910-666-8221		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 300 vdcw; 82,000 uuf ±5%; Sprague pt No. 191P82353M6			1	0.7	0.1	3.0		C32

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SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5910-667-5336		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 100 vdcw; 100,000 uuf ±20%; Sprague pt No. 181P10401T5			3	1.3	0.3	9.0		C8,C20, C27
	P	F		5910-666-8232		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 400 vdcw; 100,000 uuf ±20%; Sprague pt No. 181P10404T5			4	1.4	0.3	12.0		C44,C45, C46,C47
	P	F		5910-644-0780		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 100 vdcw; 1.2 uf ±20%; Sprague pt No. 186P10501T5			1	0.7	0.1	3.0		C16
	P	F		5910-280-7326		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 sect, 1 uf ±20%; 300 vdcw; Sprague pt No. 81P10503T5			3	1.3	0.3	9.0		C18,C22, C39
	P	F		5910-160-6756		CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 500 vdcw; 7 to 45 uuf; MIL type CV21C450			1	0.7	0.1	3.0		C49
	P	O		5805-306-2311		CASE, STANDARDIZED, COMPONENTS, ELECTRICAL: olive drab; alum; 20-5/8 in lg x 12-3/16 in x 17-5/16 in h w/o cover assy; No. SC-C-63048; Sig dwg No. SC-D-63046		NX	1	0.7	0.1	3.0		
	P	F		5340-498-9412		CATCH, LUGGAGE: secures cover; steel, olive drab fin; 2-1/16 in lg x 1 15/32 in w x 15/32 h o/a; Sig dwg SC-D-20648			10	3.1	0.7	30.0		
	P	O		5940-186-8933		CLIP, ELECTRICAL: alligator style 1/2 in max jaw opening 2 in lg x 7/16 in w x 5/16 thk; Muller Elec No. 60-CS			2	1.0	0.2	6.0		
	P	F		5950-645-4422		COIL, TELEPHONE RETARDATION: 1 wnd, 3 ohms, res 19/32 in dia x 13/16 in h; Sig dwg No. SC-C-63419			1	0.7	0.1	3.0		
	P	F		5950-645-8849		COIL, TELEPHONE RETARDATION: 1 wnd 52 ohms 19/32 in dia x 13/16 h; Sig dwg No. SC-C-62808			5	1.9	0.4	15.0		L2,L5, L6,L7, L8
		F		5950-645-8848		COIL, TELEPHONE RETARDATION: 1 wnd 8.4 ohms 1-1/2 dia x 1-1/2 in lg; Sig dwg No. SC-C-62809			1	0.7	0.1	3.0		L3

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5950-645-4529		COIL, TELEPHONE RETARDATION: 1 wnd 2.0 ohms 3.4 in lg x 1-1/16 in dia; Sig dwg No. SC-C-62810			1	0.7	0.1	3.0		L4
	P	F		5950-645-4435		COIL, TELEPHONE RETARDATION: 1 wnd 21 ohms res; 1-9/32 in lg x 21/32 in w x 1-1/2 h; Sig dwg No. SC-C-63292			4	1.4	0.3	12.0		L9, L10, L11, L12
	P	F		5935-553-2991		CONNECTOR, PLUG, ELECTRICAL: 1 conn mating end 14 rd female cont; 3-7/16 in lg x 2-1/8 in w x 1-7/8 in h o/a; 0.690 dia cable accom, type UW1326FC23			3	1.3	0.3	9.0		P1, P2, P3
	P	F		5935-521-0083		CONNECTOR, PLUG, ELECTRICAL: 21 rd male cont; 5 amp 600 vdcw; 2-3/32 in lg x 3/4 in wd x 29/32 in h; WECo dwg No. G-205513-2			1	0.7	0.1	3.0		(W4)P2
	P	F		5935-258-9963		CONNECTOR, RECEPTACLE, ELECTRICAL: 21 rd female cont 2-3/32 in h; Cinch pt No. 47A16987			1	0.7	0.1	3.0		(W4)P3
	P	F		5935-201-3999		CONNECTOR, RECEPTACLE, ELECTRICAL: 14 rd female cont; 20 amp; 1250 vdc, 1-3/16 in lg x 1-27/32 in dia; MIL type No. CS-2026(1)(S)			1	0.7	0.1	3.0		J15
	P	F		5935-201-3996		CONNECTOR, RECEPTACLE, ELECTRICAL: 14 rd male cont; 1-3/16 in lg x 1-27/32 in dia; MIL type CS-2026-(1)(P)			1	0.7	0.1	3.0		J16
	P	O		5805-392-8065		COVER: carrying case; olive drab metal, 20-9/16 in lg x 11-3/4 in w x 2-5/16 in thk; Sig dwg No. SC-C-63048			1	0.7	0.1	3.0		
	P	O		5960-188-6584		ELECTRON TUBE: reliable miniature triode; receiving, MIL-E-1, MIL type 5670			4	30.8	11.6	776.0		V1, V3, V6, V8
	P	O		5960-262-1357		ELECTON TUBE: pentode glass envelope Spec MIL-E-1, type 5654/6AK5W Item Nos. V4, V5, V7, V10, V11, V12, V13, V14, V15, V16			11	84.7	31.9	2134.0		See desc Column

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	O		5960-237-6917		ELECTRON TUBE: pentode, glass envelope, Spec, MIL-E-1 type 5725/6AS6W			1	11.6	3.5	233.6		V2
	P	F		5915-281-0280		FILTER, BAND PASS: 8 kc freq, 135 ohms input, 40,000 ohms output; 2-19/32 in lg x 2-1/32 w x 1-7/16 in h; Sig dwg No. SC-C-63425			1	0.7	0.1	3.0		FL6
	P	F		5915-356-2158		FILTER, BAND PASS: 12 kc, 135 ohms input, 135 ohm output; 2-19/32 in lg x 2-17/32 in w x 1-7/16 in h; Sig dwg No. SC-C-62834			1	0.7	0.1	3.0		FL3
	P	F		5915-281-0250		FILTER, BAND PASS: 20 kc freq 135 ohms input, 40,000 ohms output, 3-9/64 in lg x 2-17/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63423			1	0.7	0.1	3.0		FL2
	P	F		5915-281-0252		FILTER, BAND PASS: 20 kc, 135 ohms input, 40,000 ohms output, 2-19/32 in lg x 2-17/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63422			1	0.7	0.1	3.0		FL7
	P	F		5915-501-1512		FILTER, BAND PASS: 28 kc, 135 ohms input, 135 ohms output, 3-5/32 in lg x 2-17/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63424			1	0.7	0.1	3.0		FL4
	P	F		5915-523-1878		FILTER, BAND PASS: 56 kc, 135 ohms input, 40,000 ohms output, 3-9/32 in lg x 2-19/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63420			1	0.7	0.1	3.0		FL8
	P	F		5915-281-0286		FILTER, BAND PASS: 64 kc freq, 135 ohms input, 135 ohms output, 3-1/32 in lg x 2-19/32 in w x 1-7/16 in h; Sig dwg No.SC-C-63427			1	0.7	0.1	3.0		FL1
		P	F	5915-281-0267		FILTER, BAND PASS: 68 kc, 135 ohms input and output, 3-1/32 in lg x 2-19/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63426			1	0.7	0.1	3.0		FL5
		P	F	5915-281-0266		FILTER, BAND PASS: 72 kc freq, 135 ohms input, 40,000 ohms output, 3-29/32 in lg x 2-19/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63421			1	0.7	0.1	3.0		FL9

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 and AN/TCC-50 (Continued)								
	P	F		5915-281-0264		FILTER, BAND PASS: 88 kc freq, 135 ohms input , 40,000 ohms output, 3-29/32 in lg x 2-19/32 in w x 1-7/16 in h; Sig dwg No. SC-C-63428			1	0.7	0.1	3.0		FL10
	P	F		5915-501-4155		FILTER, BAND PASS: 120 kc freq, 135 ohms input, 40,000 ohms input, 4-27/32 in lg x 1-13/16 in w x 3-1/16 in h; Sig dwg No. SC-C-63429			1	0.7	0.1	3.0		FL11
	P	F		5935-192-4729		JACK, TELEPHONE: accom 3 cond plug, shank 0.206 dia x 1.093 lg; JAN type No. JJ-033			15	4.2	0.9	45.0		J1 thru J14 (W5) J1
5		O		6240-155-8706		LAMP: 60 to 8 v, 0.15 amp, T-3-1/4 bulb, 1-3/16 in lg; 3000 hr rated life type TB-14			3	3.1	0.7	30.0		I1, I2, I3
5		O		6210-643-2059		LENS, INDICATOR LIGHT: lens 1/2 in dia, glass, red, 3/4 in lg x 13/16 d o/a; Dial light Co No. 92-111			2	1.4	0.3	10.0		
5		O		6210-299-3928		LENS, INDICATOR LIGHT: 1/2 in dia, glass, colorless, lens holder included; 3/4 in lg x 13/16 in dia o/a; Dialco pt No. 92-117			1	1.0	0.2	6.0		
5		O		6210-299-6636		LIGHT INDICATOR: supplied w/o lens, accom lens 1/2 in dia x 1-3/4in lg s 3/16 in dia o/a; Dialco pt No. 922210-1			3	1.3	0.3	9.0		X11, X12, X13
5		F		6250-586-7769		LAMPHOLDER: accoml miniature bayonet base lamp, 7/16 in lg x 1-11/16 in h o/a; Drake Mfg Co No. 167C			2	1.0	0.2	6.0		
	P	O		5805-393-1848		NETWORK, FREQUENCY STABILIZING: c/o quartz crystal unit, cap, thermistorand resistor, 3-5/32 in lg x 1-1/2 in w x 2-5/8 in h o/a; Sig dwg SC-C-63417			1	0.7	0.1	3.0		Z1
	P	F		5330-292-3895		PACKING MATERIAL: synthetic rubber and cork comp; 13/32 in nom size; Armstrong Cork type No. NC-755; (Authorized quantities will be minimum or a multiple of ft in use)	ft		5		0.5	15.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL					DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D														FIGURE NO.	ITEM NO.
										AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		6625-567-2710						PROD, TEST: replaceable probe tip, black hard rubber handle, 4-15/16 in lg x 0.325 dia; ICA part No. SP-A333B WECo No. G-220891-2			2	1.0	0.2	6.0		P1, P2
	P	F		6130-356-1702						RECTIFIER, METALLIC: input 4.5 v rms single phase; output 3 vdc, 15 ma; full wave, 1 11/16 in h; Sig dwg SC-C-62504			5	1.9	0.4	15.0		CR1 CR2 CR3 CR4 CR5
	P	F		6130-250-2235						RECTIFIER, METALLIC: single phase; full wave, 9 v inout, 65 v output 1-7/8 in lg x 7/8 in w x 1-11/32 in h; Sig dwg SC-C-62839			2	1.0	0.2	6.0		CR10 CR11
	P	F		5945-259-1231						RELAY, ARMATURE: single brk26/5v dc or 115 v ac 4 amp 8,000 dc ohms res, 3-1/16 in lg x 1-5/8 in w x 1-7/16 in d o/a; Clare pt No. RP-3717-G2			2	1.0	0.2	6.0		K1, K2
	P	F		5905-279-5719						RESISTOR, FIXED, WIRE WOUND: 3.5 ohm ±5%; 18 w; MIL type RW33G3R5			1	0.7	0.1	3.0		R173
	P	F		5905-279-3519						RESISTOR, FIXED, COMPOSITION: 22 ohms ±5%; 1/2 w; MIL type RC20GF220J			24	6.0	1.4	72.0		R139 thru R162
	P	F		5905-279-1894						RESISTOR, FIXED, COMPOSITION: 82 ohms ±5%; 1/2 w; MIL type RC20GF820J			1	0.7	0.1	3.0		R169
	P	F		5905-279-3515						RESISTOR, FIXED, COMPOSITION: 110 ohms ±5%; 1/2 w; MIL type RC20GF111J Item Nos. R76, R84, R104, R112, R121, R126, R130, R134, R170, R171			10	3.1	0.7	30.0		See desc Column
	P	F		5905-252-5436						RESISTOR, FIXED, COMPOSITION: 130 ohms ±5%; 1/2 w; MIL type RC20GF131J			2	1.0	0.2	6.0		R58, R74
	P	F		5905-299-1541						RESISTOR, FIXED, COMPOSITION: 150 ohms ±5%; 1/2 w; MIL type RC20GF151J			2	1.0	0.2	6.0		R83, R102
	P	F		5905-256-0415						RESISTOR, FIXED, COMPOSITION: 160 ohms ±5%; 1/2 w; MIL type RC20GF161J			2	1.0	0.2	6.0		R93, R96

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-556-4618		RESISTOR, FIXED, FILM: 162 ohms ±1%; 1/2 w; MIL type RN70B1620F			1	0.7	0.1	3.0		R97
	P	F		5905-542-9092		RESISTOR, FIXED, FILM: 182 ohms ±1%; 1/2 w; MIL type RN70B1820F			1	0.7	0.1	3.0		R100
	P	F		5905-279-2674		RESISTOR, FIXED, COMPOSITION: 200 ohms ±5%; 1/2 w; MIL type RC20GF201J Item No. R26, R27, R32, R33, R41, R42, R47, R48			8	2.7	0.6	24.0		See desc Column
	P	F		5905-542-9383		RESISTOR, FIXED, FILM: 200 ohms ±1%; 1/2 w; MIL type RN70B2000F			3	1.3	0.3	9.0		R20, R21, R22
	P	F		5905-279-3513		RESISTOR, FIXED, COMPOSITION: 220 ohms ±5%; 1/2 w; MIL type RC20GF221J Item No. R77, R85, R105, R113, R122, R127, R131, R135			8	2.7	0.6	24.0		See desc Column
	P	F		5905-279-2593		RESISTOR, FIXED, COMPOSITION: 240 ohms ±5%; 1/2 w; MIL type RC20GF241J			1	0.7	0.1	3.0		R94
	P	F		5905-192-3971		RESISTOR, FIXED, COMPOSITION: 330 ohms ±5%; 1/2 w; MIL type RC20GF331J			4	1.4	0.3	12.0		R11, R24, R59, R25
	P	F		5905-279-3512		RESISTOR, FIXED, COMPOSITION: 430 ohms ±5%; 1/2 w; MIL type RC20GF431J Item Nos. R80, R81, R88 R89, R108, R109, R116, R117			8	2.7	0.6	24.0		See Column
	P	F		5905-192-3973		RESISTOR, FIXED, COMPOSITION: 470 ohms ±5%; 1/2 w; MIL type RC20GF471J			2	1.0	0.2	6.0		R91, R98
	P	F		5905-279-3511		RESISTOR, FIXED, COMPOSITION: 510 ohms ±5%; 1/2 w; MIL type RC20GF511J			2	1.0	0.2	6.0		R23, R69
	P	F		5905-195-6791		RESISTOR, FIXED, COMPOSITION: 680 ohms ±5%; 1/2 w; MIL type RC20GF681J			1	0.7	0.1	3.0		R164

SOURCE CODE			FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D									FIGURE NO.	ITEM NO.
					AN/TCC-7 AND AN/TCC-50 (Continued)								
P	F		5905-195-6791		RESISTOR, FIXED, COMPOSITION: 680 ohms ±5%; 1/2 w; MIL type RC20GF681J (either RC20GF681J, RC20GF122J, RC20GF162J, RC20GF202J, or RC20GF911J used in this position as required by ckt oper condition) OR			1	0.7	0.1	3.0		R136
P	F		5905-279-3509		RESISTOR, FIXED, COMPOSITION: 910 ohms ±5%; 1/2 w; MIL type RC20GF911J OR			1	0.7	0.1	3.0		R136
P	F		5905-190-8880		RESISTOR, FIXED, COMPOSITION: 1200 ohms ±5%; 1/2 w; MIL type RC20GF122J OR			1	0.7	0.1	3.0		R136
P	F		5905-279-3507		RESISTOR, FIXED, COMPOSITION: 1600 ohms ±5%; 1/2 3; MIL type RC20GF162J OR			1	0.7	0.1	3.0		R136
P	F		5905-190-8887		RESISTOR, FIXED, COMPOSITION: 2000 ohms ±5%; 1/2 w; MIL type RC20GF202J			1	0.7	0.1	3.0		R136
P	F		5905-171-1999		RESISTOR, FIXED, COMPOSITION: 820 ohms ±5%; 1/2 w; MIL type RC20GF821J			5	1.9	0.4	15.0		R29, R34 R38, R44 R54
P	F		5905-195-6806		RESISTOR, FIXED, COMPOSITION: 1000 ohms ±5%; 1/2 w; MIL type RC20GF102J Item Nos. R15, R28, R37, R43, R51, R56, R62, R68, R82, R90, R110, R118			12	3.5	0.8	36.0		See desc Column
P	F		5905-279-3508		RESISTOR, FIXED, COMPOSITION: 1,100 ohms ±5%; 1/2 w; MIL type RC20GF112J			2	1.0	0.2	6.0		R35, R36

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-256-8352		RESISTOR, FIXED, COMPOSITION: 1,200 ohms ±5%; 2 W; MIL type RC42GF122J			1	0.7	0.1	3.0		R119
	P	F		5905-190-8880		RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±5%; 1/2 w; MIL type RC20GF122J			1	0.7	0.1	3.0		R4
	P	F		5905-556-4620		RESISTOR, FIXED, FILM: 1,300 ohms ±1%; 1/2 w; MIL type RN70B1301F			1	0.7	0.1	3.0		R101
	P	F		5905-279-1757		RESISTOR, FIXED, COMPOSITION: 1500 ohms ±5%; 1/2 w; MIL type RC20GF152J Item Nos. R30, R31, R39, R40, R45, R46			6	2.3	0.5	20.0		See desc Column
	P	F		5905-279-3507		RESISTOR, FIXED, COMPOSITION: 1600 ohms ±5%; 1/2 w; MIL type RC20GF162J			2	1.0	0.2	6.0		R49, R50
	P	F		5905-279-3507		RESISTOR, FIXED, COMPOSITION: 1600 ohms ±5%; 1/2 w; MIL type RC20GF162J (either RC20GF162J, RC20GF222J, or RC20GF272J used in this postion as required by circuit oper conditions)			1	0.7	0.1	3.0		R128
						OR								
	P	F		5905-279-1876		RESISTOR, FIXED, COMPOSITION: 2,200 ohms ±5%; 1/2 w; MIL type RC20GF222J			1	0.7	0.1	3.0		R128
						OR								
	P	F		5905-279-1880		RESISTOR, FIXED, COMPOSITION: 27000 ohms ±5%; 1/2 w; MIL type RC20GF272J			1	0.7	0.1	3.0		R128
	P	F		5905-190-8887		RESISTOR, FIXED, COMPOSITION: 2,000 ohms ±5%; 1/2 w; MIL type RC20GF202J			1	0.7	0.1	3.0		R57
	P	F		5905-190-8887		RESISTOR, FIXED, COMPOSITION: 2,000 ohm ±5%; 1/2 w; MIL type RC20GF202J (either RC20GF202J, RC20GF332J, RC20GF432J, or RC20GF272J used in this position as required by ckt oper conditions)			1	0.7	0.1	3.0		R132
						OR								

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD FIELD	4TH FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-279-1880		RESISTOR, FIXED, COMPOSITION: 2,700 ohms ±5%; 1/2 w; MIL type RC20GF272J			1	0.7	0.1	3.0		R132
	P	F		5905-279-3506		RESISTOR, FIXED, COMPOSITION: 3,300 ±5%; 1/2 w; MIL type RC20GF332J			1	0.7	0.1	3.0		R132
						OR								
	P	F		5905-257-0935		RESISTOR, FIXED, COMPOSITION: 4,300 ±5%; 1/2 w; MIL type RC20GF432J			1	0.7	0.1	3.0		R132
	P	F		5905-256-8358		RESISTOR, FIXED, COMPOSITION: 2,400 ohms ±5%; 2 w; MIL type RC42GF242J			1	0.7	0.1	3.0		R62
	P	F		5905-279-1877		RESISTOR, FIXED, COMPOSITION: 2,400 ohms ±5%; 1/2 w; MIL type RC20GF242J			1	0.7	0.1	3.0		R3
	P	F		5905-279-1877		RESISTOR, FIXED, COMPOSITION: 2,400 ohms ±5%; 1/2 w; MIL type RC42GF242J (either RC20GF242J, RC20GF302J, RC20GF392J, used in this position as required by ckt oper conditions)			1	0.7	0.1	3.0		R123
						OR								
	P	F		5905-279-1751		RESISTOR, FIXED, COMPOSITION: 3,300 ohms ±5%; 1/2 w; MIL type RC20GF332J			1	0.7	0.1	3.0		R123
						OR								
	P	F		5905-279-3505		RESISTOR, FIXED, COMPOSITION: 3,300 ohms ±5%; 1/2 w; MIL type RC20GF332J			1	0.7	0.1	3.0		R123
	P	F		5905-279-1751		RESISTOR, FIXED, COMPOSITION: 3,000 ohms ±5%; 1/2 w; MIL type RC20GF302J			4	1.4	0.3	12.0		R13, R14, R60, R61
	P	F		5905-279-1751		RESISTOR, FIXED, COMPOSITION: 3,000 ohms ±5%; 1/2 w; MIL type RC20GF302J (either RC20GF302J, RC20GF302J, or RC20GF472J, used in position as required by ckt oper conditions)			1	0.7	0.1	3.0		R78
						OR								

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-279-3505		RESISTOR, FIXED, COMPOSITION: 3,900 ohms ±5%; 1/2 w; MIL type RC20GF392J			1	0.7	0.1	3.0		R78
						OR								
	P	F		5905-279-3504		RESISTOR, FIXED, COMPOSITION: 4,700 ohms ±5%; 1/2 w; MIL type RC20GF472J			1	0.7	0.1	3.0		R78
	P	F		5905-279-2591		RESISTOR, FIXED, COMPOSITION: 5,100 ohms ±5%; 1w; MIL type RC32GF512J Item Nos. R138, R165, R166, R167			4	1.4	0.3	12.0		See desc Column
	P	F		5905-279-2019		RESISTOR, FIXED, COMPOSITION; 5,100 ohms ±5%; 1/2 w; MIL type RC20GF512J (Either RC20GF512J, RC20GF622J, or RC20GF752J used in position as required by ckt oper conditions)			1	0.7	0.1	3.0		R114
						OR								
	P	F		5905-279-2673		RESISTOR, FIXED, COMPOSITION: 62,000 ±5%; 1/2 w; MIL type RC20GF622J			1	0.7	0.1	3.0		R114
						OR								
	P	F		5905-249-4195		RESISTOR, FIXED, COMPOSITION: 7,5000 ohms ±5%; 1/2 w; MIL type RC20GF752J			1	0.7	0.1	3.0		R114
						OR								
	P	F		5905-195-6453		RESISTOR, FIXED, COMPOSITION: 5,600 ohms ±6%; 1/2 w; MIL type RC20GF562J			1	0.7	0.1	3.0		R2
	P	F		5905-279-3503		RESISTOR, FIXED, COMPOSITION: 6,800 ohms ±5%; 1/2 w; MIL type RC20GF682J (either RC20GF682J, RC20GF822J, or RC20GF103J used in this pos as required by ckt oper conditions)			1	0.7	0.1	3.0		R106
						OR								

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-299-1971		RESISTOR, FIXED, COMPOSITION: 8,200 ohms ±5%; 1/2 w; MIL type RC20GF822J			1	0.7	0.1	3.0		R106
						OR								
	P	F		5905-185-8510		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 1/2 w; MIL type RC20GF103J			1	0.7	0.1	3.0		R106
	P	F		5905-249-4195		RESISTOR, FIXED, COMPOSITION: 7,500 ohms ±5%; 1/2 w; MIL type RC20GF752J (either RC20GF752J, RC20GF912J or RC20GF113J, used in this pos, as required by ckt oper conditions)			1	0.7	0.1	3.0		R86
						OR								
	P	F		5905-249-4200		RESISTOR, FIXED, COMPOSITION: 9,100 ohms ±5%; 1/2 w; MIL type RC20GF912J			1	0.7	0.1	3.0		R86
						OR								
	P	F		5905-279-2667		RESISTOR, FIXED, COMPOSITION: 11,000 ohms ±5%; 1/2 w; MIL type RC20GF113J			1	0.7	0.1	3.0		R86
	P	F		5905-279-1718		RESISTOR, FIXED, COMPOSITION: 8,200 ohms ±5%; 1 w; MIL type RC32GF822J			1	0.7	0.1	3.0		R66
	P	F		5905-185-8510		RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±5%; 1/2 w; MIL type RC20GF103J			2	1.0	0.2	6.0		R1, R12
	P	F		5905-279-2667		RESISTOR, FIXED, COMPOSITION: 11,000 ±5%; 1/2 w; MIL type RC20GF113J			1	0.7	0.1	3.0		R55
	P	F		5905-279-2616		RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±5%; 1/2 w; MIL type RC20GF153J			1	0.7	0.1	3.0		R8
	P	F		5905-249-4221		RESISTOR, FIXED, COMPOSITION: 16,000 ohms ±5%; 2 w; MIL type RC42GF163J			1	0.7	0.1	3.0		R67

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION FIGURE NO.	ILLUSTRATION ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5905-171-2004		RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±5%; 1/2 w; MIL type RC20GF223J Item Nos, R79, R87, R107, R115, R124, R129, R133, R137, R172			9	2.7	0.6	27.0		See desc Column
	P	F		5905-279-2548		RESISTOR, FIXED, COMPOSITION: 24,000 ohms ±5%; 1 w; MIL type RC32GF243J			2	1.0	0.2	6.0		R70, R71
	P	F		5905-279-3499		RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±5%; 1/2 w; MIL type RC20GF273J			1	0.7	0.1	3.0		R19
	P	F		5905-279-3498		RESISTOR, FIXED, COMPOSITION: 43,000 ohms ±5%; 1/2 w; MIL type RC20GF433J Item Nos. R75, R103, R111, R120, R125			5	1.9	0.4	15.0		See desc Column
	P	F		5905-279-3515		RESISTOR, FIXED, COMPOSITION: 110 ohms ±5%; 1/2 w; MIL type RC32GF111J Item Nos. R76, R84, R104, R112, R121, R126, R130, R134, R170, R171			10	3.1	0.7	30.0		See desc Column
	P	F		5905-195-6761		RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±5%; 1/2 w; MIL type RC20GF104J			4	1.4	0.3	12.0		R6, R18, R65, R163
	P	F		5905-193-3981		RESISTOR, FIXED, COMPOSITION: 120,000 ohms ±5%; 1/2 w; MIL type RC20GF124J			2	1.0	0.2	6.0		R16, R73
	P	F		5905-279-2522		RESISTOR, FIXED, COMPOSITION: 150,000 ohms ±5%; 1/2 w; MIL type RC20GF154J			2	1.0	0.2	6.0		R7, R10
	P	F		5905-171-2003		RESISTOR, FIXED, COMPOSITION: 200,000 ohms ±5%; 1/2 w; MIL type RC20GF204J			3	1.3	0.3	9.0		R5, R64 R72
	P	F		5905-192-0667		RESISTOR, FIXED, COMPOSITION: 220,000 ±5%; 1/2 w; MIL type RC20GF224J			2	1.0	0.2	6.0		R52, R53
	P	F		5905-279-2518		RESISTOR, FIXED, COMPOSITION: 430,000 ohms ±5%; 1/2 w; MIL type RC20GF434J			1	0.7	0.1	3.0		R9

SOURCE CODE	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
										FIGURE NO.	ITEM NO.
A B C D			AN/TCC-7 AND AN/TCC-50 (Continued)								
P F	5905-279-2516		RESISTOR, FIXED, COMPOSITION: 510,000 ohms ±5%; 1/2 w; MIL type RC20GF514J			1	0.7	0.1	3.0		R17
P F	5905-279-1868		RESISTOR, FIXED, COMPOSITION: 1.1 meg ±5%; 1/2 w; MIL type RC20GF115J			1	0.7	0.1	3.0		R174
P F	5905-591-8938		RESISTOR, VARIABLE: 1 sect, 1.200 ohms ±10%; 2 w; Sig dwg pt No. SC-D-62818-7			3	1.3	0.3	9.0		R92, R95 R99
P F	5340-355-9839		RETAINER, CATCH: used as latch on case, steel, 1-3/8 in lg x 3/4 in w x 11/32 in h o/a; Sig dwg SC-B-62577			10	1.4	0.3	10.0		
P O	5305-206-5544		SCREW, EXTERNALLY RELIEVED BODY: Fil Hd slotted, 10-32 thd 5/8 in lg; Sig dwg No. SC-B-62467			4	1.4	0.3	12.0		
P O	5305-592-6550		SCREW, EXTERNALLY RELIEVED BODY: RD hd slot drive 10-32 thd, 15/16 in lg; Sig dwg No. SC-B-62664-7			4	1.4	0.3	12.0		
P F	5960-224-4871		SEMI-CONDUCTOR DEVICE, DIODE: germanium xtal, 1/2 in lg x 0.250 dia; Spec MIL-E-1C, type No. 1N70			4	1.4	0.3	12.0		CR6 thru CR9
P O	5960-262-0015		SHIELD, ELECTRON TUBE: accom Retma tube envelope, style T-5/2(6-1), 1-3/8 in lg x 0.958 dia o/a; type No. TS102U01			17	4.6	1.0	50.0		
P O	5960-262-0345		SHIELD, ELECTRON TUBE: accom Retma tube envelope, style T6-1/2 (6-1), 1-1/2 in lg x 1.062 dia o/a; type TS103U01			6	2.3	0.5	20.0		
P O	8465-275-5755		SLING CARRYING, BAG AND CASE: cotton webbing; 19-3/4 in lg x 1-1/8 w; olive drab, Sig dwg SC-C-63052			2	1.0	0.2	6.0		
P F	5935-160-1365		SOCKET, ELECTRON TUBE: 1-3/16 in h x 0.035 w x 1-13/32 in lg; type TS103P01 (total qty of 6; 4 in use;			6	2.3	0.5	18.0		XV1, XV3 XV6, XV8

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D										FIGURE NO.	ITEM NO.
						AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5935-260-0516		SOCKET, ELECTRON TUBE: 7 cont miniature 1-1/8 in lg x 0.900 wd x 25/32 in h; JAN type TS102P01 (5 reg for mtg spare tubes) (Item nos. XV2,XV4,XV5,XV7,XV9 thru XV16)			17	3.5	0.8	34.0		See desc column
	P	F		5805-392-6432		SPRING ASSEMBLY: used to secure frame in case; 7 in lg x 3/4 in w x 9/16 in thk o/a; Sig dwg No. SC-B-62552			4	0.8	0.1	4.0		
	P	F		5930-636-1004		SWITCH, LEVER, PILE UP: 2 lvr pos locking, 1 amp, 500 v dc max; 1-7/8 in lg x 1-1/16 in w x 1-3/32 in h o/a; Sig dwg No. SC-C-63522			1	0.7	0.1	3.0		S1
	P	F		5930-636-1476		SWITCH, LEVER, PILE UP: 2 lvr pos locking, 1 amp 500 v dc max; 1-7/8 in lg x 1-1/16 in w x 1-3/32 in h o/a; Sig dwg No. SC-C-63430			1	0.7	0.1	3.0		S1
	P	F		5930-752-3036		SWITCH, LEVER PILE UP: 2 lever position 4 C contact arrangements; 1-7/8 in lg x 1-9/32 in w x 1-3/32 in h o/a; Sig dwg SC-C-63431			1	0.7	0.1	3.0		S4
	P	F		5940-553-3394		TERMINAL STUD: 19/32 in lg 1/4 across flats, 15.9 kv rms: brkdn, 4-40 thd; Whitso Inc No. 2L17A4 (Item nos. E2,E25,E26,E27,E29,E52, E56,E61,E62)			8	2.7	0.6	24.0		See desc column
	P	F		5940-542-8158		TERMINAL STUD: 1-3/32 in lg 1/4 across flats, 4.6 kv rms; brkd 4-40 thd; Kellogg EPS-263 (Item nos E1,E3 thru E24,E28,E30 thru E32,E34, E35,E39 thru E50,E53 thru E60)			49	8.0	1.9	98.0		See desc column
	P	F		5940-642-3963		TERMINAL STUD: terminal feed thru insulated 7/8 in lg 11/32 in w x 5/16 in h o/a; 4.5 kv rms brkdn; 1/4-24 thd; Winchester Elec Co FT-5			4	1.2	0.2	8.0		E33,E36, E37,E38
	P	F		5940-204-6984		TERMINAL BOARD: 2 phenolic term boards, 56 cerm inc; 2-23/32 in lg x 1-7/8 in w x 1/8 in thk; Sig dwg No. SC-C-63395			1	0.7	0.1	3.0		

SOURCE CODE				FEDERAL STOCK NUMBER	DESIGNATION BY MODEL					DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	3RD-FIELD	4TH-FIELD	5TH DEPOT	ILLUSTRATION	
A	B	C	D														FIGURE NO.	ITEM NO.
										AN/TCC-7 AND AN/TCC-50 (Continued)								
	P	F		5950-648-2622						TRANSFORMER, AUDIO FREQUENCY: 25,000 ohms pri 35 ohms secd 1-5/16 in h x 2-7/32 in lg x 9/16 in w; Sig dwg SC-C-63434			4	1.4	0.3	12.0		T15,T17, T19,T20
	P	F		5950-645-6371						TRANSFORMER, AUDIO FREQUENCY: input type, pri, 300 ohms secd 20,000 ohms 500 v test 27/32 in lg x 9/16 w x 19/32 in h; Sig dwg SC-C-62806			2	1.0	0.2	6.0		T2,T5
	P	F		5950-648-2538						TRANSFORMER, AUDIO FREQUENCY: 33.75 ohms pri 135 ohms secd, 1-9/32 in h x 27/32 in lg x 9/16 in w; Sig dwg SC-D-62807			1	0.7	0.1	3.0		T18
	P	F		5950-645-5205						TRANSFORMER, AUDIO FREQUENCY: 0.95 ohms pri secd, 1030 ohms o/a dim 1-11/16 in lg x 57/64 in w x 9/16 in d; Sig dwg SC-C-63435			4	1.4	0.3	12.0		T21 thru T24
	P	F		5950-681-2366						TRANSFORMER, AUDIO FREQUENCY: 12,000 ohms pri 300 ohms secd, 1/12 in h x 1-3/16 in lg x 1 in w; Sig dwg SC-C-62811			3	1.4	0.3	9.0		T7,T8, T9
	P	F		5950-679-2058						TRANSFORMER, AUDIO FREQUENCY: 120,000 ohms secd; 1-1/2 h x 1-3/16 in lg x 1-1/32 in w; Sig dwg SC-C-62812			3	1.4	0.3	9.0		T4 thru T6
	P	F		5950-569-0166						TRANSFORMER, AUDIO FREQUENCY: pri 120,000 ohms 2 secd, 300 ohms ea; 1-3/16 in lg x 1-1/32 in 2 x 1-1/2 in h; Sig dwg SC-C-63433			5	1.9	0.4	15.0		T1,T3, T12,T13, T14
	P	F		5950-648-2281						TRANSFORMER, AUDIO FREQUENCY: line type, 365 ohms pri 600 ohms secd; 2 in h x 1-3/8 in lg x 29/32 in w; Sig dwg SC-C-67309			1	0.7	0.1	3.0		T10
	P	F		5950-648-2269						TRANSFORMER, AUDIO FREQUENCY: line type 135 ohms pri 415 ohms secd; 2 in h x 1-3/8 in lg x 29/32 in w; Sig dwg SC-C-63432			1	0.7	0.1	3.0		T11

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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USAMICOM (4)
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USASCC (4)
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Armies (2) except
Seventh (5)
EUSA (5)
Corps (2)
USAC (3)
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507th USASA Gp (5)
508th USASA Gp (5)
318th USASA Bn (5)
319th USASA Bn (5)
420th USASA Det (5)
Svc Colleges (2)
Br Svc Sch (2) except
USASESCS (60)
USASCS (5)
USAARMS (5)
Sig Fld Maint Shops (2)
AMS (1)
USAERDAA (2)
USAERDAW (13)
GENDEP (2)
Sig Sec GENDEP (5)
Sig Dep (12)
A Dep (2) except
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TOAD (14)
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SHAD (3)
NAAD (5)
SVAD (5)
CHAD (3)
ATAD (10)
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USATC AD (2)
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WRAMC (1)
Instl (2) except
Ft Monmouth (70)
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Ft Huachuca (10)
Ft Carson (21)
Ft Knox (12)
Ft Devens (5)
WSMR (5)
USASETAF (5)
Units organized under following TOE's (2 copies each):
11-35
11-36
11-39
11-56
11-57
11-97
11-98
11-105
11-106
11-117
11-127
11-155
11-157
11-357
11-500 (AA-AC)
11-587
11-592
11-597

NG: State AG (3); units—same as Active Army except allowance is one copy.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

TM 11-2139-35/T. O. 31W1-2TCC7-64
C 6

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *15 May 1969*

DS, GS, and Depot Maintenance Manual
Including Repair Parts and Special Tool Lists
TERMINALS, TELEPHONE AN / TCC-50

TM 11-2139-35, 14 November 1958, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 1 of C2") indicates that pertinent material was published in that change.

Page 2, paragraph 1. Make the following changes:

Subparagraph *b* (page 1 of C 2). Line 3, delete "TM 11-2139-20P; line 7, delete "and TM 11-5805-317-35P"; line 8, after AN/TCC-7", add: and AN/TCC-50.

Subparagraph *c*. Delete and substitute:

c. The maintenance allocation chart is published in TM 11-2139-20; the basic issue items list is published in TM 11-2139-10; the organizational repair parts list is published in TM 11-5805-317-20P, and the DS, GS, and depot repair parts list is published as appendix II in this manual.

Subparagraph *d* (page 1 of C 5). Delete and substitute:

d. Reporting of Equipment Publication Improvements. 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, New Jersey 07703.

Page 323, appendix I (page 61 of C2, page 47 of C4, page 1 of C5). Delete and substitute:

APPENDIX I
REFERENCES

Following is a list of references applicable and available to the field and depot repairman of Telephone Terminal AN/TCC-7 and AN/TCC-50.

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	Modification Work Orders.
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
TA 11-17	Signal Field Maintenance Shops.
TA 11-100 (11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TA 11-101 (11-158)	Allowances of Signal Corps Expendable Supplies for Signal Depot Company.
TB SIG 328	Telephone Carrier System Test Facilities Kit MK-155/TCC.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TOE 11-158E	Signal Depot Company.
TM 9-213	Painting Instructions for Field Use.

TM 11-381	Cable assembly CX-1065/G, Telephone Cable Assemblies CX-1606/G, and CX-1512/U, Telephone Loading Coil Assembly CU-260/G, Electrical Connector Plugs U-176/G and U-226/G, and Maintenance Kit, Cable Splicing MK-640/G.
TM 11-1214	Instruction Book for Oscilloscope OS-8A/U.
TM 11-1214A	Oscilloscope OS-8C/U.
TM 11-2044	Attenuators, TS-402/U, and TS-402A/U.
TM 11-2139-10	Operator's Manual: Terminals, Telephone AN/TCC-7 and AN/TCC-50.
TM 11-2139-20	Organizational Maintenance Manual: Terminals, Telephone AN/TCC-7 and AN/TCC-50.
TM 11-2140-10	Operator's Manual: Telephone Repeater AN/TCC-8 and Telephone Repeater AN/TCC-21.
TM 11-2140-20	Organizational Maintenance: Telephone Repeater AN/TCC-8 and Telephone Repeater AN/TCC-21.
TM 11-2140-35	Field and Depot Maintenance: Telephone Repeater AN/TCC-8 and Telephone Repeater AN/TCC-21.
TM 11-2142	Telephone Terminal AN/TCC-3 and Telephone Terminal AN/TCC-23.
TM 11-2143	Telephone Test Sets TS-712/TCC-11 and TS-712A/TCC-11.
TM 11-2150	Telephone Carrier Systems Using Terminals, Telephone AN/TCC-7 and AN/TCC-50, Repeater, Telephone AN/TCC-8 (AN/TCC-21), Repeater, Telephone AN/TCC-11 and Telephone Test Set TS-712/TCC-11.
TM 11-2151	Organizational, DS, GS, and Depot Maintenance Manual: Audio Level Meters ME-71A/FCC, ME-71B/FCC, and ME-71C/FCC.
TM 11-2604	Tests Sets I-199 and I-199A.
TM 11-5057	Frequency Meter AN/USM-26.
TM 11-5805-224-20P	Organizational Maintenance Repair Parts and Special Tools List: Modem, Telephone TA-219/U.
TM 11-5805-224-35P	DS, GS, and Depot Maintenance Repair Parts and Special Tools List: Modem Telephone TA-219/U.
TM 11-5805-240-12	Operator's and Organizational Maintenance Manual: Repeater, Telephone AN/TCC-11.
TM 11-5805-240-35	Field and Depot Maintenance Manual: Repeater, Telephone AN/TCC-11.
TM 11-5805-245-20P	Organizational Maintenance Repair Parts and Special Tools List: Power Supply PP-827/U.
TM 11-5805-245-35P	Field and Depot Maintenance Repair Parts and Special Tools List: Power Supply PP-827/U.
TM 11-5805-247-12	Organizational Maintenance Manual (Including Repair Parts and Special Tools List): Converter, Telegraph-Telephone Signal TA-182/U.
TM 11-5805-247-35	DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tools List: Converter, Telegraph-Telephone Signal TA-182/U.
TM 11-5805-248-20P	Organizational Maintenance Repair Parts and Special Tools List: Power Supplies PP-826/U and PP-826A/U.
TM 11-5805-248-35P	DS, GS, and Depot Maintenance Repair Parts and Special Tools List: Power Supplies PP-826/U and PP-862A/U.
TM 11-5805-317-20P	Organizational Maintenance Repair Parts and Special Tools List: Telephone, Terminal AN/TCC-7 and Telephone, Terminal AN/TCC-50.
TM 11-5820-287-12	Operator and Organizational Maintenance Manual: Radio Sets AN/TRC-24, AN//GRC-75, AN/GRC-78, AN/GRC-81, and AN/GRC-81A; Radio Terminal Sets AN/TRC-35, AN/GRC-76, AN/GRC-79, and AN/GRC-82; Radio Relay Set AN/TRC-36, Radio Repeater Sets AN/GRC-77, AN/GRC-80, and AN/GRC-83; Radio Set Groups AN/TRA-25, AN/TRA-25A, and OA-3668A/TRC-24.
TM 11-5820-287-34	Field Maintenance Manual: Radio Sets AN/TRC-24, AN/GRC-75, AN/GRC-

78, AN/GRC-81, and AN/GRC-81A; Radio Terminal Sets AN/TRC-35, AN/GRC-76, AN/GRC-79, and AN/GRC-82; Radio Relay Set AN/TRC-36; Radio Repeater Sets AN/GRC-77, AN/GRC-80, and AN/GRC-83; and Radio Set Groups AN/TRA-25, AN/TRA-25A and OA-3668A/TRC-24.

TM 11.5820-287-50 Depot Maintenance Manual: Radio Sets AN/TRC-24, AN/GRC-75, AN/GRC-78, AN/GRC-81, and AN/GRC-81A; Radio Terminal Sets AN/TRC-35, AN/GRC-76, AN/GRC-79, and AN/GRC-82; Radio Relay Set AN/TRC-36; Radio Repeater Sets AN/GRC-77, AN/GRC-80 and AN/GRC-83; and Radio Set Groups AN/TRA-25, AN/TRA-25A, and OA-3668A/TRC-24.

TM 11-5965-216-15P Operator's, Organizational, Field and Depot Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart: Handset TS-9-F.

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 11-6625-218-12 Organizational Maintenance Manual: Frequency Meter AN/TSM-16.

TM 11-6625-238-12P Operator and Organizational Maintenance Repair Parts and Special Tools List: Telephone Carrier System Test Facilities Kit MK-155/TCC.

TM 11-6625-239-12 Operator's and Organizational Maintenance Manual: Electronic Multimeters TS-505A/U, TS-505B/U; Multimeters TS-505C/U and TS-505D/U.

TM 11-6625-251-15 Organizational, DS, GS, and Depot Maintenance Manual: Test Set TS-140/PCM, Signal Generator SG-15/PCM, and SG-15A/PCM and Decibel Meter ME-22/PCM and ME-22A/PCM.

TM 11-6625-252-12P Operator and Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart: Oscilloscopes OS-8B/U and OS-8C/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 11-6625-316-12 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 11-6625-356-12 Operator and Organizational Manual: Transmission Measuring Sets TS-559A/FT, TS-559B/FT, TS-559C/FT and TS-559D/FT.

TM 11-6625-358-15 Operator, Organizational, DS, GS, and Depot Maintenance Manual: Signal Generators SG-71/FCC, SG-71A/FCC, SG-71B/FCC, and SG-71C/FCC.

TM 11-6625-366-15 Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.

TM 11-6625-444-15 Operator, Organizational, Field and Depot Maintenance Manual: Digital Voltmeters AN/GSM-64 and V-34A.

TM 38-750 Army Equipment Record Procedures.

Changes No. 5, appendix II. Make the following changes:

Page 2, section I, paragraph 1*b*(1)*(b).* After "categories", add the following sentence:

"A" applies to assemblies that are not procured or stocked as such but are made up of two or more units, each of which carries an individual stock number and description and is procured and stocked and can be assembled by units at indicated maintenance categories.

Change Federal stock numbers for the following items:

Page	*Item*	*Federal stock number delete*	*Federal stock number substitute*
8	FILTER, LOW PASS	5915-501-4049	5915-281-0297
12	RESISTOR, FIXED, FILM	5905-552-7208	5905-578-4861

Page	Item	Federal stock number delete	Federal stock number substitute
	RESISTOR, FIXED, FILM	5905-552-3547	5905-552-2442
	RESISTOR, VARIABLE	5905-284-3430	5905-195-9777
14	TERMINAL STUD	5940-642-3963	5940-280-1728
15	CAPACITOR, FIXED, PAPER, DIELECTRIC	5910-306-5456	5910-303-5456
	CAPACITOR, FIXED, PAPER DIELECTRIC	6910-280-7326	5910-280-7326
18	CAPACITOR, FIXED, PAPER DIELECTRIC	5910-306-5456	5910-303-5456
21	TERMINAL STUD	5940-642-3963	5940-280-1728
	TRANSFORMER, AUDIO FREQUENCY	5960-645-6324	5950-645-6324
	CAPACITOR, FIXED, PAPER DIELECTRIC	5910-306-5456	5910-303-5456
22	JACK, TIP	5935-259-0015	5935-817-3027
24	RESISTOR, FIXED, COMPOSITION	5905-354-1777	5905-254-1777
	RESISTOR, FIXED, FILM	5905-552-3547	5905-552-2442
25	RESISTOR, FIXED, FILM	5960-646-5635	5905-646-5635
26	CAPACITOR, FIXED, MICA DIELECTRIC	5910-101-5639	5910-834-5883
30	RESISTOR, FIXED, FILM	5905-646-5768	5905-850-4693
31	RESISTOR, FIXED, COMPOSITION	5905-291-2903	5905-279-2662
33	SOCKET, ELECTRON TUBE	5035-260-0516	5935-260-0516
	TERMINAL STUD	5940-642-3963	5940-280-1728
37	KNOB	5355-558-2395	5355-284-5176
47	CAPACITOR, FIXED, MICA DIELECTRIC	5905-101-4013	5910-101-4013
49	SEMI-CONDUCTOR DEVICE, DIODE	5960-557-5032	5961-557-5032
52	CAPACITOR, FIXED, PAPER DIELECTRIC	5910-284-5071	5910-644-3492
54	CONNECTOR, ECEPTACLE, ELECTRICAL	5935-257-7060	5935-549-8225
	FILTER, BAND PASS	5915-280-0287	5915-281-0287
55	KNOB	5355-558-2395	5355-284-5176
56	PLUG, TELEPHONE	5935-187-4561	5935-192-4753
57	RESISTOR, FIXED, FILM	5905-542-9531	5905-552-5341
59	RESISTOR, FIXED, FILM	5905-542-9524	5905-279-6983
63	TERMINAL, STUD	5940-642-3963	5940-280-1728
65	CAPACITOR, FIXED, MICA DIELECTRIC	5910-101-5614	5910-179-2148
66	CAPACITOR, FIXED, PAPER DIELECTRIC	5910-667-5047	5910-667-5353
	CAPACITOR, FIXED, PAPER DIELECTRIC	5910-809-8654	5910-806-9634
78	RESISTOR, FIXED, COMPOSITION	5905-193-3981	5905-192-3981
79	RESISTOR, VARIABLE	5905-591-8938	5905-226-9457
	SEMI-CONDUCTOR DEVICE, DIODE	5960-224-4871	5961-557-5032
80	SPRING ASSEMBLY	5805-392-6432	5805-392-6423
	TERMINAL STUD	5940-642-3963	5940-280-1728

Reference Federal stock number. Make the following changes:

Page 6, Federal stock number "5805-306-2310". Description column, change "WECo dwg SO-D-62844" to: Sig dwg SC-C-62844.

Page 7, Federal stock number "5805-392-5692". Description column, change "Sig dwg SO-C-62846" to: Sig dwg SC-C-62846.

Page 13, Federal stock number "5305-206-5544". Description column, change "Sig dwg No. SO-B-62467" to: Sig dwg No. SC-C-62467.

Page 26, Group II. Add the following item in the columns indicated below:

SOURCE CODE column, subcolumn B: P; subcolumn C: F.

FEDERAL STOCK NUMBER column: 5940-254-2244.

DESCRIPTION column: CAP, RUBBER: PO-U-106/U Binding Post; ECOM dwg SC-C-76202-1.

QTY IN UNIT column: 18.

3RD-FIELD column: 3.5.

4TH-FIELD column: 0.8.

5TH-DEPOT column: 36.0.

Page 27, Federal stock number "5805-306-2309". Description column, delete "WECo part/spec No. CS-55101".

Page 28. Make the following changes:

Federal stock number "5950-645-4431". Description column, delete "WECo pt spec No. GA-50289".

Federal stock number "5915-281-0268". Description column, delete "WECo Spec No. GA-50210".

Federal stock number "5915-281-0265". Description column, delete "WECo pt/spec No. GA-50211.

Page 34. Make the following changes:

Federal stock number "5950-648-2281". Description column, delete "WECo pt/Spec No. GS51118".

Federal stock number "5950-646-4398". Description column, delete "WECo Spec No. GA-51120".

Federal stock number "5950-645-6403". Description column, delete "WECo Spec No. GA-61122".

Page 35. Make the following changes: Federal stock number "5805-503-0864". Source code column, subcolumn C, change "P" to: A. 3rd-Field column, delete "0.7". 4th-Field column, delete "0.1". 5th-Depot column, delete "3.0". Federal stock number "6625-669-0271". Source code column, subcolumn C, change "P" to: A. 3rd-Field column, delete "0.7". 4th-Field column, delete "0.1". 5th-Depot column, delete "3.0".

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, (qty rqr block no. 279) Direct and General Support Maintenance requirements for the AN/MRC-102 Radio Set.

Changes in force: C 2, C 4, C 5, C 6, and C 7

TM 11-2139-35/TO 31W1-2TCC7-64
C 7

CHANGE No. 7

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON, D.C., *24 September 1970*

DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tools Lists

TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

TM 11–2139–35/TO 31W1–2TCC7–64, 14 November 1958, is changed as follows:

NOTE

The parenthetical reference to a previous change (example: page 1 of C 2) indicates that pertinent material was published in that change.

Page 196, figure 91. Make the following changes:

Under the "200 VOLT POWER SUPPLY" block add: PP–827/U OR PP–3135/U.

Near "CARRIER SUPPLY TEST CABLE ASSEMBLY" change: 10V DC to: 12V DC, 200V DC, to: 200 ±2V DC, and 6.3V AC to: 6.3 ±0.5V AC.

In the upper right section show the ground terminal of VOLTMETER, METER ME–30A/U connected to terminal R of TEST PLUG ASSEMBLY.

Page 302, figure 133. Make the following changes:

Under the "200 VOLT POWER SUPPLY" block add: PP–827/U OR PP–3135/U.

Near "CARRIER SUPPLY TEST CABLE ASSEMBLY" change: 10V DC to: 12V DC, 200V DC to: 200 ±2V DC, and 6.3V AC to: 6.3 ±0.5V AC.

In the upper right section show the ground terminal of VOLTMETER, METER ME–30A/U connected to terminal R of TEST PLUG ASSEMBLY.

Page 275, paragraph 167.10*c* (page 17 of C 2), item 5. Make the following changes:

"Test equipment control settings" column. Delete "Keys 40, 3, and 2 aligned with white line parallel to short dimension of panel (45 db)." and substitute: "Adjust for 52-dB loss".

"Test procedures" column. Make the following changes: Delete subparagraphs *c*, *d*, *f*, *g*, *h*, *i*, *j*, and *k* and substitute:

c. Adjust the TS–402/U for 50-dB loss.

d. Adjust the TS–402/U for 47-dB loss.

f. Adjust the TS–402/U for 45-dB loss.

g. Hold the ATTENUATOR 20-dB pushbutton on the TEST PANEL operated, and adjust the TS–402/U for 42-dB loss. Note TEST PANEL meter indication. Release the pushbutton.

h. Hold the ATTENUATOR 20-dB pushbutton on TEST PANEL operated, and adjust the TS–402/U for 32-dB loss. Note TEST PANEL meter indication. Release the pushbutton.

i. Adjust the TS–402/U for 55-dB loss.

j. Adjust the TS–402/U for 57-dB loss.

k. Disconnect measuring cord plug from test jack assembly (D, fig. 128.4).

"Performance standards" column. Delete subparagraphs *k* and *l* and substitute:

k. None.

Page 276, Chapter 4, heading (page 3 of C 4). Change to:

DEPOT OVERHAUL STANDARDS.

Page 6 of C 4, paragraph 173. Make the following changes:

Subparagraph *c*(4), line 4. After "assembly" add: The difference between this output level indication and –13dbm is the overall loss.

Page 7 of C 4, subparagraph *d*(9), line 8. Delete "2.4 db" and substitute: −.4 dbm ±2.4.

Subparagraph *e*(4), line 4. Delete "between" and substitute: in series with two parallel-connected, 1-μf capacitors across.

Page 8 of C 4, paragraph 174*b*(1), line 5. Change "−48.4 and −49.6 db" to: −42 and −44db.

Page 10 of C 4, paragraph 174. Make the following changes:

Subparagraph *e*(16), last line. After "assembly" add: Adjust the TS–402/U for 5-dB loss.

Subparagraph *e*(21), chart, "ME–30(*)/U indication (db)" column. Delete "4.9 to 8.5" and substitute: ±1.8 dbm of the level recorded in Test No. 1 above.

Page 11 of C 4, subparagraph *e*(25), chart, "ME–30(*)/U indication (db)" column. Delete "2.4 to 6" and substitute: ±1.8 dbm of the level recorded in Test No. 1 above.

Page 11 of C 4, paragraph 175. Make the following changes: Subparagraph *a*(10), line 5. Change "8" to: −8.

Page 14 of C 4, subparagraph *e*(10), line 4. Delete "3.5 volts dc ±0.5" and substitute: 3.5 volts dc ±1.

Page 15 of C 4, subparagraph *e*(24), lines 3 and 4. Delete "terminals T1 and R of the test plug assembly" and substitute: the SPL SERV 12- and 60-kc OUT binding posts.

Page 18 of C 4, figure 132.1, "POWER TEST CABLE ASSEMBLY" terminal board. Change the terminal designations as follows: "S" to "H" and "H" to "S"

Page 24 of C 4, paragraph 177. Make the following changes:

Subparagraph *c*(5), chart, "ME–30(*)/U Indications (db)," Test No. 6, line 1. Change "1" to: 3.

to: 2.7 db.

Subparagraph *c*(7), line 7. Change "8.5 db" to: 13 db.

Subparagraph *c*(8), last line. Add the following after "above": Disregard the CALL lamp and buzzer indications.

Subparagraph *c*(9), line 7. Change "1.5 db" to: 3.5 db.

Page 25 of C 4, subparagraph *d*(1), line 2. After "source" add: Connect a 301-ohm resistor across terminals C and P, and D and R of the power test cable assembly.

Subparagraph *d*(3), line 3. Change "−13.5 db" to: −17.5 db.

Subparagraph *d*(5), line 4. After "PANEL" add: Connect a 600-ohm resistor across the 2 W EXT binding posts.

Subparagraph *d*(7), last line, Delete "4 db ±2" and substitute: 8 dB ±2 less than the indication in *c*(5) above, Test No. 1.

Subparagraph *f*(1), last line. After "circuit" add: with the 10-vdc supply disconnected, strap terminals A and T on the power test cable assembly.

Page 26 of C 4, subparagraph *f*(7), line 5. Delete "0.5 db ±1 greater than" and substitute: within 1.5 dB of.

Subparagraph *f*(10), last line. Change "−40.5" to: −42.5.

Subparagraph *f*(14), last line. After "counterclockwise" add: and the TS–402(*)/U to provide 0-dB loss. Operate the cable reels to next AN/TCC–7 or 8 on the ORDER WIRE PANEL to the 0–11 position.

Subparagraph *f*(15), lines 6 and 7. Change "−37 db ±25" to: −57 dB ±5.

Page 27 of C 4, subparagraph *f*(23), last line. Change "−4.5 db ±2" to: −4.0 to −9.5 dB.

Subparagraph *f*(24), line 7. Delete "−11.5 db ±2" and substitute: 7 dB ±2 below the output obtained in (23) above.

Paragraph 178. Make the following changes: Subparagraph *b*. Delete subparagraphs (1) and (2) in their entirety.

Page 28 of C 4. Delete subparagraph *b*(3). Change subparagraph designation from "(4)" to "(1)" and in line 2, change "continuing" to: starting. Change subparagraph designations from "(5)" and "(6)" to: (2) and (3).

Subparagraph *c*(2), last line. Change "0.77 and 0.585 volt" to: .58 and .94 volt.

Subparagraph *e*(1)(*b*), last line. Delete "volts ac" and substitute: ±0.3 vac.

Page 29 of C 4, subparagraph *f*(11), last line. Delete "more" and substitute: less.

Subparagraph *g*(2), last line. Delete "volts ac" and substitute: ±0.3 vac.

Page 33 of C 4, paragraph 181.

Subparagraph *a*(8), last line. Change "90" to: 100.

Page 34 of C 4, subparagraph *b*(2), line 1. Delete "The AN/GSM–64 will indicate 600 volts dc."

Subparagraph *b*(3), line 4. After "milliamperes" add: Adjust the variable load resistor to obtain an indication of 600 volts on the AN/GSM–64.

Subparagraph *b*(4), last line. Change "268" to: 265.

Page 36 of C 4, subparagraph *g*(2), line 9. Change "510" to: 500.

Subparagraph *h*(1), line 2. After "control" add: from the extreme clockwise position to.

Lines 7 and 8. Delete "between 90" and substitute: 90 milliamperes or less counterclockwise.

Lines 8 and 9. Delete "indicated on the" and substitute: or greater in the extreme clockwise position, as indicated on the power supply.

Subparagraph *i*(9). Delete subparagraph (9) in its entirety.

Page 37 of C 4. Delete subparagraphs *i*(10) and (11) in their entirety.

Subparagraph *j*(2), line 1. Delete "600V ADJ control" and substitute: variable load resistor.

Subparagraph *j*(6), line 1. Change "Rapidly" to: Slowly.

Paragraph 182*a*(7), last line. Change "23" to: 25.

Page 40 of C 4, paragraph 183, line 4. After "below." add: Section II (para. 173 through 182) forms a part of this standard.

Page 42 of C 4, paragraph 188*b*(2), lines 6 and 7. Delete "approximately 0 db" and substitute: 0 dB or greater.

TM 11-2139-35/T. O. 31W1-2TCC7-64

By Order of the Secretaries of the Army and the Air Force:

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

Official:

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The Adjutant General.

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  SAAD (30)
  LBAD (14)
  TOAD (14)
  ATAD (10)
  LEAD (7)
  NAAD (5)
  SVAD (5)
  CHAD (3)
  SHAD (3)
Gen Dep (2)
Sig Sec. Gen Dep (5)
Sig Dep (12)
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USACRREL (2)
WRAMC (1)
Sig FLDMS (2)
Units org under fol TOE (2 ea.):
  11–15
  11–18
  11–19
  11–35
  11–39
  11–85
  11–97
  11–98
  11–117
  11–247
  11–302
  11–500(AA–AC). (RC)
  29–134

ARNG: State AG (3); units—same as active Army except allowance is one (1) copy each.
USAR: None.
For explanation of abbreviations used, see AR 310–50.

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#498

TM 11-2139-35/TO 31W1-2TCC7-64
C8

CHANGE
No. 8

DEPARTMENTS OF THE
ARMY AND THE AIR FORCE
WASHINGTON DC, *31 March 1983*

DS, GS and Depot Maintenance Manual INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

TM 11-2139-35/TO 31W1-2TCC7-64, 14 November 1958, is changed as follows:

Page 2, paragraph 1. Paragraph 1*d, e* and *f* are superseded as follows:

d. Consolidated Index of Army Publications and Blank Forms. Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

e. Maintenance Forms, Records and Reports.

(1) *Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (Army). Air Force personnel will use AFR 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting.

(2) *Reporting of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

(3) *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C/DLAR 4500.15.

f. Reporting Equipment Improvement Recommendations (EIR).

(1) *Army.* If your Telephone Terminal AN/TCC-7 or AN/TCC-50 needs improvement, let us know. Send us an EIR. You, the user; are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, NJ 07703. We'll send you a reply.

(2) *Air Force.* Air Force personnel are encouraged to submit EIR's in accordance with AFR 900-4.

Page 138, paragraph 103. Make the following changes:

b (1). Change "3.25 ±.5", to ".325 ±.05".

b (3). Delete.

Page 154, paragraph 113. Make the following changes:

a (1). Change "..test cable assembly, 135 – ohm resistor, and...", to "...test cable assembly, closed loop jumpers and...".

b. Change paragraph heading to: "*b.* Carrier Transmitting and Receiving Circuit Loop Test."

b (2). Replace this paragraph with: "(2). Connect the voltmeter across terminals C and P of the carrier test cable assembly (B, fig. 75). The voltmeter should indicate 0 db-1 db."

c (1), (2), and (3). Replace with:

c. High Pass Transmitting and Receiving Circuit Response Test. The output at carrier test cable assembly, terminals C and P (B, fig. 75) shall be 0 db-1 db at the following frequencies: 37 KHz, 12 KHz and 80 KHz. Reference input level of 0 db at terminals F and S is set at 30 KHz.

Paragraph 114. Make the following changes:

a.(1). Change "...test cable assembly, 135-ohm resistor and...", to "...test cable assembly, closed loop jumpers and...".

b. Change heading to: "*b. Order Wire Transmitting and Receiving Circuit Loop Test.*"

b (2). Replace with: "(2). Connect the voltmeter to terminals S and F of the carrier test cable assembly (C, fig. 75). The voltmeter should indicate between −3.5 db minimum and −5.5 db maximum.

c (1) and (2). Replace with: "*c. Low Pass Order Wire Transmitting and Receiving Response Test.*" The output at carrier test cable assembly, terminals S and F (C, fig 75) shall be between −3.5 db minimum and −5.5 db maximum at the following frequencies: 1 KHz, 4 KHz and 300 KHz. Reference input level of 0 db at terminals L and M is set at 3 KHz.

Page 276, paragraph 167.18. Make the following changes:

Step 9, Test Procedures column, step *i:* Change to, "Operate 12 +28 KC Switch on Carrier Supply to OFF."

Step 13, Performance Standards, step *b:* Add, "No indication, or indication is to the left of −7 db. CARRIER SUPPLY PANEL, 68 KC alarm light should light. Alarm should sound."

Step 15, Test Procedures, step *b:* Change to "Disconnect test equipment shown in E and F, figure 128.8. Connect SG-71B/FCC output to SPECIAL SERVICE 60-108 KC IN binding posts."

Step 16, Test Procedures, step *b:* Add, "Disconnect hookup wires of SG-71B/FCC from SPECIAL SERVICES 60-108 KC IN binding posts and reconnect to SPECIAL SERVICES 12-60 KC IN binding posts."

Chapter 4. Make the following changes:

Page 282, paragraph 173. Add the following below the heading.

NOTE

This paragraph covers Telephone Modem TA-219/U and the following subassemblies:

Modulator Subassembly (Modem Channel 1) NSN 5805-00-378-5587

Modulator Subassembly (Modem Channel 2) NSN 5805-00-351-7461

Modulator Subassembly (Modem Channel 3) NSN 5805-00-351-7462

Modulator Subassembly (Modem Channel 4) NSN 5805-00-351-7463

Make the following changes:

Subparagraph *a* (5), "When testing a subassembly, install it in a TA-219/U. Perform only those tests as apply to the channel corresponding to the subassembly under test."

Subparagraph *b* (5). Add after, "−48 db ± 1", "(−47 to −49 db). The difference between this output level indication and −13 db is the overall loss figure. Record this difference for use in paragraph 173*c* (4)."

Subparagraph *c* (4). Replace with: "(4) Use the ME-30( )/U to measure the output level across terminals A and K of the transmission test cable assembly. The difference between this output level indication and +15 db (as adjusted in subparagraph (2) above), is the overall loss figure. To calculate the transmitting overload loss, subtract the overall loss figure recorded from subparagraph *b* (5) above from the overall loss obtained in this test. The difference will be 6 db or greater."

Subparagraph *d* (1). Add: "Connect SG-71/FCC No 1 terminals C and M of the supply test cable assembly, adjust its output frequency for 8 KHz at an output level of 0.82 volts. Maintaining 0.82 volts output adjust and connect SG-71/FCC No. 1 as indicated in chart *b* (7) above to test channels 2, 3 and 4.".

Page 284, paragraph 173. Make the following changes:

Subparagraph *d* (9). Change the last sentence as follows: "...The output level indication at the 4WR binding posts shall be within +1.0 or −3.8 db of the output recorded in (6) above.".

Subparagraph *e* (1). Change to, "(1) with the GAIN control adjusted to its maximum ccw position, operate the TS-402( )/U switches...".

Subparagraph *e* (4). Change last sentence as follows: "Connect a 600-ohm resistor in series with two parallel-connected, 1-uf capacitor across the 2W 4WT binding posts.".

Subparagraph *e* (5). Change the last sentence as follows: "The indication will be −35 dbm or greater negative value.".

Page 292, paragraph 177. Make the following changes:

Subparagraph *a* (1). Delete second sentence.

Subparagraph *c* (1). Delete, "...and a 600-ohm resistor..." from the second sentence.

Subparagraph *c* (1). Add, "Connect Terminals 3 and 6 of transformer T-109 to the 2W EXT binding posts of the ORDER WIRE PANEL.".

Page 293, paragraph 177. Make the following changes:

Subparagraph *c* (2). Delete second sentence.

Subparagraph *c* (3). Delete.

Subparagraph *c* (5), Test No. 3. Change "Indications" column from "−26 db ±5" to, "−21 db or greater negative value.".

Subparagraph *c* (6). In the last sentence, change, "0.7 db" to, "0.6 ±1 db".

Subparagraph *c* (7). Replace the second sentence with, "The indication on the ME-30( )/U will be 11 ±0.8 db below the indication noted in (6) above."

Make the following changes:

Subparagraph *d* (2). Replace with, "(2) Operate TS-402( )/U switches to provide 0 db attenuation. Use jumper wires and connect terminals 1 and 4 of transformer T-101 to terminals 2 and 3 of TB-101 on the ORDER WIRE PANEL.".

Subparagraph *d* (3). Add to the end of the first sentence: "measured across the output terminals of T-101.". Delete second sentence.

Subparagraph *d* (5). Delete.

Subparagraph *d* (9). Delete second sentence.

Subparagraph *d* (11). Delete second sentence.

Figure 133, paragraph 177. Delete the 600-ohm resistor (circuit B) and NOTE 3. Delete both 100-ohm resistors (Circuit C).

Subparagraph *c* (1). Add, "Connect terminals 3 and 6 of transformer T-109 to the 2W EXT binding posts of the ORDER WIRE PANEL.".

Page 293, paragraph 177. Make the following changes:

Subparagraph *c* (2). Delete second sentence.

Subparagraph *c* (3). Delete.

Subparagraph *c* (5). Test No. 3. Change "Indications" column from "−26 db ±5" to, "−21 db or greater negative value.".

Subparagraph *c* (6). In the last sentence, change, "0.7 db" to, "0.6 ±1 db".

Subparagraph *c* (7). Replace the second sentence with, "The indication on the ME-30( )/U will be 11 ±0.8 db below the indication noted in (6) above.".

Make the following changes:

Subparagraph *d* (2). Replace with, "(2) Operate TS-402( )/U switches to provide 0 db attenuation. Use jumper wires and connect terminals 1 and 4 of transformer T-101 to terminals 2 and 3 of TB-101 on the ORDER WIRE PANEL.".

Subparagraph *d* (3). Add to the end of the first sentence: "measured across the output terrminals of T-101.". Delete second sentence.

Subparagraph *d* (5). Delete.

Subparagraph *d* (9). Delete second sentence.

Subparagraph *d* (11). Delete second sentence.

Figure 133, paragraph 177. Delete the 600-ohm resistor (Circuit B) and NOTE 3. Delete both 100-ohm resistors (Circuit C).

Make the following changes:

Subparagraph *f* (10). Change last sentence as follows: "The ME-30( )/U will indicate −41.5 ±2 db.".

Subparagraph *f* (15). Change last sentence to read: "The ME-30(*)/U will indicate −50 db or greater negative value.".

Page 295, paragraph 180*b* (3). Delete "R 15" from test 5, column 4.

Page 297, paragraph 181. Make the following changes:

Insert Figure 135.1 before subparagraph *a*.

Subparagraph *a* (1). Replace with: "(1) Connect the equipment as shown in figure 135.1 with connector P1 of the power supply cable connected to the output of the TF-171/USM. Adjust the variable load switches S1 and S2 to OFF, connect Multimeter TS-352(*)/U to A and B terminals, and adjust load for an indication of 6,000 ohms. Disconnect the TS-352(*)/U and adjust variable load switch S1 to ON."

Subparagraph *a* (4). Replace with: "(4) after a 5-minute warmup period, position the power supply AC POWER switch to OFF, and adjust the variable load switch S1 to OFF."

Subparagraph *a* (6). Replace with: "(6) Connect Multimeter TS-352(*)/U across terminals A and B of the variable load and adjust for an indication of 4,000 ohms. Disconnect the TS-352(*)/U and adjust the variable load switch S1 to ON."

Subparagraph *a* (8). Replace the last sentence with: "The indication on the power supply panel CURRENT meter will drop the 0, then rapidly rise to between 75 and 105 milliamperes.".

Subparagraph *b* (1). Replace with: "(1) Operate the power supply AC POWER switch and variable load switch S1 to OFF. Connect the TS-352(*)/U across A and B terminals of the variable load. Adjust the variable load for 6,000 ohms. Disconnect the TS-352(*)/U and adjust the variable load switch S1 to ON.

Subparagraph *b* (2). Change as follows: "(2) Connect the AN/GSM-64 across terminals A and B of the variable load. Operate the power supply AC POWER switch to ON. The CURRENT meter will

increase to between 65 and 95 milliamperes within 8 seconds, as timed with the stopwatch. Recheck the..."

Subparagraph *b* (3). Replace the last two sentences with: "The buzzer will sound. Operate the ALARM CUTOFF switch to vertical. The buzzer will be silenced. The AN/GSM-64 will indicate between 588 and 612 Vdc.".

Subparagraph *b* (4). Replace with: "(4) Use the AN/GSM-64 to measure the dc voltage across terminals B and D of the variable load. The indication shall be between 262.5 and 273.5 Vdc."

Subparagraph *c* (1) and (2). Replace with: "Connect the ME-30(*)/U to the RIPPLE terminals on the variable load. The ripple voltage shall be 0.2 volts or less."

Subparagraph *d* (2). Change the last two sentences as follows: "...measure the ripple voltage across the RIPPLE terminals of the variable load. The ripple voltage shall be 0.2 volts or less."

Subparagraph *d* (5). Replace with: "(5) Use the ME-30(*)/U and measure the ripple voltage across the RIPPLE terminals of the variable load. The ripple voltage shall be 0.2 volts or less."

Subparagraph *e* (1). Change the first three sentences as follows: "(1) Disconnect ME-30(*)/U assembly. Connect the AN/GSM-64 across terminals A and B of the variable load. Slowly reduce..."

Subparagraph *e* (3). Add to the last sentence: "...there is a time delay."

Subparagraph *e* (4). Replace the first sentence with: "(4) Connect the AN/GSM-64 across terminals A and B of the variable load and adjust the variable load for 680 volts. Operate the..."

Subparagraph *f* (1). Change the first sentence as follows: (1) Connect the AN/GSM-64 across terminals A and B of the variable load. Increase the..."

Subparagraph *f* (2). Replace with: "(2) Operate the AC Power switch of the power supply and the variable load switch S1 to OFF. Connect the TS-352(*)/U across terminals A and B of the variable load and adjust the variable load for 6,000 ohms. Disconnect the TS-352(*)/U, and adjust the variable load switch S1 to on."

Subparagraph *f* (3). Change the last sentence as follows: "...The dc power will be restored immediately. After a time delay the LOAD ALARM and HIGH VOLTAGE..."

Subparagraph *f* (4). Change the first sentence as follows: "(4) Connect the AN/GSM-64 across terminals A and B of the variable load and adjust the variable load for an indication of 570 volts. Adjust the..."

Subparagraph *g* (2). Change the third sentence as follows: "...indication on the AN/GSM-64. While the voltage is being reduced to 510 volts minimum, a low voltage cutoff will occur, the LOW VOLTAGE and ALARM lamps will light, and the buzzer will sound at cutoff."

Subparagraph *g* (3). Change the second sentence as follows: "The dc output will be restored; then a low voltage cutoff will occur after 10 seconds (use the stopwatch for this measurement)."

Subparagraph *h* (1). Change as follows:

"*(2)* Set the 2X 1800 (ohms) switch to ON. Slowly operate the LOAD CURRENT control completely counterclockwise. To prevent cutoff during this test, simultaneously operate the variable load resistor to maintain an indication on the AN/GSM-64 above 550 volts. At the maximum counterclockwise position of the LOAD CURRENT control adjust the variable load resistor for an AN/GSM-64 indication of 600 $\pm$10 volts dc. At this point the indication on the CURRENT meter shall be 90 milliamperes or less.

(b) Slowly operate the LOAD CURRENT control completely clockwise. To prevent cutoff during this test, simultaneously operate the variable load resistor to maintain an indication on the AN/GSM-64 below 650 volts. At the maximum clockwise position of the LOAD CURRENT control adjust the variable load resistor for an AN/GSM-64 indication of 600 $\pm$10 volts dc. At this point the indication on the CURRENT meter shall be 115 milliamperes or more."

Subparagraph *i* (1). Change the first two sentences as follows: "Adjust the output voltage to indicte after a time delay..."

Subparagraph *i* (7). Replace second sentence with "...on. Change Switch 2X 1800 (ohms) from short position to ON. Set load resistors counterclockwise. Repeat if necessary, readjust variable resistor."

Subparagraph *i* (8). Replace with: "(8) Position the power supply AC POWER switch and variable load switch S1 to OFF, and adjust the 600 volt ADJ control fully counterclockwise."

Subparagraph *i* (9). Replace with: "(9) Connect the TS-352(*)/U across terminals A and B of the variable load. Adjust the variable load for an indication of 4,000 ohms. Disconnect the TS-352(*)/U and

adjust the variable load switch S1 to ON."

Page 298, paragraph 182. Make the following changes:

Subparagraph *a* (1). Replace with: "(1) Connect the equipment as shown in figure 135.1 with connector P1 of the power supply cable connected to the output of the TF-171/USM. Adjust the variable load switches S1 and S2 to OFF; connect Multimeter TS-352(*)/U to its A and B terminals, and adjust for an indication of 6,000 ohms. Disconnect the TS-352(*)/U and adjust the variable load switch S1 to ON. Apply ac power to the TF-171/USM and operate the power supply AC POWER switch to ON. Adjust the output of the TF-171/USM for an indication of 115 vac on the TS-352(*)/U. After a 5-minute warmup period, operate the power supply AC POWER switch to OFF."

Subparagraph *a* (4). Change the last sentence as follows: "...completely counterclockwise: LOAD CURRENT, LOW-VOLT ALARM, HIGH-VOLT ALARM and 600 v ADJ."

Subparagraph *a* (6). Replace with: "(6) Adjust the variable load switch S1 to OFF, connect the TS-352(*)/U across its terminals A and B and adjust the load resistance for an indication of 4,600 ohms. Disconnect the TS-352(*)/U and adjust the variable load switch S1 to ON."

Subparagraph *c* (1). Replace with: "(1) Adjust the variable switches S1 to OFF, and S2 to ON. Connect the TS-352(*)/U across the variable load terminals A and B, and adjust the load resistance for 2,600 ohms. Adjust the variable load switch S1 to ON."

Subparagraph *c* (3). Change the last sentence as follows: "Operate the power supply AC POWER swithc to OFF, and the ALARM CUTOFF switch to vertical. Operate the variable load switches S1 to OFF and S2 to ON."

Subparagraph *d* (1). Replace with: "(1) Connect the TS-352(*)/U across terminals A and B of the variable load. Adjust the variable load for an indication of 6,000 ohms on the TS-352(*)/U and adjust the variable switch S1 to ON."

Subparagraph *d* (2). Delete first sentence.

Subparagraph *d* (3). Add the following between the first and second sentences: "Adjust the variable load resistor for 600 ±2 volts dc as indicated on the AN/GSM-64."

Subparagraph *d* (4). Change the first sentence as follows: "(4) Connect the AN/GSM-64 across terminals B and D of the variable load."

Subparagraph *f* (1). Replace with: "(1) Adjust the variable load switch S1 to OFF, and connect the TS-352(*)/U to its A and B terminals. Adjust the load resistance for an indication of 6,000 ohms on the TS-352(*)/U. Disconnect the TS-352(*)/U and adjust the variable load switch S1 to ON."

Subparagraph *f* (2). Replace with: "(2) Adjust the output of the TF-171/USM for an indication of 115 volts on the TS-352(*)/U. Connect the AN/GSM-64 across terminals A and B of the variable load."

Subparagraph *f* (3), (4) and (5). Replace with:

"(3) Operate the power supply AC POWER switch to ON. Adjust the variable load resistor for an indication of 532 volts on the AN/GSM-64. Slowly adjust the LOW-VOLT ALARM control until cutoff occurs. This is the normal adjustment position for the LOW-VOLT ALARM control. When the power supply stabilizes, hand tighten the locking nut of the LOW-VOLT ALARM control."

"(4) Adjust the variable load resistor for an indiction of 600 ±10 volts on the AN/GSM-64. After a time delay the LOAD ALARM and LOW-VOLTAGE indicators will extinguish and the buzzer will silence."

"(5) Decrease the output voltage by means of the variable load resistor until cutoff occurs. The AN/GSM-64 will indicate between 530 and 535 volts at the time of cutoff. The LOW VOLTAGE AND LOAD ALARM indicators will light and the buzzer will sound at the time of cutoff. Restore the power supply to normal by readjustment of the variable load resistor for an indiction of 600 ±10 volts on the AN/GSM-64.

Subparagraph *g* (3). Change the last sentence as follows: "...AN/GSM-64. After 18 seconds the LOAD ALARM..."

Paragraph 182*h* (1) and (2). Replace with:

"Connect the ME-30(*)/U to the RIPPLE voltage terminals on the variable load. The ripple voltage shall be 0.2 volts or less."

Page 305, paragraph 188. Make the following changes:

Subparagraph *a* (4). Change the second sentence to read: "The indication on the TEST PANEL meter will be adjusted to..."

Subparagraph *d* (3). Change to read: "The noise indication on the TS-559(8)/FT meter will not exceed +10 dba."

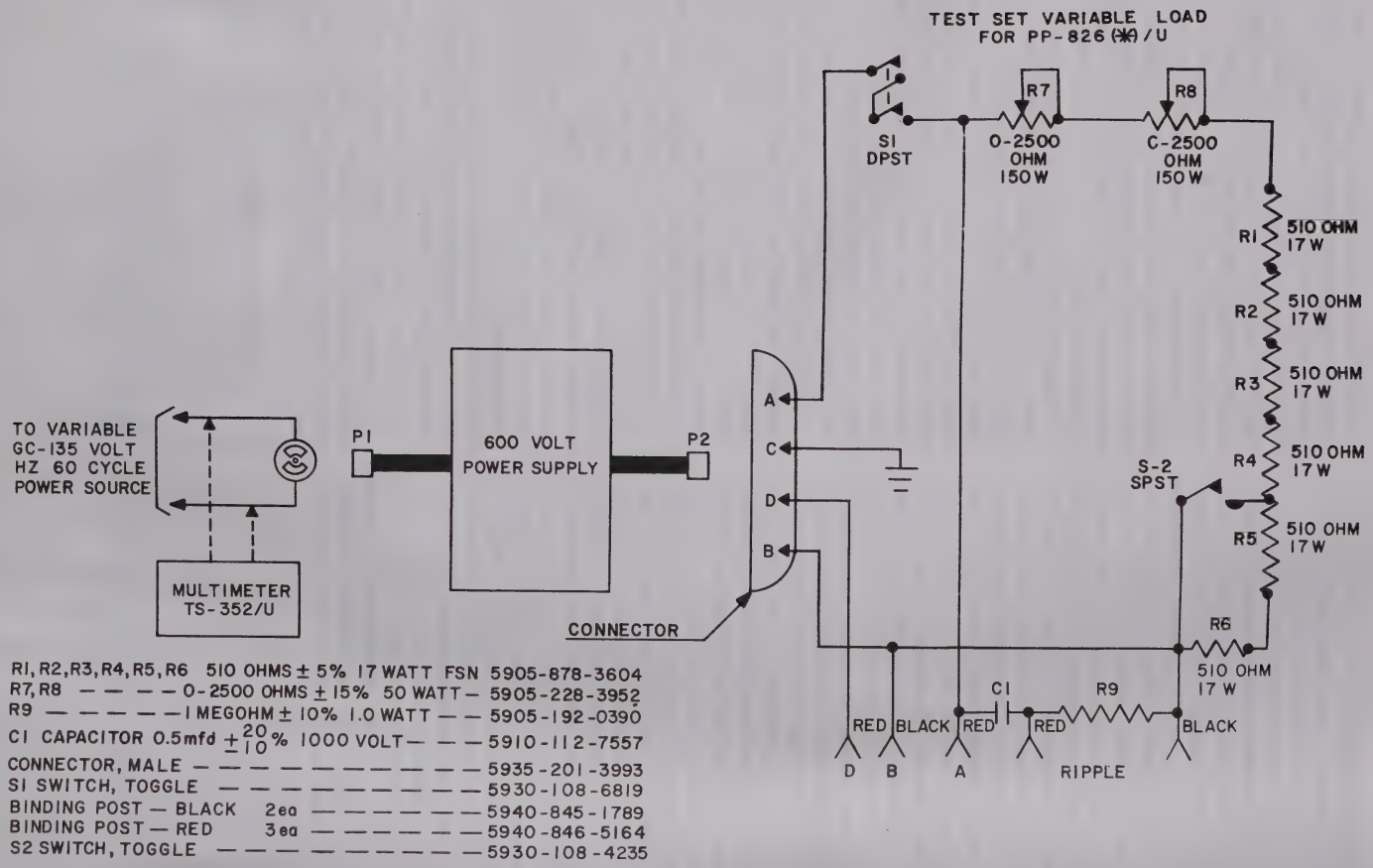


Figure 135.1. Power Supply PP-826(*)/U, Final Test Setup.

Page 318, paragraph 197. Make the following change:

Subparagraph *e.* Reverse table headings "Measure" and "Send".

By Order of the Secretaries of the Army, the Navy, and the Air Force:

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Chief of Staff

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T.O. 31W1-2TCC7-64C
(ARMY) TM 11-2139-35

SUPPLEMENT

TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT
AND
DEPOT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

F34601-72-D-0655

THIS PUBLICATION SUPPLEMENTS T.O. 31W1-2TCC7-64 DATED 14 NOVEMBER 1958. A SUITABLE REFERENCE TO THIS SUPPLEMENT WILL BE MADE ON THE TITLE PAGE OF THE BASIC PUBLICATION.

PUBLISHED UNDER AUTHORITY OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE

1 AUGUST 1972

1. PURPOSE.

This supplement is issued to amend the basic publication.

2. INSTRUCTIONS.

FIGURE 18

On Connector P-103 change Pin "R" to "E," and "E" to "R."

END

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(USAF) T.O. 31W1-2TCC7-64D
(ARMY) TM 11-2139-35

SUPPLEMENT

JAN 31 1977

TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

THIS PUBLICATION SUPPLEMENTS T.O. 31W1-2TCC7-64 DATED 14 NOVEMBER 1958. Reference to this supplement will be made on the title page of the basic manual by personnel responsible for maintaining the publication in current status.

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

8 JANUARY 1977

NOTE

Reference this supplement adjacent to the affected area on the following page.

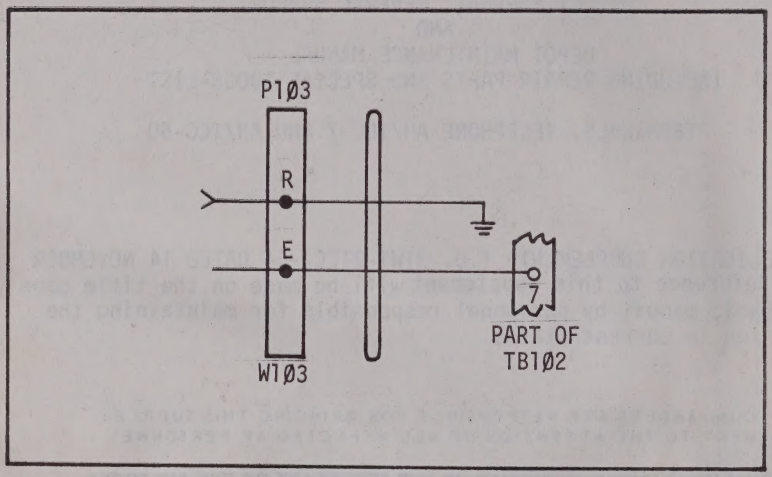
Figure 18.

1. PURPOSE.

The purpose of this supplement is to reflect corrective action of AFTO Form(s) 22 against the basic manual.

2. INSTRUCTIONS.

On Figure 18, in junction panel schematic on connector P103 at left side of schematic, reverse pins E and R as shown below.



THE END

09 AUG 1983

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SUPPLEMENT

TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

TERMINALS, TELEPHONE AN/TCC-7 AND AN/TCC-50

THIS PUBLICATION SUPPLEMENTS TO 31W1-2TCC7-64 (TM 11-2139-35) DATED 14 NOVEMBER 1958. Reference to this supplement will be made on the title page of the basic manual by personnel responsible for maintaining the publication in current status.

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

27 APRIL 1983

1. PURPOSE.

To introduce OSHA generated WARNINGS into the basic manual.

2. INSTRUCTIONS.

a. On page 254, the CAUTION header, contained under the "corrective measures" column for Step 20, is changed to read WARNING.

b. On page 308:

(1) Prior to paragraph 191.c., the following WARNING is added:

WARNING

Prior to performing maintenance/repair all electrical power will be removed from the system. Power circuits will be locked out and tagged. Use grounding rod on all high voltage coils and capacitors. Then ground system until work is completed.

(2) The existing CAUTION contained in paragraph 191.b. is deleted.

c. On page 311:

(1) Prior to paragraph 194.(1), the following WARNING is added:

WARNING

Prior to performing maintenance/repair all electrical power will be removed from the system. Power circuits will be locked out and tagged. Use grounding rod on all high voltage coils and capacitors. Then ground system until work is completed.

(2) The existing CAUTION in paragraph 194.(1) is deleted.

THE END