TM 11-5831-201-35

TECHNICAL MANUAL

DS, GS, AND DEPOT MAINTENANCE MANUAL

CONTROL, INTERCOMMUNICATION SET C-1611D/AIC AND DISCRIMINATOR, DISCRETE SIGNAL MD-736/A

This copy is a reprint which includes current pages from Changes 1 and 2, 3. The title was changed by C1 to read as shown above.

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1970

C A U T I O N

To avoid transistor damage make sure that all power switches are in the OFF position before changing cable connections. Check the battery voltage and polarity before making connections. TRANSISTORS AND PRINTED CIRCUITS MAY BE PERMANENTLY DAMAGED BY IMPROPER VOLTAGE.

Change No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 July 1990

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL

CONTROL, INTERCOMMUNICATION SET C-1611D/AIC (NSN 5831-00-933-9822) AND DISCRIMINATOR, DISCRETE SIGNAL MD-736/A (NSN 5831-00-937-7633)

TM 11-5831-201-35, 15 May 1970, is changed as follows:

1. Title of manual is changed as shown above.

2. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

Remove pages	Insert pages
i and ii	i and ii
1-1	1-1 and 1-2
2-1 and 2-2	2-1 and 2-2
2-7 and 2-8	2-7 and 2-8
3.1-7 and 3.1-8	3.1-7 through 3.1-8.1/ (3.1-8.2 blank)
4-3 and 4-4	4-3 and 4-4
6-1 and 6-2	6-1 and 6-2
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TECHNICAL MANUAL
NO. 11-5831-201-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 15 *May* 1970

Direct Support, General Support, and Depot Maintenance Manual
CONTROL, INTERCOMMUNICATION SET C-1611D/AIC (NSN 5831-00-933-9822) AND DISCRIMINATOR, DISCRETE SIGNAL MD-736/A (NSN 5831-00-937-7633)

*This manual together with TM 11-5831-201 12, January 1970, supersedes TM 11 -5831-201-15, 2 March 1966 in its entirety.

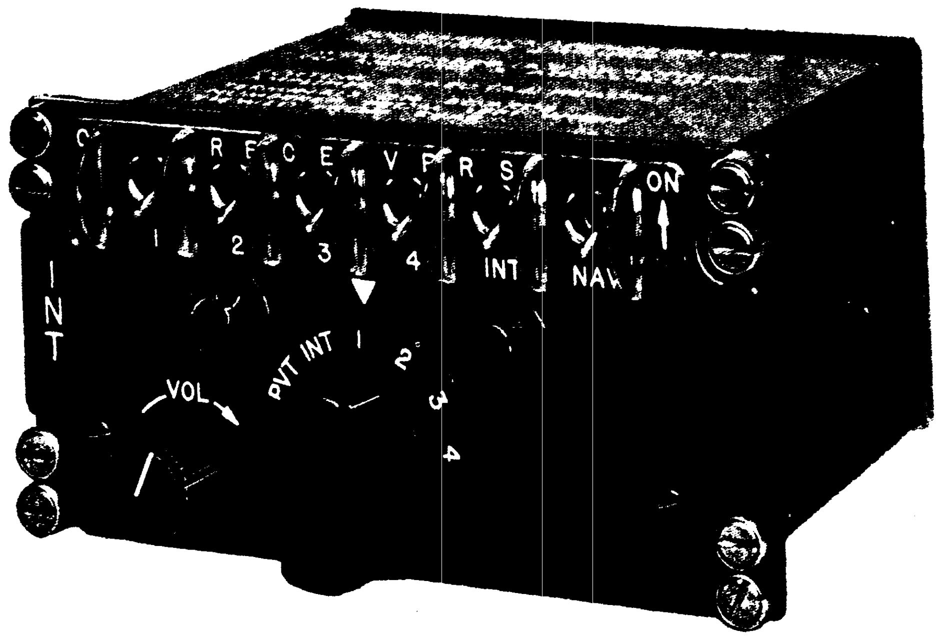

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Figure 1-1. Control, Intercommunication Set C-1611D/AIC.

CHAPTER 1

INTRODUCTION

1-1. Scope

This manual contains instructions for direct support, general support and depot maintenance for Control, Intercommunication Set C-l161D/AIC, and auxiliary equipment, Discriminator, Discrete signal MD-736/A. It includes instructions appropriate to direct support, general support, and depot categories for troubleshooting, testing, aligning, and repairing the equipment and replacing maintenance parts. It also lists tools, materials and test equipment for performing the required maintenance. Detailed functions of the C-1611D/AIC are covered in the circuit analysis section of Chapter 2. Refer to Chapter 6 for circuit analysis and maintenance instructions for the MD-736A.

1-2. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ME-PS, Fort Monmouth, New Jersey 07703-5000.

1-3. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 25-30 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

1-4. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, as contained in Maintenance Management Update.

b. Reporting of Item and Packaging Discrepancies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MCO 4430.3J.

c. Transportation Discrepancy Report (TDR) (SF 361). Fill out and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-5. Destruction of Army Electronics Materiel

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

1-6. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness.

1-7. Reporting Equipment Improvement Recommendation (EIR)

If your equipment 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 or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

CHAPTER 2

FUNCTIONING

Section I. SYSTEM APPLICATION

2-1. General

The C-1611 D/AIC may be operated in any one of four modes as determined by the setting of the switches (transmit-interphone selector switch S1 and RECEIVERS switch S2 through S7) in the control circuits. The four modes of operation are: two-way (air-to-air and air-to-ground) radio communication, radio receiver monitoring, intercommunication (interphone) between all crew stations on the aircraft, and private interphone. The private interphone option provides uninterruptible communication between two crew stations. A block diagram analysis of each mode of operation and of the power filter circuit is contained in paragraph 2-2. Circuit analysis of the C-1611D/AIC is contained in paragraphs 24 through 2–6. Circuit analysis of the Discriminator, Discrete Signal MD–736/A is covered in chapter 6. A typical aircraft system application is shown in figure 2-1. Control, Intercommunication Set C-1611D/AIC is referred to throughout this manual as the control set.

2-2. Block Diagram Analysis, C-1611D/AIC
(fig. 2-2)

A block diagram analysis of the four modes of operation is contained in a, *b*, *c*, and *d* below. The power filter is described in e below.

a. *Two-Way Radio Communication.* This mode of operation connects the output signal of the microphone, through microphone preamplifier circuit A3, microphone amplifier A4, and the control circuits, to the radio transmitter selected by transmit-interphone selector switch S1. Automatic gain control (agc) feedback from microphone amplifier A4 is applied to the agc circuit which, in turn, regulates the gain of the microphone input to preamplifier A3Q1. Switch S1 in the control circuits connects the output of the radio receiver associated with the selected radio transmitter, through the control circuits to headset amplifier A2, where the receiver output is amplified and applied to the earphones.

b. Radio Receiver Monitoring. The outputs of all radio receivers in the aircraft (except the emergency receiver) are connected to the RECEIVERS switches in the control circuits. The output of the emergency receiver is applied through the control circuits to headset amplifier A2 regardless of the selected mode of operation. When a RECEIVERS switch is closed, the output signal of the connected radio receiver is applied through the control circuits to headset amplifier A2, where it is amplified and applied to the earphones.

c. Intercommunication Circuit. When the control circuits are arranged for intercommunication among members of the aircraft crew, the input from the interphone line is applied through the control circuits and headset amplifier A2 to the earphones. The microphone output is applied, through microphone preamplifier A3, microphone amplifier A4, and the control circuits to headset amplifier A2, to the interphone line. The portion of the signal applied to headset amplifier A2 is received by the earphones as sidetone. The portion of the amplified signal applied to the interphone line is received at other stations to which the line is connected.

d. Private Interphone Communication. When the transmit-interphone switch is arranged for private interphone communication, an audio signal from the microphone is applied, through microphone preamplifier A3, microphone amplifier A4, and tramsit-interphone selector switch S1, to headset amplifier S2 and the earphones (sidetone), and to the private interphone line. The input from the private interphone line is applied, through transmit-interphone switch S1 in the control circuits and headset amplifier A2, to the earphones. The output of the private interphone mode is 10 decibels (db) less than when the unit

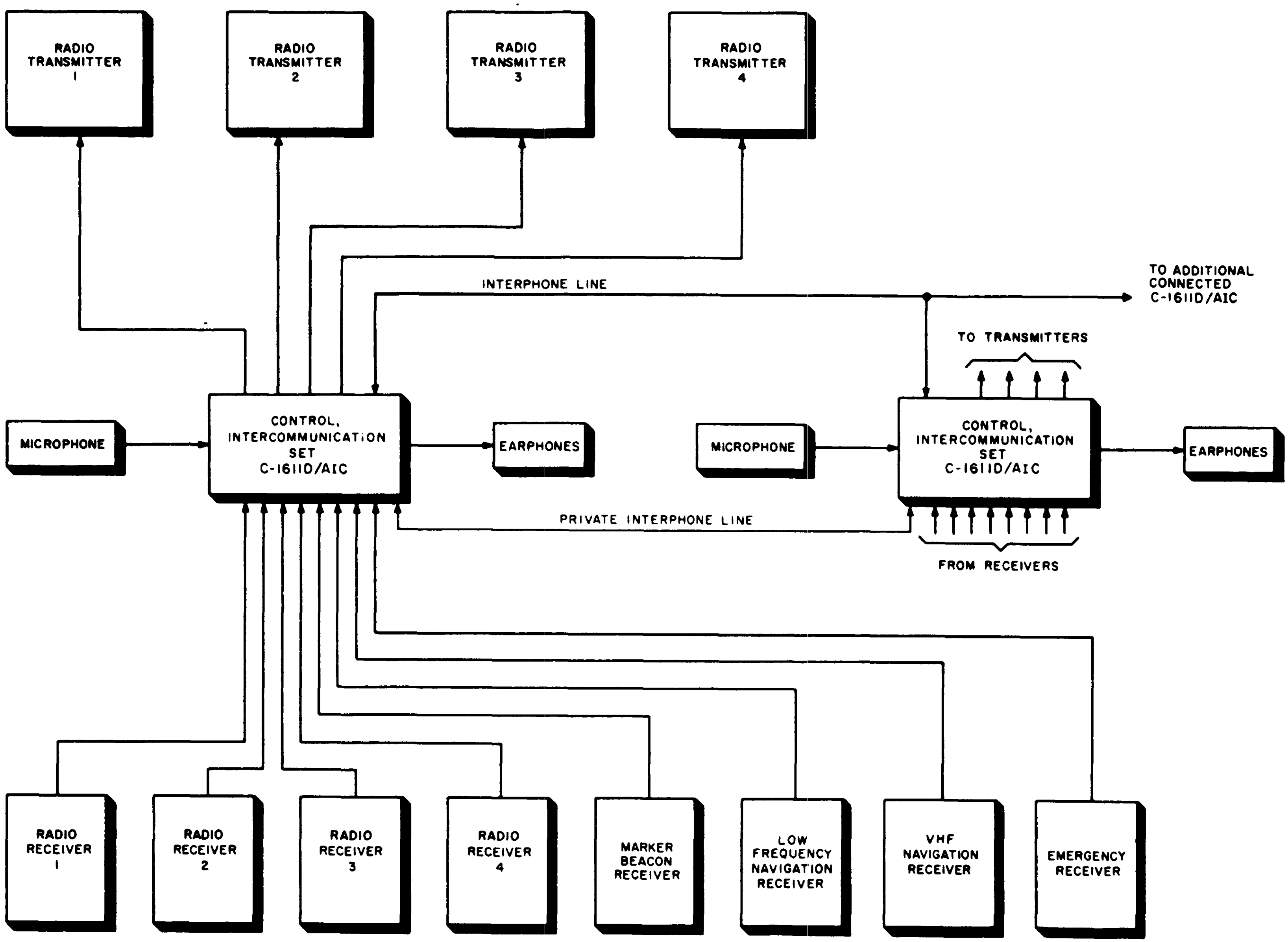

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Figure 2-1. Control, Intercommunication Set C-1611D/AIC typical system block diagram.

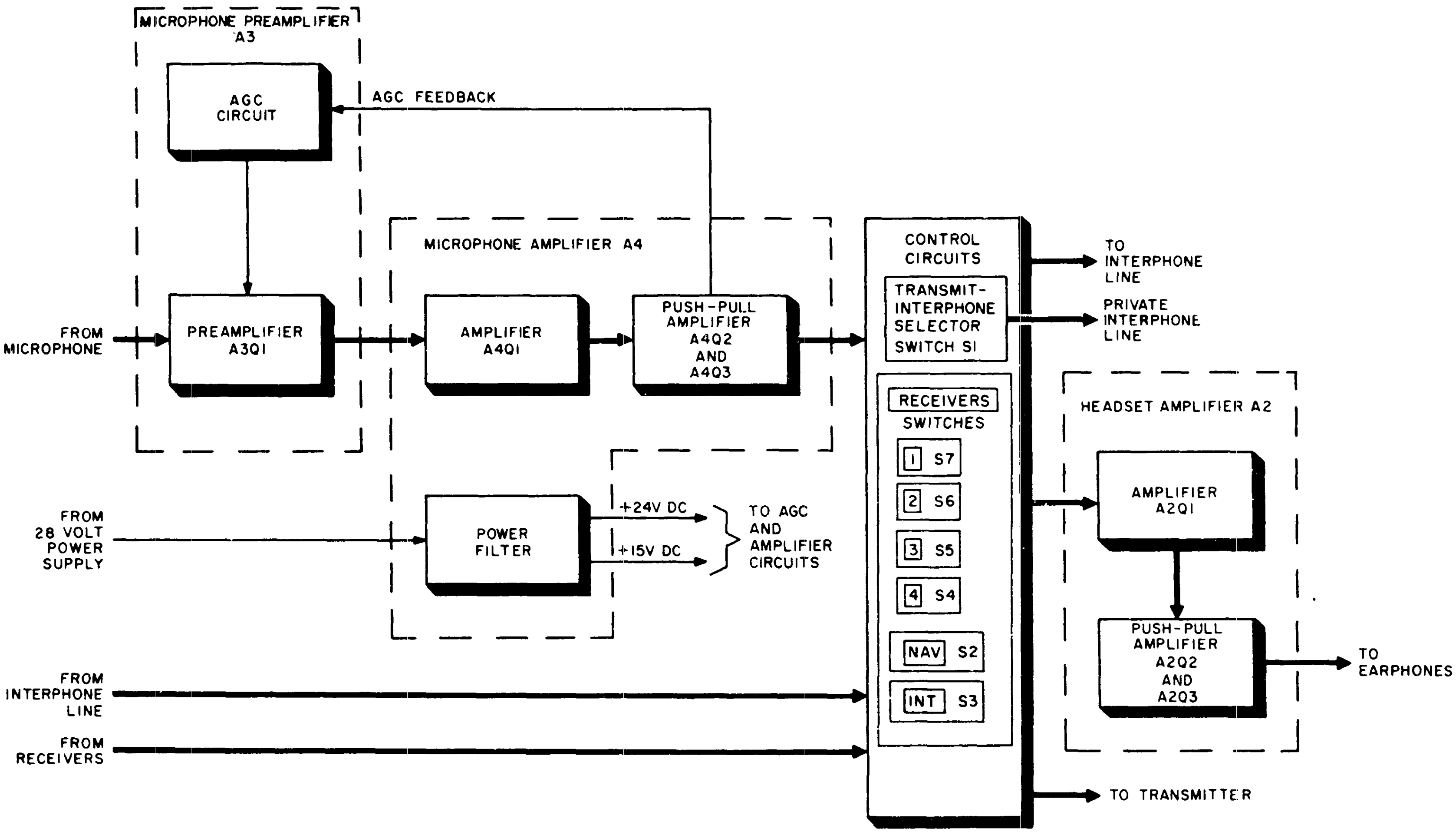

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Figure 2-2. Control, Intercommunication Set C-1611D/AIC, block diagram.

is operating in the other modes (a, b, and c above).

e. Power Filter. The power filter contains two voltage dividers, a filter network, and a voltage regulator, which converts the input from the aircraft's +28-volt direct current (de) power supply to +24 volts dc and +15 volts dc. The unfiltered and unregulated +24-volt dc output to applied to the push-pull amplifiers in the headset amplifier A2 and microhone amplifier A4. The regulated and filtered +15-volt dc output is the man power supply and powers the agc circuit and all the amplifiers in the control unit except the push-pull amplifiers.

f. Differences in Models. Several models of the C-1611D/AIC are covered in this manual. Refer to table in figure 7-3 for circuit differences.

Section II. CIRCUIT ANALYSIS OF CONTROL, INTERCOMMUNICATION SET C-1611D/AIC

2-3. Control Circuits
(fig. 7-2)

u. *General.* The control circuits include switches S1 through S7. VOL control Rl, and interphone relay K1. The functions of the control circuits when transmitting over the two-way radio, receiving singals from the radio and navigational receivers, or communicating over the interphone system are given in *b* through e below.

NOTE

The return path for all audio signals described in *b* through e below is through the audio common lead and pin 19 of connector J1.

b. Transmit-Interphone Selector Switch S1.

(1) Position 1, 2, 3, or 4 of transmit-interphone selector switch S1 selects one of four two-way radio receivers and transmitters, which are connected to the control set for two-way radio communication purposes, and connects it through the control set to the headset and microphone. In addition, S1 selects the interphone line for aircraft crew intercommunication when it is placed in the INT position. When switch S1 is placed in the PVT position, it selects the private interphone line for intercommunication with another connected crew station.

(2) When switch S1 is position 1, 2, 3, or 4, the input of headset amplifier A2 is connected through the control circuits to the output of the selected radio receiver. The output of microphone amplifier A4 is connected to the input of the selected radio transmitter.

(3) The circuits for positions 1,2,3, and 4 of switch S1 are similar and differ primarily in the pins of connector Jl, switch S1, and the radio receivers and transmitters connected in each circuit. Because the circuits are similar, it is assumed that switch S1 is in position 4 in the circuit analysis given in c and d below.

c. Radio Tramitting Control Circuit.

(1) When transmitter 4 is used to transmit a radio signal, transmit-interphone selector switch S1 is in position 4. In this position, the audio output of microphone amplifier A4 is applied, through contacts 2-4 of relay Kl, contacts 8½R-7 of switch S1A, and pin 28 of connector Jl, to transmitter 4. Transmitter 4 is keyed by an external ground from a transmit-interphone talk switch. The path is from the switch, through pin 15 of connector Jl, contacts 2½R-1, of switch SIB and pin 1 of connector Jl, to the transmitter 4 control.

(2) A control set presents 150 ohms impedance to a radio transmitter which is selected by switch S1. A 150-ohm resistor (R2, R3, R4, or R5) is connected across each of the four transmitter output circuits of the control set when switch S1 is in the INT position to present an input impedance to each transmitter. When switch S1 is in position 1, 2, 3, or 4, the resistor connected across the transmitter output circuit of the control set and associated with the selected switch position is disconnected from the output circuit.

(3) The 150-ohm output impedance of the control set (transformer A4T2 secondary) is presented to the radio transmitter input, *For example:* With switch S1 in position 4, the output of the control set transmitter circuit presents 150 ohms impedance to transmitter 4 across pin 28 of connector J1 and the audio common lead. Resistor R5 is disconnected from the control set output circuit at contact 7 on SIC rear. With switch S1 in position 4, resistor R2 presents 150 ohms impedance to transmitter 1, R3 presents 150 ohms to transmitter 2, and R4 presents 150 ohms to transmitter 3.

(4) This constant input impedance must be than one control set is installed in an aircraft. The constant impedance prevents a change in the input power level to the transmitter when two or more control sets select the same transmitter. If

each control set presents 150 ohms impedance to all transmitters at all times, and three control sets are installed in one aircraft, the input circuit of each radio transmitter sees 50 ohms impedance at all times whether it is selected by one, two, or three control sets. This constant impedance presented to the radio transmitters permits the modulation level of the transmitters to be adjusted for a particular input power level.

d. Receiving Circuits.

(1) Monitoring. A receiver may be selected for monitoring by placing the associated RECEIVERS 1, 2, 3, or 4 switch in the ON position. *For example:* When RECEIVERS 1 switch S7 is placed in the ON position, the output from receiver 1 is applied to the headset amplifier, through pin 30 of connector Jl, contacts 2–1 of S7, resistor A1R10, and VOL control R1. RECEIVERS 1, 2, 3, and 4 switches may be turned ON at the same time for simultaneous monitoring of all two-way radio receivers.

(2) *Marker beacon, navigation and emergency receivers.* When RECEIVERS NAV switch S2 is in the ON position, the outputs of the marker beacon, uhf navigation, low frequency navigation receivers are simultaneously applied to headset amplifier A2 through isolation resistors A1R3 and A1R4, respectively, contacts 5–4 of S2, and VOL control R1. The output of the low frequency receiver is applied to the headset amplifier through contacts 2–1 of S2 and series resistor A1R2. The output of the emergency receiver is applied to the headset amplifier through AlR1, and is not controlled by a switch. Resistor A1R1 prevents the output of the navigational low frequency receiver from being reflected back to the navigational low frequency receiver. Resistors A1R7 through A1R10 are isolating resistors for receivers. 4 through 1, respectively.

(3) *Receiving circuits associated with transmitters.* When transmit-interphone selector switch S1 is in position 1, 2, 3, or 4, the output of the receiver associated with the selected transmitter is applied to headset amplifier A2, With the receiver automatically selected, all transmission by the operator is heard in the headset. With switch S1 in position 4, the output of receiver 4 is applied to the headset amplifier through pin 29 of connector Jl, contacts 2-3 of RECEIVERS 4 switch S4, contacts 1 and 2½R of switch S1, series resistor A1R6 and VOL control R1. Resistor A1R6 prevents the output of a selected receiver from being reflected back through S1A to a nonselected receiver. RECEIVERS 1, 2, 3, and 4 switches, and the RECEIVERS NAV switch enable the operator to simultaneously monitor the outputs of up to eight receivers, but transmit-interphone selector switch S1 selects only one receiver at a time.

e. Intercommunication Circuits (figs. 7-2 and 3).

(1) *General.* During the intercommunication mode of operation, the output of microphone amplifier A4 is connected to the interphone line and also to the input of headset amplifier A2 through the contacts of energized relay K1. This mode of operation can be activatd from a control switch, such as a transmit-interphone talk switch, a hot mike switch, or a crew station talk switch.

(2) *Hot mike or crew station talk switch operation.* When a control switch, such as a hot mike or crew station talk switch, is turned on, pins 14 and 17 of J1 supply ground to operate relay K1 and turn on microphone amplifier A4. When relay K1 operates, the microphone amplifier A4 is applied through relay K1 contacts 2–8 to the interphone line. The output of A4 (sidetone) is also applied through contacts 2-8 and 7–1 of relay Kl, isolating resistor A1R11 and VOL control Rl, to the headset amplifier. Resistor A1R11 prevents the output of a receiver, selected by its associated RECEIVERS switch, from being applied over the interphone line.

(3) *Transmit-interphone talk switch operation.*

(a) An externally connected transmit-interphone talk switch provides the operator with two ways of using the interphone. In one mode, a control switch such as one on a transmit-interphone talk switch is in the interphone position ((b) below). This permits interphone operation regardless of the position of transmit-interphone selectcr switch S1. In the other mode, a control switch such as a transmit-interphone talk switch is in the transmit position, and transmit-interphone selector switch S1 is placed in the INT position ((c) below).

(b) When the transmit-interphone talk switch is placed in the interphone position, the coil of relay K1 is grounded through pin 14 of connector J1; microphone amplifier A4 is turned on by the ground applied through pin 17 of J1. With K1 energized, the output of A4 is applied to the interphone line and to headset amplifier AZ ((2) above).

(c) When the transmit-interphone talk switch is in the transmit position and transmit-interphone selector switch S1 is placed in the INT position, relay K1 is operated through pin 15 of connector J1 and contacts $2^1/_2$R and 5 of switch SIB. A ground, applied to pin 17 of connector Jl, completes the circuit to microphone amplifier A4. With K1 operated, the output of A4 is applied to the interphone line and to headset amplifier A2 ((2) above.)

(4) *RECEIVERS INT switch operation*. When RECEIVERS INT switch S3 is in the ON position, the output of the receiver; selected by placing its associated switch in the ON position, is applied over the interphone line, through the respective series resistor, isolating resistor A1R5, switch S3, and closed contacts 5 and 7 of relay K1. With S3 at ON, the output of the receiver selected by S1 is also applied over the interphone line.

f. Private Interphone Circuit (fig. 7-3).

(1) *General* The private interphone circuit may be externally connected to provide push-to-talk control ((2) below) or hot mike control ((3) below). The transmitting and receiving circuits are explained in (4) and (5) below.

(2) *Push-to-talk control circuit.* When an externally connected push-to-talk type switch (such as a crew station talk switch or a transmit-interphone talk switch) is closed, ground from the switch is connected through pin 17 of J1 to the amplifier control to turn on microphone amplifier A4.

(3) *Hot mike control circuits.* For hot mike operation, pins 16 and 17 of J1 are externally connected. When transmit-interphone selector switch S1 is turned to PVT, ground is connected to the amplifier control (terminal 3) of microphone amplifier A4. Ground for the amplifier control is applied, through contacts 8½R and 12 of SIB, pin 16 of Jl, and an external connection, to pin 17 of J1 to turn on microphone amplifier A4.

(4) *Private interphone transmitting circuit.* With microphone amplifier A4 turned on ((2) or (3) above), an audio signal from the microphone is applied through microphone preamplifier A3 (para 2-5b) and microphone amplifier A4 (para 2-6). The amplified output of A4 is applied, through contacts 24 of relay Kl, contacts 8½R and 12 of SIA, and pin 6 of Jl, to the private interphone line. Sidetone from contact 12 of SIA is applied, through contacts 6 and 2½R of SIA, mister A1R6, VOL control Rl, and headset amplifier A2 (para 2-4), to the earphones.

(5) *Private interphone receiving circuit.* An audio signal from the private interphone line is applied, through pin 6 of Jl, contacts 6 and 2½R of S1A, resistor A1R6, VOL control Rl, and headset amplifier A2, to the earphones.

2-4. Headset Amplifier A2

(fig. 7-3)

Headset amplifier A2 consists of a single-ended amplifier (A2Q1) transformer-coupled to a push-pull amplifier (A2Q2 and A2Q3). The imput to A2 is supplied from the selected receiver or interphone line; the output is applied to the earphones.

a. Input Circuits. The input from the receiver is transformer-coupled through windings 1–2 and 3-4 of transformer A2T1 to the base of A2Q1. Capacitor A2C1 is a dc blocking capacitor. The +15-volt dc input of headset amplifier A2 is amplied to the junction of resistors A2R1 and A2R2. Resistors A2R1 and A2R3 from a voltage divider. The voltage at the junction of these resistors places the base at a lower potential than that of the emitter, providing forward bias for the base-emitter junction. Capacitor A2C3 is a standard emitter bypass capacitor; capacitor A2C2 provides a high frequency feedback path. Resistor A2R2 is an emitter-swamping resistor which provides bias stabilization. The amplified output of A2Q1 is developed across the 1–2 winding of transformer A2T2.

b. Push-Pull Amplifier Circuit.

(1) The voltage induced across the secondary of A2T2 is simultaneously applied to the bases of transistors A2Q2 and A2Q3. The voltage across the 4-5 winding of transformer A2T2 is applied to A2Q2, and the voltage across the 3-4 winding is applied to A2Q3. The —24-volt dc supply Volt. age is applied to the junction of resistors A2R5 and A2R6. Winding 1–2 of A2T3, resistor A2R4. the 4–5 winding of A2T2, and A2RT1 in parallel with A2R9 form a voltage divider. The voltage at the junction of A2R4 and terminal 5 of A2T2 is such that the base-emitter junction of A2Q2 is forward biased. The base-to-collector junction is reverse-biased through resistor A2R4. Forward bias for the base-emitter junction of A2Q3 is developed across thermistor A2RT1 in parallel with A2R9 and the 4-3 winding of A2T2. Resistor A2R7 provides reverse bias for the base-collector junction of A2Q3.

(2) Thermistor A2RT1 maintains a constant output current by providing bias stabilization. In a transistor, the emitter current, and thus the collector or output current, is sensitive to temperature variations. The emitter current is also proportional to the forward bias (emitter-to-base voltage). When the temperature rises, the output current tends to rise. However, as temperature rises, the resistance of thermistor A2RT1 de-

creases, causing a decrease in the forward bias. This decrease reduces the emitter current. Thus, the output current is maintained at a fairly constant level. If the temperature decreases, the resistance of A2RT1 rises. This increases the forward bias, which increases the emitter current. The increase in emitter current compensates for any decrease in current caused by the decreasing temperature. The temperature limits of the thermistor are from —25°c to +75°C (49°F to 167°F).

(3) Additional bias stabilization for A2Q2 and A2Q3 and degenerative feedback to increase the input resistance of the circuit are provided by emitter-swamping resistors A2R5 and A2R6, respectively.

c. Output Circuit. The outputs of transistors A2Q2 and A2Q3 are developed across windings 1-2 and 2-3, respectively, of A2T3. Capacitor A2C4 shunts the medium frequency components (above 6,000 Hz) of the output around the primary of A2T3. Resistor A2R8, connected between the collector of A2Q3 and the base of A2Q1, provides negative feedback to amplifier A2QI. The voltage induced in the 4-5 winding of A2T3 is applied to the earphones.

2-5. Microphone Preamplifier A3 and Age Circuits

(fig. *7-3)*

a. Preamplifier Circuit.

(1) The audio input from tne microphone is applied across winding 1–2 of transformer A3T1 through terminals 1 and 2 of A3. The voltage developed across winding 3–4 is coupled to the base of the transistor A3Q1 through coupling capacitor A3C3. Resistors A3R1 and A3R9 provide the potential for the emitter of A3Q1 when the transistor is in a quiescent state. Resistor A3R1, A3R5, A3R7, and A3R6 form a voltage divider for the base of A3Q1 at the junction of A3R5 and A3R7. This voltage divider supplies a base potential that is less positive than the emitter potential and thus provides forward bias for A3Q1.

(2) The voltage at the junction of resistors A3R7 and A3R6 provides reverse bias for the collector-base junction of A3Q1. The output of A3Q1 is developed across A3R6 and applied to the input of the microphone amplifier through pin 7 of A3 and pin 1 of A4. Capacitor A3C1 filters the +15-volt dc input; capacitor A3C4 is an emitter bypass capacitor.

(3) The emitter of A3Q1 is bypassed to alternating current (ac) ground through capacitor A3C4, terminal 8 of microphone preamplifier A3 and contacts 7 through 11 and 8½R of transmit-interphone selector switch S1 B when S1B is in position 4, 3, 2, 1, and INT. When S1 is at PVT, the emitter bypass through A3C4 is opened at SIB. This causes degeneration of preamplifier A3Q1 and decreases its output to microphone amplifier A4. When S1 is at PVT, the output of the microphone amplifier is 10 db less than when S1 is in position 1, 2, 3, 4, or INT.

b. Agc Circuits.

(1) The agc circuit maintains a constant output voltage for varying inputs. With no signal input, the + 15-volt dc input at pin 3 of A3 sets up the agc level. Resistors A3R2. A3R3, and A3R10 form a voltage divider. This divider sets the voltage at the cathode of A3CR1 at approximately +7 volts dc and also sets the voltage at the anode of A3CR2 at approximately + 8 volts dc. Conduction through A3CR2 causes A3C5 to charge to approximately +7 volts dc with the polarity shown in figure 7-3. The voltage also causes capacitor A3C2 to charge through current-limiting resistor A3R4. The voltage on the anode and cathode of A3CR1 is the same; therefore, A3CR1 does not conduct and capacitor A3C2 remains charged.

(2) When a crewmember speaks into the microphone, the audio input signal is amplified by preamplifier A3Q1 on A3 and by amplifier A4Q1 and push-pull amplifiers A4Q2 and A4Q3 on A4. The output at the collector of A4Q2 (para 2-6d) is fed hack to the agc circuit through diode rectifier A4CR1, terminal 2 of A4, terminal 4 of A3, and current-limiting resistor A3R11. Diode A4CR1 conducts only on the positive half-cycle so that only positive pulses are fed back through the agc circuit. If this voltage is below 7 volts, it has no effect on the agc circuit.

(3) If the feedback voltage is above 7 volts, capacitor A3C5 charges to the higher voltage. This higher voltage cuts off A3CR2 and is applied to the anode of A3CR1 through current-limiting resistor A3R4. With A3CR1 conducting, capacitor A3C2 discharges through the diode and the agc secondary 5–6 winding of A3T1. Because of mutual inductance between windings 5–6 and 3-4 of A3T1, a voltage is induced in input secondary winding 3–4 which opposes the voltage induced from the 1–2 winding. This reduces the input to A3Q1, which, in turn, reduces the output.

(4) When the output of A4Q2 drops below

+7 volts dc, capacitor A3C5 discharges to this voltage and the circuit reverts back to its quiescent state.

2-6. Microphone Amplifier A4 and Power Filter Circuits

(fig. 7-3)

a. Input Circuit. The output of microphone preamplifier A3 is coupled to the base of transistor A4Q1 in microphone amplifier A4, through terminal 7 of A3, pin 1 of A4, and coupling capacitor A4C4. Capacitor A4C3 bypasses the frequencies above 6,000 cps. Base voltage for A4Q1 is supplied by the 15-volt dc output of the power filter, through a voltage divider consisting of resistors A4R6 and A4R7. Resistor A4R8 provides emitter voltage and also acts as an emitter-swamping resistor which provides bias stabilization. The base-emitter voltage is such that this junction is forward biased. Capacitor A4C5 is an emitter bypass capacitor for A4Q1.

b. Amplifier Control. The amplified output of A4Q1 is developed across winding 1–2 of transformer A4T1. When a talk switch, such as a hot mike switch, transmit-interphone talk switch, or a crew station talk switch is closed, a ground is applied to winding 1-2 of A4T1 through pin 3 of A4 and current-limiting resistor A4R9. With this ground present, the collector circuit for amplifier A4Q1 is complete and the output of A4Q1 is transformer-coupled to push-pull amplifier A4Q2 and A4Q3. If the talk switch is not closed, the collector circuit for amplifier A4Q1 is open, no emitter-to-collector current flows, and no output is generated. Capacitor A4C6 bypasses any ac transients caused by operation of the talk switch.

c. Push-Pull Amplifier Circuit.

(1) When the talk switch is closed, the output of A4Q1 is transformer-coupled to the bases of A4Q2 and A4Q3. The +24 volts dc from the power filter is applied to resistor A4R11, variable resistor A4R14, winding 3-4 of A4T1, resistor A4R10, and terminals 3 and 2 of A4T2. This arrangement provides forward bias for the base-emitter junction of A4Q2.

(2) Collector-base bias is provided by the voltage at the junction of A4R10 and terminal 3 of A4T2. The base-emitter junction of A4Q3 is forward-biased by the voltage divider consisting of resistor. A4R12, variable resistor A 4R14, winding *4-5* of A4T1, resister A4R13, and terminals 1 and 2 of A4T2. Collector-base bias is obtained at terminal 5 of A4T1 through resistor A4R13.

(3) Resistors A4R11 and A4R12 also act as emitter-swamping resistors to provide increased bias stability. The variable resistor A4R14 also provides bias stabilization for A4Q2 and A4Q3.

d. Output Circuit. The output of A4Q2 and A4Q3 is developed across the primary of transformer A4T2. The agc voltage is taken off the collector of A4Q2 and applied to the agc circuit on A3 through diode rectifier A4CR1. Capacitor A4C7, which shunts the 1-3 winding of A4T2, prevents oscillations when no load is connected to the output of microphone amplifier A4 and by-passes frequency components above 6,000 Hz. Feedback resistor A4R5, from the collector of A4Q2 to the base of A4Q1, provides negative feedback. The voltage induced in secondary winding 4-5 of transformer A4T2 is applied to the control circuits through terminals 4 and 5 of A4.

e. *Power Filter Circuit.* The power filter provides two output voltage levels of +24 volts dc ((1) below) and +15 volts dc ((2) below) for the amplifiers in the control unit.

(1) *Plus 24-volt dc output circuits.* The +28-volt dc input from the power bus in the aircraft is applied to the power filter circuit through terminals 8 and 9 (ground) of microphone amplifier A4. Resistors A4R1 and A4R2 form a voltage divider across the +28-volt dc input. The +24-volt dc output from the junction of A4R1 and A4R2 is applied to push-pull amplifier A4Q2 and A4Q3 and, through terminal 6 of A4 to headset amplifier A2.

(2) *Plus 15-volt dc output circuit.* The +28-volt dc input is also applied across a filter network consisting of resistors A4R3 and A4R4 with capacitors A4C1 and A4C2. Resistors A4R3 and A4R4 drop the input voltage to +15 volts dc at the output which is taken ktwen the junction of resistor A4R4 and Zener diode A4CR2. The +15-volt dc output is applied through terminal 7 of A4 to the microphone preamplifier, age, microphone amplifier, and headset amplifier circuits. Zener diode A4CR2 functions as a voltage regulator across the output of the +15-volt dc supply.

CHAPTER 3

DIRECT SUPPORT MAINTENANCE

Section I. GENERAL

3-1. Scope of Direct Support Maintenance

The maintenance procedures given in this chapter supplement the procedures described in organizational maintenance manual TM 11-5831-201–20. The systematic troubleshooting procedures, which begin with the operational troubleshooting checks performed at an organizational level, are carried to a higher level in this chapter. If visual inspection of the control set fails to determine the cause of trouble, localization and isolation procedures are required. These procedures are covered in paragraphs 3-4 through 3-8.

3-2. Test Equipment, and Materials Required

The following chart lists the test equipment required for troubleshooting the control set, and the assigned common name for each piece of test equipment.

Test equipment	Technical manual	Common name
Multimeter TS-862B/U.	TM 11-6625-366-15	Multimeter
Signal Generator AN/URM-127.	TM 11-6625-683-15	Audio oscillator
Multimeter ME-26B/U.	TM 11-6625-200-12	Vtvm.
Test Set, Radio TS-1588/AIC.	TM 11-6625-441-12	Test set.

3-3. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective control set is to sectionalize the fault. Sectionalization means tracing the fault to a major component. The second step is to localize the fault. Localization means tracing the fault to a defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers, can often be located by sight, smell, and hearing. The majority of faults, however, must be isolated by checking voltages and resistances.

b. Sectionalization. Listed below is a group of tests arranged to reduce unnecessary work, and to aid in trading trouble in a defective control set. The control set consists of four subassemblies: switchboard Al, headset amplifier A2, microphone preamplifier A3, and microphone amplifier A4. The first step is to locate the subassembly at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All visual signs should be observed and an attempt made to sectionalize the fault to a particular subassembly.

(2) *Operational Tests.* Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. The operational test chart (para 3-7) contains such a test.

c. *Localization.* Localization consists of those procedures performed by direct support maintenance personnel to determine the general area of trouble. If headset amplifier A2, microphone preamplifier A3, or microphone amplifier A4 (board A2, A3, or A4) is faulty, replace the entire board. If the faulty part is mounted on the chassis or on switchboard Al, replace the part Use the troubleshooting chart (para 3-8) and the operational test (para 3-7) to localize a fault.

d. Isolation. Isolation procedures are used by direct support maintenance personnel to find a faulty part on the main chassis or on switchboard Al (para 3-8).

e. *Reference Designations.* The component parts of the C–1611D/AIC are mounted on four printed circuit boards and the front and rear panels. Each printed circuit board is assigned a name and a reference symbol (switchboard Al, headset amplifier A2, microphone preamplifier A3, and microphone amplifier A4). The component parts mounted on each printed circuit board are identified by a two-part reference designation. *For example,* a resistor mounted on switchboard Al is designated AlR1. The first part of the reference designation (Al) identifies the part in terms of the printed circuit board on which it is mounted; the second part of the designation (R-1 in the example) identifies the specific component part. Component parts lacking the first part of the reference designation (such as Rl, S1, or Kl) are mounted on the front or rear panels. (Refer to TM 11-5831-201-35P.)

Section II. DIRECT SUPPORT TROUBLESHOOTING

3-4. Visual Inspection

a. Carefully inspect the circuit elements in the control set before starting to troubleshoot the equipment. In many cases, the cause of a trouble is a broken wire, overheated resistor, or some similar defect. Since these faults can often be observed during a visual check, complex troubleshooting techniques may be avoided. If the cause of trouble cannot be visually detected it is then necessary to use the troubleshooting data to localize (paras 3–6, 3–7, and 3–8) and isolate (paras 4-2 and 4-3) the defective part. To perform a visual inspection, disassemble the control set (para 4-7) and check for the following:

(1) Positive action of all front panel switches.

(2) Loose, frayed, or broken wires.

(3) Blistered or discolored resistors on board Al, A2, A3, or A4.

(4) Cracked boards Al, A2, A3, and A4.

(5) Defective printed circuit wiring.

(6) Loose or poorly soldered joints.

b. If the trouble is found, repair it and reassemble the control set (para 4-7b). If the trouble is not located, leave the control set disassembled and proceed with the operational test (para 3–6).

3-5. Test Setup

a. Fabrication. Operational tests of the C-1611D/AIC control set (para 3-7) are *made* with the control set connected in a test setup as shown in figure 3-1. *Functional testing* of the control set may be made with Test Set TS–1588/AIC.

NOTE

When using the TS-1588/AIC, only those procedures outlined in the TS-1588/AIC manual (TM 11-6625-441-12) may be used. The operational tests 1 through 27 (para 3-7) cannot be made with the TS–1588/AIC, with its present design characteristics. The chart in *b* below lists the material required to fabricate the test setup.

Mount the resistors, terminal board, and bus wire on a rigid mounting board made from any available insulating material, such as wood or some type of plastics. Solder all connections to the bus wire. Connect at least four screwdown, or other type of pressure-type terminals, to the bus wire for connecting one lead from the audio oscillator, the volt-ohmmeter, and two vacuum tube voltmeters (vtvm) equipments to the bus wire. Form a cable of 22-gage leads and solder the leads to the pins on the connector (Cannon DC-375), as shown in figure 3–1.

b. Materials Chart. The following chart lists the materials required to fabricate the test setup. The function of each circuit element is also listed. The test equipment required is listed in paragraph 3–2.

Material	Quality	Description	Function
Receptacle	1	37-pin female receptacle, Cannon DC-375.	Mates with connector J1 on control unit.
Terminal board	1	24-pin (rein)	Test points.
10,000-ohm resistors	2	+10 percent, ½ watt	Limiting resistors.
150-ohm resistors	14	±10 percent, ½ watt	Load resistors.
18-ohm resistor	1	±10 percent, ½ watt	Load resistor.
15-ohm resistor	1	±10 percent, ½ watt	Load resistor.
10ohm resistor	2	±10 percent, ½ watt	Load resistors.
Power supply	1	+28-volt dc, 4-ampere output-	Primary power supply.
Switch	2	Double-pole, single-throw momentary contact.	Opens transmitter, amplifier, and interphone control lines.
Leads	23	22-gage, 4-in. long	Connect pins of connector to terminal board.
Lead	1	22-gage, 3-in. long	Connect pins of connector DC-375 to ground bus and to 10,000-ohm load resistors.
Leads	1	10-gage (min). 20-in. long.	Ground bus.

CHAPTER 3.1

ALTERNATE TESTING AND TROUBLESHOOTING

Section I. OPERATIONAL TESTING

3.1-1. General

a. Testing procedures 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 equipment. These procedures set forth specific requirements that repaired equipment must meet before returning to the using organization. These procedures may also be used as a guide for testing equipment that has been repaired at third echelon if the proper tools and test equipment are available,

b. Read and comply with the instructions preceding each chart before attempting to comply with the chart instructions. Perform each step in sequence; do not vary the sequency. For each step, perform all the required actions in the test equipment control settings and equipment under test control settings columns; then perform each specific test procedure and verify against performance standards.

c. For reading simplicity, Test Set, Radio TS–1588 A/AIC will be referred to as the interphone test set, and Control, Intercommunication Set C–161lD/AIC as the interphone control.

3.1-2. Test Equipment Required

All test equipment needed to perform the test procedures are listed in the test equipment chart 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. Test equipment required is listed below.

Nomenclature	*Federal stock No.*	*Technical manual or supply bulletin*
Test Set, Radio TS-1588A/AIC		TM 11-6625-441-12
		TM 11-6625–441-35
Audio Oscillator TS-421A/U		TM 11-6625-335-12
Output Meter TS-585A/U		TM 11-5017
Multimeter, Electronic TS-352/U		TM 11-6625-366–15
Headset Microphone H-101/U		TM 11-5965-215-15
Power Supply PP-l104A/G .		TM 11-5126
Tool Kit, Radar and Radio Repairman TK-871U		SB 11-604

3.1-3. Test Equipment Purpose

a. Test Set, Radio TS–1588A/AIC is used to check the serviceability of Control, Intercommunication Set C–1611D/AIC during bench testing conditions. The TS–1588A/AIC connects a power supply, a headset microphone, an audio oscillator, an output meter, and a multimeter to provide visual and audible monitoring of the transmitting, receiving, and interphone circuits of the interphone control undergoing testing, The interphone test set is connected to the interphone control by attaching connector P1 of the interphone test set to receptacle J1 on the interphone control.

b. A headset-mike is required to apply voice signals to, and monitor voice signals from the interphone control undergoing testing. The headset-mike is plugged into HDST MIC jack J? on the interphone test set control panel.

c. An audio oscillator is required to supply audio signals to the circuits of the interphone control. The audio oscillator is plugged into AUDIO and OSC-GNB binding posts J1 and J2 respectively on the interphone test set control panel.

d. An output meter is required to monitor the output audio signals from the circuits of the interphone control. The output meter is plugged into OUTPUT and MTR-GND binding posts J4 and J3 respectively on the interphone test set control panel.

e. A multimeter is required to measure the input voltage from the 28-volt dc power supply. The multimeter is plugged into the +28V and GND binding posts on the interphone test set control panel.

f. A 28-volt dc power supply, capable of delivering l-ampere of current is required to provide power to the interphone control and interphone test set, The power supply is connected to the insulated battery clips on the interphone test set.

3.1-4. Interphone Control Operating Controls and Indicators

(fig. 3.1-1).

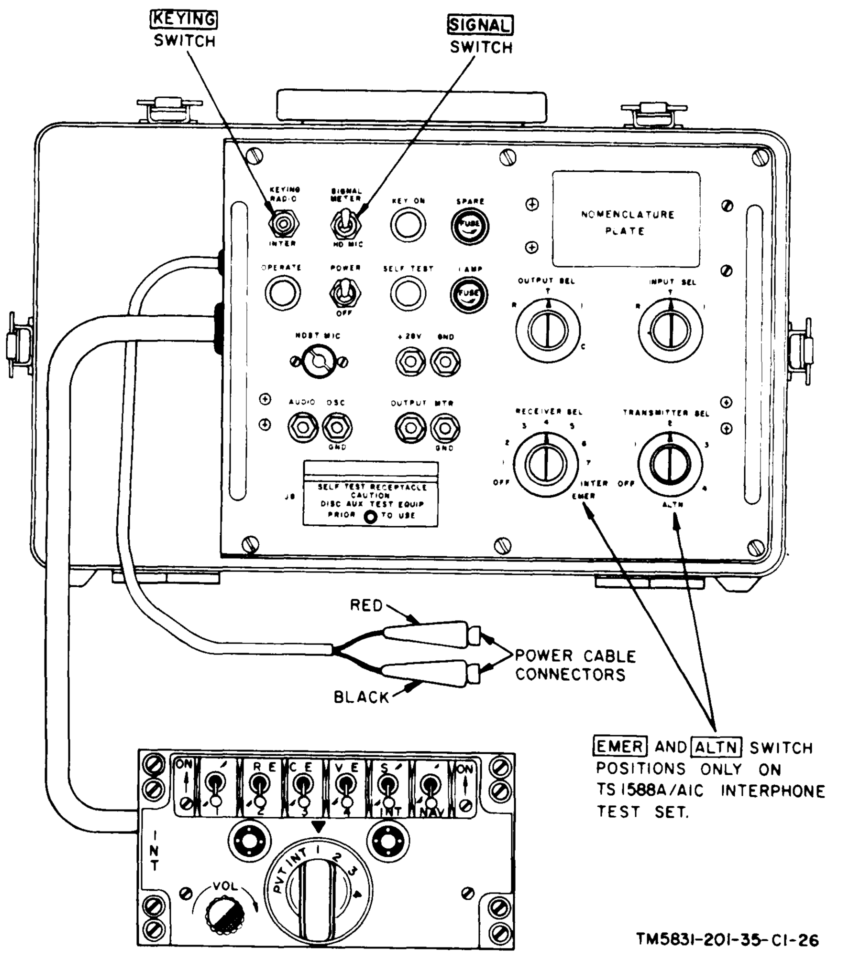


Figure 3.1-1. Control, Intercommunication Set C-1611D/AIC and Test Set, Radio TS-1588A/AIC control panels

Control, indicator or connector	*Function*
Transmit-interphone selector switch S1 : Positions PVT, INT, and 1 through 4.	*a.* PVT position: Selects private interphone line circuit and hot mike control circuit. b. INT position: Selects interphone line circuit for crew intercommunication, c. Positions 1, 2, 3, and 4: Selects one of four two-way radio receiver and transmitter circuits,
RECEIVERS-1 switch S7: Positions ON and OFF (down).	ON position: Selects receiver 1 audio in circuit,

Control, indicator or connector	*Function*
RECEIVERS-2 switch S6: Positions ON and OFF (down).	ON position: Selects receiver 2 audio in circuit,
RECEIVERS-3 switch S5: Positions ON and OFF (down).	ON position: Selects receiver 3 audio in circuit.
RECEIVERS-4 switch S4: Positions ON and OFF (down).	ON position: Selects receiver 4 audio in circuit.
RECEIVERS-INT switch S3: Positions ON and OFF (down).	ON position: Selects interphone line circuit via interphone relay K1.
RECEIVERS-NAV switch S2: Positions ON and OFF (down).	ON position: Selects navigational low frequency receiver audio in circuit, VHF navigation receiver audio in circuit, and marker beacon receiver audio in circuit.
VOL control RI: Positions full cw and full CCW.	Controls intensity of audio input and output signals.
Panel lights DS1 and DS2	When illuminated, provides indication of 28-volt dc into interphone control, and provides lighting of interphone control panel.
Connector J 1	Provides interface connection.

3.1-5. Interphone Test Set Operating Controls and Indicators (fig. 3.1-1).

Control, indicator, or fuse	*Function*
POWER-OFF switch S7: Positions POWER and OFF.	*a.* POWER position: Provides 28-volt de to interphone test set and interphone control. b. OFF position: Deactivates 28-volt dc to interphone test set and interphone control.
KEYING switch S1 : Positions RADIO, midposition, and INTER.	a. RADIO position: Energizes interphone control circuit. *b.* Midposition: Places interphone control in receiver mode. c. INTER position: Energizes interphone control transmitter control circuit.
Signal switch S6: Positions METER and HD MIC.	*a.* METER position and when INPUT SEL switch S3 is set to T position: Applies audio oscillator input to interphone control transmit audio input circuit; also applies interphone control output (selected by OUTPUT SEL switch S2) to OUTPUT MTR-GND binding posts J4 and J3 respectively on interphone test set. *b.* HD MIC position: Applies head-set-mike audio to interphone control transmit audio input circuit; also applies selected interphone control audio output to HDST MIC jack J7 on interphone test set.
OUTPUT SEL switch S2: Positions R, T, I, and C.	Selects and applies interphone control audio output to interphone test set OUTPUT and MTR-GND binding posts J4 and J3 respectively, or HDST MIC jack J7 as follows: *Switch Position* — *Action* R — Selects headset audio output. T — Selects transmission audio output. I — Selects interphone line audio output. C — Not used,
INPUT SEL switch S3: Positions R, T, and I.	Applies audio oscillator input to interphone control audio input circuit as follows: *Switch Position* — *Action* R — Applies audio to receiver circuit, selected by RECEIVER SEL switch S4. T — Applies audio to transmission audio input circuit when SIGNAL switch S6 to METER. I — Applies audio to interphone line audio input,

Control, indicator, or fuse	Function
RECEIVER SEL switch S4: Nine positions on Test Set, Radio TS-1588/AIC, and ten positions on Test Set, Radio TS-1588A/AIC.	Applies audio oscillator input to interphone control receiver circuit corresponding to selected positions as follows: *Switch Position* — *Action* OFF — Deactivates audio inputs to interphone control. 1 through 4 — Applies audio input to receivers 1 through 4. 5 — Applies audio input to maker beacon receier, 6 — Applies audio input to VHF navigation receiver. 7 — Applies audio input to navigational low frequency receiver. INTER — Applies audio input to private intcrphone line and interphone receiver. EMER (Only on Test Set, Radio TS-1588A AIC). — Applies audio input directly to headset.
TRANSMITTER SEL switch S5: Five-positions on Test Set, Radio TS-1588/AIC, and six-positions on Test Set, Radio TS–1588A /AIC.	Selects the interphone control transmitter control output, and transmitter audio output to OUTPUT J4 and MTR-GND J3 binding posts when OUTPUT SEL switch S2 is set to T. Selected positions are as follows: *Switch Position* — *Action* OFF — Deactivates interphone control transmitter control output and transmitter audio output. 1 through 4 — Selects transmitters 1 through 4 control output and audio output. ALTN (Only on Test Set, Radio TS-1588.4/ AIC), — Selects alternate transmitter 1 control output.
KEY ON indicator light I3	Lights when selected interphone control transmitter control output circuit is energized (when KEYING switch S1 is set to RADIO) or when interphone control transmitter audio output circuit is energized (when KEYING switch S1 is set to INTER). Also lights when lamp PRESS TO TEST feature is depressed,
OPERATE indicator light I1	Lights when POWER-OFF switch S7 is set to POWER, and when lamp PRESS TO TEST feature is depressed with test cable connector PI plugged into SELF TEST RECEPTACLE J8.
SELF TEST indicator light I2	Lights when test cable connector PI is plugged into SELF TEST RECEPTACLE J8. Lights when lamp PRESS TO TEST feature is depressed with POWER-OFF switch S7 set to POWER and test cable connector PI not plugged into SELF TEST RECEPTACLE J8.
HDST MIC jack J7 -. . . .	Provides connector for headset-mike to interphone test set hookup.
+28V J5 and GND J6 binding posts	provides connectors for multimeter to monitor 28-volt dc power supply entering interphone test set.
OUTPUT MTR-GND binding posts, J4 and J3 respectively.	Provides connectors for output meter to interphone test set hookup.
AUDIO OSC-GND binding posts, J1 and J2 respectively	Provides connectors for audio oscillator to interphone test set hookup.
SELF TEST RECEPTACLE J8	Provides plug-in receptacle for test cable connector P1 for operational check of interphone test set.

Control, indicator, or fuse	*Function*
1 AMP FUSE F1	Provides overload protection of interphone test set circuits and interphone control units.
SPARE FUSE F2 .	Provides interphone test set with spare fuse.
Test cable connector PI .	When plugged into SELF TEST RECEPTACLE J8, affords for operational check of interphone test set circuits.
Power supply cable clips (ground clip is black, positive clip is red).	Provides interphone test set with connectors for 28-volt dc *power* supply.

3.1-6. Operational Test Procedure

a. The operational tests are used in conjunction with the troubleshooting chart to determine the extent of the trouble in the interphone control. The interphone test set is used to test each receiver, transmitter, and interphone circuit of Control, Intercommunication Set C-1611D/AIC. The operational tests include the following, each checking a different portion of the control unit:

(1) Starting procedure (para 3.1-8).

(2) Testing receive and interphone circuits (para 3.1-9).

(3) Testing transmit circuits (para 3.1-10).

(4) Testing hot mike and sidetone circuits (para 3.1-11).

(5) Stopping procedure (para 3.1-12).

b. Perform all the tests listed in the operational test chart in the order given. List the numbers of the tests not producing satisfactory results. Compare these test numbers (and other trouble symptoms) with the symptoms and operational test numbers listed in the troubleshooting chart (para 3.1–13).

3.1-7. Operational Test Charts

a. The operational test charts list the procedures used to determine the extent of trouble in an interphone control unit; perform the tests in the step-by-step sequence given. Figure 3.1–2 shows the test setup connections used for testing the interphone control. To understand the electrical interface between the interphone control and the interphone test set refer to TM 11–6625–441–12, TM 11-6625–441-35 and this manual.

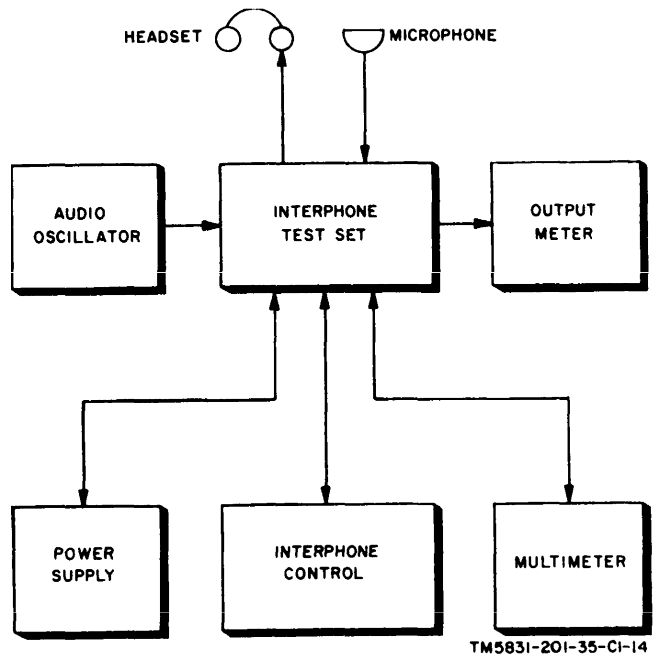


Figure 3.1-2. Control, Intercommunication Set C-1611D/AIC test setup, block diagram.

b. The two basic configurations of Test Set, Radio TS–1588(*)/AIC are identical except for the addition of an EMER position on RECEIVER SEL switch S4 and an ALTN position on TRANSMITTER SEL switch S5 installed on Test Set, Radio TS–1588A/AIC. Test Set, Radio TS-1588A/AIC is specifically called out in the test procedures where these additional functions are used. If Test Set, Radio TS–1588A/AIC testset is not being used, disregard those portions of the test procedure.

3.1–8. Starting Procedure

a. Test Equipment and Materials.

(1) Test Set, Radio TS–1588( )/AIC.
(2) Audio Oscillator TS–421A/U.
(3) Output Meter TS–585A/U.
(4) Multimeter, Electronic TS–352/U.
(5) Headset Microphone H–101/U.
(6) Power Supply PP–1104A/G.

b. Test Connections and Conditions. Connect the equipment as shown in figure 3.1–2.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
1	*Test Set, Radio TS–1588( )/AIC* POWER-OFF switch S7: OFF.	None	None	None.
2	*Power Supply PP–1104A/G* Power supply: OFF.	None	None	None.
3	*Audio Oscillator TS–421A/U* 1 Kilohertz (KHz).	None	Allow five minute warmup period.	Interphone control panel lamps DS1 and DS2 should light.
4	*Power Supply PP–1104A/G* ON and adjust to 27.5 ± 0.5 vdc on multimeter.	None	None	None.

3.1–9. Testing Receive and Interphone Circuits

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
1	Same as paragraph 3.1–8, steps 1 through 4	Same as paragraph 3.1–8, steps 1 through 4.	Same as paragraph 3.1–8 steps 1 through 4.	Same as paragraph 3.1–8 steps 1 through 4.
2	*Test Set, Radio TS–1588 (*)/AIC*			
	a. OUTPUT SEL switch S2: R	*a.* VOL control R1: fully clockwise.	*a.* Adjust audio oscillator for 0.5 volt rms output measured on multimeter.	*a.* None.
	b. INPUT SEL switch S3: R	*b.* RECEIVERS switches OFF	*b.* Set output meter for 8 ohms	*b.* None.
	c. RECEIVER SEL switch S4: 1	*c.* Transmit-interphone selector switch S1: 1.	*c.* Simultaneously rotate interphone test set RECEIVER SEL switch S4 and interphone control transmit-interphone selector switch S1 to positions 2, 3, and 4.	*c.* Output meter should read 110 ± 48 mw.
	d. TRANSMITTER SEL switch S5: OFF	None	None	None.

3	*a.* Same as step 2	*a.* Same as step 2 except set transmit-interphone selector switch S1 to INT.	*a.* Rotate interphone test set RECEIVER SEL switch S4 from 1 through 7.	*a.* Output meter should read zero.
			b. Rotate interphone test set RECEIVER SEL switch S4 to INTER.	*b.* Output meter should read 110 ±48 mv.
			c. On Test Set, Radio TS-1588A/AIC, rotate interphone test set RECEIVER SEL switch S4 to EMER.	*c.* Output meter should read 27 ±12 mv.
4	*a.* Same as step 2	*a.* Same as step 3 except set RECEIVERS switches S2, S4, S5, S6 and S7 to ON.	*a.* Rotate interphone test set RECEIVER SEL switch S4 from position 1 through 6.	*a.* Output meter should read 110 ±48 mv.
			b. Pause at each RECEIVER SEL switch S4 position, vary interphone control VOL control R1 from full clockwise to full counter clockwise and back to full clockwise.	*b.* Output meter should read from 0 to 110 ±48 mw.
			c. Rotate interphone test set RECEIVER SEL switch S4 to position 7.	*c.* Output meter reading: 27 ±12 mw.
			d. Vary interphone control VOL control R1 from full clockwise to full counter clockwise and back to full clockwise.	*d.* None.
			e. Rotate interphone test set RECEIVER SEL switch to S4 to INTER.	*e.* Output meter should read 110 ± 48 mw.
			f. Vary interphone control VOL control R1 from full clockwise to full counter clockwise and back to full clockwise.	*f.* Output meter should vary from 0 to 110 ± 48 mw.
			g. On Test Set, Radio TS-1588A/AIC rotate interphone test set RECEIVER SEL switch S4 to EMER.	*g.* Output meter reading: 27 ± 12 mw.
			h. Vary interphone control VOL control R1 from full clockwise to full counter clockwise and back to full clockwise.	*h.* Output meter should not vary.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
5	*a.* Same as step 2	*a.* RECEIVERS switches S2, S4, S5, S6, S7: OFF.	*a.* Rotate interphone test set RECEIVER SEL switch S4 to INTER.	*a.* Output meter reading: 110 ± 48 mw.
		b. RECEIVERS INT switch S3: ON.	None	None.
		c. Transmit-interphone selector switch S1: 1.	None	None.
6	*a.* Same as step 2 except set interphone test set RECEIVER SEL switch S4 to INTER.	*a.* Same as step 5 except set transmit-interphone selector switch S1 to INT and RECEIVERS INT switch S3 to OFF.	*a.* Vary interphone control VOL control R1 from full clockwise to full counter clockwise and back to full clockwise. *b.* If testing of transmit circuits is not required, perform stopping procedure, (para 3.1-12).	*a.* Output meter should vary from 0 to 110 ± 48 mw.
7	a. Same as step 2 except set interphone test set RECEIVER SEL switch S4 to position 1 thru 7 to detect audio bleed through.	a. VOL control: fully clockwise b. RECEIVERS switches: OFF. c. Transmit-interphone selector switch S1: INT.	a. With the T.S.-585 Audio meter set at "MULT by 1," inject a .5 VRMS audio signal through equipment under test.	a. There should be a "0" reading in all positions of RECEIVER SEL switch on Test Set by rotating this switch from position 1 thru position 7.

3.1–10. Testing Transmit Circuits

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
1	Same as paragraph 3.1–8 steps 1 through 4.	Same as paragraph 3.1–8, steps 1 through 4.	Same as paragraph 3.1–8 steps 1 through 4.	Same as paragraph 3.1–8 steps 1 through 4.
2	*Test Set, Radio TS–1588(*)/AIC*			
	a. OUTPUT SEL switch S2: T	*a.* VOL control R1: Mid position.	*a.* Adjust audio oscillator 0.425 volt output.	*a.* None.
	b. INPUT SEL switch S3: T	*b.* RECEIVERS switches S2 through S7: OFF.	*b.* Adjust output meter for 150 ohms load.	*b.* None.
	c. RECEIVER SEL switch S4: OFF	*c.* Transmit-interphone selector switch S1: 1.	*c.* Set interphone test set KEYING switch S1 to RADIO position and hold.	*c.* KEY ON light I3 should light and output meter should read 44 ± 26 mw.
	d. TRANSMITTER SEL switch S5: 1	*d.* None	*d.* Release interphone test set KEYING switch S1.	*d.* KEY ON light I3 should go out.
	e. None	*e.* None	*e.* Simultaneously rotate interphone test set TRANSMITTER SEL switch S5 and interphone control transmit-interphone selector switch S1 to positions 2, 3, and 4. At each position place and hold interphone test set KEYING switch S1 in RADIO position.	*e.* KEY ON light I3 should light and output meter should read 44 ± 26 mw.

	f. None	*f.* None	*f.* Release interphone test set KEYING switch S1.	*f.* KEY ON light I3 should go out and output meter should drop to zero.
	g. None	*g.* None	*g.* Rotate interphone test set OUTPUT SEL switch S2 to position I and hold KEYING switch S1 to INTER.	*g.* Output meter should read 44 ± 26 mw.
	h. None	*h.* None	*h.* Release interphone test set KEYING switch S1.	*h.* Output meter should drop to zero.
	i. None	*i.* None	*i.* Rotate interphone control transmit-interphone selector switch S1 to PVT.	*i.* Output meter should read 8.1 ± 4 mw.
	j. None	*j.* None	*j.* If testing of sidetone and hot mike circuits is not required, perform stopping procedure, (para 3.1–12).	*j.* None.

3.1–11. Testing Hot Mike and Sidetone Circuits

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
1	Same as step 1 paragraph 3.1–8	None	None	None.
2	*Test Set, Radio TS–1588(*)/AIC*			
	a. OUTPUT SEL switch S2: R	*a.* Transmit-interphone selector switch S1: INT.	*a.* Position headset-microphone on operators head.	*a.* None.
	b. RECEIVER SEL switch S4: INTER	*b.* VOL control R1: Full clockwise.	*b.* Place and hold interphone test set SIGNAL switch S6 to HD MIC, and KEYING switch S1 to INTER; speak into mike.	*b.* Sidetone should be audible from the headset.
	c. None	*c.* None	*c.* Release interphone test set SIGNAL switch S6 and KEYING switch S1.	*c.* Sidetone shall cease.
3	*a.* Same as step 2	*a.* Transmitter-interphone selector switch S1: PVT.	*a.* Place and hold interphone test set SIGNAL switch S6 to HD MIC; speak into mike.	*a.* Sidetone shall be audible from the headset.
	b. None	*b.* None	*b.* Release interphone test set SIGNAL switch S6.	*b.* Sidetone shall cease.
	c. None	*c.* None	*c.* If further testing is not required, perform stopping procedure, (para 3.1–12).	*c.* None.

3.1–12. Stopping Procedure

Step No.	Test equipment control settings	Equipment under test control settings	Test procedures	Performance standard
1	*a.* None	*a.* None	*a.* Rotate interphone test set RECEIVER SEL switch S4 and TRANSMITTER SEL switch S5 to OFF.	*a.* None.
	b. None	*b.* None	*b.* Rotate interphone control VOL control R1 fully counter clockwise and insure RECEIVERS switches S2 thru S7 are OFF.	*b.* None.
	c. None	*c.* None	*c.* Set interphone test set POWER-OFF switch S7 to OFF.	*c.* OPERATE light I1 should go out.
	d. None	*d.* None	*d.* Disconnect interphone test set cable connector P1 from interphone control.	*d.* None.
	e. None	*e.* None	*e.* Deactivate 28-volt dc power supply.	*e.* None.
	f. None	*f.* None	*f.* Disconnect interphone test set cable connector P1 from interphone control.	*f.* None.
	g. None	*g.* None	*g.* Install dust protector over interphone control connector J1.	*g.* None.
	h. None	*h.* None	*h.* Disconnect interphone test set power supply cables from 28-volt dc.	*h.* None.
	i. None	*i.* None	*i.* Roll and store interphone test set power supply cables and cable connector P1 in storage compartment.	*i.* None.
	j. None	*j.* None	*j.* Disconnect audio oscillator, output meter, headset mike, and multimeter from interphone test set.	*j.* None.

Section II. TROUBLESHOOTING

3.1-13. Troubleshooting Chart

a. Use of Chart. The troubleshooting charts may be used separately or in conjunction with the operational test charts (para 3,1–8 through 3.1–12) to localize trouble to a defective printed circuit board or part. The item number in the symptom column lists the paragraphs and step numbers that correspond to the numbers in the step No. column of the operational test charts (para 3.1–8 through 3.1–12). Use the item number when using the troubleshooting chart in conjunction with the operational test charts. The symptom column lists abnormal indications that may be observed during performance of checks or operation. The probable trouble column lists control unit troubles that can cause the abnormal indication listed in the symptom column. The correction column lists the parts to be replaced or checked.

b. Using Troubleshooting Chart Separately. When the control unit trouble symptoms are unknown, perform the operational test (para 3.1-8 through 3.1-12). List the step number of each operational test that does not produce the desired results. After all operational tests have been completed, one or more operational step numbers will be listed. Compare the listed operational step numbers with those numbers listed in the symptom column to locate the appropriate probable troubles, and the corrections. If more than one step number is listed, compare the entire group of numbers with those groups listed in the troubleshooting chart before making individual checks of each test step number.

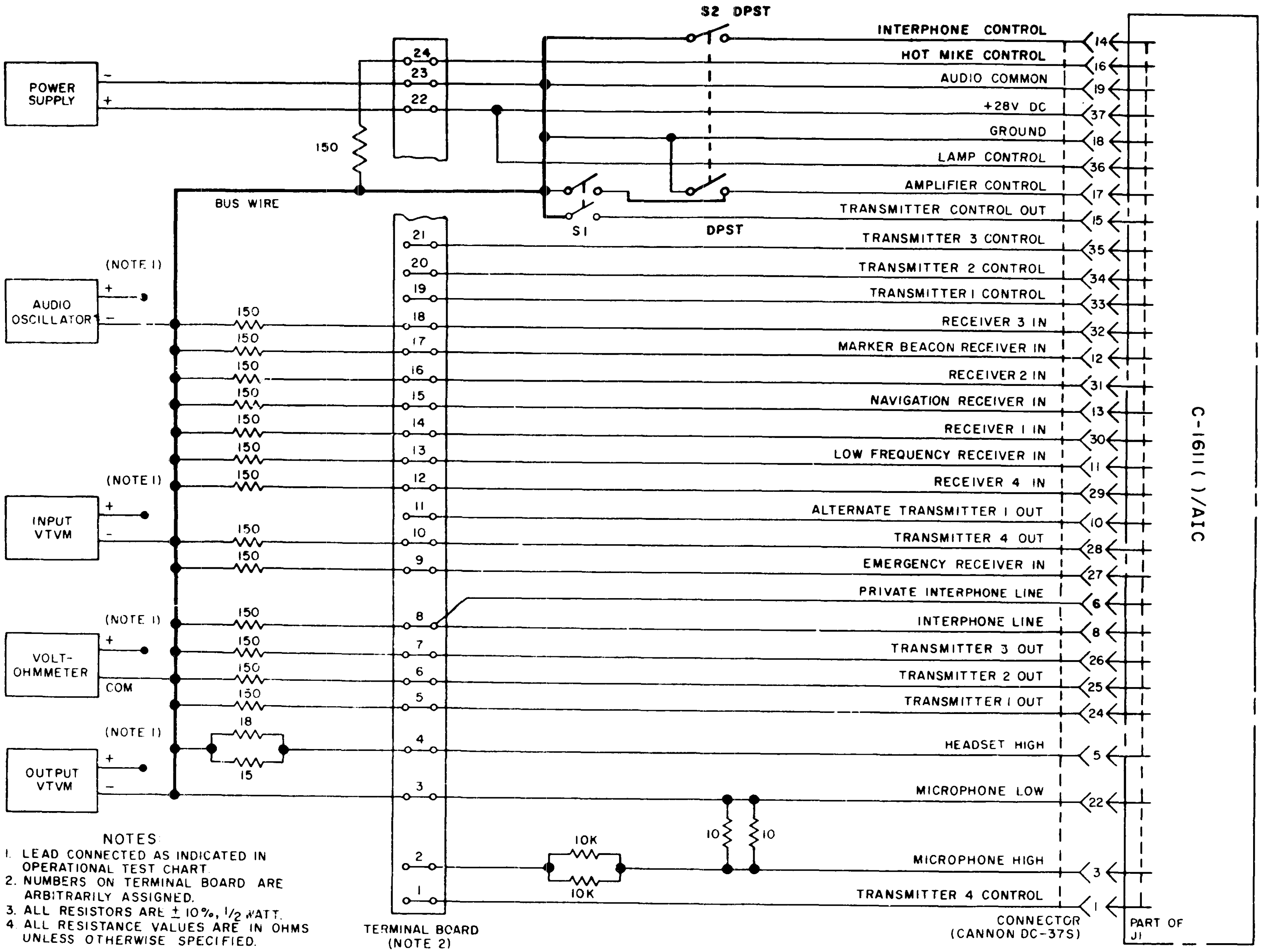
For example, assume that operational tests paragraph 3.1-9, steps 1 through 3 fail to provide the desired results. These numbers will be listed when the operational tests are completed. When these test step numbers are compared to those numbers listed in the symptom column of the troubleshooting chart, the first, second, and third entries under paragraph 3.1–9 will compare with the test step numbers obtained by the operational test. A check of the probable troubles listed for these entries should be made before proceeding with any other tests.

c. Troubleshooting Chart.

	Symptom	Probable trouble	Correction
3.1-8, 3	Interphone control panel lamps DS1 and DS2 do not light.	Defective panel light	Replace panel light.
		Defective system cabling	Check cabling.
		Defective wiring	Perform continuity check from pin 36 to ground; replace defective wiring.
3.1-9, 2*c*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at positions 1, 2, 3, and 4.	Defective resistor A1R6	Check resistor A1R6; replace if defective.
		Defective wiper arm contact 2½R on selector switch S1A.	Check continuity through S1A contact and wiper arm; replace S1 if defective.
3.1-9, 2*c*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at 1.	Defective RECEIVERS 1 switch S7	Check continuity of S7; replace if defective.
		Defective contact 4 on selector switch S1A	Check continuity through S1A contact and wiper arm; replace S1 if defective.
3.1-9, 2*c*	Output meter reading out of tolerance with transmit interphone selector switch S1 at 2.	Defective RECEIVERS 2 switch S6	Check continuity of S6; replace if defective.
		Defective contact 3 on selector switch S1A	Check continuity through S1A contact and wiper arm; replace S1 if defective.
3.1-9, 2*c*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at 3.	Defective RECEIVERS 3 switch S5	Check continuity of S6; replace if defective.
		Defective contact 2 on selector switch S1A	Check continuity through S1A contact and wiper arm; replace S1 if defective.
3.1-9, 2*c*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at 4.	Defective RECEIVERS 4 switch S4	Check continuity of S4; replace if defective.
		Defective contact 1 on selector switch S1A	Check continuity through S1A contact and wiper arm; replace S1 if defective.
3.1-9, 3*a*, and 4*e*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at INT.	Defective RECEIVERS INT switch S3	Check continuity of S3; replace if defective.
		Defective contact 5 on selector switch S1A	Check continuity through S1A contact and wiper arm; replace S1 if defective.
		Defective resistor A1R6	Check resistor A1R6; replace if defective.
		Defective wiper arm contact 2½R on selector switch S1A.	Check continuity through S1A contact and wiper arm; replace S1 if defective.
3.1-9, 3*c*, and 4*g*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at INT with interphone test set RECEIVER SEL switch S4 at EMER.	Defective resistor A1R1	Check resistor A1R1; replace if defective.
3.1-9, 4*a*	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at 5.	Defective resistor A1R3	Check resistor A1R3; replace if defective.
		Defective RECEIVERS NAV switch S2	Check continuity of S2; replace if defective.
3.1-9, 4*a*	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at 6.	Defective resistor A1R4	Check resistor A1R4; replace if defective.
		Defective RECEIVERS NAV switch S2	Check continuity of S2; replace if defective.
3.1-9, 4*b*, 4*d*, 4*f*, 4*h*, and 6*a*	Output meter reading does not vary or is not within tolerance when VOL control R1 is varied at each RECEIVER SEL switch S4 position.	Defective VOL control R1	Check VOL control R1; and replace if defective.
		Defective resistor A1R12	Check resistor A1R12; replace if defective.
		Defective headset amplifier printed circuit board A2.	Replace board A2.
3.1-9, 4*c*	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at 7.	Defective RECEIVERS NAV switch S2	Check continuity of S2; replace if defective.
		Defective resistor A1R2	Check resistor A1R2; replace if defective.
3.1-9, 4*g*	Output meter reading out of tolerance	Defective RECEIVERS 1 switch S7	Check continuity of S7; replace if defective.

	with interphone test set RECEIVER SEL switch S4 at 1.	Defective resistor A1R10	Check resistor A1R10; replace if defective.
3.1–9, 4*a*	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at 2.	Defective RECEIVERS 2 switch S6 Defective resistor A1R6	Check continuity of S6; replace if defective. Check resistor A1R6; replace if defective.
3.1–9	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at 3.	Defective RECEIVERS 3 switch S5 Defective resistor A1R8	Check continuity of S5; replace if defective. Check resistor A1R8; replace if defective.
3.1–9, 4*a*	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at 4.	Defective RECEIVERS 4 switch S4 Defective resistor A1R7	Check continuity of S4; replace if defective. Check resistor A1R7; replace if defective.
3.1–9, 5*a*	Output meter reading out of tolerance with interphone test set RECEIVER SEL switch S4 at INTER and interphone control RECEIVERS INT switch S3 in ON.	Defective RECEIVERS INT switch S3 Defective resistor A1R6	Check continuity of S3; replace if defective. Check resistor A1R6; replace if defective.
3.1–10, 2*c*, 2*e*, 2*g*, and 7–9, 2	Output meter reading out of tolerance with transmit-interphone selector switch S1 in any transmit or interphone position.	Defective relay K1 Defective S1B wiper Defective microphone preamplifier A3 or amplifier A4.	Check and replace relay K1 if defective. Check S1B wiper arm; replace S1 if defective. Replace both boards A3 and A4.
3.1–10, 2*c*, and 2*d*	Output meter reading out of tolerance with transmit interphone selector switch S1 on 1.	Defective contact 10 on selector switch S1A or defective contact 4 on S9B. Defective resistor R2	Check continuity through S1A, S1B, contacts and wiper arm; replace S1 if defective. Check resistor R2; replace if defective.
3.1–10, 2*e*, 2*f*, 2*g*, and 2*h*	Output meter reading out of tolerance with transmit-interphone selector switch S1 on 2.	Defective contact 9 on selector switch S1A or defective contact 3 on S1B. Defective resistor R3	Check continuity through S1A, S1B contacts and respective wiper arms; replace S1 if defective. Check resistor R3; replace if defective.
3.1–10, 2*e*, and 2*f*	Output meter reading out of tolerance with transmit-interphone selector switch S1 at 3.	Defective contact 8 on switch S1A or defective contact 2 on S1B. Defective resistor R4	Check continuity through S1A, S1B contacts and respective wiper arms; replace S1 if defective. Replace resistor R4 if defective.
3.1–10, 2*e*, and 2*f*	Output meter reading out of tolerance with transmit interphone selector switch S1 at 4.	Defective contact 7 on selector switch S1A or defective contact 1 on S1B. Defective resistor R5	Check continuity through S1A, S1B contacts and respective wiper arms; replace S1 if defective. Replace resistor R5 if defective.
3.1–10, 2*g*, and 2*h*	Output meter reading out of tolerance with transmit interphone selector switch S1 at 1 and interphone test set RECEIVERS SEL switch S4 at ALTN.	Defective contact 4R on switch S1C	Check continuity through S1C contact and wiper arm; replace S1 if defective.
3.1–10, 3*a*, and 3*b*	Output meter reading out of tolerance with transmit interphone selector switch S1 at INT.	Defective contact 5 on selector switch S1B	Check continuity through S1B contact and wiper arm; replace if defective.
3.1–10, 3*a*	Output meter reading out of tolerance with transmit interphone selector switch S1 at INT and interphone test set KEYING switch S1 ON.	Defective contacts 2 and 8 or winding of relay K1.	Check continuity of relay K1 contacts and winding; replace K1 if defective.
3.1–10, 3*c*	Output meter reading out of tolerance with transmit interphone selector	Defective contacts 8½R of S1A or 8½R of S1B.	Check continuity through S1A and S1B contacts; replace S1 if defective.

	Symptom	*Probable trouble*	*Correction*
	switch S1 at PVT.	Defective contacts 2–4 of relay K1	Check continuity of relay contacts; replace if defective.
3.1–11, 2	No sidetone heard in headset when talking on interphone line.	Defective wiper arm on S1A	Check S1A wiper arm; replace if defective.
		Defective resistor A1R11	Check resistor A1R11; replace if defective.
		Defective relay K1	Check relay K1; replace if defective.
3.1–11, 3	No sidetone heard in headset when talking on private interphone.	Defective contacts 8½R of S1B Defective contacts 2½R on S1A.	Check continuity through S1A and S1B contacts; replace S1 if defective.



NOTES:
1. LEAD CONNECTED AS INDICATED IN OPERATIONAL TEST CHART.
2. NUMBERS ON TERMINAL BOARD ARE ARBITRARILY ASSIGNED.
3. ALL RESISTORS ARE ± 10%, 1/2 WATT.
4. ALL RESISTANCE VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED.

Figure 3-1. Control, Intercommunication Set C-1611D/AIC, test setup schematic diagram.

3-6. Operational Test Procedure

a. General The operational bats are used in conjunction with the troubleshooting chart to determine the extent of the trouble in the control set. The operational tests include 27 different tests, each checking a different portion of the control set. Perform all the tests listed in the operational test chart (para 3-7) in the order given, List the numbers of the tests not producing satisfactory results. Compare these test numbers (and other trouble symptoms) with the symptoms and operational test numbers listed in the troubleshooting chart (para 3-8).

NOTE

When the TS-1588/AIC is used for a functional teat of the control set, use only the procedures outlined in TM 11-6626441-12.

b. Test procedure.

(1) Fabricate the test setup (para 3-5)

(2) Be sure the control unit is disassembled (para 4-7a).

(3) Connect the test setup connector to connector J1 on the control set.

(4) Connect the ground leads of the +28-volt dc power supply, audio oscillator, input vtvm, and output vtvm to the ground bus wire. Connect the common lead of the voltohmmetir to the bus wire.

(5) Be sure the power supply is turned off; then connect the positive power supply lead to pin 22 on the terminal board.

(6) Turn on the power supply and adjust the output voltage to 27.5 volts.

(7) Adjust the audio oscillator output to 1,000 Hz. Adjust output as indicated.

(8) operate test setup switches S1, S2, as directed by notes in Test No. column.

(9) Turn the control set VOL control fully clockwise.

(10) Perform all the tests listed in the operational test chart (para 3-7) in the order given. Connect the test equipment to the terminal board terminals listed in the chart. *Do not connect the voltohmmeter (arranged as an ohmmeter) when measuring volts. Damage to the voltohmmeter may result.* While performing these tests, it will be necessary to change the positive lead connections of the input vtvm and the audio oscillator as listed in the *Audio oscillator and input vtvm connections* column of the chart. The output limits are read from the voltohmmeter (arranged as an ohmmeter) or the output vtvm, depending on whether the results are listed in the *Ohms* or the *Volts* portion of the *Output limits* column in the chart. Connect the positive lead of either the out put vtvm or the voltohmmeter (depending on whether the results are listed in the *Ohms* or *Volts* portion of the output limits column) to the terminal board pin listed in the *Output vtvm or voltohmmeter connections* of the chart.

(11) List the test numbers of all tests that do not produce the results listed in the *Output limits* column.

(12) Compare the test numbers listed, with the *Operational test No.* Column in the troubleshooting chart (para 3–8). If more than one test number is listed, check the entries in the troubleshooting chart that contain more than one test number. Use the troubleshooting chart to further localize the trouble.

NOTE

Pin connections in the input and output columns of the test chart refer to the terminal board connections on the test setup.

3-7. Operational Test Chart

The following chart lists the operational tests used to determine the extent of trouble in a control set. Perform the tests in the order given. Figure 3–1 shows the test setup connections and lists the designations of the leads within the control set that are tested by each connection to the test setup. Compare these lead designations (fig. 3-1) with those shown on the schematic diagram of the control set (fig. 7–3) to trace a circuit through the control set for troubleshooting purposes. Refer to NOTES at end of test chart for explanation of letters in *Test No.* column.

Test No	circuit tested	Audio oscillator and input vtvm		RE-ERS switch turned ON	Tranamit-inter-phone selector switch position	Output vtvm or voltohmmeter		
							Output limits	
		Pin connec-tions	Input			Pin connec-tions	Volts	Ohms
1	Receiver 1 input circuit through selector switch and headset amplfier.	14	0.5	None	1	4	0.67 tol.19	
2	Receiver 1 input circuit through RECEIVERS 1 switch and headset amplifier.	14	0.5	1	2	4	0.67to l. 19	
3	Receiver 2 input circuit through selector switch and headset amplifier.	16	0.5	None	2 2	4	0.67 1.19	

Test No.	Circuit tested	Audio oscillator and input vtvm		RE-CEIV-ERS switch turned ON	Transmit-interphone selector switch position	Output vtvm or voltohmmeter		
		Pin connections	Input volts			Pin connections	Output limits	
							Volts	Ohms
4	Receiver 2 input circuit through RECEIVERS 2 switch and headset amplifier.	16	0.5	2	3	4	0.67 to 1.19	
5	Receiver 3 input circuit through selector switch and headset amplifier.	18	0.5	None	3	4	0.67 to 1.19	
6	Receiver 3 input circuit through RECEIVERS 3 switch and headset amplifier.	18	0.5	3	4	4	0.67 to 1.19	
7	Receiver 4 input circuit through selector switch and headset amplifier.	12	0.5	None	4	4	0.67 to 1.19	
8	Receiver 4 input circuit through RECEIVERS 4 switch and headset amplifier.	12	0.5	4	3	4	0.67 to 1.19	
9	Interphone circuit through RECEIVERS INT switch and headset amplifier.	8	0.5	INT	3	4	0.67 to 1.19	
10	Interphone circuit through selector switch and headset amplifier.	8	0.5	None	INT	4	0.67 to 1.19	
11	Marker beacon receiver input circuit through RECEIVERS NAV switch and headset amplifier.	17	0.5	NAV	1	4	0.67 to 1.19	
12	Vhf navigation receiver input circuit through RECEIVERS NAV switch and headset amplifier.	15	0.5	NAV	1	4	0.67 to 1.19	
13	Navigational low-frequency receiver input circuit through RECEIVERS NAV switch and headset amplifier.	13	0.5	NAV	1	4	0.26 to 0.48	
14	Emergency receiver input circuit and headset amplifier.	9	0.5	None	1	4	0.26 to 0.48	
[a] 15	Microphone preamplifier and transmitter No. 1 output circuit.	2	0.425	None	1	5	1.63 to 3.28	
[a] 16	Microphone preamplifier and amplifier and alternate transmitter No. 1 output circuit.	2	0.425	None	1	11	1.63 to 3.28	
[a] 17	Microphone preamplifier and amplifier and transmitter No. 2 output circuit.	2	0.425	None	2	6	1.63 to 3.28	
[a] 18	Microphone preamplifier and transmitter No. 3 output circuit.	2	0.425	None	3	7	1.63 to 3.28	
[a] 19	Microphone preamplifier and amplifier and transmitter No. 4 output circuit.	2	0.425	None	4	10	1.63 to 3.28	
[b] 19.1	Microphone preamplifier and interphone line	2	0.425	None	4	8	1.63 to 3.28	
20 (See note)	Test No. 20 is a two part test as follows:							
[a] 20.1	Microphone preamplifier	2	0.2	None	INT	8	Reference db	
[a] 20.2	Private interphone circuit	2	0.2	None	INT	8	5 to 10 db	
[a] 21	Microphone preamplifier and interphone line	2	0.425	None	INT	8	1.63 to 3.28	
[a] [c] 22	Microphone preamplifier and headset amplifier	2	0.425	None	INT	4	0.04 to 0.17	
[a] 23	Transmitter No. 1 control circuit	None	None	None	1	19		0
[a] 24	Transmitter No. 2 control circuit	None	None	None	2	20		0
[a] 25	Transmitter No. 3 control circuit	None	None	None	3	21		0
[a] 26	Transmitter No. 4 control circuit	None	None	None	4	1		0
27	Hot mike control circuit	None	None	None	PVT	24		0

[a] Close momentary switch S1 to obtain output.
[b] Close momentary switch S2 to obtain output.
[c] Turn volume control fully counterclockwise (ccw).
Note. (Test No. 20).
(1) Record output limits reading in INT position.
(2) Record output limits reading in PVT position.
(3) The difference in output limit reading must be between 5 and 10 db below the reference level of test No. 20.1.

3–8. Troubleshooting Chart

a. Use of Chart. The troubleshooting chart (*b* below) may be used separately or in conjunction with the operational test chart (para 3–7) to localize trouble to a defective printed circuit board or part. The *Operational test No.* column lists numbers that correspond to the numbers in the *Test No.* column of the operational test chart (para 3-7). Use the Operational test No. column when using the troubleshooting chart in conjunction with the operational test chart. The *Symptom* column lists abnormal indications that may be observed during preflight checks or inflight operation. The *Probable trouble* column lists control set troubles that can cause the abnormal indication listed in the *Symptom* column. The *Procedure* column lists the parts to be checked.

(1) *Using troubleshooting chart separately.* When the trouble symptom is known, compare it with those listed in the *Symptom* column of the chart (b below).

{2) *Using troubleshooting chart with operational test chart.* When the control unit trouble symptoms are unknown, perform the operational test (para 3-7). List the test number of each operational test that does not produce the desired results (para *3-6b (10* and (11)). After all operational tests (Nos. 1 through 27) have been completed, one or more operational test numbers will be listed. Compared the listed operational numbers with those listed in the *Operational test No.* column to locate the appropriate probable trouble, and the test procedure. If more than one test number is listed, compare the entire group of numbers with those groups listed in the troubleshooting chart before making individual checks of each test number. *For example:* Assume that operational tests No. 1, 3, 5, 7, and 10 fail to provide the desired results. These numbers will be listed when the operational tests are completed. When these test numbers are compared with those listed in the *Operational test No.* column of the troubleshooting chart below, note that the fifth entry compares with the test numbers obtained by the operational test. A check of the probable troubles listed for the fifth entry would be made before proceeding with any other tests.

NOTE

Before proceeding be sure that visual inspection checks (para 3-4a) have been performed. The troubleshooting procedures are based on the assumption that the wiring is good. If the defective part cannot be found by the use of these procedures, check the wiring a second time.

Operation test No.	Symptom	Probable trouble	Procedure
None	Control set completely dead; no transmission or reception.	Defective microphone amplifier printed circuit board A4.	Power filter defective; replace board A4 (para 4-7).
None	Output of transmitter varies as more than one control set selects same transmitter.	Defective R2, R3, R4 or R5. -------	Check R2, R3, R4, and R5. Replace defective resistors.
None	Noisy or low output from all radio receiver lines and interphone line.	*a.* Defective VOL control RI ------- *b.* Defective AlR12--------------- c. Defective headset amplifier printed circuit board AZ.	a. Check R1 and replace if defective. *b.* Check A1R12 and replace if defective. c. Replace board A-2 (para 4-7).
	No reception from receiver 1 with transmit-interphone selector switch S1 at 1.	Defective RECEIVERS 1 switch, S7. Defective contact 4 on selector switch ASIA.	Check continuity of S7. Replace if defective (para 4-6). Check continuity through S1A contact and wiper arm. Replace S1 if defective (para 3-9a).
1, 3, 5, 7 and 10.	No reception from receiver 1, 2, 3, or 4 or over the interphone line with S1 in respective positions.	Defective AlR6------------------ Defective wiper arm contact 2½ R on selector switch S 1 A.	Check AlR6. Replace if defective. Check continuity through S1A contact and wiper arm. Replace S1 if defective.
2	No reception from receiver 1 with RECEIVERS 1 switch S7 at ON.	Defective RECEIVERS 1 switch S7. Defective A1R10- ----------- -- ---------	Check continuity of S7. Replace if defective (para 3-10). Check A1R10. Replace if defective.
3	No reception from receiver 2 with transmit-interphone selector switch S1 at 2.	Defective RECEIVERS 2 switch S6. Defective contact 3 on selector switch S1A.	Check continuity of S6. Replace if defective (para 3-10). Check continuity through S1A contact and wiper arm. Replace S1 if defective (para 3-9a).
4	No reception from receiver 2 with RECEIVERS 2 switch S6 at ON.	Defective RECEIVERS 2 switch S6. Defective AlR6------------------	Check continuity of S6. Replace if defective (para 3–10). Check A1R6, Replace if defective.

Operation teat No.	Symptom	Probable trouble	Procedure
5	No reception from receiver 3 with transmit-interphcme selector switch S1 at 3.	Defective RECEIVERS 3 switch S5.	Check continuity of S5, Replace if defective (para 3-10),
		Defective contact 2 on selector switch S1A.	Check continuity through S1A contact and wiper arm. Replace S1 if defective (para 3-9a).
6	No reception from receiver 3 with RECEIVERS 3 switch S6 at ON.	Defective RECEIVERS 3 switch S5.	Check continuity of S5, Replace if defective (para 3-10).
		Defective AlR8-------------------	Check Al R8. Replace if defective.
	No reception from receiver 4 with transmit-interphone selector switch S1 at 4.	Defective RECEIVERS 4 switch S4.	Check continuity of S4. Replace if defective (para 3-10).
		Defective contact 1 on selector switch S1A.	Check continuity through S1A contact and wiper arm. Replace S1 if defective (para 3-9a).
8	No reception from receiver 4 with RECEIVERS 4 S4 at ON.	Defective RECEIVERS 4 switch S4.	Check continuity of S4. Replace if defective (para 3-10).
		Defective AlR7-------------------	Check A1R7. Replace if defective.
9	No reception over interphone line with RECEIVERS INT switch S3 at ON.	Defective RECEIVERS INT switch S3.	Check continuity of S3. Replace if defective (para 3-10).
		Defective AlR5-------------------	Check Al R5. Replace if defective.
9 and 10	No reception over interphone line with S3 at ON or with S1 at INT.	Defective contacts on relay K1 ------	Check continuity of relay K1 contacts. Replace K1 if defective (para 3(9a).
		Defective RECEIVERS INT switch S3.	Check continuity of S3. Replace if defective (para 3-10).
10	No reception over interphone line with transmit-interphone selector switch S1 at INT.	Defective RECEIVERS INT switch S3.	Check continuity of S3. Replace if defective.
		Defective contact 5 on selector switch S1A.	Check continuity through S1A contact and wiper arm. Replace S1 if defective (para 3-9a).
11	No reception from marker beacon receiver with RECEIVERS NAV switch S2 at ON.	Defective AlR3------------------	Check AlR3, replace if defective.
11 and 12	No reception from either navigation or marker beacon receiver with RECEIVERS NAV switch S2 at ON.	Defective RECEIVERS NAV switch S2.	Check continuity of S2. Replace if defective (para 3-10).
12	No reception from vhf navigation receiver with RECEIVERS NAV switch S2 at ON.	Defective AlR4-------------------	Check A1R4. Replace if defective.
13	No reception from low frequency receiver with RECEIVERS NAV switch S2 at ON.	***a.*** Defective RECEIVERS NAV switch S2.	***a.*** Check continuity of S2. Replace if defective (para 3–10).
		b. Defective A1R2----------------	***b.*** Check Al R2. Replace if defective.
14	No reception from emergency receiver.	Defective AIRl -------------------	Check Al R1. Replace if defective.
15 through 26	No transmission over any transmitter or over interphone line.	***a.*** Defective relay K1------------	***a.*** Check and replace K1 if defective.
		b. Defective SIB wiper-- ---------	***b.*** Check SIB wiper arm. Replace Al if defective.
		c. Defective microphone preamplifier A3 or amplifier A4.	c. Replace both boards A3 and A4 (para 4-7).
15 and 19	No transmission over any transmitter.	Defective contacts 2 and 4 on relay K1.	Check contacts for continuity, and replace K1.
15 and 23	No transmission over transmitter No. 1 with transmit-interphone selector switch S1 at 1.	Defective contact 10 on selector switch S1 A or defective contact 4 on S1B.	Check continuity through S1A, SIB contacts and respective wiper arm. Replace S1 if defective (para 3-9).
16	No transmission over alternate transmitter No. 1 withftransmit interphone selector switch S1 at 2.	Defective contact 4R on selector switch S1C.	Check continuity through SIC contact and wiper arm. Replace S1 if defective (para 3-9).
17 or 24	No transmission over transmitter No. 2 with transmit-interphone selector switch S1 at 2.	Defective contact 9 on selector switch S1A, or defective contact 3 on S1B.	Check continuity through S1A and S1B contacts and respective wiper arms. Replace S1 if defective (para 3-9).

Operation test No.	Symptom	Probable trouble	Procedure
18 or 25	No transmission over transmitter No, 3 with transmit-interphone selector switch S1 at 3.	Defective contact 8 on selector switch S1A or defective contact 2 on SIB.	Check continuity through S1A and SIB contacts and respective wiper arms. Replace S1 if defective (para 3-9).
19, 19.1 or 26	No transmission over transmitter No. 4 with transmit-interphone selector switch S1 at 4.	Defective contact 7 on selector switch S1A or defective contact 1 on SIB.	Check continuity through S1A and SIB contacts and respective wiper arms. Replace if defective (para 3-9).
22	No transmission over private interphone line.	*a.* Defective contacts 8½R-12 of SIB, or 8½R-12 of S1A. b. Defective contacts 2-4 of relay K1.	a. Check continuity through S1A and SIB contacts. Replace S1 if defective (para 3-9). *b.* Check continuity of relay K1 contacts. Replace K1 if defective.
23	No transmission over interphone line with transmit-interphone selector switch S1 at INT and , transmit-interphone talk switch in transmit position.	*a.* Defective contact 5 on selector switch SIB. b. Defective relay K1 ------------	*a.* Check continuity through SIB contact and wiper arm. Replace if defective (para 3-9). b. Check and replace K1.
24	No transmission over interphone line when hot mike or transmit-interphone talk switch is operated.	Defective contacts 2 and 8 or winding of relay K1.	Check continuity of relay K1 contacts and winding. Replace K1 if defective.
24	No sidetone heard in headset when talking on the interphone line.	*a.* Defective wiper arm on S1A ---- *b.* Defective A1R1l --------------- c. Defective K1-----------------	*a.* Check S1A wiper arm. Replace S1 if defective. *b.* Check A1R1l and replace. c. Check and replace K1 if defective.
27	No output over private interphone line. Input normal.	Defective contacts 8½R-12 of S1B.	Check continuity through SIB contacts. Replace S1 if defective (para 3-9).
None	No sidetone or input from private interphone line. Output normal.	Defective contacts 2½R-6 of S1A.	Check continuity through S1A contacts. Replace S1 if defective (para 3-9).

Section III. DIRECT SUPPORT REPAIRS, REMOVAL, AND REPLACEMENT

3-9. General Parts Replacement Techniques

a. Except for switchboard Al and its mounted RECEIVERS switches S2 through S7, parts on the front and rear mounting plates (fig. 3-4) can be easily replaced after the front or rear mounting plates have been removed from the control set, by following the standard parts replacement procedures.

b. Replacement procedures for switchboard Al and switches S2 through S7 are given in paragraph 3-10.

c. When replacing wiring in the control set, refer to the wiring diagram (fig. 7-3).

d. When replacing transmit-interphone selector switch S1, tag each lead before unsoldering it from its terminal. Orient the replacement switch on the front mounting plate in exactly the same position as the original switch before securing it to its mounting.

3-10. Replacing Switchboard Al and Switches S2 through S7

a. Removal. To remove one of the RECEIVERS switches, proceed as follows:

(1) Remove the VOL control and the transmit-interphone selector switch knobs.

(2) Remove the panel lights.

(3) Remove the four screws that hold the front panel to the front mounting plate, and remove the f rent panel.

(4) Remove the screws that hold the front and rear mounting plates, from the rear of the control unit.

(5) Remove the hexagonal nuts that hold RE. CEIVERS switihes S2 through S7 to the front mounting plate.

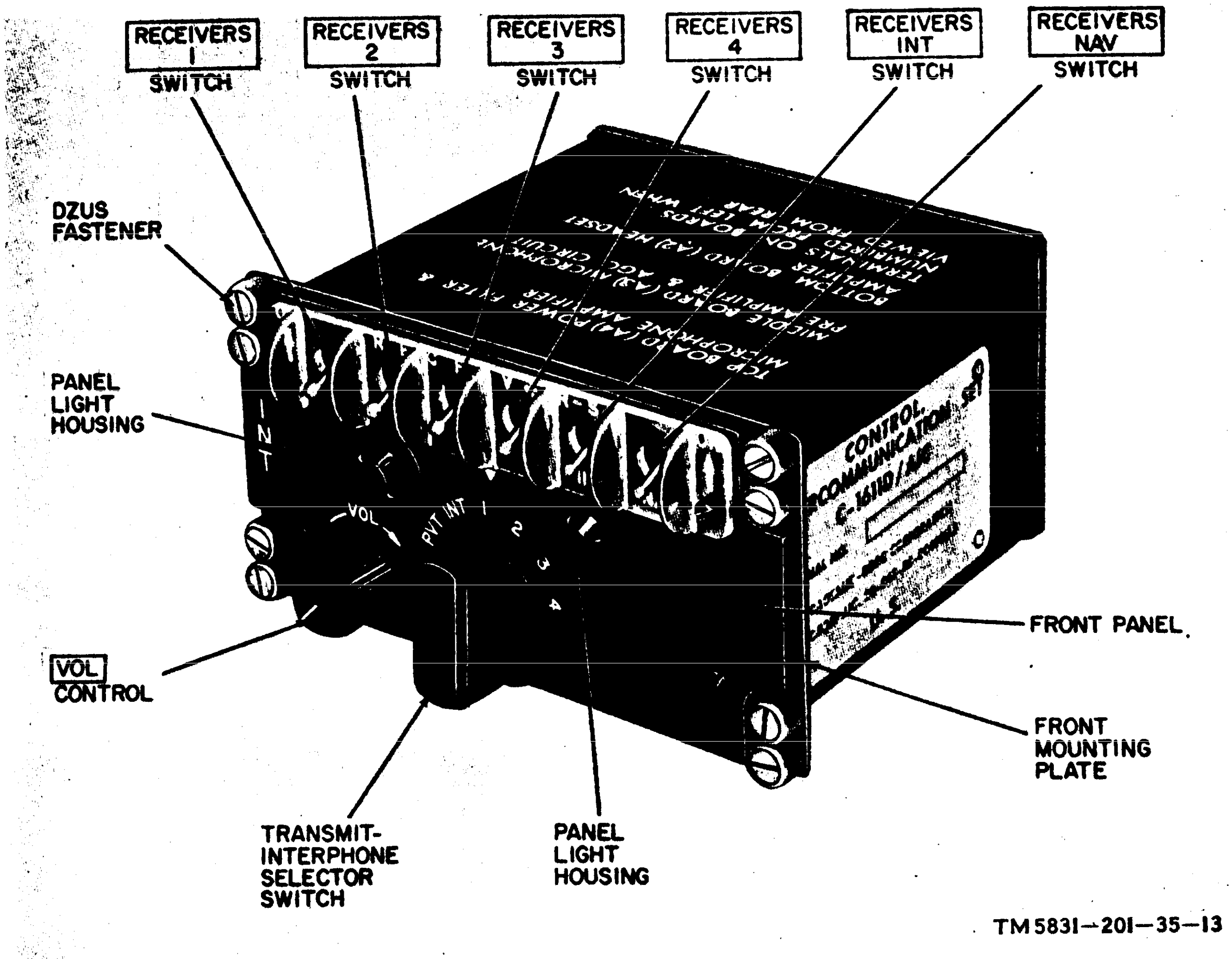


Figure 3-2 Control, Intercommunication Set C-1611D/AIC, showing locations of front panel controls.

(6) Lift switchboard Al with its attached six switches from the f rent mounting plate.

(7) Tag and unsolder all wires from the defective switch (fig. 3-5).

(8) Cut the exposed terminals of the defective switch as close to the front of switchboard Al as possible.

(9) Lay the pencil-type soldering iron across three terminals on one side of the switch to melt the solder at all three terminals simultaneously. Repeat the operation to free -the other three Switch terminals

(10) Remove the switch.

b. Replacement. To replace a RECEIVERS switch, proceed as follows :

(1) Insert the terminals of the new switch through their holes in switchboard Al.

(2) Solder the switch terminals to the copper pads on the front of switchboard Al.

“ (3) Solder the wiring harness leads to the turrets on the new switch (fig. 7-4).

(4) Place switchboard Al in position on the front mounting plate.

(5) Secure switchboard Al to the front mounting plate with the hexagonal nuts.

(6) Place the front and rear mounting plates on either end of the chassis, and secure with screws.

(7) Place the front panel in position on the front mounting plate and secure it with the screws that were removed (a(4) above).

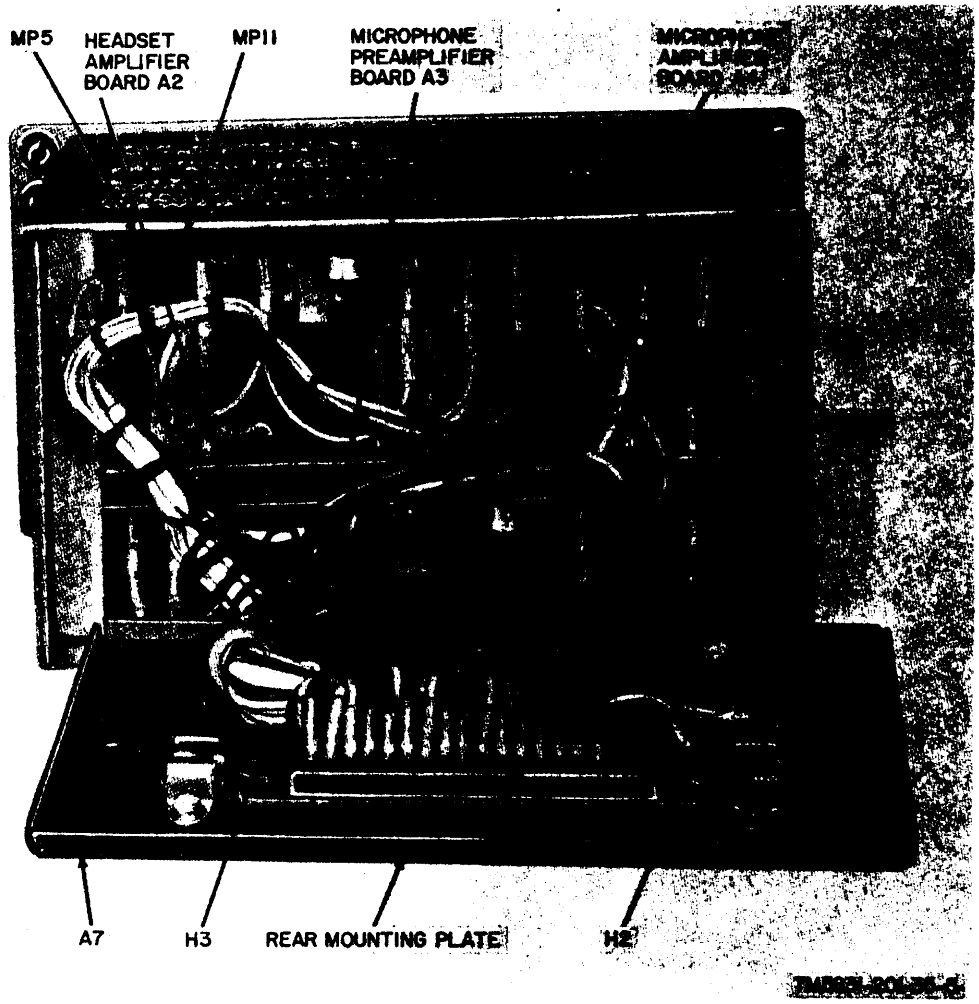


Figure 8-9. Control, Intercommunication Set C-1611D/AZC, 8howing locations of rear mounting plate components and printed circuit boards.

CAUTION

Do not overtighten the screws.

(8) Replace the front panel knobs and panel lights.

3-11. Checking Equipment

Check the equipment after troubleshooting and before returning it to service. Perform the operational test (para 3-6). The output levels given in the operational test chart (para 3-7) should be obtained in each step of the test.

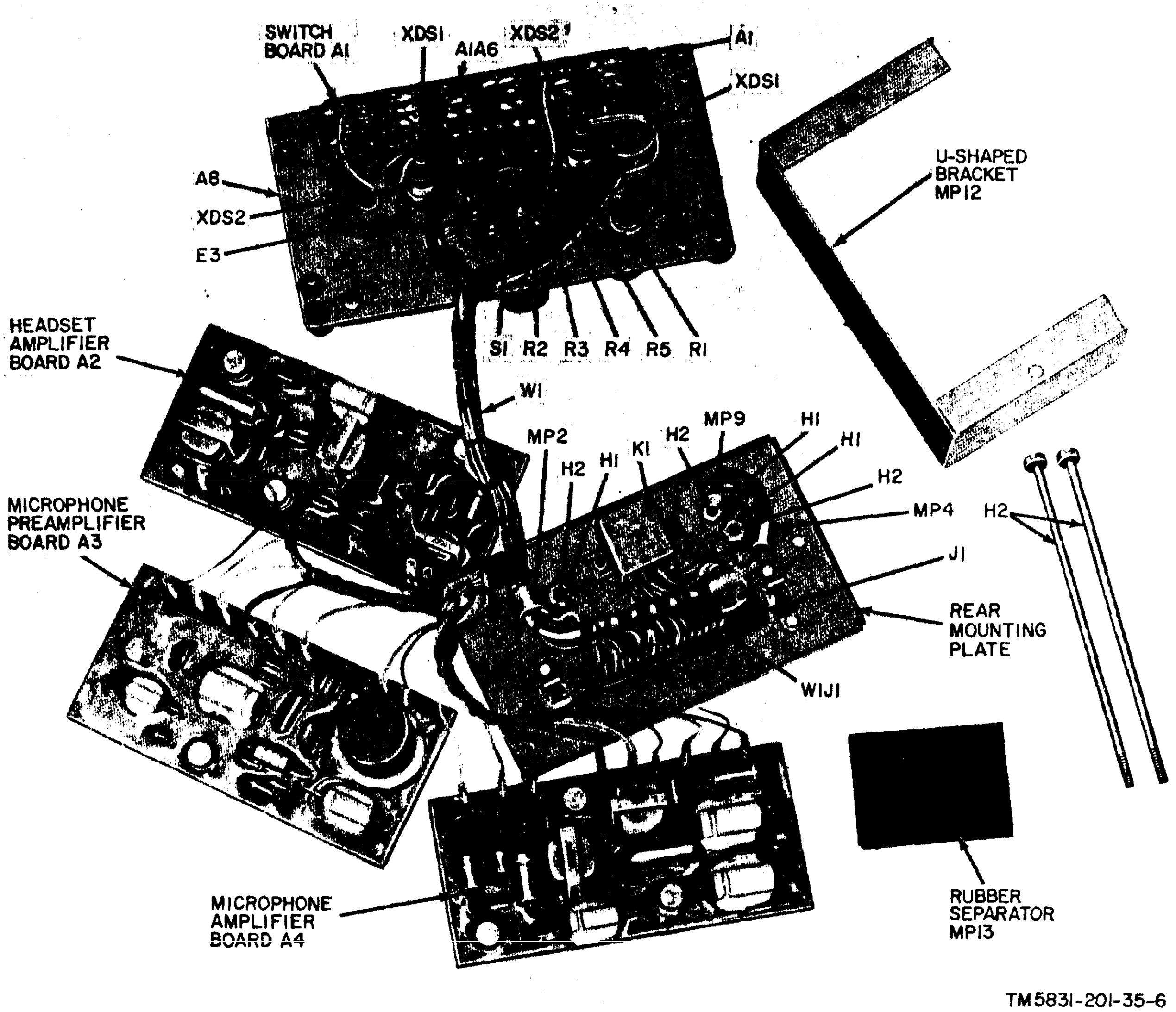


Figure 3-4. Control, Intercommunication Set C-1611D/AIC, printed circuit boards and wiring harness.

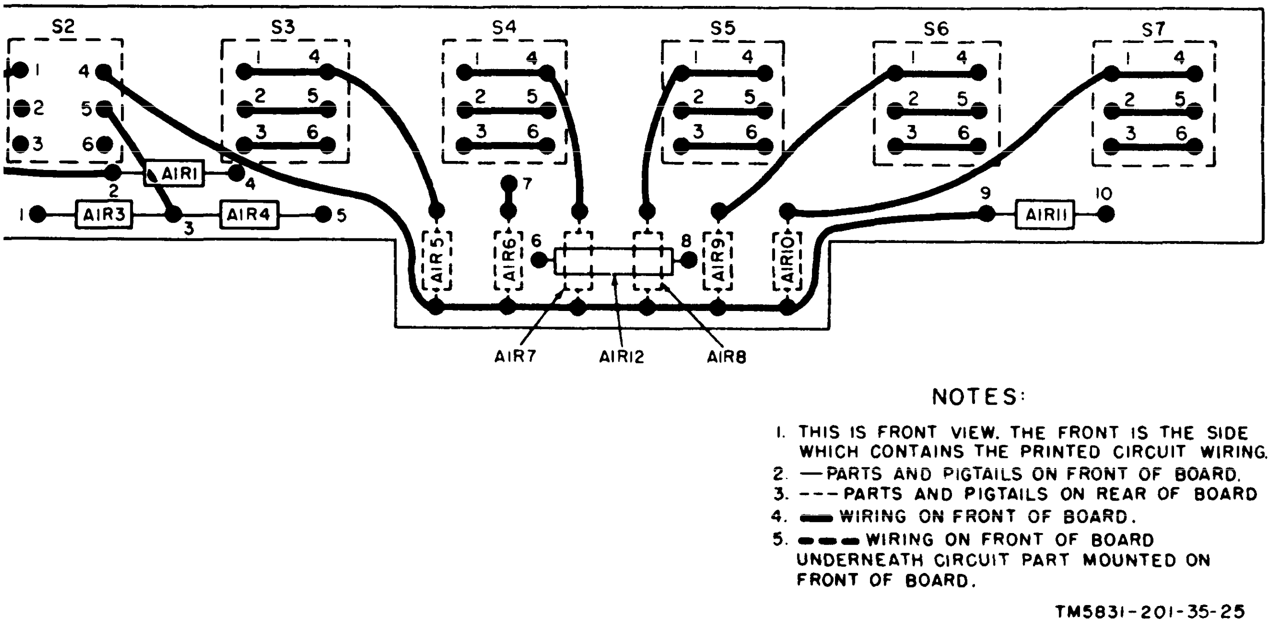


Figure 8-5. Switchboard A1, front view, printed circuit wiring

CHAPTER 4

GENERAL SUPPORT AND DEPOT MAINTENANCE

Section I. TROUBLESHOOTING

4-1. Scope of General Support and Depot Maintenance

General support and depot troubleshooting procedures cover those procedures that are applicable to the isolation of troubles due to faulty subassemblies A2, A3, and A4 in the C-1611D/AIC. When malfunction of the control set is traced to a defective printed circuit board (A2, A3, or A4) the entire board should be replaced. No repair or replacement of any component part on the boards should be made unless authorized to do so. The maintenance and repair procedures in sections II and III in this chapter are provided as emergency measure only.

4-2. Test Points, Voltage and Resistance Measurements

a. *General*. The voltage and resistance measurements are used to locate faulty circuit boards A2, A3, or A4. The test points for headset amplifier AZ, microphorie preamplifier A3, and microphone amplifier A4 are shown in figures 4–1, 4-2, and 4-3. Use the test point voltage and resistance charts in conjunction with the schematic diagram (fig. 7-3) and the transformer winding resistances (para 4–3) to isolate the trouble to a defective part. When it has been determined that an A2, A3, or A4 circuit board is defective, replace the entire circuit board. Repairs to the circuit boards shall not be made unless authorized as an emergency measure, When such emergency repairs are accomplished, replace the repaired circuit board at the earliest opportunity. See paragraph 4—5 for emergency board repair techniques. Figure 7–4 shows how boards A2, A3, and A4 are connected to the control set harness.

b. Test Procedure. Since most defective printed circuit wiring can be found by visual inspection (para 3-4), the voltage and resistance charts should be used to isolate a defective part. Make all voltage and resistance checks between the test point listed in the chart and ground lug El on the rear mounting plate (figs. 3-4 and 7-4). When a trouble has been localized to board A2, A3, or A4, proceed as follows to isolate the trouble to a deftive part:

CAUTION

Be extremely careful when making any measurements near a transistor or diode terminal. A momentary short may permanently damage the transistor or diode.

(1) Connect the defective board (A2, A3, or A4) to a control set that is in good operating condition.

(2) Connect the control set to the test setup and follow the procedures given in paragraphs 3-6b (1) through (10).

(3) Operate the six RECEIVERS switches on the control set to their off (down) position.

(4) Operate Transmit-interPhone selector switch S1 on the control set to the INT position.

(5) Connect the positive lead of the audio oscillator to pin 2 on the terminal board of the test setup (fig. 3–1).

(6) Using voltohmmeter arranged as a dc voltmeter, make the dc voltage checks listed in the *Dc volts* column of the chart below pertaining to board A2, A3, or A4.

(7) Use the vtvm and make all the ac voltage checks listed in the *Ac volts* column of the chart pertaining to the printed circuit board being tested. Do not connect the vtvm to test points that have no values listed in the *Ac volts* column of the voltage and resistance chart.

(8) Disconnect the control set from the test setup.

(9) Arrange the voltohmmeter as an ohmmeter and make the forward resistance measure-

\ VI

ments listed in the chart ((12) below) pertaining to board AZ, A3, or A4. Observe the meter polarity while making this test.

NOTE

In order to make contact with wires and terminals that are covered with epoxy it is necessary to use test probes with needlesharp points.

(10) Reverse the ohmmeter test leads and make the reverse resistance checks listed in the appropriate chart.

(11) After the trouble has been definitely isolated to a particular part, replace the circuit part if authorized, or replace the entire circuit board. Use the R x100 or R x 1,000 ranges of the ohmmeter to prevent transistor or diode damage. Use the capacitor and resistor values listed on the schematic diagram, the transformer winding resistances (para 4-3), the crystal test set, the crystal resistance values ((12) below), and the transistor tester as aids in isolating the trouble to a defective part.

(12) The resistance values for the crystal diodes in the control set are listed below. The following tests are made with the voltohmmeter, using the R x 100 scale. The surrounding temperature should be approximately 70° Fahrenheit.

(13) In the following circuit board tests, only the terminals with harness wires attached need to be tested. The wired terminal test points, for circuit boards A2, A3, and A4 are readily accessible by removing the rear mounting plate. These tests should indicate whether or not the circuit board is functioning normally. If the test readings shown on the charts are not obtained, the board should be removed and replaced with a new one. Further testing of the circuit boards requires the removal of the boards from the case Refer to paragraphs 4-5 and 4-6.

CAUTION

Do not use the R x 1 or R x 10 ohmmeter ranges or damage to diodes and transistors may result.

Diode	Forward resistance (ohms)	Reverse resistance (ohms)
1N457 -------- -------- ------	6	Infinite
1N718-----------------------	8	Infinite
1N965B ----------------------	9	Infinite

NOTE

These provide only an indication of the condition of the diode and should be used only when a crystal set set is not available. If the circuit using the tested diode is still inoperable after the diode has been checked, replace the diode,

c. ***Headset Amplifier Az, Voltage and Resistance*** *Chart (fig.* 4-1).

Test	Dc volts	Ac volts	Common test lead connected to ground bus (ohms)	Common test lead connected to test point (ohms)
A1	o	0.0425	Infinity	Infinity
A2	o	------ ---	Infinity	Infinity
A3	0	----- ----	0	0
A4	16	-----------	760	10
A6	24	----------	400	40
A6	0	1.6	0	0
A7	0	0	0.5	0.5
A8	9.0	0.045	4,000	450
A9	9.2	0.008	270	1,800
A10	0.72	6.5	850	800
A11	24	3.7	750	205
A12	24	2.0	400	250
A18	0.12	16	65	66
A14	24	8.7	760	210
A16	23.8	2.0	400	260
A16	0.12	16	60	60

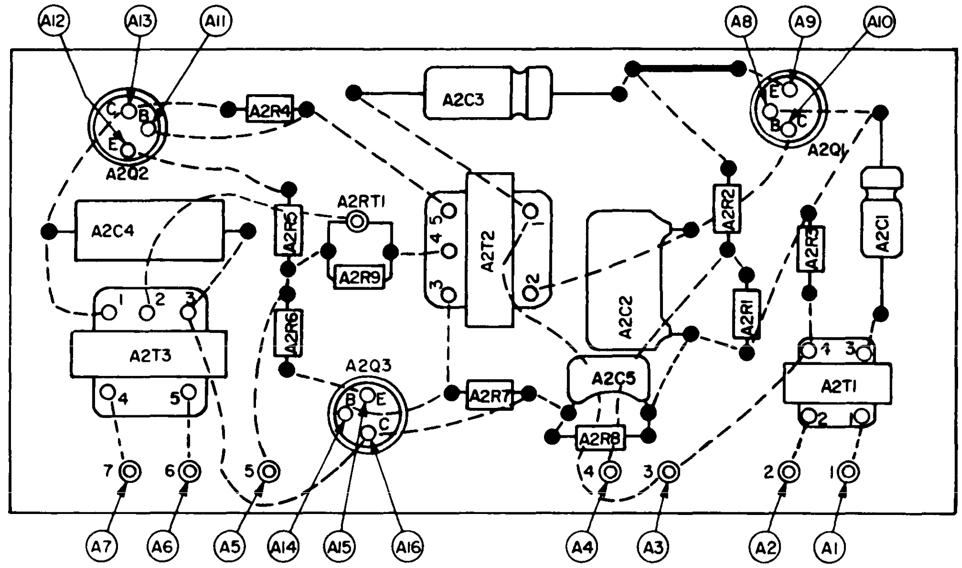
d. Microphone Preamplifier A3, Voltage and Resistance Chart (fig. 4-2),

Test point	Dc volts	Ac volts	Common test lead connected to ground bus (ohms)	Common tets lead connectad to test point (ohms)
B1	0	------ ---	Infinity	Infinity
B2	0	------ ---	Infinity	Infinity
B3	15	------ ---	750	10
B4	8.1	-----------	l 60,000	1,000
B5	0	------ ---	0	0
B6	0	------- --	0	0
B7	3.8	0.013	900	**960**
B8	8.2	0.0022	7)000 i	1,000
B9	8.4	0.0027	1,100	1,400
B10	7.8	-----------	6,600	6,000
B11	8.1	-----------	l 60,000	3,000

This circuit has a large time constant. Allow several seconds for the meter to stabilize.

e. *Microphone Amplifier A4, Voltage and Restitance Chart (fig. 4-3).*

Test point	Dc volts	Ac volts	Common test lead connected to ground bus (ohms)	Common test lead connectad to test point (ohms)
C1	3.8	0.013	900	960
C2	8.1	------- -	l 60,000	1,000
C3	0	------- -	3,600	60,000
C4	0	2.66	Infinity	Infinity
C6	0	.------ -	Infinity	Infinity
C6	24	--------	400	50



NOTES:

1. THIS IS A FRONT VIEW. THE FRONT IS THE SIDE ON WHICH THE CIRCUIT PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ---- WIRING ON REAR OF BOARD.
4. ━━ WIRING ON FRONT OF BOARD.

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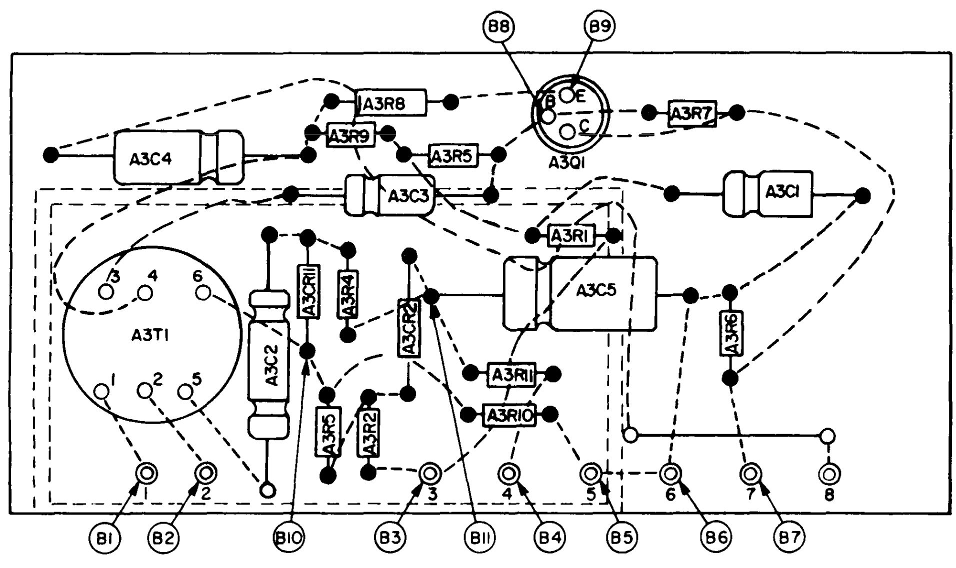
Figure 4-1. Headset amplifier A2, showing printed wiring, circuit element, and test points.



NOTES:

1. THIS IS A FRONT VIEW. THE FRONT IS THE SIDE ON WHICH THE CIRCUIT PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ---- WIRING ON REAR OF BOARD.
4. SHIELD AND SEPARATOR ON REAR OF BOARD.

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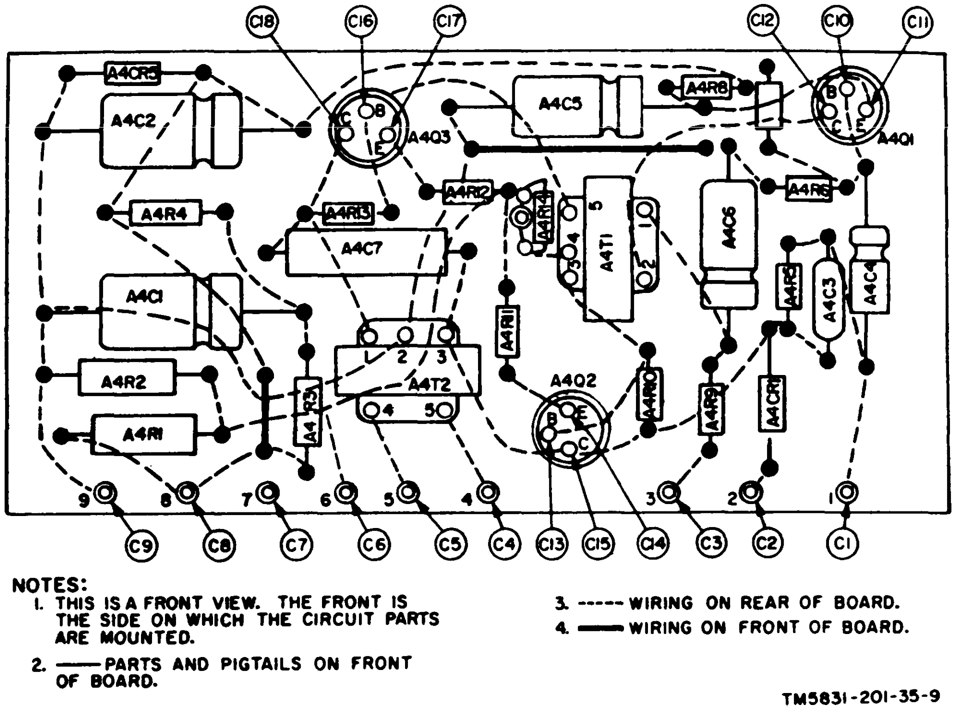
Figure 4-2. Microphone preamplifier and agc circuit As showing printing wiring circuit elements and test points.



printed wiring, circuit elements and test points.

Test point	Dc volts	Ac volts	Common test lead connected to ground bus (ohms)	Common test lead connected to test point (ohms)
C7	15	----------	750	750
C8	27.5	----------	450	450
C9	0	----------	0	0
C10	9.1	.018	4,000	4,000
C11	9.3	.0038	2,000	2,200
C12	3.0	2.3	2,000	[1] 50,000
C13	24	1.5	750	65
C14	24	0.93	410	250
C15	0.13	6.6	65	65
C16	24	1.5	750	65
C17	24	0.93	410	250
C18	0.13	6.6	65	65

1 The circuits have a large time constant Allow several eeconde for the meter to stabilize

4-3. Transformer Winding Resistances

The dc resistances of the transformer windings in control sets are listed below.

Transformer	Terminals	Ohms
A2T1	1–2	9
	3–4	11
A2T2	1–2	260
	3–4	210
	4–5	210
	3–5	420
A2T3	1–2	70
	2–3	70
	1–3	140
	4–5	0.7
A3T1	1–2	4
	3–4	21
	5–6	156
A4T1	1–2	260
	3–4	210
	4–5	210
	3–5	420
A4T2	1–2	70
	2–3	70
	1–3	140
	4–5	15

Section II. GENERAL SUPPORT AND DEPOT REPAIR PROCEDURES

4-4. General

General support repair consists of repair and replacement of elements on the printed circuit boards. It also includes disassembly and reassembly of the control set, and replacement techniques.

4-5. Replacement Techniques

a. Boards .A2, A3, A4. Special repair techniques (para 4-7) are required to replace parts on transistorized boards A2, A3, and A4, and must be authorized as emergency repairs. To remove a board from the control set (para 4–6), unsolder and remove the wiring harness leads. When reconnecting board A2, A3, or A4 to the wiring harness refer to the wiring diagram (fig. 7-4) and to *b* below.

b. Wiring Harness Connections to Boards A2, A3, and A4 (figs. 7-3 and 7-4). Wiring harness leads are terminated in sleeve-type connectors which are soldered to the board terminals. Connect wiring harness leads to the terminal board terminals as follows:

(1) Place a ½-inch length of insulated sleeving over the lead.

(2) Press the sleeve connector onto the pin terminal. Solder the connection and pull the insulated sleeving over the connector and terminal.

4-6. Control Set Disassembly and Reassembly

To remove board A2, A3, or A4 (figs. 3–3 and 3-4) from the control set, disassemble the entire unit; then unsolder the wiring harness leads from the printed circuit board terminals. Mark and tag all wires.

a. Disassembly.

(1) Remove the two retaining screws, flat washers, and lockwashers that hold the front and rear mounting plates to the case from the rear of the control set. Note the position of the U-bracket in the front of the set.

(2) Position one of the narrow edges of the rear mounting plate against the rear edges of boards A2, A3, and A4 so that the rear mounting plate will clear the case when it is pushed through.

(3) Carefully push boards A2, A3, and A4 through the chassis by pushing the rear mounting plate against the printed circuit boards.

(4) A shock absorbing rubber separator is located between printed circuit boards A2 and A3. Locate and remove this pad to prevent its loss.

NOTE

When the printed circuit boards are pushed out, the U-bracket is also forced out.

b. Reassembly.

(1) Check to be sure that the wiring harness leads (fig. 7-4) are tightly soldered to their respective terminals on switchboard Al (fig. 3–5), headset amplifier A2 (fig. 4-1), microphone preamplifier A3 (fig. 4-2), and microphone amplifier A4 (fig. 4–3). Refer to figures 3–3 and 3–4 when performing steps (2) through (8) below.

(2) Push the rear mounting plate through the chassis from the front.

(3) Place the shock absorbing rbing rubber separator between printed circuit boards A2 and A3. Center the separator on the circuit side of printed circuit board A2.

(4) Insert boards A2, A3, and A4 in their respective chassis guides.

(5) Slide boards A2, A3, and A4 to the rear of the chassis as. far as they will go.

(6) Insert the U-bracket in the position noted in *a(1)* above.

(7) Secure the front and rear mounting plates to the control set with the two retaining screws, lockwashers, and flat washers.

(8) The retaining screws should not be tightened beyond the torque limit of 3 inch-ounces.

4-7. Printed Circuit Board Repair Techniques

a. General Printed circuit repairs are divided into three areas of trouble: a defective printed circuit board (Al, A2, A3, or A4), defective conductors, or defective parts. If the board is cracked, broken, or blistered, replace it.

CAUTION

Only pencil-type soldering irons with a maximum capacity of 40 watts should be used when repairing printed circuits.

b. Printed Circuit Board Coating Identification. Printed circuit boards A2, A3, and A4, component parts, and conductors are coated with a protective compound. Identify the type of coating used before starting repairs.

(1) *Serial-numbered control sets 1 through* 566. On printed circuit boards A2 and A4, Hysol 6232 epoxy is used on the component part side of the board, and Lacquer, Fungus resistant, MIL Specification MIL-V–173a, or equivalent, is used on the conductor side of the board. Hysol 6232 is used on both sides of board A3; no protective compound is used on board Al. Before any re-

pairs or replacements can be made, the protective compound must be removed from the immediate area. When the repairs or replacements are completed, the area must be cleaned and the protective compound reapplied. Removal and replacement procedures for both types of protective compounds are given in c and *d* below.

WARNING

Hysol 6232 is toxic. Be sure the work area is well ventilated before attempting any repairs that require the use of Hysol 6232. If Hysol 6232 comes in contact with the skin, wash thoroughly with soap and water immediately.

(2) *Serial-numbered control sets 567 and higher.* Circuit boards. component parts, and conductors are identified by the white epoxy coating around some of the parts. Printed circuit boards A2, A3, and A4 are epoxy-coated on both sides. Coating is not used on board Al. It is recommended that repairs not be made on epoxy coated boards, but that the entire board be replaced. However, emergency repairs can be made if authorized. Before any repairs or replacements can be made, the epoxy must be removed from the immediate area of repair. When the repairs or replacements are completed, the area must be cleaned and the epoxy reapplied. Refer to c and d below for epoxy removal and application procedures.

c. *Removal of Printed Circuit Board Protective Compounds.* Remove the protective coating from printed circuit boards as described in (1) and (2) below.

(1) *Removal of lacquer and Hysol* 623,2 *from circuit boards in serial-numbered control sets **1** through 566.*

(a) Remove the lacquer (MIL spec MIL-V.173a) by dissolving it with Toluol, Federal Specification TT-T–548a, and wiping the area clean with a lint free cloth.

(b) Remove Hysol 6232 by applying heat from a 40-watt soldering iron to the areas being repaired. Wipe heated Hysol 6232 from the area to be cleaned with a lint free cloth.

CAUTION

Do not apply heat any longer than necessary. Prolonged heating may damage the printed wiring on the printed circuit board.

(2) *Removal of epoxy from circuit boards in serial-numbered control sets 567 and higher.* Remove epoxy by applying heat from a 40-watt soldering iron equipped with a blade tip to the areas being repaired. Scrape away heated epoxy and wipe the area being cleaned with a lint free cloth.

CAUTION

Do not apply heat any longer than necessary. Prolonged heating may damage the printed wiring on the printed circuit board.

d. *Applying Printed Circuit Board Protective Compounds,* Apply protective coating(s) to printed circuit boards as described by the following procedure:

(1) *Application of lacquer and Hysol 6232 to circuit boards in serial-numbered control units 1 through* 566.

(a) Thoroughly clean the area surrounding the repair with methyl ethyl ketone, Federal Specification TT–M–261 (2), or equivalent. Lacquer (MIL Spec MIL-V-173a) may then be brushed or sprayed on the repaired area. Hysol 6232 must be prepared before it can be applied to a printed circuit board. To prepare and apply Hysol 6232, proceed as follows:

CAUTION

Since boards A2, A3, and A4 slide into grooves on the main chassis, the overall thickness of the board and its protective coating must not exceed 0.093 inch for a distance of $^1/_8$ inch from each edge.

(b) Add 82 parts by weight of Hysol 6232 B to 100 parts by weight of Hysol 6232 A.

NOTE

Hysol 6232 mixture must be applied within 30 minutes after preparation.

(c) Stir the mixture thoroughly.

(d) Brush the mixture on the repair areas of the printed circuit board.

(e) Heat an oven to 70°C (158°F).

(f) Bake the board in the oven for approximately 1 hour.

(2) *Application of epoxy to circuit boards in serial-numbered control units 567 and higher,*

(a) Thoroughly clean the area surrounding the repair with Inhibisol (SM-D-379825-1).

(b) Mask terminals on component side of board.

CAUTION

Since boards A2, A3, and A4 slide into grooves on the main chassis, the overall thickness of the board and its protective coating must exceed 0.093 inch for a dis-distance of $^{1}/_{6}$ inch from each edge.

(c) Brush-coat area of repair approximately 0.012 inch thick with Epoxy SM–B–379829 and air-dry at room temperature for 1 hour and bake at 140° F for 2 hours.

(d) If one of the following parts, A2C3, A3C1, A3C4, A3C5, A3T1, A4CI, A4C2, A4C5 is replaced, brush coat these parts with Epoxy SM-B–379875. Air-dry for 30 minutes at room temperature and bake at 1400 F for 2 hours.

(e) Repeat step c above.

(f) Remove masking from board terminals. Terminals must be free of epoxy for future soldering.

e. Repairing Defective Conductors. A conductor is considered to be defective if it has a pinhole, notch, or cut that exceeds 30 percent of its width. To repair defective conductors on the printed circuit boards, proceed as follows:

(1) Remove the protective compound (c above).

(2) Place a short length of flat bus wire over the conductor so that the pinhole, cut, or notch is covered, and hold it firmly in place.

(3) Solder the entire length of the bus wire to the conductor on the printed circuit board.

CAUTION

Do not apply heat any longer than necessary. Prolonged heating may damage the printed circuit board.

NOTE

If heat separates the conductor from the printed circuit board, replace the board.

(4) Apply the protective compound to the repaired area (b(2) above).

f. Replacing Defective Parts.

(1) Defective parts can be either standard parts, such as resistors and capacitors, or heat-sensitive parts, such as transistors and diodes. All parts are replaced as described in (2) below, except that the precautions listed in *(a), (b),* and (c) below must be observed when replacing transisters and diodes.

(a) Do not use a soldering iron with a greater capacity than *40* watts.

(b) When replacing a diode, leave a loop in each lead as in the original diode installation. When soldering, clamp the loop with long-nosed pliers to act as a heat sink.

CAUTION

Do not use a soldering gun; damaging voltages can be induced in heat-sensitive components.

(c) When replacing a transistor, use long-nosed pliers as a heat sink between the solder joint and the transistor while applying heat from the soldering iron. Grasp the transistor lead near the transistor.

(d) Make all solder joints quickly, Do not apply heat any longer than absolutely necessary.

(2) To remove a component from a printed circuit board, proceed as follows:

(a) Cut the leads near the mounting holes on the component part side of the board.

(b) Remove the protective component (c above).

(c) Apply heat at the mounting holes until the solder is melted. Remove all old leads.

CAUTION

z. Do not apply heat any longer than necessary. Prolonged heating may damage the board.

2. Any undue pressure on the lead before the solder is completely melted may separate the mounting pad from the printed circuit board.

(d) Heat the solder around the mounting holes and remove the solder with a stiff-bristled brush.

(e) Bend the leads of the replacement part to fit the mounting holes.

(f) Insert the leads in the mounting holes and press the part flat on the board.

(g) Cut the leads and leave approximately $^{1}/_{8}$ inch 011 the underside of the board.

(h) Bend the leads toward the maximum conducting area and press them flat on the board.

(i) Solder the leads to the mounting pad laying the soldering iron point directly on the leads,

CAUTION

P: acing the soldering iron directly on the mounting pad may cause the mounting pad to separate from the board.

(j) Apply the protective compound (d above.)

Section III. GENERAL SUPPORT TESTING PROCEDURES

4-8. General

a. Testing procedures are prepared for use by Electronics field maintenance shops and Electronics service organizations responsible for general support maintenance of electronics equipment to determine the acceptability of repaired electronics equipment. These procedures set forth specific requirements that repaired electronics equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for the testing of equipment that has been repaired at direct support.

b. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence*. For each step, perform all the actions requited in the *Control settings* columns; then perform each specific test procedure and verify it against its performance standard.

4-9. Test Equipment and Material Required

All test equipment, tools, material, and other equipment required to perform the testing procedures given in this section are listed in the chart Mow.

a. *Test Equipment and Material.*

Nomenclature	Technical manual	Common name
Special test setup per fig. 3-1.	....	Test setup
Signal Generator AN/URM-127.	TM 11-6625-683-15	Audio oscillator
Electronic Multimeter ME-26B/U.	TM 11-6625-200-12	Vtvm.
Dc power supply, 27.5 volts, 1 ampere minimum.		
Spectrum analyzer TS-723A/U.	TM 11-5097	Distortion meter.

b. Test Connections and *Conditions.* Connect the control set to the test equipment as shown in figure 5–1 and **as** described in the procedures column for each test. Apply 27.5 vdc power, turn on all test equipment and allow a warmup period of 10 minutes.

c. *Measuring Voltages and Output.* Multimeter ME–26B/U is described as the input vtvm and is used to measure the audio oscillator voltage input to the control set. The meter function of the Spectrum Analyzer TS-723A/U is used to measure the output readings.

4-10. Test Facilities

Primary power requirements are 27.5 volts dc at 1 ampere, plus the power required for the test equipment. Temperature, humidity, and atmospheric pressure are not critical.

4-11. Physical Tests and Inspection

This inspection supplements the preventive maintenance checks and services described in TM 11–5831–201-20.

a. Test Equipment and Material. Toolkit, Electronic Equipment TK-101/G is the only test equipment required for these tests.

b. Procedure. Examine the control unit for the following:

Step No.	Control settings: Teat equipment	Control settings: Equipment under teat	Test procedure	Performance standard
		Control set		
1	None ----------------------	Controls may be in any position.	a. Inspect all mechanical parts for loose or missing screws, bolts, or nuts. *b.* Inspect connector, switches, and VOL control for Ioose or damaged parts. c. Inspect cabinet for damage, missing parts, and condition of finish and panel lettering.	*a.* Screws, bolts, and nuts will be in place and tightly secured. *b. No loose* or damaged parts. c. No damaged or missing parts. External painted surfaces must not show bare metal. Panel lettering will be legible.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			Note. Touchup painting is recommended in lieu of refinishing whenever practical. Screwheads, receptacles, and plated fasteners will not be painted or polished with abrasives.	
2			Check the equipment for applicable modification work orders (MWO's). See DA Pam 310-7 for list of MWO's.	MWO will be incorporated, and the equipment will be marked accordingly.

4-12. Operational Test

Perform a complete operational test of the repaired or reconditioned control set as outlined in steps *a*, *b*, and c below.

a. Fabricate the test setup described in paragraph 3–5.

b. Conduct the operational test outlined in paragraph 3–6. This test checks the gain of the amplifiers in the control set in addition to all the switching functions. The output levels should be as specified in the operational test chart (para 3–7) for each step of the test.

c. After the operational test has been completed, perform the frequency response, agc, and distortion tests outlined in paragraphs 4-13, 4-14, and 4-15.

4-13. Frequency Response Test

a. Test Equipment and Materials.

Special test setup, figure 3–1.
Signal Generator AN/URM-127.
Electronic Multimeter ME–26B/U.
Spectrum Analyzer TS-723A\U.
27.5 vdc power source.

b. Test Connections and Conditions. Same as paragraph *4-9b.*

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	*FREQUENCY RESPONSE TEST*			
	Signal Generator AN/URM–127	*Control set*		
	POWER switch: ON FREQ. RANGE MULTIPLIER switch: X 10 Dial: 100 (1000Hz) ATTENUATOR: as directed OUTPUT CONTROL: as directed	Set all RECEIVERS switches to OFF. Set transmit-interphone selector switch to position 1.	*a.* Connect control set to test setup (paras 3-5 and 3-6). *b.* Connect audio oscillator OUTPUT test lead and input vtvm AC test lead to pin 14 of test setup terminal board.	*a.* None. *b.* None.
	Multimeter ME–26B/U FUNCTION switch: AC AC ZERO: zero meter reading RANGE: IV		*c.* Connect spectrum analyzer METER INPUT test lead to pin 4 of test setup terminal board. *d.* Adjust audio oscillator ATTENUATOR and OUTPUT CONTROL for a 0.5-volt reading on input vtvm.	*c.* None. *d.* None.
	Spectrum analyzer TS–723A/U POWER switch: ON METER RANGE switch: as directed FUNCTION switch: METER:		*e.* Turn spectrum analyzer METER RANGE switch for an on-scale	*e.* None.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedure	Performance standard
			reading on the DECIBELS scale.	
			f. Record db reading on spectrum analyzer meter.	*f.* None.
			g. Adjust audio oscillator dial to 30 (300 Hz), and readjust OUTPUT CONTROL for a 0.5-volt reading on input vtvm.	*g.* Db reading should not vary more than +1 or −3db of level established in step *f* above.
			h. Adjust audio oscillator FREQ. RANGE MULTIPLIER switch to X100, dial to 60 (6000 Hz) and readjust OUTPUT CONTROL for a 0.5-volt reading on input vtvm.	*h.* Same as step *g* above.
			i. Reset audio oscillator to 1,000 Hz, 0.5-volt output level.	*i.* None.
			j. On control set, rotate VOL control R1 counterclockwise.	*j.* Output indication on spectrum analyzer meter should decrease.
			k. Return VOL control R1 to its extreme clockwise position.	*k.* None.
			l. Connect audio oscillator and input vtvm to pin 2 of terminal board.	*l.* None.
			m. Connect spectrum analyzer to pin 5 of terminal board.	*m.* None.
			n. Adjust audio oscillator ATTENUATOR and OUTPUT CONTROL to obtain a 0.075-volt reading on the input vtvm.	*n.* On test setup, press switch S1 to ON position and record db reading on spectrum analyzer meter.
			o. Adjust audio oscillator dial to 30 (300 Hz) and readjust audio oscillator output level to 0.075 volt.	*o.* None.
			p. On test setup, press switch S1 to ON, and record db reading on spectrum analyzer meter.	*p.* Db reading should not vary more than +1 and −6.5 db of level established in step *n* above.
			q. Adjust audio oscillator FREQ. RANGE MULTIPLIER to X100 and dial to 50 (5000 Hz), readjust audio oscillator output level to 0.075 volt.	*q.* None.
			r. On test setup, press switch S1 to ON, and record db reading on spectrum analyzer meter.	*r.* Db reading should not vary more than +1 and −6.5db of level established in step *n* above.

4–14. Agc Circuit Test

a. Test Equipment and Materials. Same as paragraph 4–13*a*.

b. Test Connections and Conditions. Same as paragraph 4–9*b*.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedures	Performance standard
2	*AGC CIRCUIT TEST* *Signal Generator AN/URM-127* Adjust controls as directed *Multimeter ME-26B/U* Adjust controls as directed *Spectrum analyzer* Adjust controls as directed.	Same as step 1. Set all RECEIVERS switches to OFF. Set transmit-interphone selector switch to position 1. On the test setup, press switch S1 to ON position when taking readings.	*a.* Check that audio oscillator and input vtvm are connected to pin 2 of terminal board, and spectrum analyzer is connected to pin 5 of terminal board. *b.* With FREQ. RANGE MULTIPLIER switch at X10 and dial at 100 (1000 Hz), adjust audio oscillator output level to 0.425 volt on input vtvm. *c.* Set input vtvm RANGE switch to 10V, and advance audio oscillator ATTENUATOR and OUTPUT CONTROL to obtain a 4.25-volt reading on input vtvm.	*a.* None. *b.* Record db reading on spectrum analyzer meter. *c.* Reading on spectrum analyzer meter should be within 5 db of output level obtained in step *b* above.

4–15. Distortion Test

a. Test Equipment and Materials. Same as paragraph 4–13*a*.

b. Test Connections and Conditions. Same as paragraph 4–9*b*.

c. Procedure.

Step No.	Control settings: Test equipment	Control settings: Equipment under test	Test procedures	Performance standard
3	*DISTORTION TEST* *Signal Generator AN/URM-127* Same as step 1 except set dial to 30 (300 Hz)	Same as step 1. Be sure to press switch S1 on test setup to ON	*a.* Check that audio oscillator and input vtvm are con-	*a.* None.

Step No.	Control settings		Test procedures	Performance standard
	Test equipment	Equipment under test		
	Multimeter ME-26B/U Same as step 1. *Spectrum Analyzer TS-723A/U* POWER switch: ON AF-RF INPUT switch: AF FUNCTION switch: SET LEVEL Signal INPUT control: MIN FREQUENCY RANGE switch: X10 METER RANGE switch: 100 percent	when taking readings.	nected to pin 2 on the terminal board, and spectrum analyzer is connected to pin 5 on the terminal board. Set audio oscillator to 300 Hz at 0.425 volts.	
			b. Adjust spectrum analyzer signal INPUT control for full-scale deflection of meter. Set function switch to DISTORTION; adjust BALANCE control for minimum meter reading; continuously adjust FREQUENCY and BALANCE controls for minimum.	*b.* Spectrum analyzer should indicate not more than 5 percent distortion.
			c. Connect audio oscillator and input vtvm to pin 14 of terminal board.	*c.* None.
			d. Connect the distortion analyzer to pin 4 of terminal board.	*d.* None.
			e. Adjust audio oscillator output level to obtain a 0.5-volt reading on the input vtvm.	*e.* None.
			f. Reset spectrum analyzer FUNCTION switch to SET LEVEL.	*f.* None.
			g. Repeat step *b* above	*g.* Spectrum analyzer should indicate not more than 7 percent distortion.

CHAPTER 5
DEPOT MAINTENANCE AND DEPOT OVERHAUL STANDARDS

Section I DEPOT MAINTENANCE

5-1. Scope of Depot Maintenance

Depot maintenance consists of those maintenance procedures that are beyond the capability of general support maintenance facilities and are required to return the equipment to a performance status equivalent to that of new equipment. The maintenance procedures are those indicated for direct and generah support plus those procedures that "may be required for mechanical and/or structural repairs, nessary for equipment rebuilding and overhaul All rebuilding procedures must conform with the general requirements for electronic equipment as indicated in TB SIG 355-series bulletins.

5-2. Tools, Test Equipment, and Materials Required

Refer to paragraphs 3-2,3-5, and 4-9 for the tools and test equipment required for depot maintenance and testing procedures. All test equipment and materials required are readily available through normal depot facilities.

Section II DEPOT OVERHAUL STANDARDS

5-3. Applicability of Depot Overhaul Standards

Control, Intercommunication Set C-1611D/AIC must be thoroughly tested for fictional and operational integrity after rebuild or repair, to insure 'that it meets the required performance standards for return to stock and reissue. It is mandatory that equipment to be reissued or returned to stock for reissue meet all the performance standards.

5-4. Applicable References

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

b. Modification Work Orders. Perform all modification work orders (MWO's) applicable to this equipment before making the specified tests. DA Pam 310-7 lists all available modification work orders.

5-5. Test Facilities Required

The following items are required for depot testing.

Item	*Technical manual*	*Common name*
Audio Oscillator TS421/U and TS-421A/U or	TM 11-6625-355-12	Audio oscillator
Signal Generator AN/URM-127	TM 11-6625-683-15	
Multimeter ME-26B/U	TM 11-6625-206-12	Vtvm
Multimeter TS-352B/U	TM 11-6625-366-15	Multmeter
Spectrum AnaIyzer TS-723A/u	TM 11-5097	Distortion meter
special test setup (fig. 3-1)	....	Test setup
Test set Radio TS-1588A/AIC	TM 11-6625-441-12	InterPhone test set
Output Meter TS-585A/U	TM 11-5017	Output meter
Power supply PP-1104A/G	TM 11-5126	Power supply
Headset-Microphone H-1O1/U	TM 11-5965-215-15	Headset-microphone

5-6. General Test Requirements

The general support testing procedures in chapter 4 form the basis for the depot overhaul standards (DOS) tests. Perform the tests in the order in which they are presented and observe that the results meet the performance standards for each test. Testing will be simplified if connections and front panel control and switch settings are made initially and adjustments are made as required for the individual tests.

CAUTION

This equipment contains transistorized circuits in printed circuit boards A2, A3, and A4. If any test equipment item does not have an isolation transformer in its power supply circuit, connect one between the power supply source and the test equipment. A suitaxle transformer is identified by FSN 5950-356-1779.

a. Connect the equipment as shown in figure 3-1.2 for performance of the tests in paragraph 5-7, and figure 5-1 for the performance of the tests listed in paragraphs 5-8,5-9, and 5-10.

b. Adjust the power supply to 27.5 ±0.5 vdc. Use Multimeter TS-352B/U to monitor the power supply and to maintain it within the prescribed limits.

c. Allow the equipment to warm up at least 10 minutes before proceeding with the tests.

5-7. Operational Test

Perform the tests given in paragraphs 3.1-6 through 3.1-12.

5-8. Frequency Response Test

Perform the test given in paragraph 4-13.

5-9. Agc Circuit Test

Perform the test given in paragraph 4-14.

5-10. Distortion Test

Perform the test given in paragraph 4-15.

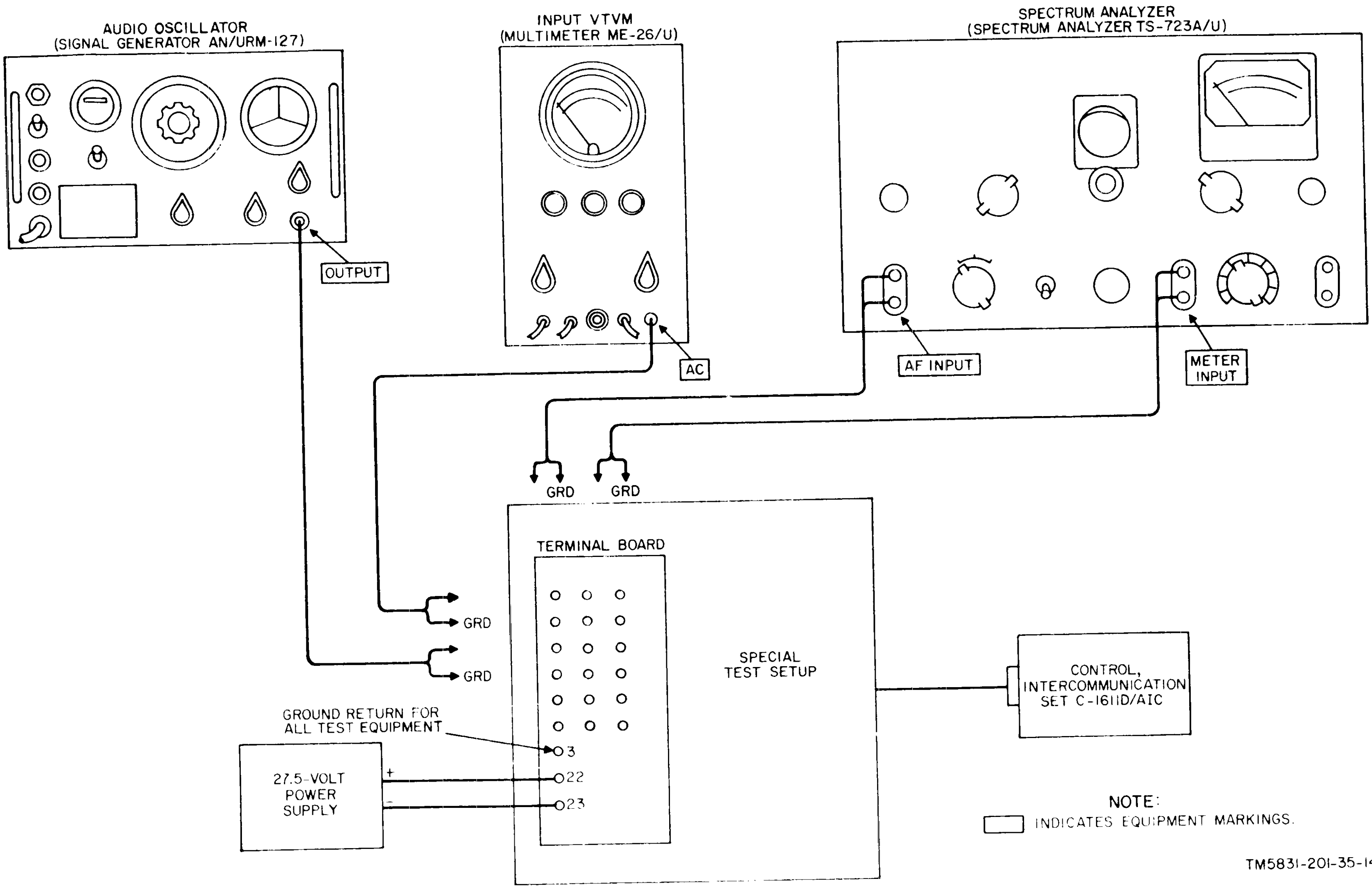


Figure 5–1. Frequency response, agc, and distortion test setup.

CHAPTER 6

AUXILIARY EQUIPMENT

6-1. Purpose of Auxiliary Equipment

Discriminator, Discrete Signal MD–736/A is used in conjunction with Control, Intercommunication Set C–1611D/AIC and is wired into the audio and control lines for each of the communication and liaison radio sets in an aircraft. The MD–736/A performs two functions during operation. One function is to disable the fm radio receiver circuits, while the VHF, UHF, or HF radio transmitter 'is being used by the pilot, copilot, or crew chief. The other function is to discriminate between high and low audio levels between the C–1611D/AIC and the VHF, UHF, and HF radio transmitters.

6-2. Circuit Analysis of the MD-736/A (fig. 6-2)

a. Fm Receive Disabling Circuit. The fm receive disable circuit consists of relay K1 and diodes CR1, CR2, CR3, CR4, CR5, and CR6. When the VHF, UHF, or HF radio transmitter (transmitter No. 2, 3, or 4) is keyed by the press-to-talk switch on a microphone, a ground is established through the transmitter No. 2, 3, or 4 control line. Since CR1, CR2, or CR3 (depending on which radio transmitter is keyed) is now connected between 27.5 volts dc and ground, it will start to conduct. Current flow through K1 causes it to become energized opening up contacts 3 and 4 of relay K1. This opens up (or disables) the receive circuit of the fm radio (receiver No. 1).

b. High and Low Audio Level Discrimination. Audio output from the C–1611D/,AIC can be distributed by transmitter No. 2, 3, or 4 audio out lines to the MD–736/A. The line used is dependent on which transmitter is being used for communications. The audio input to the MD–736/A is coupled across a transformer (T1,T3, or T5) to two diodes connected in parallel. If the audio input is on the positive swing the bottom diode will have a tendency to conduct. If it is on the negative swing, the top diode will have a tendency to conduct. However, before conduction through the diodes takes place, the internal resistance of the diodes must be overcome to cause current to flow through the output transformer (T2, T4, or T6). Since low level input signals are not strong enough to cause the diodes to conduct, they are clipped from the output. Only those input signals that are strong enough to cause the diode to conduct will appear at the output to the transmiti ter being used. This serves to filter out weak audio signals (crosstalk) that may be introduced from one receiver audio line to another.

6-3. MD-736/A Testing and Troubleshooting

a. The MD–736/A must be removed from the aircraft if it fails in any of its functions during maintenance checkout procedures. Prior to disconnecting the MD–736/A from the interphone junction box, remove the cover from the MD-736/A and perform a visual inspection check. The purpose of visual inspection is to locate faults without testing or measuring circuits.

b. If the MD–736/A must be removed from the aircraft for bench testing, troubles can be isolated by making the resistance measurements indicated in the resistance chart below. Determine that power source is disconnected.

c. Use a multimeter and refer to the schematic diagram in figure 6-2 to isolate the faults. Refer to figure 6-3 and figure 6-4 for parts location and identification.

d. The circuit board digram in figure 6-5 will assist the repairman in the removal and replacement of component parts and to locate hairline cracks on the board which can cause intermittent operation. Follow the same wherever applicable as in the removal and replacement procedures for the C–1611D/AIC, paragraph 4-7 e and *f.* When a new MD–736/A is replaced in the aircraft, perform the operational checks specified in the configuration manual for the particular aircraft.

e. Refer to the appropriate aircraft configuration manual or the applicable modification work order (MWO) for instructions on installation and removal procedures and for wiring connections to the aircraft interphone junction box.

Measure between—	Resintaece
Pin 34 (TB1) and pin 34 (TB2).	635 ohms ±10%. (forward resistance) ∞ (backward resistance).
Pin 35 (TB1) and pin 35 (TB2).	635 ohms ±10% (forward resistance) ∞ (backward resistance).
Pin 1 (TB1) and pin 1 (TB2).	635ohms +10% (forward resistance) ∞ (backward resistance).
Pin 26 (TB1) and pin 19----.	11 ohms
Pin 26 (TB2) and pin 19---- -	11 ohms
Pin 26 (TB1) and pin 19---- -	11 ohms
Pin 26 (TB2) and pin 19---- -	11 ohms
Pin 28 (TB1) and pin 19---- -	11 ohms
Pin 28 (TB2) and pin 19----.	11 ohms
Pin 19 and metal case ------- -	∞
Pin 34 (TB1) and pin 1 K1	1350 ohms ±10% (forward resistance).
Pin 35 (TB1) and pin 2 K1	1350 ohm ±10 (forward resistance).
Pin 1 (TB1) and pin 2 KI	1350 ohms ±10 To (forward resistance).

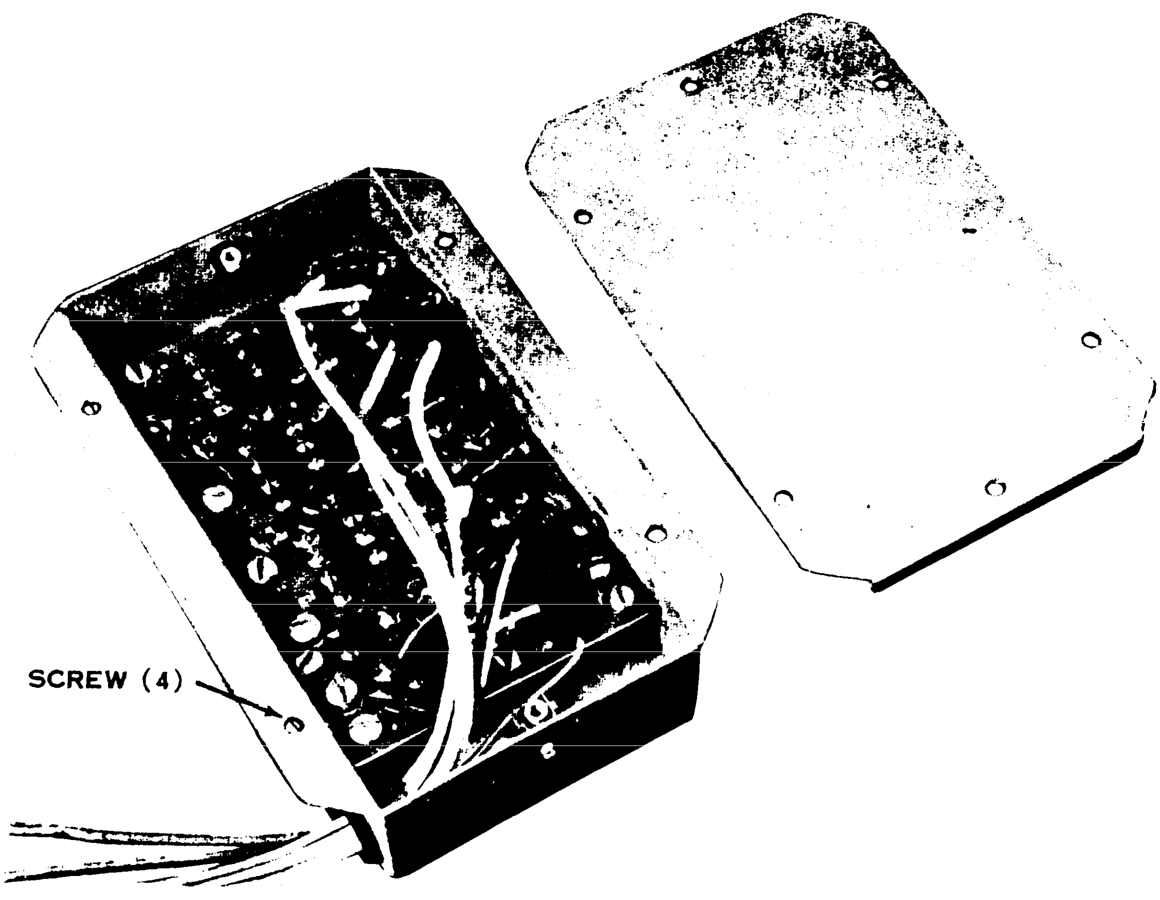


Figure 6-1. Discriminator, Discrete Signal MD-736/A cover removed.

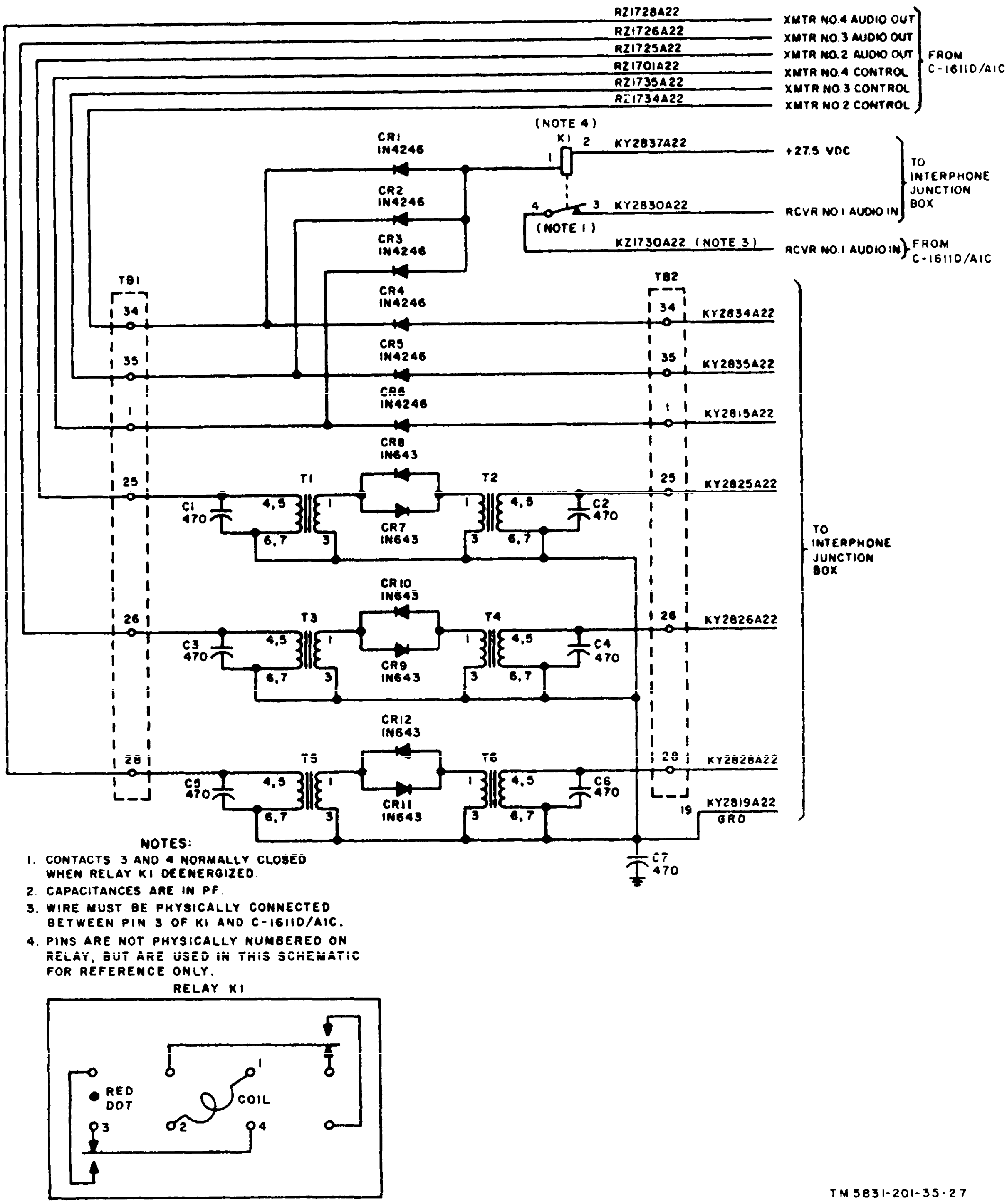


Figure 6-2. Discriminator, Discrete Signal MD-736/A schematic diagram

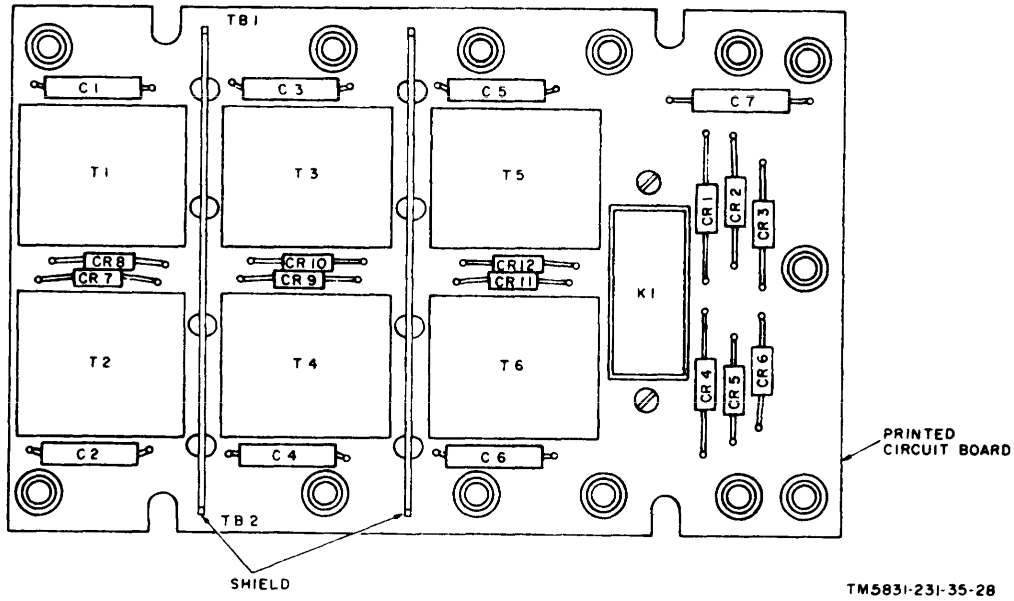


Figure 6-9. Discriminator, Discrete Signal circuit board parts location.

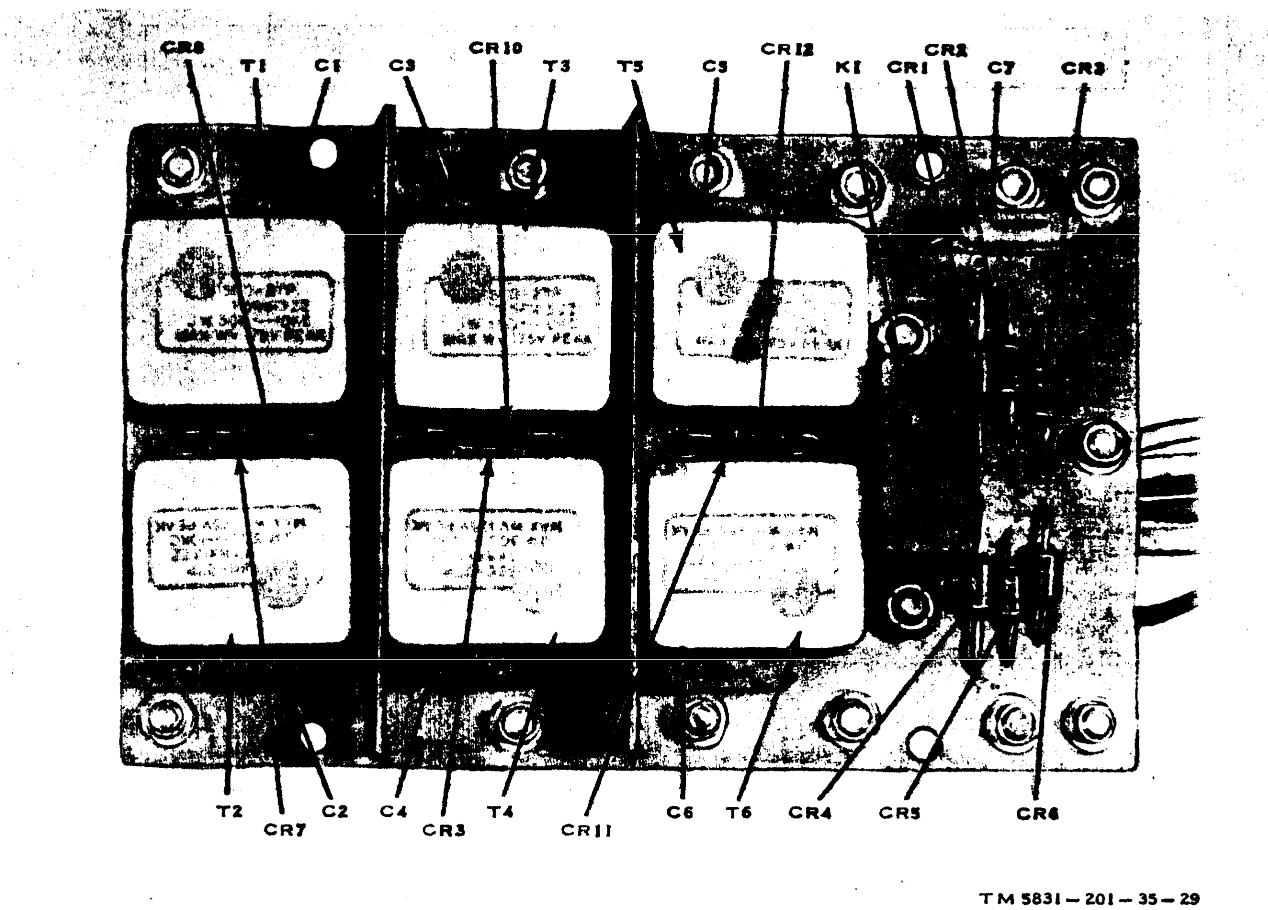


Figure 6-4. Discriminator, Discrete Signal MD-786/A circuit board with mounted components.

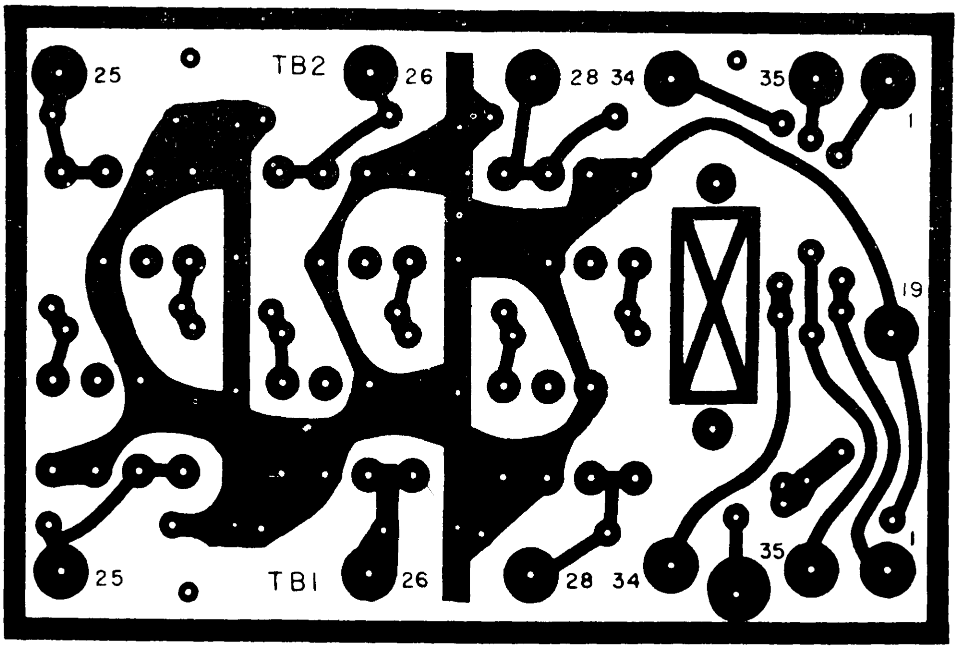
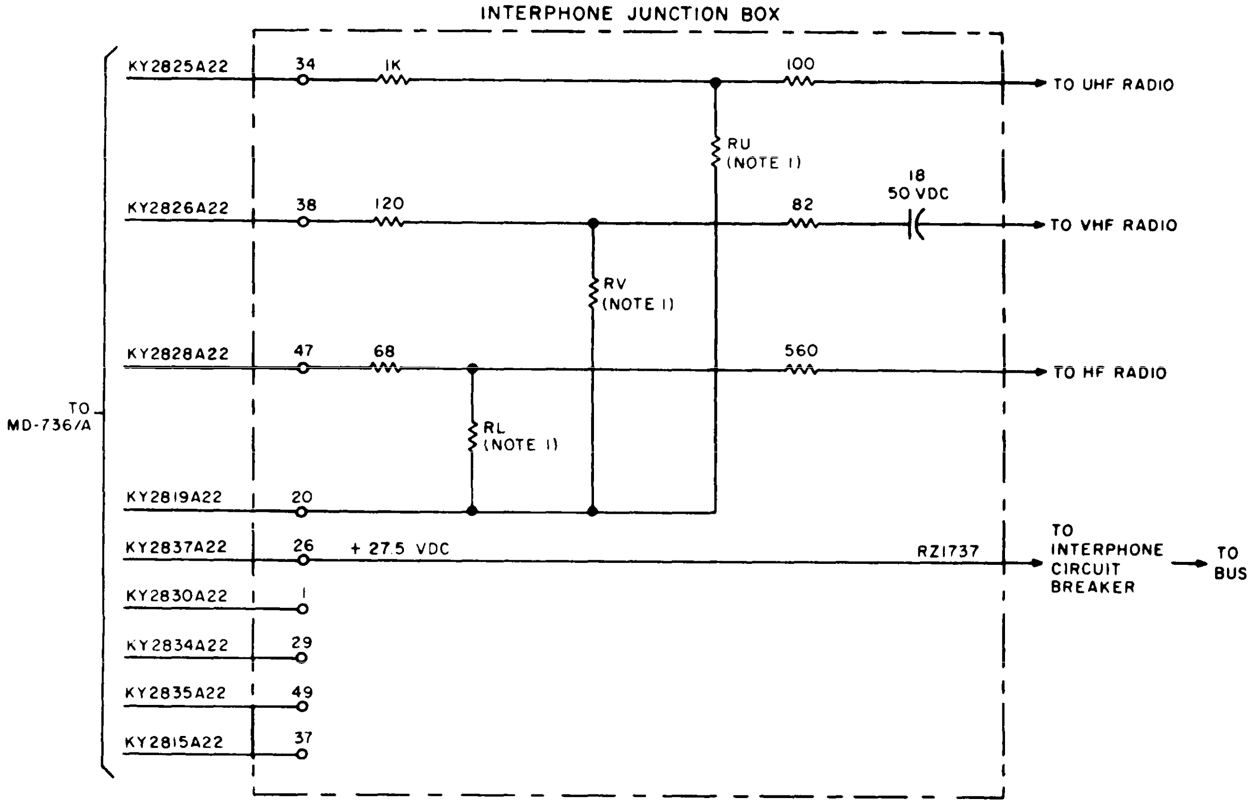


Figure 6–5. *Discriminator, Discrete Signal MD-736/A, printed circuit board.*



NOTE:
RESISTANCE VALUES SHOWN IN TABLE I MUST BE COMPLIED WITH IN ORDER TO BALANCE OUT CIRCUITS DUE TO ADDITION OF THE MD-736/A

EQPT	NO. OF C-1611/AICS USED IN AIRCRAFT	EXISTING VALUE RU, RV, OR RL	RU, RV, OR RL CHANGE REQUIRED	ACCEPTED SUBSTITUTE RU, RV OR RL
AN/ARC-54 OR AN/ARC-51BX	1	43 RU	71.5	68
	2	56	96.4	100
	3	82	178	180
	4	120	363	390
	5	180	1400	1500
	6	240	3300	3300
AN/ARC-102	1	150 RV	915	1000
AN/ARC-73	1	33 RL	51	56
	2	39	61.7	56
	3	47	77.5	82
	4	56	92.3	100
	5	68	125.0	120
	6	100	221.0	220

TM 5831-201-35-31

Figure 6-6. Interface of MD-736/A TO INTERPHONE JUNCTION BOX

CHAPTER 7

FINAL ILLUSTRATIONS

The following illustrations are contained in this chapter:

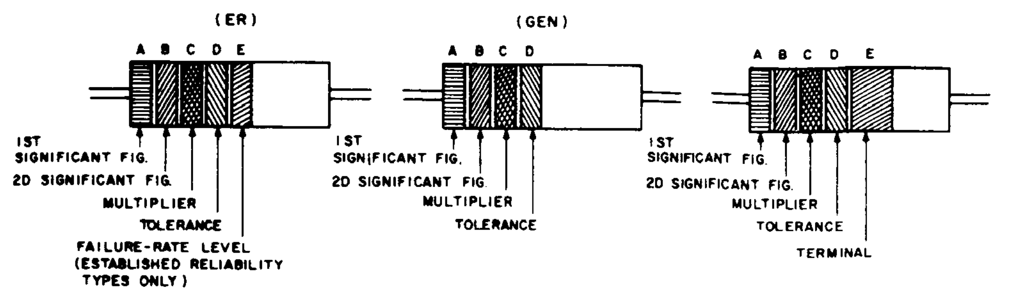
Figure 7-1, color code markings for MIL-STD resistors, capacitors, and inductors;

Figure 7-2, Control, Intercommunication Set C-1611D/AIC control circuits, simplified schematic diagrams;

Figure 7-3 Control, Intercommunication Set C-1611D/AIC schematic diagram;

Figure 7-4, Control, Intercommunication Set C-1611D/AIC wiring diagram, less printed wiring and circuit elements for boards Al, A2, A9, and A4.

Figure 7–5, Microphone Amplifier Board A4.



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

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

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

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

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

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

BAND D — THE RESISTANCE TOLERANCE.

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

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

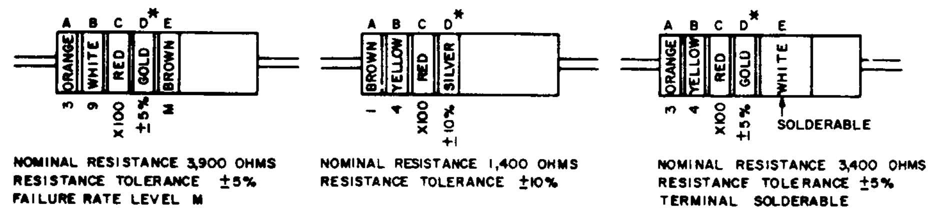
SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS 10R0 = 10.0 OHMS

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

EXAMPLES OF COLOR CODING

(ER) (GEN)



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

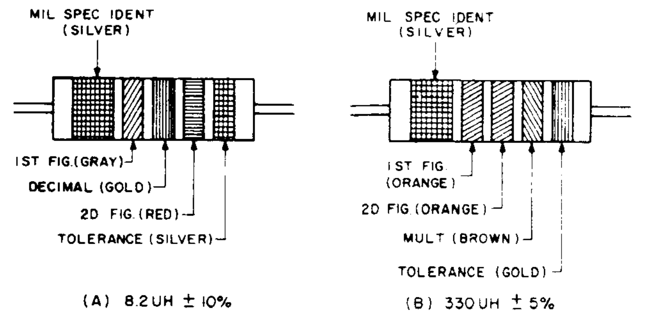
NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.



(A) 8.2UH ±10%

(B) 330UH ±5%

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

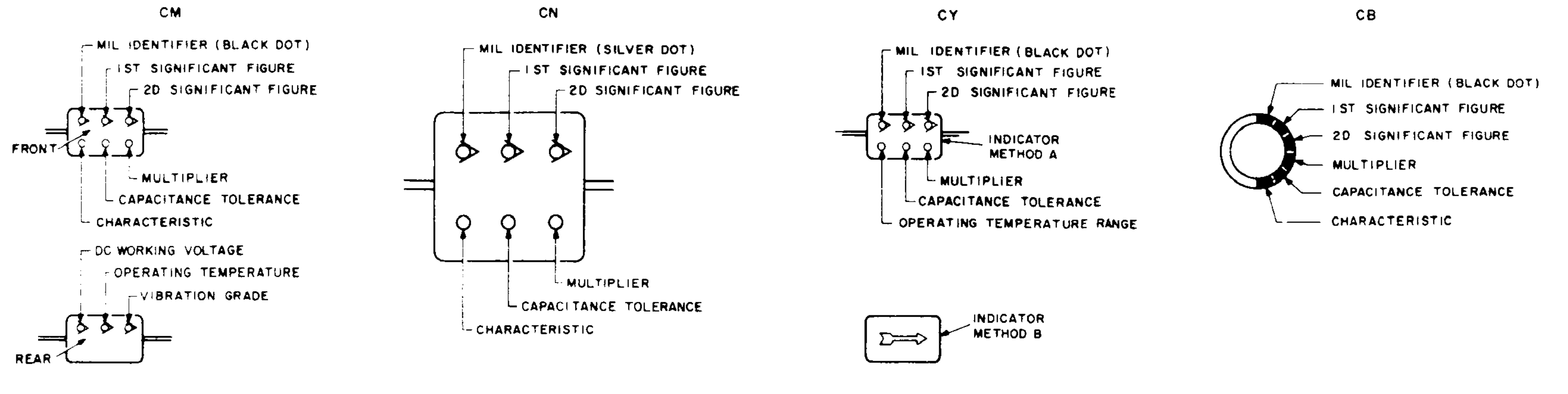
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

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

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

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

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

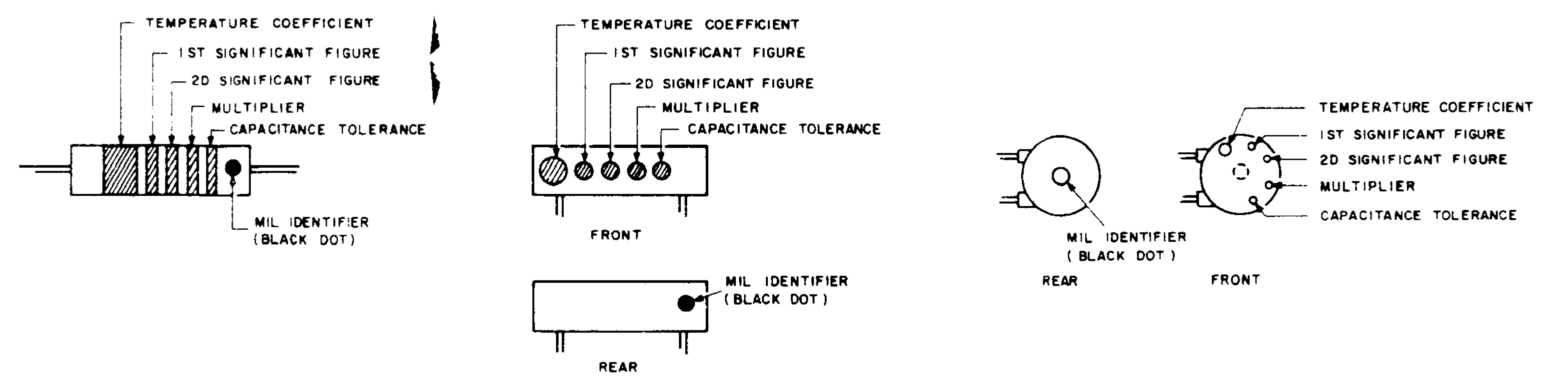


MICA-DIELECTRIC

PAPER-DIELECTRIC

GLASS-DIELECTRIC, GLASS CASE

MICA, BUTTON TYPE



AXIAL LEAD

RADIAL LEAD

DISK-TYPE

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

COLOR	MIL ID	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM, CY CB	0	0	1			±20%	±20%		A			−55° TO +70°C	10-55 HZ
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				−55° TO +85°C	
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E				−55° TO +125°C	10-2,000HZ
GREEN		5	5		±5%				F			500		
BLUE		6	6										−55° TO +150°C	
PURPLE (VIOLET)		7	7											
GREY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN				±10%	±10%	±10%	±10%						

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

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

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-25D, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

ESC-FM 4113-69

Figure 7-1. Color code markings for MIL-STD resistors, capacitors, and inductors.

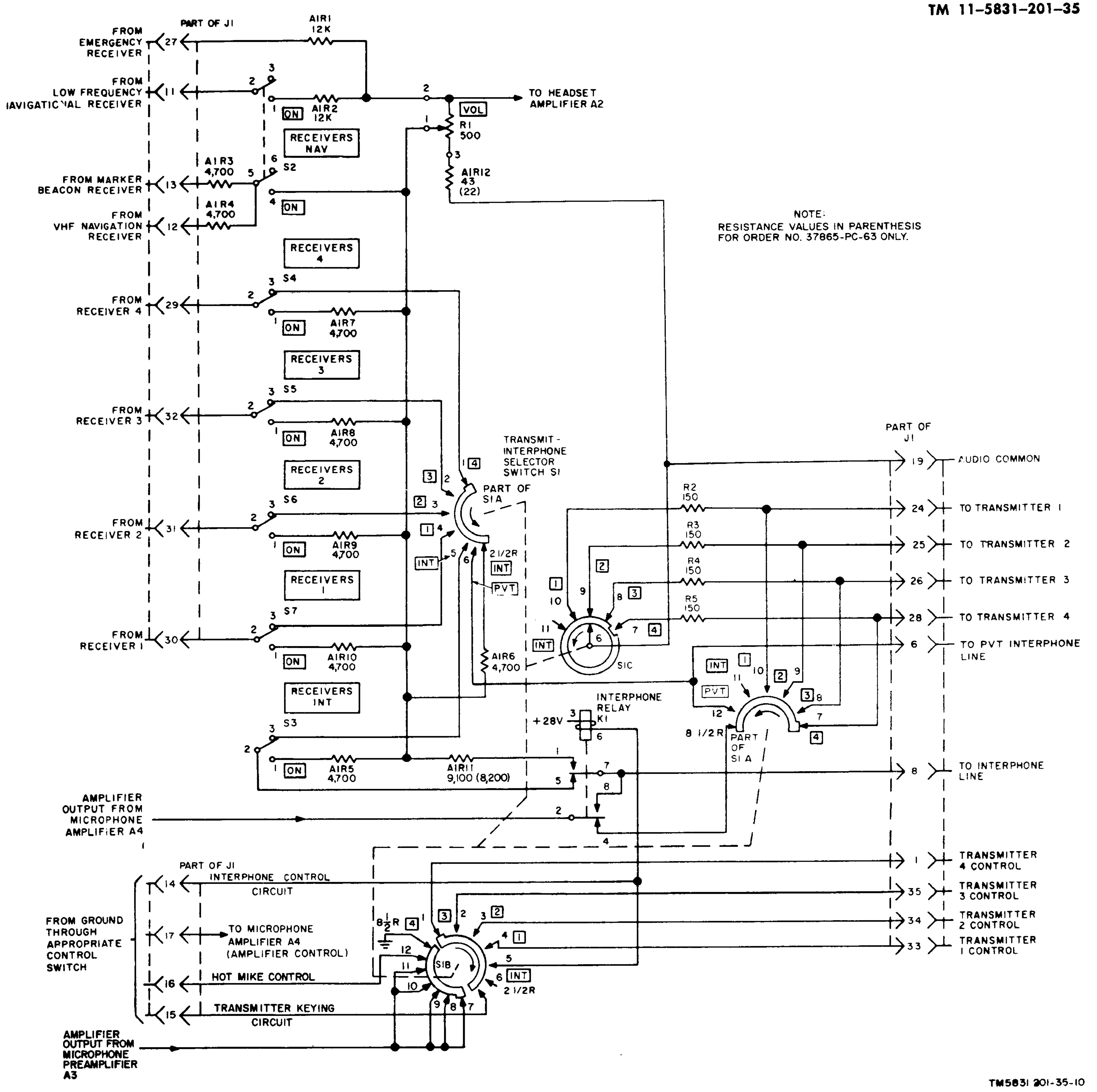


Figure 7-2. Control, Intercommunication Set C-1611D/AIC control circuits, simplified schematic diagram.

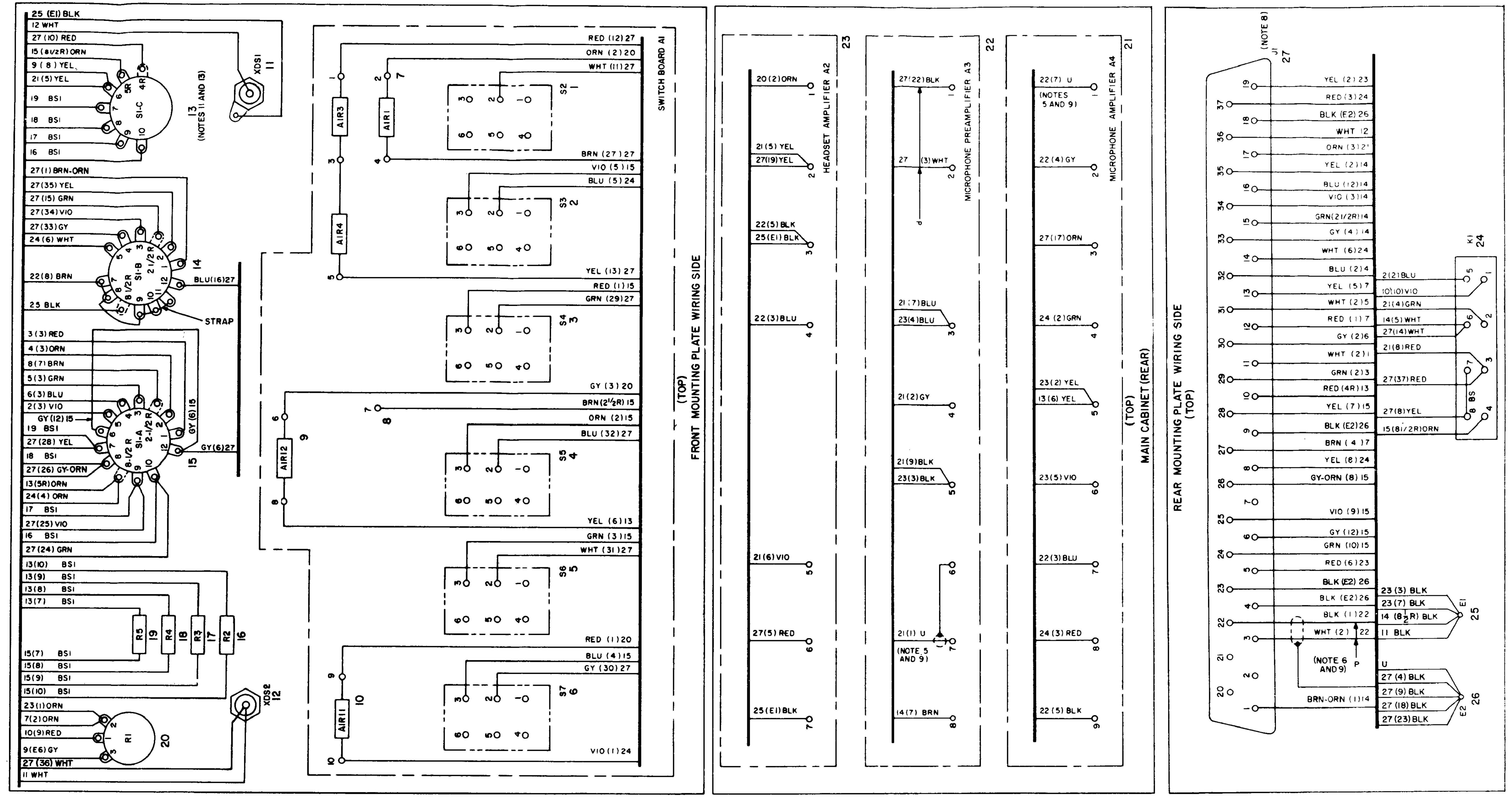
NOTES:

1. SWITCH S1 IS SHOWN IN EXTREME CLOCKWISE POSITION AS VIEWED FROM REAR. WAFER S1A IS NEAREST KNOB END OF SWITCH. SWITCH TERMINALS DESIGNATED "R" ARE ON KNOB SIDE OF WAFER.
2. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UF.
3. ALL TEST POINT MEASUREMENTS ARE MADE WITH RESPECT TO CHASSIS GROUND ONLY WHEN EQUIPMENT IS IN TEST JIG.
4. ▭ INDICATES EQUIPMENT MARKING.
5. ⏚ SIGNIFIES CHASSIS GROUND.
6. (A1) SIGNIFIES TEST POINT.
7. CONNECTOR J1 IS VIEWED FROM THE WIRING SIDE
8. A4CR2 IS A ZENER DIODE.
9. SEE "DIFFERENCES IN MODELS" TABLE FOR PARTS VALUES.

DIFFERENCES IN MODELS

SERIAL NOS.	1-566	567-3,760	3,776-25,156	25,157-26,919	26,920-29,489
A1R11	8,200 OHMS	9,100 OHMS	9,100 OHMS	9,100 OHMS	9,100 OHMS
A2C2	680 UUF	330 UUF	330 UUF	330 UUF	330 UUF
A2C5	NOT USED	NOT USED	NOT USED	110 UUF	68 UUF
A4C6	47 UF	40 UF	40 UF	40 UF	40 UF
A4C7	0.1 UF	0.01 UF	0.01 UF	0.01 UF	0.01 UF
A4CR2	1N718	1N965B	1N965B	1N965B	1N965B

Figure 7-3. Control, Intercommunication Set C-1611D/AIC schematic diagram

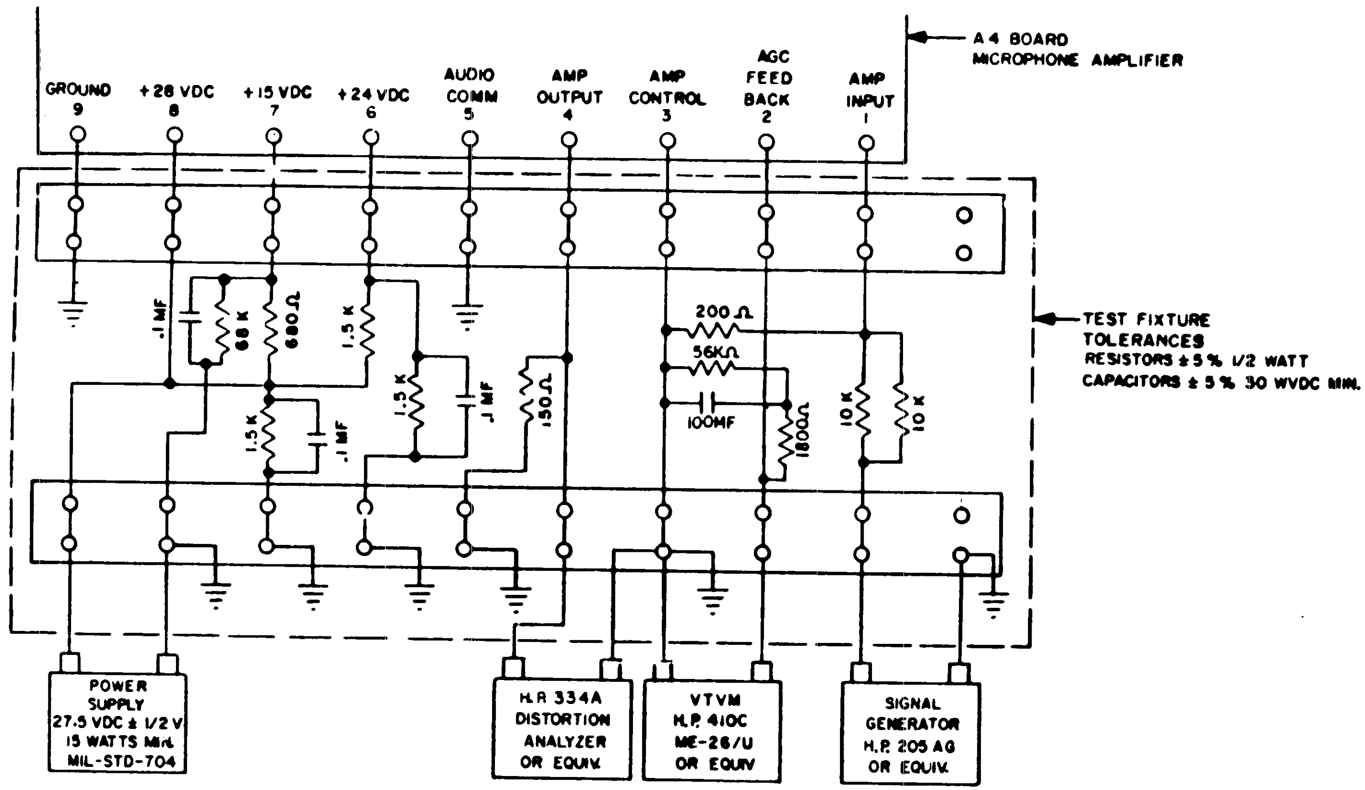


NOTES:

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. THE NUMBER IN PARENTHESES ON EACH WIRE (ADJACENT TO THE STATION NUMBER) CORRESPONDS TO THE TERMINAL CONNECTION AT THE STATION TO WHICH THAT WIRE RUNS
3. BS DENOTES 020 DIA TINNED, ANNEALED COPPER WIRING
4. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING INSULATED WITH SILICON IMPREGNATED FIBERGLASS SLEEVING
5. U DENOTES SHIELDING 22 GAGE WIRE WITH EXTRUDED TEFLON JACKET
6. P DENOTES SHIELDED PAIR
7. WIRES NOT OTHERWISE SPECIFIED ARE 24 GAGE WITH TEFLON JACKET
8. TEFLON SLEEVING IS PLACED OVER WIRES AND TERMINALS OF CONNECTOR J1
9. TEFLON SLEEVING IS PLACED OVER SHIELD OF WIRE
10. ALL TERMINALS OF SWITCHES S2 THROUGH S7 ARE SOLDERED TO PRINTED WIRING ON BOARD A1
11. WAFER SWITCH S1 IS VIEWED FROM END OPPOSITE CONTROL KNOB WAFER NEAREST CONTROL KNOB IS SECTION A
12. ONLY WIRED TEMINALS OF S1 ARE SHOWN
13. TERMINALS OF S1 DESIGNATED R ARE ON KNOB SIDE OF WAFER
14. TERMINALS SHOWN WITHIN DASHED LINES (STATIONS 1 THROUGH 6) ARE PART OF SWITCHES WHICH ARE MOUNTED ON THE REAR OF THE BOARD.

TM5831-201-35-12

Figure 7-4. Control, Intercommunication Set C-1611D/AIC wiring diagram, less printed wiring and circuit elements for boards A1, A2, A3, and A4.



NOTE
CONNECT THE A4 BOARD TO THE ELECTRICAL TEST FIXTURE AS SHOWN.
CONNECT THE TEST EQUIPMENT TO THE ELECTRICAL TEST FIXTURE AS SHOWN.

Figure 7-5. Microphone Amplifier Board A4

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APPENDIX A

REFERENCES

Following is a list of applicable references available to the direct support, general support, and depot maintenance technician of Control, intercommunication Set C-1611D/AIC, and Discriminator, Discrete Signal MD-736/A.

DMWR 11-5800-214	Depot Maintenance Work Required for Communications-Electronics Equipment.
FM 11-62	Communications-Electronics Fundamentals: Solid State Devices and Solid State Power Supplies.
TM 11-6625-201-20	Organizational Maintenance Manual: Control Intercommunication Set C-1611D/AIC and Discriminator, Discrete Signal MD-736/A.
TM 11-5831-201-24P	Organizational Maintenance Repair Parts and Special Tool Lists: Control, Intercommunication Set C-1611D/AIC and Discriminator, Discrete Signal MD-736/A.
TM 11-5831-201-35	DS, GS, and Depot Maintenance Repair Parts and Special Tool List: Control, Intercommunication Set C-1611D/AIC and Discriminator, Discrete Signal MD-736/A.
TM 11-6625-200-15	Operator and Organizational Maintenance Manual : Multimeter ME-26/U, ME-26B, ME-26C/U, and ME-26D/U.
TM 11-6625-203-12	Operator and Organizational Maintenance Manual: Multimeter AN/URM-105, Including Multimeter ME-77/U.
TM 11-6625-441-12	Operator and Organizational Maintenance Manual : Test Set, Radio TS-1588/AIC.
TM 11-6625-683-14	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Signal Generator AN/URM-127.
TM 11-750-244-2	Destruction of Army Electronics Materiel (Electronics Command).
DA Pam 738-750	The Army Maintenance Management System (TAMMS).
DA Pam 25-30	Consolidated Index of Army publications and Blank Forms.

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