TECHNICAL MANUAL

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

NORTHEAST ELECTRONICS CORPORATION NOISE-LEVEL-VU MEASURING SET MODEL TTS-37B

HEADQUARTERS, DEPARTMENT OF THE ARMY

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This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however contain available information that is essential to the operation and maintenance of the equipment.

SECTION 1

INTRODUCTION

1.A1. Scope

This manual describes the Northeast Electronics Corporation Noise-Level-Vu Measuring Set Model TTS-37B and covers its operation, and organizational, direct and general support, and depot maintenance. It includes inspection, testing, and calibration procedures, and replacement of parts available to organizational, DS, GS, and depot maintenance personnel.

1.A2. Indexes of Publications

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

b. Refer to the latest issue of -A Pam 310-7 to determine if there are current, applicable modification work orders (1m,O's) pertaining to this equipment.

1.A3. Forms and Records

a. Report of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army), NAVSUP Publication 378 (Navy), AFR 71-4 (Air Force) and MCO P4610-5 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (S9361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38 (Army), NAVSUP Pub 459 (Navy), AFM 75-34 (Air Force), and MCO P4610.19 (Marine Corps).

d. Reporting of Equipment Manual Improvements, Report of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to: Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-ME-NMP-EM, Fort Monmouth, New Jersey 07703.

1.A4. Items Comprising an Operable Equipment

FSN	Item	Quantity	Dimensions (in)			Weight(lb)
			Height	Depth	Width	
6625-918-5721	NEC Noise-Level-Vu Measuring Set, Mdl TTS-37B	1	8	10	11	

1.0 GENERAL

1.01 The Model TTS 37B is a compact, transistorized set designed to measure a wide range of transmission levels, VU, and noise. It has a sensitivity of -80 dbm and 0 dbrn on the meter scales respectively. Switchable filters are provided internally to either attenuate the low frequency band around 60 cycles and its harmonics, or to attenuate frequencies above the voice band; a filter which provides C-message weighting is also included. Provisions for dialing out on a line are available, as is a hold coil for holding the circuit.

1.02 Two monitor jacks are provided. One provides a DC output which may be used to drive a 1 ma recorder. The second jack provides an AC output which may be used to drive an impulse noise measuring set. a telephone headset to determine the nature of the signal, or to drive external circuits, thereby using the Model TTS 37B as a variable, high gain amplifier.

1.03 The sensitivity of the set can be varied from -80 dbm to +20 dbm in one db and 10 db steps by means of two attenuators; these attenuators are also calibrated in dbrn from 0 to 100 dbrn in blue numbers for easy identification. Circuits of either 600 or 900 ohms, balanced or unbalanced, can be measured in either a terminated or a bridging condition.

1.04 Noise to ground can be measured with a 40 db loss; a longitudinal drain is supplied. A BATT TEST push button switch is provided which monitors the condition of the internal batteries and determines if 48 volts is properly connected. A diode is provided to protect the internal circuits against damage in the event the wrong polarity of 48 volts is inadvertently applied.

1.05 The set is equipped with two 9 volt batteries which provide approximately 150 hours of life. The set can also be operated from 48 volt station battery.

2.0 PERFORMANCE AND SPECIFICATIONS

2.01 Meter

A 4½" meter with several scales is provided as follows:

a. Scale tracking accuracy (+3 to -3 on meter): ±.15 db max error.

b. VU-DB scale calibrated in black divisions and numbers from +3 to -15 db. Between +3 and -3 the scale is calibrated in 0.2 db divisions. 0.5 db divisions are used between -3 and -10 and 1 db divisions are used between -10 and -15.

c. DBRN scale calibrated in black divisions end blue numbers from 13 to -5 dbrn. Between 13 and 7 the scale is calibrated in 0.2 db divisions. 0.5 db divisions are used between 7 and 0 and 1 db divisions are used between 0 and -5.

d. A VU quality scale is marked in three colors:
Green between 0 and +3 db
Yellow between -6 and 0 db
Red between -15 and -6 db.

e. A BATT TEST scale with a green arc to indicate GOOD

2.02 Range of Measurements

a. Level Measurements: +23 dbm to -95 dbm
b. Noise Measurements: 113 dbrn to -5 dbrn
c. Noise to Ground Measurements: 113 dbrn to -5 dbrn

2.03 Input Impedances

Balanced input transformer:

a. Terminated: 600 or 900 ohms +5%, with a phase angle of less than 5° when hold coil is out

b. Bridging: 12,000 ohms on 600 ohm circuit
15,000 ohms on 900 ohm circuit

c. Longitudinal Drain: Across the line - 85,000 ohms
To ground - 100,000 ohms

2.04 Frequency Response

The frequency response for designated positions of the FILTER switch, normalized to 1 KC at room temperatures, is as follows: (see figures 9 and 10 for typical curves)

C-MSG: -3 db from 625 to 675 cps and 2800 to 3100 cps
-40 db from 85 to 115 cps and 6000 to 7000 cps

HIGH PASS: Not less than 45 db rejection at 60 cps
-3 db from 13 KC to 16 KC with 18 db per octave slope at higher frequencies

3 KC: +0.15 from 230 to 1500 cps
-3 db from 2.8 KC to 3.2 KC with 18 db per octave slope at higher frequencies

15 KC: +0.15 db from 300 to 5000 cps
-3 db from 13 KC to 16 KC with 18 db per octave slope at higher frequencies

2.05 Attenuator Accuracy: ±0.1 db max. error

2.06 Hold Circuit

A low resistance hold coil can be switched in or out. At frequencies below 200 cps this coil will have an effect on the response characteristic and will therefore affect the accuracy of measurements.

2.07 AC Monitor Output

a. Output Impedance: 600 ohms

b. Output Level: -10 dbm when meter reads 0 db

2.08 DC Monitor Output

a. The DC output is approximately 0.8 ma when meter reads 0 dbm

b. The DC resistance of the external measuring circuit, such as a recorder, should not exceed 300 ohms and must be isolated from ground.

2.09 Stability of Calibration

a. Stability with Temperature (300F to 1200F, with respect to readings at 72 F): +0.15 max. change.

b. Stability with Battery Voltage (within green BATT TEST arc on meter): +0.1 db max. change.

2.10 Power Requirements

a. Battery Operation: Requires two 9 volt Eveready 2356 batteries or equivalent. Current drain 20 ma (without AC mon).
b. Battery Life: Intermittent use -- approximately 150 hours Continuous use -- approximately 100 hours

c. 48 Volt Operation: Requires 48 volt office battery Current drain 50 ma

2.11 Size

8" x 11" x 10"

2.12 Weight

13 pounds

3.0 CONTROLS AND TERMINALS

The following controls and terminals are available:

3.01 Controls

a. Step Attenuator: 0 to -10 dbm and 10 to 0 dbrn in 1 db steps (dbrn markings are in blue)

b. Step Attenuator: +20 to -70 dbm and 90 to 0 dbrn in 10 db steps (dbrn markings are in blue)

c. Filter Selector Switch: C-Message, High Pass, 3 KC, 15KC

d. Input Selector Switch:
Dial and Talk
900 ohms bridging
900 ohms term.
Noise to ground
600 ohms term.
600 ohms bridging

e. Hold: ON-OFF

f. Power: ON-OFF

g. Battery Test Switch

3.02 Terminals

Two binding posts for LINE
Jack for LINE
Jack for Dial or Tel Set
Binding post for GROUND
Jack for EXT 48V power - T=Neg, S=Gnd
Jack for AC monitoring
Jack for DC monitoring
All Jacks accept type 310 plugs

4.0 CIRCUIT DESCRIPTION

Schematic Diagram

4.01 The schematic diagram of the instrument is shown in Figs 1 through 6.

4.02 The gain of the set is obtained from three amplifiers. Each amplifier is enclosed with a large amount of negative feedback to insure gain stability. The inherent noise level of the set is at least -100 dbm and approaches -120 dbm when the C-message filter is used. The circuit can be divided into the following basic elements:

a. Input Circuit
b. 10 db Step Attenuator
c. Amplifier 1
d. Filter Switching Network
e. 1 db Step Attenuator
f. Amplifier 2
g. Amplifier 3
h. Metering Circuit
i. Monitoring Circuits
j. Power Section

4.03 Input Circuit (Fig. 1)

The input line connections are made to a balanced transformer with DC blocking capable of withstanding 150 volts DC of either polarity. Terminating resistors for 600 and 900 ohm input impedances can be switched directly across the input line and the DC blocking is still maintained. These resistors are switched at the equal potential or center-tapped point to maintain balance. The hold coil, which can be switched across the line, is also switched at the center-tapped position for the same reason. The input circuit is balanced at least 80 db at 60 cps, 70 db at 1000 cps, and better than 60 db up to 10 KC.

4.04 A longitudinal drain, whose center tap is connected to ground through a resistor, is supplied.

4.05 The transformer has a 1:1 ratio. Since the secondary of this is loaded by a high impedance, the primary of the transformer also looks like a high impedance. This reflected impedance is seen in the bridging positions of the INPUT switch. It is nominally 12,000 ohms for 600-ohm circuits and 15,000 ohms for 900-ohm circuits: the bridging losses will be less than 0.2 db for frequencies down to approximately 100 cycles.

4.06 10 db Step Attenuator

This is a three-section attenuator which is the main sensitivity adjustment of the set. 30 db is available in one section and is merely a tapped voltage divider. Two other sections, each having 30 db loss, can be switched ahead of this. For the first 30 db of loss the tapped voltage divider only is used. For 40 db of loss, which corresponds to the -30 db position of the SENS control, a single 30 db section is placed ahead of the step voltage divider and 10 db of loss is brought into the output section. Thus the stepped divider is used for the 10 db steps, and the other two sections are brought in as necessary to extend the range of these 10 db steps. 1% resistors are used, which assures an attenuator accuracy better than ±0.15 db. Normally the accuracy is better than this, particularly at the higher sensitivities.

4.07 Amplifier 1 (Fig. 2)

Amp 1 is basically a two-stage voltage amplifier with negative feedback. An emitter follower is incorporated in the output stage since this amplifier drives the filter sections.

4.08 Q102, Q103, and Q104 comprise the amplifying section. Q102 is a conventional common emitter whose bias is obtained from the collector for DC stabilization. Q103 is also operated in the common emitter, but since this is also an NPN, bias conditions and polarities are reversed. Q104 operates as a common collector or emitter follower to isolate the filter impedances from the collector of Q103 to which it is DC connected. The emitter current of Q104, both AC and DC, is eventually returned to a resistor which is common to the emitter of Q102; this comprises negative feedback. For the circuit shown approximately 30 db of feedback is achieved and is effective over the entire band of frequencies. The two diodes in the emitter of Q104 are a battery compensating network. If the battery voltage decreases, the emitter current of Q104 will also decrease. This raises the impedance of these two diodes, which decreases is the negative feedback by a slight amount, thereby keeping the overall gain of the set relatively independent of the battery voltage. The emitter of Q104 supplies an output through an RC network which keeps DC and voltage transients producing by switching from subsequent stages. The nominal output impedance of the amplifier is in the order of 5 ohms, due to its emitter follow type output and heavy amounts of feedback. A series resistance is used to bring this up to a value to match the filter characteristics, which is basically 600 ohms.

4.09 Filter Switching Network

This selects the proper components to produce the responses shown in Figs. 9 and 10.

4.10 1 db Step Attenuator

This is a conventional stepped voltage divider which presents a 640-ohm impedance to the filter and is terminated by the high impedance of Amp 2. One percent resistors are used, which assures an accuracy better than ±0.15 db. Normally the accuracy is better than this, particularly at the higher sensitivities.

4.11 Amplifier 2 (Fig. 4)

This is a three-stage amplifier incorporating negative feed- back consisting of Q201, Q202, and Q203. Overall feedback is applied from the emitter of Q203 to the emitter of Q201, while the output is taken from the collector of Q203. Q201 is a conventional common emitter amplifier with collector to base bias. Q202 is also a common emitter configuration, but since this is an NPN, the emitter is returned to battery while the collector is returned

to ground. The output of Q202 which appears at its collector is direct coupled to the base of Q203. This is also of the common emitter configuration. The emitter of Q203 contains a large amount of DC resistance to give the proper amount of current when its base is connected to the collector of Q202. Most of this resistance is bypassed by C203 so chat degenerations at signal frequencies will not occur at this point. The unbypassed part of the emitter resistance is R209, which is common to the emitter of Q201. This provides overall loop feedback which stabilizes the gain of the entire amplifier.

4.12 Amplifier 3 (Fib. 5)

Amplifier 3 consists of Q301 and Q302. Both are operated as common emitters with bias derived from the collector for DC stabilization. The output of Q302 is applied to the diode bridge which is returned to the emitter of Q301 and thus supplies negative feedback. The operation of such a network can be best described on a half cycle basis. When the signal at the collector of Q302 is a negative half cycle, CR302 will not conduct, due to its polarity connection. CR301 will conduct. The signal, however, cannot go through CR303. It can go through the meter and through CR304 back to the emitter of Q301.

4.13 When the collector Q302 goes positive, similar reasoning will show that the path of conduction will be through CR302, the meter, CR303 back to the emitter of Q301. Note that on this half cycle the meter also conducts from right to left. Thus the meter has a pulsating of full wave type current. The ballistics of the meter will ignore the peaks and respond to the average value of DC. The meter is calibrated so that this average value reads in RMS value. The characteristics of such a circuit linearize the resistances of the diodes. For instance, as the resistance of the diodes increase, either due to temperature changes or to decreased meter current, the feedback is automatically adjusted so that the meter current is a linear function of the input voltage. This is true for wide ranges of temperature and also true for greatly mismatched diodes, thus the circuit is relatively uncritical either to component values or diode voltage current relationships.

4.14 The use of the diode bridge in the feedback loop produces two results. The bridge is loading the output of Q302; since it is a non-linear bridge, it can be expected that the waveform at Q302 will be distorted. This is true, and the waveshape appears as a flattened sine wave with very sharp edges around the center of the curve. The edges are produced by the fact that for a fraction of a volt on either side of zero the diodes are not conducting and unload the collector circuit. The flattening is a result of the fact that the diode resistance goes down as the voltage goes up. It therefore, tends to flatten out the peaks of the sine wave. The feedback mechanism produces a linear current through

the diodes. The two half cycles of current are recombined at the emitter of Q301 to form a perfect sine wave.

4.15 Metering Circuit

The meter is used for two functions. One is to measure the level applied to the line terminals of the set and under this condition it is applied to the diode bridge of Amplifier 3. It is also used for battery test at which time it is disconnected from Amplifier 3 and connected between battery and ground through a drop ping resistance which conv2rts the milliamp meter into a voltmeter to monitor the condition of the battery.

4.16 The ballistics of the meter are similar to those of a VU meter.

4.17 Monitoring Circuits

The DC MONITOR jack provides means to connect an external milliamp meter or recorder in series with the meter of the set. See. Fig. 6. The characteristics of Amplifier 3, with the diode bridge incorporated in the feedback loop, produce a high impedance or constant current source for the meter. Thus, the external meter can have a wide range of resistance. It is advisable, however, to insure maximum accuracy of the reading, to keep this resistance of the external meter recorder below 300 ohms. It is also necessary, again due to the manner in which the DC current is developed, to keep the external meter or recorder off ground electrically, since otherwise part of the feedback will be shorted out. Whenever the meter reads 0 dbm, the available current is slightly less than 1 ma.

4.18 The AC MONITOR consists of Q303, which samples part of the signal available in Amplifier 3, amplifies it, and provides a given source of impedance available to the AC MONITOR jack. See Fig 5. The signal which this amplifier samples is at the emitter of Q301 in Amplifier 3. This is a low impedance point, a sine wave, and is still a direct function of the signal appearing at the line jacks. The input impedance of the monitor amplifier, 0303, it high enough so that it does not shunt the emitter resistance of Q301, and therefore it does not materially influence the amount of feedback or the value of the gain of either Amplifier 3 or the en- tire set. To conserve internal battery power, the collector suppl1 of Q301 is normally cut off until the plug is inserted into the AC MON jack. The signal available at the AC MON jack is DC blocked so that a DC resistance can be inserted between the tip and ground of the jack. This DC blocking is done by an electrolytic which means that if any DC voltage should be applied to the tip of the AC MON jack, it should not exceed 9 volts negative or 12 volts positive

4.19 The frequency response of the monitoring circuit is -3 db at 4-4100 cycles and 15 KC for the flat 15 KC position. For other

filter positions, the response at the monitor jack is identical with the response to the meter. Signal to noise output at this jack will always be better than 30 db for meter readings of at least -3 dbm. The output level is -10 dbm when the meter reads 0 dbm.

4.20 Power Section

For an amplifier with this much gain and with such a low frequency response, it is necessary to insure that there is no impedance in common with the amplifier supply. Since certain areas of these amplifiers have bandwidths which extend down to 1 cycle, ordinary RC coupling is inadequate except with. extremely large values of capacitance. The decoupling in this set may appear slightly unconventional, in that Amplifier 1 and Amplifier 2 are decoupled from the battery supply by a transistor, Q1. See Fig. 6. Essentially this transistor is operated as a series device although strictly speaking it can be considered as an emitter follower. It operates with sufficient base bias to insure saturation and very little collector to emitter voltage drop, and with a capacitor, C2, from base to ground. The base is held relatively fixed by this capacitance and the emitter must follow the base. The effect of such a circuit is the same as a conventional RC decoupling network except that the RC product is effectively increased by the beta of the transistor. In other words, we get the same amount of de- coupling with 100 mfd as we would with 5000 mfd in conventional RC decoupling.

4.21 Amplifier 3 is supplied through a conventional RC decoupling, the chief function of which is to keep the battery impedance relatively constant and insure that no local feedback introduced by an aging battery will seriously affect the low frequency response.

4.22 When a plug with 48 volts of the proper polarity is inserted in the 48-volt jack, CR1 will conduct and CR2, a zener diode, will conduct in the reverse direction and maintain a constant volt- age. R10 limits the amount of current through the zener diode to a proper value. The use of the zener and the series transistor filter produces sufficient filtering so that the proper signal to noise will be obtained, provided the noise on the station battery does not exceed 1 volt peak to peak at 10 cycles or higher. When 48 volts is applied to the set, the battery is disconnected.

4.23 The battery test resistor is connected to the meter from the zener diode. This is the primary point of power application whether it is from internal or external batteries. Notice that the reading of the battery test can only occur when the power switch is on and thus represents a load on the batteries.

5.0 TROUBLESHOOTING

5.01 In the event of a grossly inaccurate or missing meter reading the following can be checked.

5.02 Batteries. These should always be checked first. This is conveniently done by depressing the BATT TEST button and observing a meter deflection within the green arc. To replace batteries, remove the four screws (#10) which hold the front panel to the case. Lift the panel (and attached components) directly out of the case. Disconnect the red and black wires from the batteries. These can be unsnapped with slight finger pressure. Remove the two screws which hold the metal plate over the batteries. The old batteries can now be removed and fresh ones installed in the same place. Unsnap the black strap from the two old batteries and snap this to the new batteries. (This cannot be done except to the correct terminals.) Fasten the metal plate back to hold the batteries. Reconnect the red and black wires to the batteries. (These also can only be connected properly.) Being careful not to short the components on the set, turn the POWER switch ON and depress the BATT TEST. Deflection of the meter into the green arc indicates all is proper. Turn POWER off. Replace the set in the case. Re- fasten the panel to the case with the four #10 screws. (It is usually wise to secure the threads c- all four before tightening.

5.03 **FUNCTION** Switch - To be in the proper position.

5.04 **SENS** - To be of sufficient sensitivity to give a reading.

5.05 **INPUT** - Connected to the proper jack or pair of terminals.

5.06 **DC MON** - If a plug is inserted, it must have a low DC resistance.

5.07 **FILTER** - Set to allow the frequency of the input signal to pass.

5.08 Should all connections and settings be proper and no meter reading occurs, the circuitry can be checked. The following checks are made with a 1000 cps signal applied at 0 dbm level.

5.09 **Input Circuit** - Put SENS in -70 dbm position. Turn POWER 0--.F With either a VTVM or oscilloscope (CRO) trace the path of the signal. With the CRO grounded to case, look at pin 7 of the transformer It. The signal should be approximately 2 volts peak to peak. This should also appear at S7 on the wiper of the second deck from the chassis, and the wiper of the deck farthest from the chassis. (If the FUNCTION switch is on 600 either BRIDGING or TERM, the signal at S7 will be slightly less than at T1). The signal at S7 should also appear at the base of Q2. This is point R on the printed circuit hoard. (Figs. 7 and 8 show the layouts of the two printed circuit boards with significant points indicated.)

5.10 **Amp 1** (Q102, Q103, Q104) - Set SENS to -40 dbm. The CRO should have a deflection sensitivity of at least 0.1 volt/cm. Place the CRO input at point 0. This is the output of Amp 1. The level here should be approximately 0.2 volts peak to peak. If it

is, Amp 1 is satisfactory. If there is no output or it is very low, proceed with the next step.

5.11 **Am 1 DC** - Measure (20,000 ohms per volt--no less than 10 volts full scale) the collector voltages of Q102 and Q103 as shown on the schematic. These DC voltages are for a fresh set of batteries.

5.12 **Filter** - If the signal appears normal at point 0, check point T, it should be approximately 0.06 volts peak to peak.

5.13 **Amp 2** - If the signal is normal to point T, place SENS on 0 dbm and check the level at the collector of Q203; it should be approximately 0.15 volts peak to peak. If not, check the DC voltages of Amp 2 as shown on the schematic.

5.14 **Amp 3** - If the point in step 5.13 is normal, check, with the CR0, the level at C304. This should be approximately 1.5 volts peak to peak and appear flattened. If not, check the DC voltages of Amp 3 as shown on the schematic.

Calibration

5.15 No external calibration control is available. Normally no calibration is required, as the set is extremely stable and should hold its calibration for a long period of time. It may be desirable to make a routine check periodically to determine if there has been any change in calibration.

5.16 The calibration is checked by applying an extremely accurate 0 dbm 1000 cps signal to the line jack and setting both attenuators at 0 dbm. The meter should read 0 db. If it does not, the set should be recalibrated.

5.17 To calibrate the set, remove the set from its case. Apply a 1 mw 1000 cps signal to the line jack and adjust R308, which is located on the amplifier board until the meter reeds 0 db.

6.0 OPERATION

6.01 Level Measurements

a. Open lid. (May be detached by moving lid to the right.)

b. Turn POWER switch ON.

c. Depress BATT TEST key and note if meter needle falls in green arc marked GOOD. Replace batteries with Eveready 2356 or equivalent if Step 3 indicates bad.

d. Set INPUT switch to desired impedance.

e. Set FILTER switch to desired filter.

f. Connect circuit to be tested to either the LINE jack or LINE binding posts.

g. Set SENS attenuator switches to obtain a convenient reading on the meter. A more accurate measurement may be obtained if the meter needle falls between the black numerals +3 and -3 dbm.

h. The level is the algebraic sum of the SENS switches reading (WHITE NUMBERS ONLY) and the meter reading (BLACK NUMBERS ONLY). Likewise, the SENS switches readings are the algebraic sum of the white numerals.

Example:

SENS Switches	Meter Reading	Level
+7 (WHITE)	+2 (BLACK)	+9
+15 (WHITE)	-3 (BLACK)	+12
0 (WHITE)	-1.6 (BLACK)	-1.6
-10 (WHITE)	+2.4 (BLACK)	-7.6
-15 (WHITE)	-0.6 (BLACK)	-15.6

i. To monitor the tone being measured, insert a 310 plug connected to a telephone headset in the MON AC jack. (This output jack can be connected to a 600 ohm impedance receiving device with little effect on the meter reading.)

6.02 Noise Measurements

a. Follow Steps a through f under 6.01. Level Measurements.

b. Set the SENS switches to 85 (blue numbers).

c. Connect circuit to be tested to either the LINE jack or LINE binding posts.

d. Reset SENS switches to obtain a convenient reading on the meter, preferably between 7 dbrn and 13 dbrn (blue numbers only).

e. The noise reading is then the algebraic sum of the SENS switches reading (BLUE NUMBERS ONLY), and the meter reading (BLUE NUMBERS ONLY).

Example:

SENS Switches	Meter Reading	Level
27 (BLUE)	7 (BLUE)	34 DBRN
35 (BLUE)	10 (BLUE)	45 DBRN
22 (BLUE)	12 (BLUE)	34 DBRN

f. To monitor the noise being measured, insert a 310 plug connected to a telephone headset in the MON AC jack. This output jack can be connected to a 600 ohm impedance receiving device with little effect on the meter readings.

NOTE 1: When recording noise measurements, the type of filter should be indicated such as 42 dbrn-C-MSG or 85 dbrn 15 KC flat.

NOTE 2: To make "noise to ground" measurements, set in- put switch to N-GND and connect a good ground to the GND binding post.

6.03 VU Measurements

a. Follow Steps a through g under 6.01, Level Measurements.

b. Set SENS switches to white numerals to obtain reference point.

c. Meter needle deflections into the green (0 db to +3 db) and yellow (-6 db to 0 db), or red (-15 db to -6 db), arcs may now be noted.

6.04 To Talk

a. Set INPUT switch to DIAL AND TALK.

b. Connect a telephone headset to the DIAL jack.

c. Connection is now established to the circuit connected to the LINE jack.

NOTE: Circuit under test must supply DC talk battery.

6.05 To Dial

a. Set INPUT switch to DIAL AND TALK.

b. Connect a dial or subscriber’s set with a dial to the DIAL jack.

c. A number may now be dialed on the circuit connected to the LINE jack.

6.06 To Hold and Release

Operate HOLD key to ON to hold a circuit, OFF to release.

NOTE 1: The HOLD circuit when ON will hold a circuit connected to the LINE jack when the INPUT switch is in any position.

NOTE 2: The HOLD coil may be influenced by strong magnetic fields. This normally occurs in the more sensitive positions. Relocation of the set away from the field, orientation within the field, or operation on HP or C-MSG will reduce the effect.

6.07 To Operate on 48 Volts

a. Insert a cord in jack marked 48V FIRST; the tip must be connected to battery and the sleeve to ground.

b. Connect other end to 48-volt supply.

c. Operate POWER switch to ON.

d. Depress BATT TEST key and observe correct polarity and voltage by the meter needle swinging to the green GOOD arc.

6.08 To DC Monitor or Record

a. Follow normal procedure under 6.01, 6.02, and 6.03.

CAUTION: The external DC monitor (recorder or meter) device must have a relatively low resistance (not over 300 ohms) and must be isolated from ground.

b. Connect monitoring device to the MON 1 MA jack (tip and ring). If the monitoring device's resistance is right, there will be no change in reading on the TTS 37B meter.

c. Calibrate external monitor. (O db will produce between 0.7 ma and 1 ma.)

6.09 Storage

Always attach lid to test set when not in use. This automatically turns POWER switch to OFF position when it is closed.

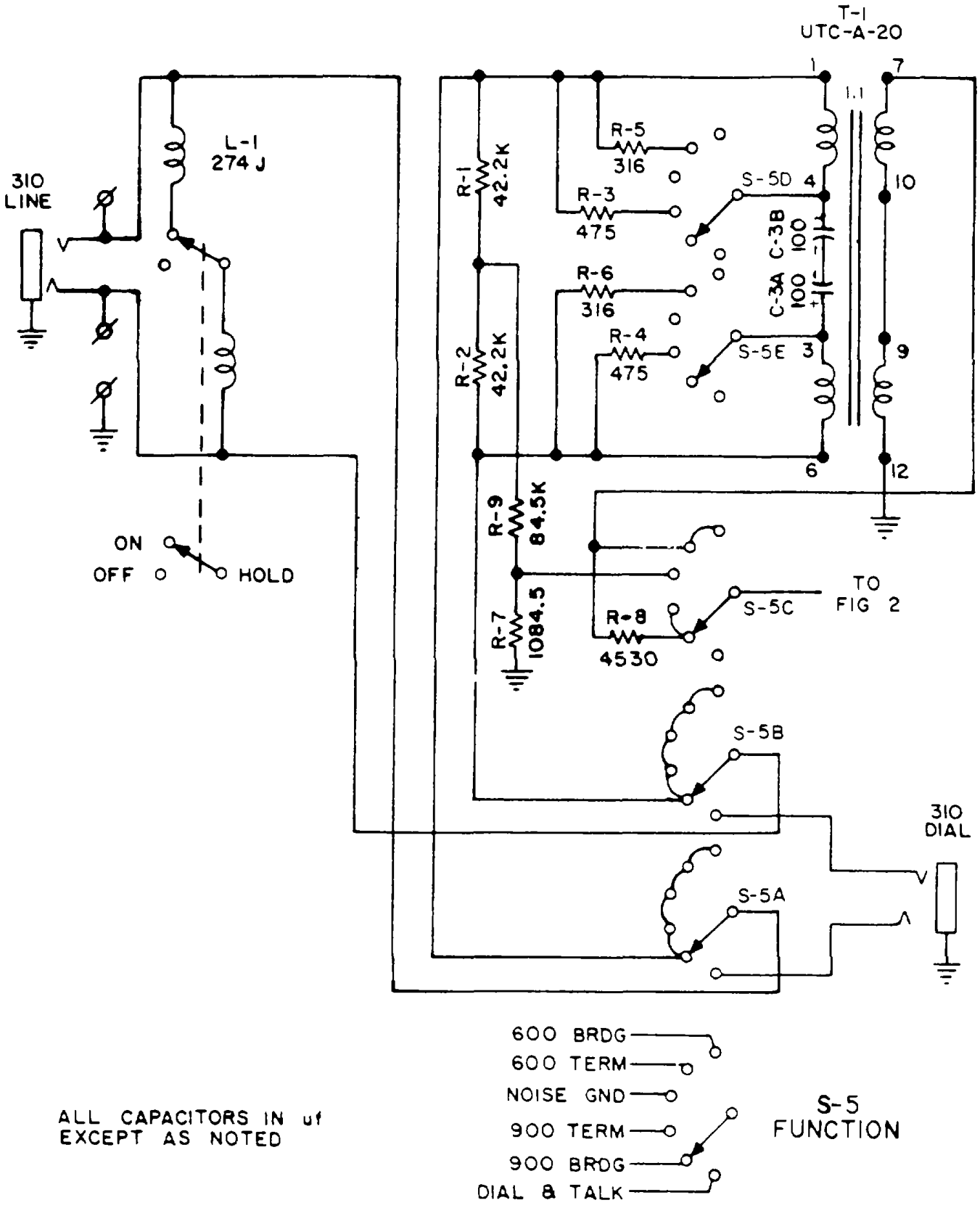


FIGURE 1. MODEL TTS--37B INPUT CIRCUIT, SCHEMATIC DIAGRAM.

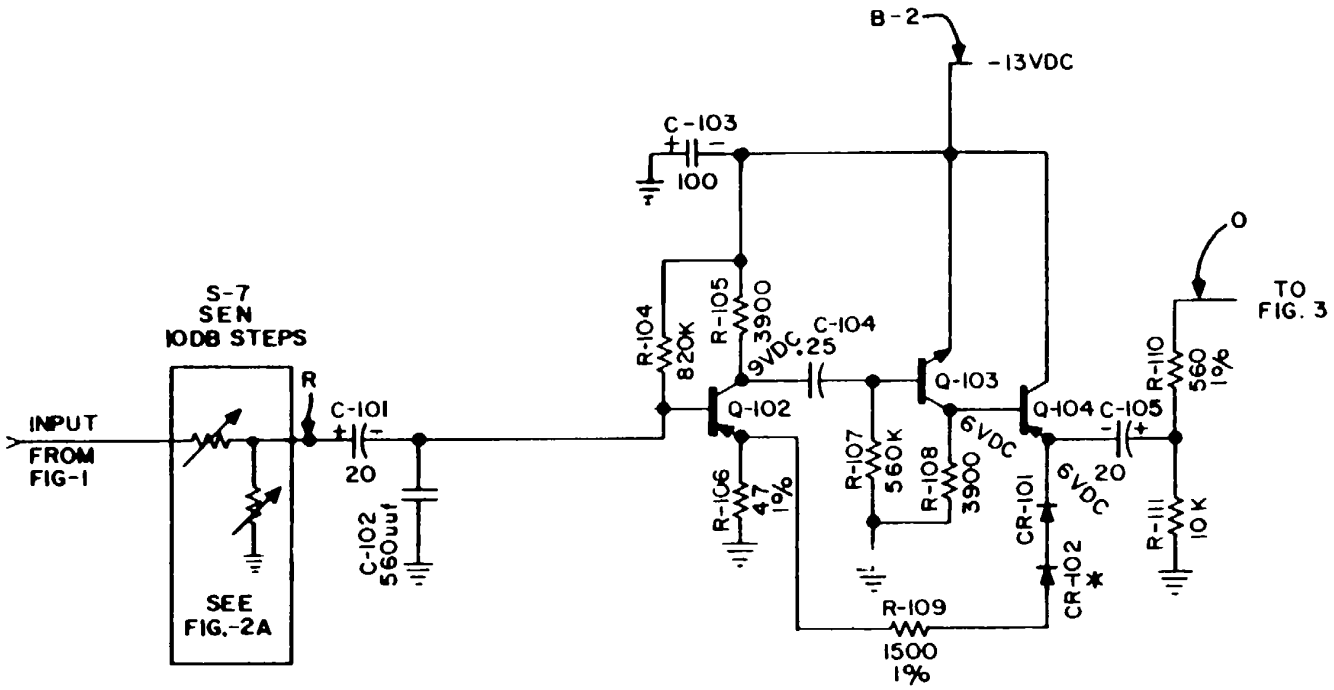


FIGURE 2. MODEL TTS--37B AMPLIFIER ONE, SCHEMATIC DIAGRAM.

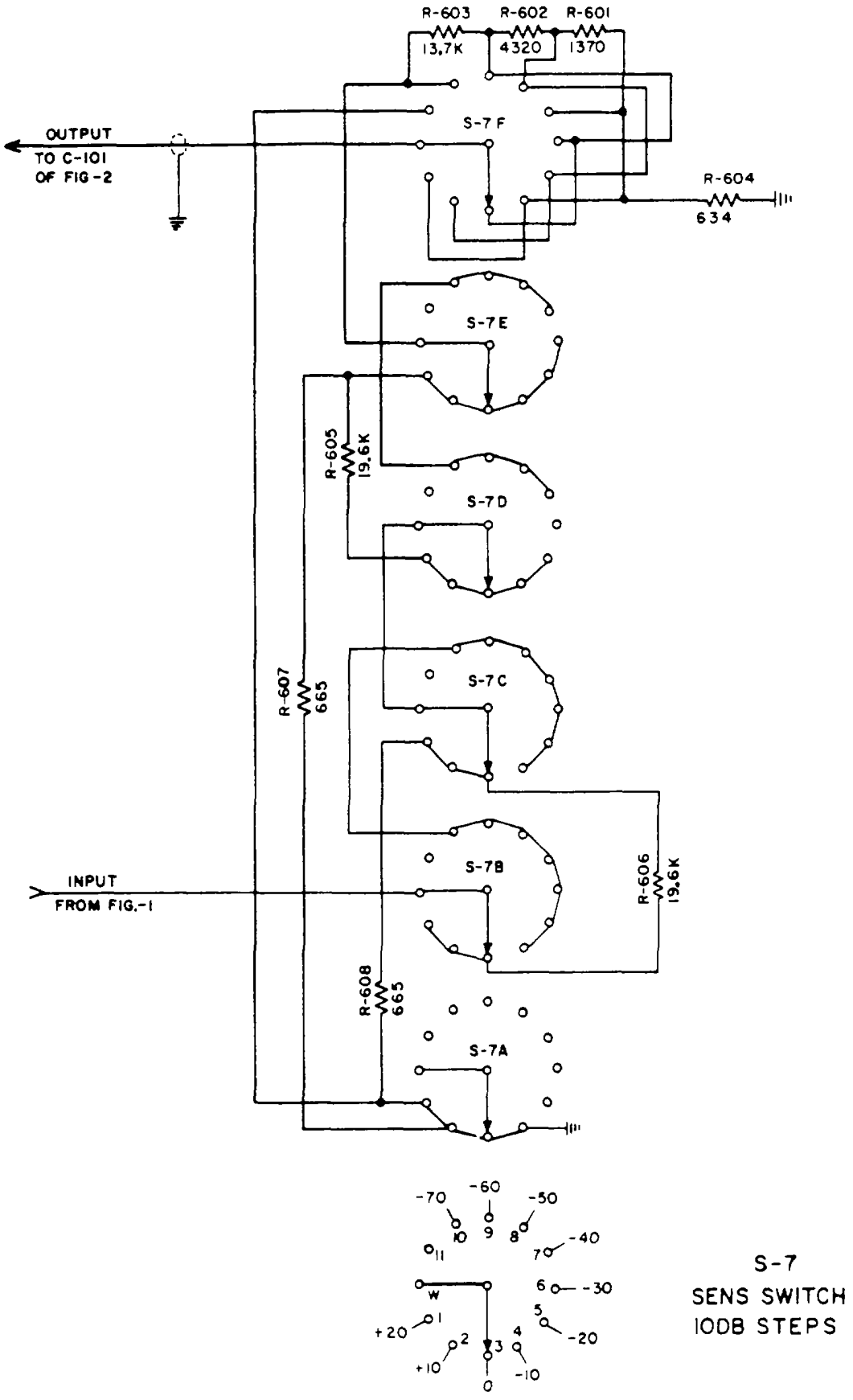


FIGURE 2A. MODEL TTS--37B TEN--DB STEP ATTENUATOR SWITCH S7, SCHEMATIC DIAGRAM.

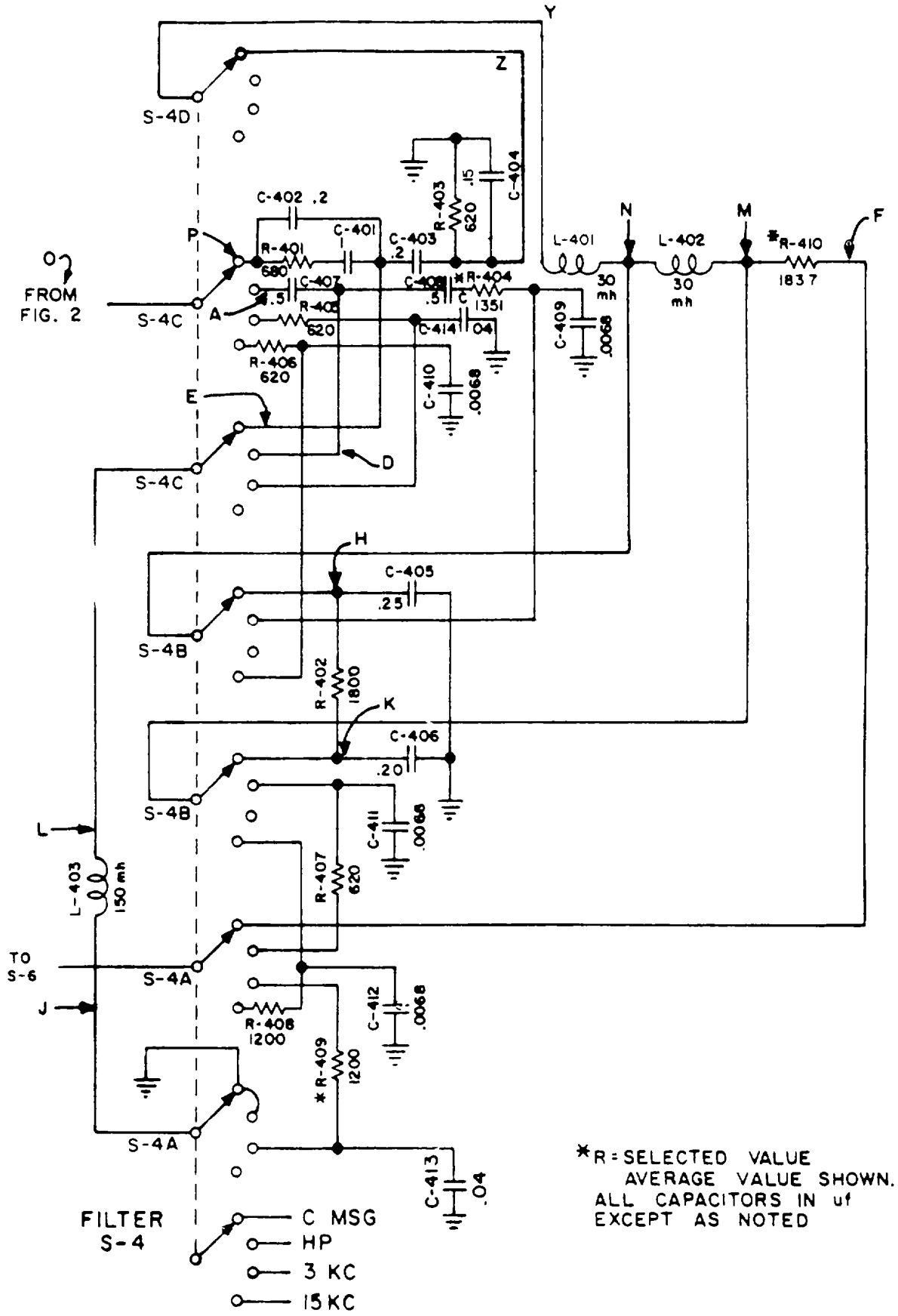


FIGURE 3. MODEL TTS-37B FILTER SWITCHING NETWORK, SCHEMATIC DIAGRAM.

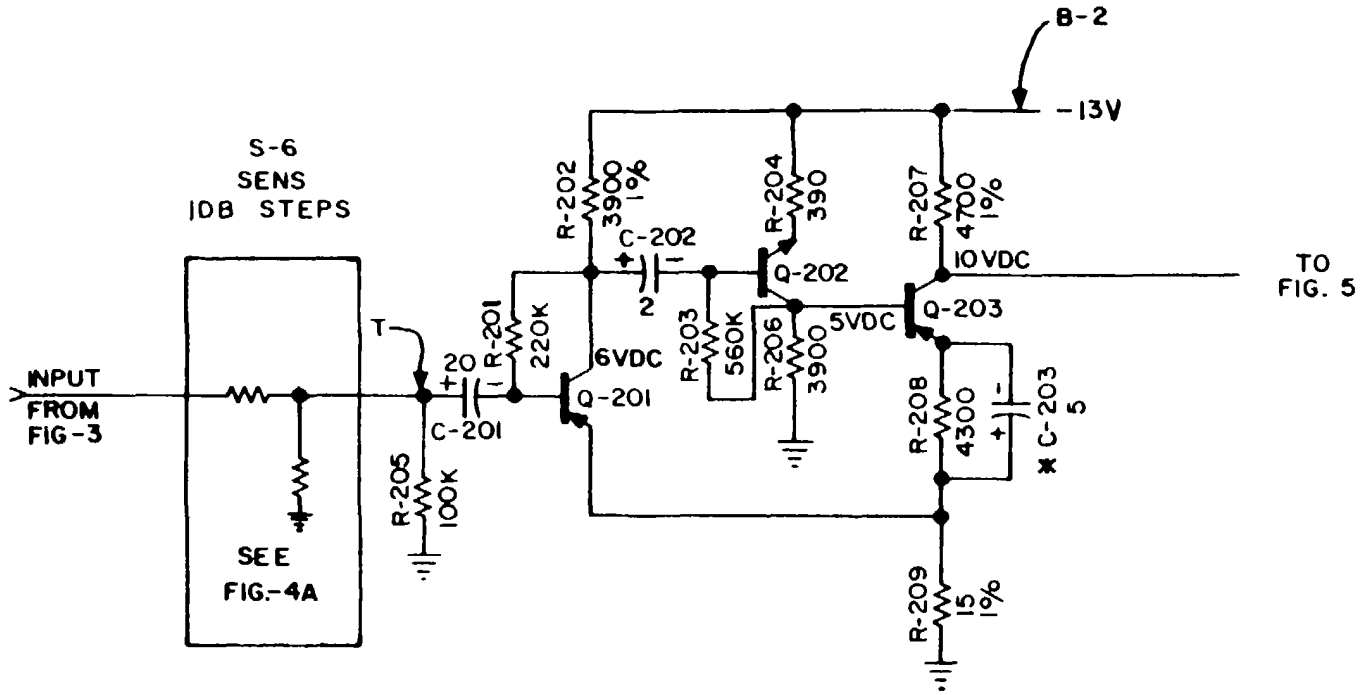


FIGURE 4. MODEL TTS--37B AMPLIFIER TWO, SCHEMATIC DIAGRAM.

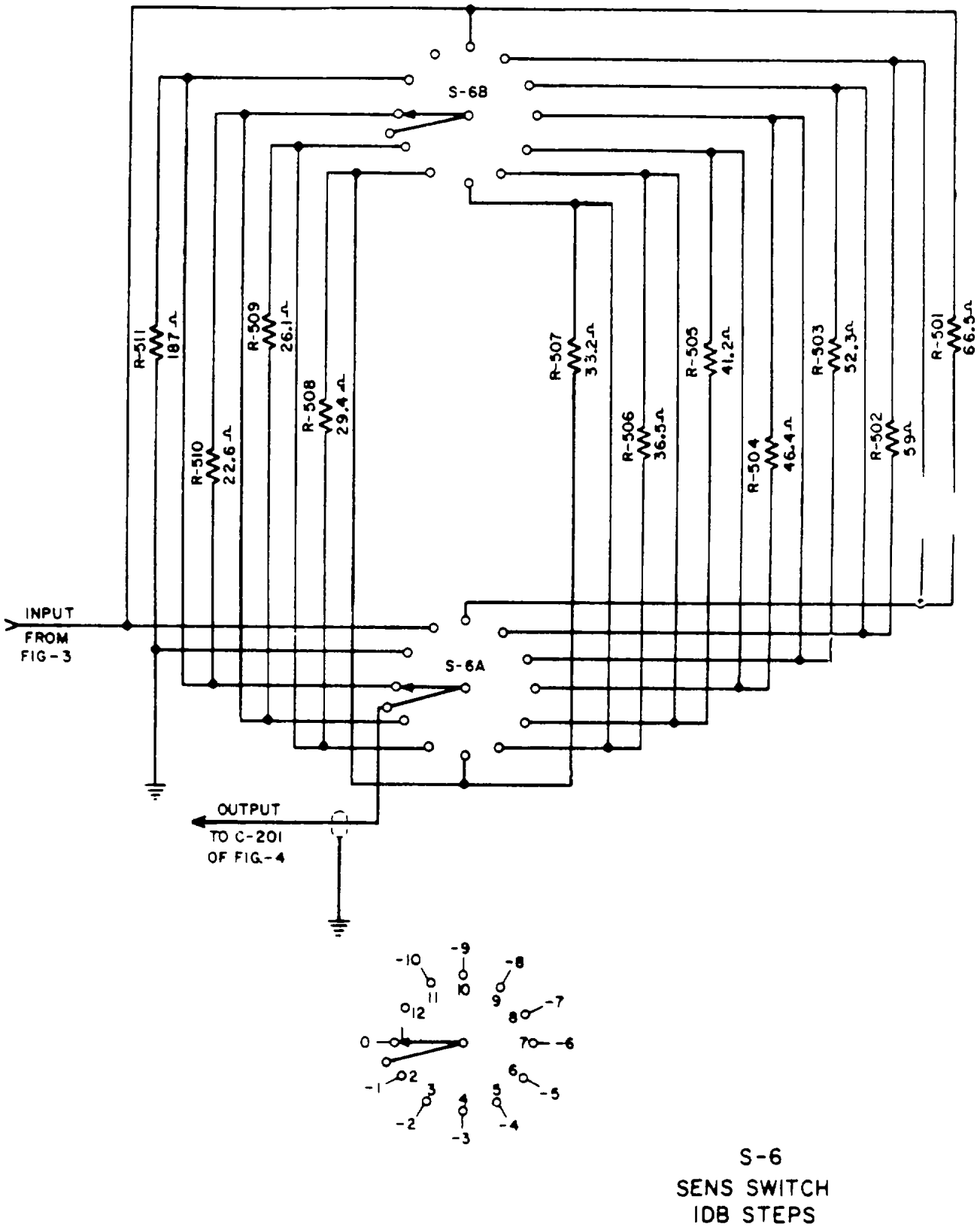


FIGURE 4A. MODEL TTS-37B ONE--DB STEP ATTENUATOR SWITCH S6 SCHEMATIC DIAGRAM.

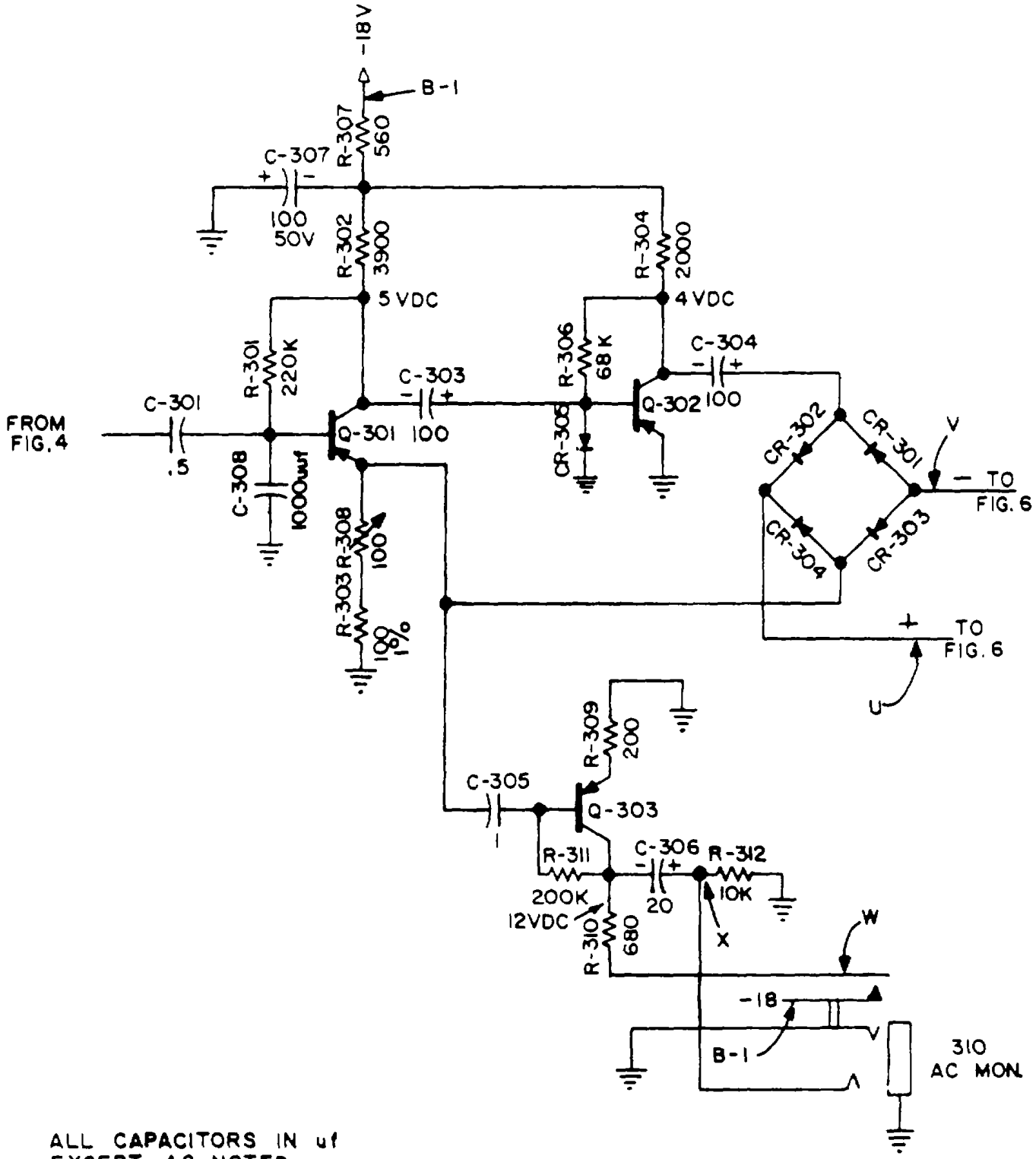


FIGURE 5. MODEL TTS-37B AMPLIFIER THREE, AND AC MONITORING CIRCUIT, SCHEMATIC DIAGRAM.

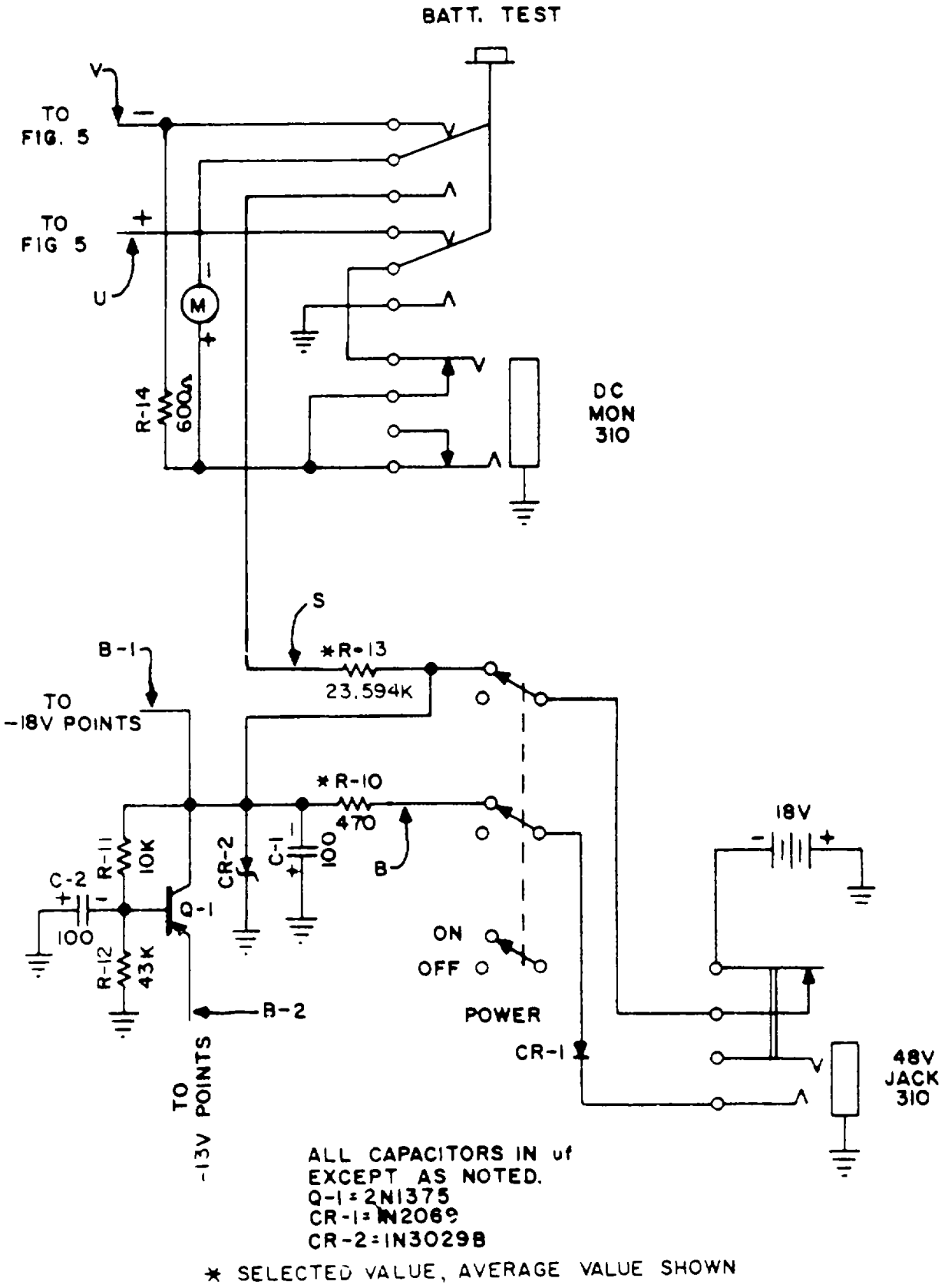


FIGURE 6. MODEL TTS-37B POWER AND DC MONITORING CIRCUITS, SCHEMATIC DIAGRAM

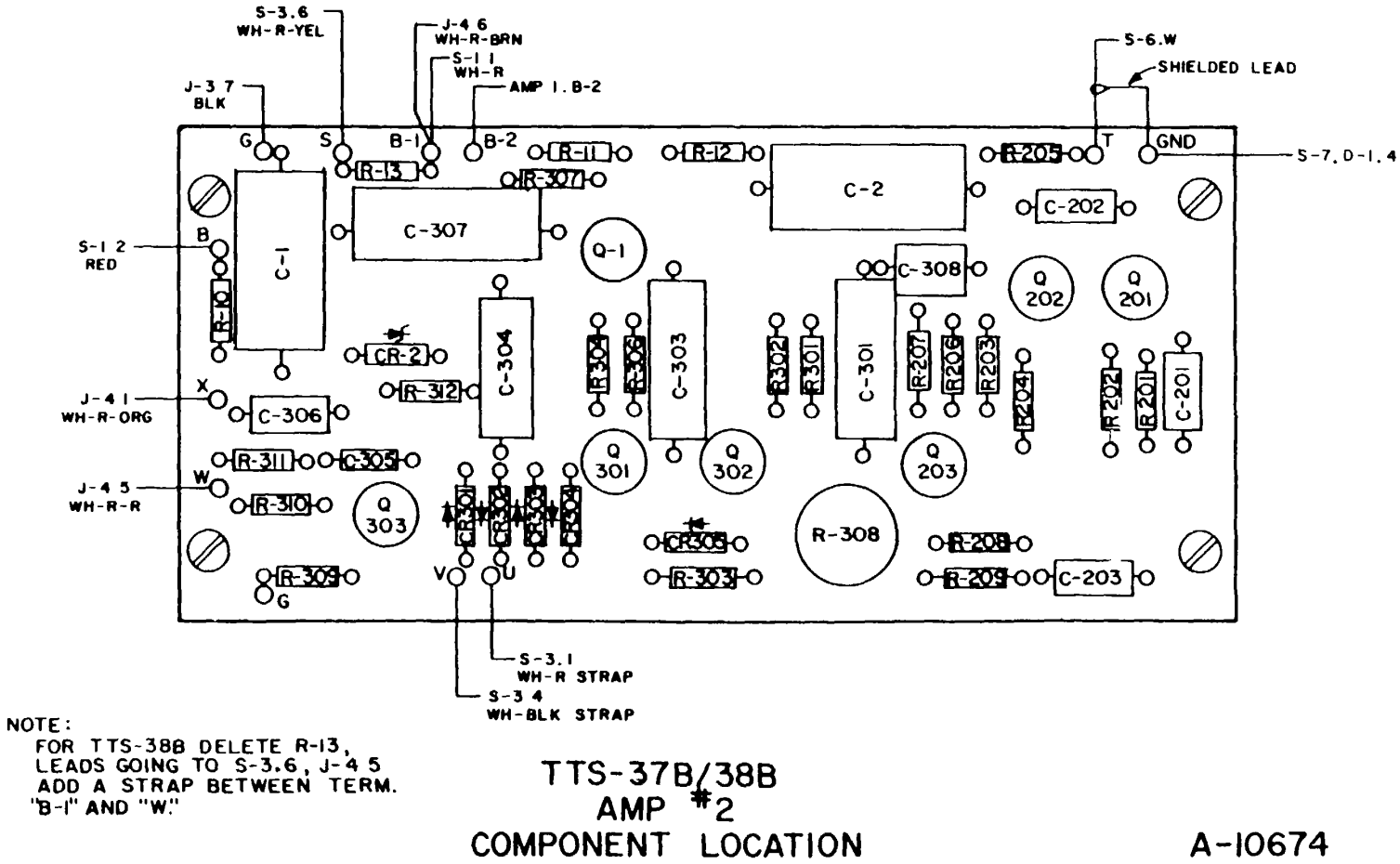
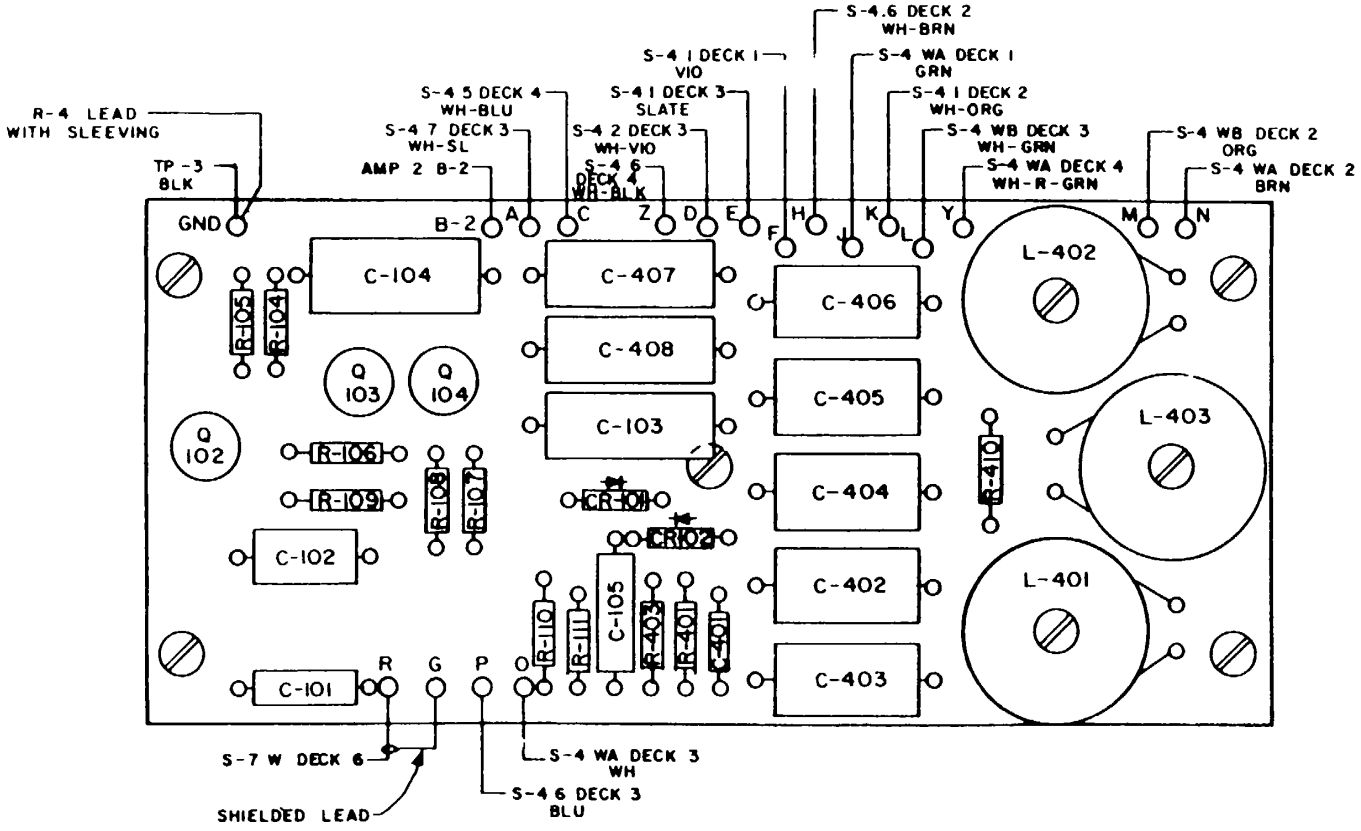


FIGURE 7. MODEL TTS-37B MONITORING CIRCUIT AND AMPLIFIERS TWO AND THREE, COMPONENT LOCATION



TTS-37B/38B
AMP #1
COMPONENT LOCATION A-10673

FIGURE 8. MODEL TTS--37B FILTER NETWORK AND APLIFIER ONE, COMPONENTS LOCATION

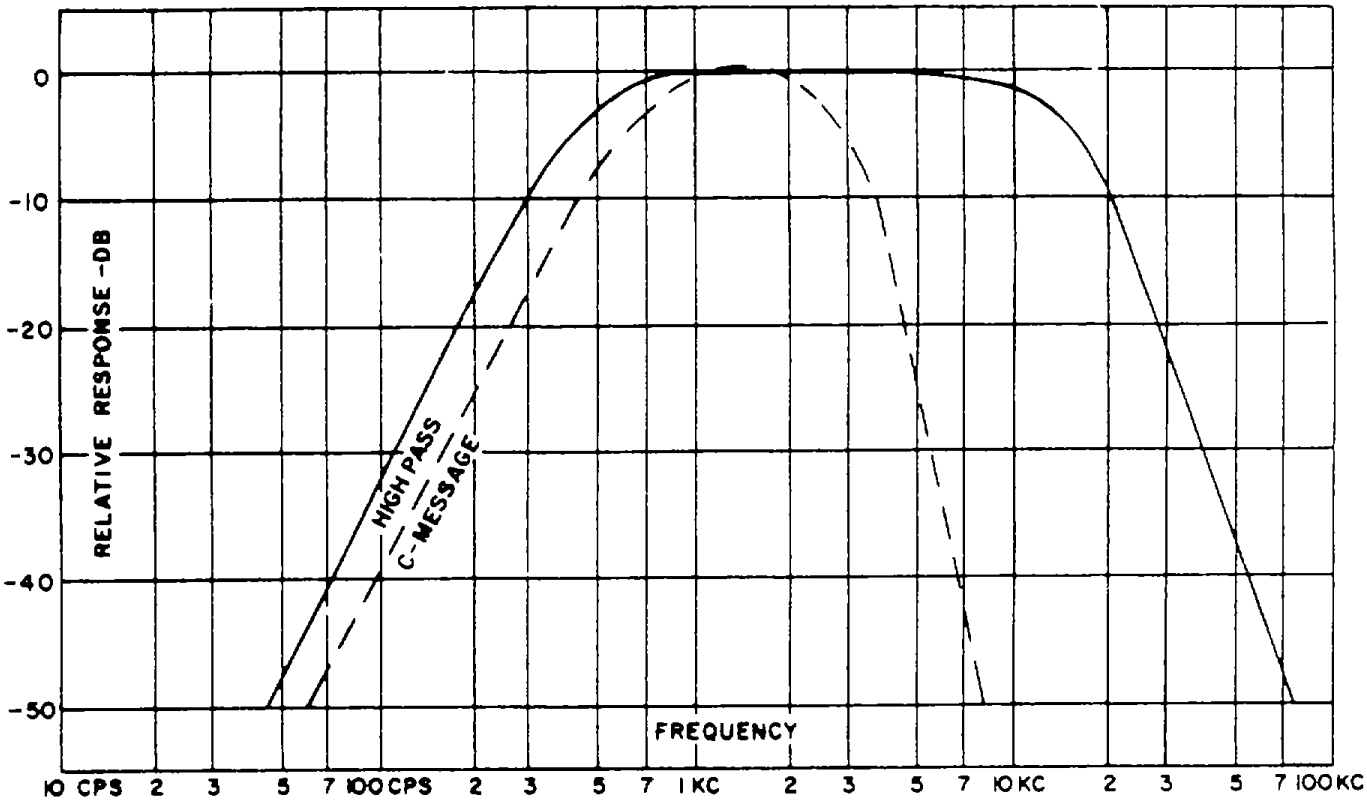


FIGURE 9. MODEL TTS--37B FREQUENCY RESPONSE WITH C-MESSAGE AND HIGH PASS FILTERS

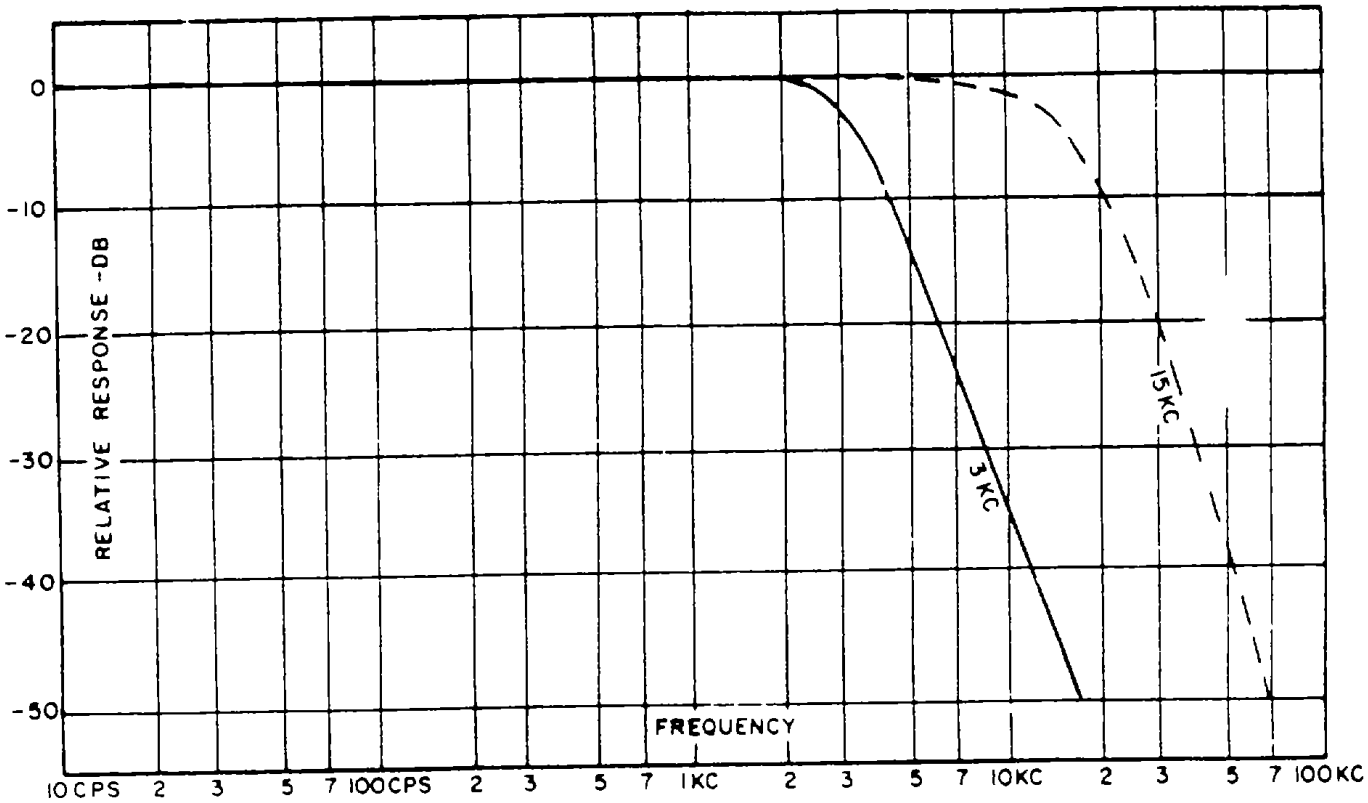


FIGURE 10. MODEL TTS--37B FREQUENCY RESPONSE CURVES FOR 3KC and 15KC FILTERS

7.0 OPERATOR'S MAINTENANCE INSTRUCTIONS

7.01 Scope of Operator's Maintenance

The maintenance duties assigned to the operator of the TTS-37B are listed below, with a reference to the paragraphs covering the specific maintenance function

a Operator's daily preventive maintenance checks and services (para 7.04 and 7.05)

b Cleaning (para 7.06)

7.02 Items Required for Maintenance

Only the following items are required for maintenance:

a Trichloroethane (FSN 6810-664-0273)
b Cleaning cloth (FSN 8305-267-3015)

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

7.03 Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable

a Systematic Care The procedures given in paragraphs 7.04, 7.05, and 7.06 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment

b Preventive Maintenance Checks and Services The preventive maintenance checks and services chart (para 7.05) outlines functions to be performed at specific intervals These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition *and* in good operating condition To assist operators in maintaining combat serviceability, the chart indicates what to check, how to check and what normal conditions are the References column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures If the defect cannot be remedied by the operator, higher category maintenance or repair is required Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750

7.04 Preventive Maintenance Checks and Services Periods Daily checks and services must be performed on the TTS-37B

a The daily preventive maintenance checks and services chart given in paragraph 7.05 specifies the checks which must be performed on a daily basis

7.05 Operator's Daily Preventive Maintenance Checks and Services Chart

Sequence No	Item to be inspected	Procedure	References
1	Exterior surfaces	Clean the exterior surfaces	Para 7.06
2	Switch handles	Set the filter selector and the input selector switches to each of their positions Observe that the action is smooth and free of binding	Para 3 01
3	Operation	check for normal operation	Para 6 01 thru 6 08

7.06 Cleaning

Inspect the interior of the TTS-37B The exterior surfaces should be free of dirt and fungus

a Remove loose dirt with a clean soft cloth

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

b Remove grease, fungus, and ground-in dirt with a cloth dampened (not wet) with trichloroethane

SECTION 8

8.0 ORGANIZATIONAL, DS, AND GS MAINTENANCE INSTRUCTIONS

8.01 Scope of Organizational, DS, and GS MAINTENANCE

a Organizational maintenance consists of the following:
(1) Quarterly preventive maintenance (para 8.03 & 8.04)

(2) Touchup painting (para 8.05)

8.02 Tools, Materials and Test Equipment Required

The tools, materials, and test equipment required for organizational maintenance are as follows:

a Tools Tool Kit, Radio Technician (on site)

b Materials

(1) Trichloroethane (FSN 6810-664-0273)

(2) Cleaning cloth (FSN 8305-267-3015)

c Test Equipment Refer to appendix B for required test equipment

8.03 Quarterly Preventive Maintenance

Quarterly preventive maintenance checks and services on the TTS-37B are required All deficiencies or short-comings will be recorded in accordance with the requirements of IM 38-T750 Perform all the checks and services listed in the organizational quarterly preventive maintenance checks and services chart (para 8.04) in the sequence listed

8.04 Organizational Quarterly Preventive Maintenance Checks and Services Chart

Sequence No	Item to be inspected	Procedure	References
1	Completeness.....	Check to see that the equipment is complete	Para 1 01 through 1 05
2	Installation.....	Check to see that the equipment is properly installed	None
3	Cleanliness	Check to see that the equipment is clean	Para 7.06
4	Preservation.....	Check all surfaces for evidence of rust, fungus, or corrosion Spot-paint bare spots	Para 7.06 & 8.05 TB 746-10, TB SIG 364 & TB SIG 255-3
5	Publications	Check to see that all publications are complete, serviceable, and current	DA Pam 310-4
6	Modifications.....	Check DA Pam 310-7 to determine if new, applicable MWO's have been published must be applied Immediately All NORMAL MWO's must be scheduled	DA Pam 310-7 & TM 38-75 All URGENT MWO's

8.05 Touchup Painting

When the finish on the metal parts of the equipment has been badly scarred or damaged, lightly sand them with fine sandpaper Use #00 or #000 sandpaper (FSN 5350-271-7939) and trichloroethane to clean the surface down to the bare metal Brush two thin coats of paint on the bare metal Refer to applicable cleaning and refinishing practices specified in TB 746-10

8.06 General Parts Replacement Techniques

Most of the electronic parts in the TTS-37B can be easily reached Carefully remove the printed circuit board before replacing part #, Observe the following precautions a Install replacement parts in essentially the same position as the original part to avoid undesired coupling

b Use a pencil-type soldering iron with a 25-watt capacity If only ac-operated soldering irons are available, use an isolating transformer Do not use a soldering gun; damaging voltages can be induced in components

c When soldering transistor leads, solder quickly; where wiring permits, use a heat sink (such as long-nosed pliers) between the solder Joint and the transistor Use approximately the same length and dress of transistor leads as used originally

d The circuit boards of the TTS-37B(are of rugged construction and can be soldered to directly However, components being soldered must be protected with heat sinks during soldering operations Defective components may be unsoldered, and lead fragments may be removed from the boards The replacement component should be soldered to the same points on the circuit board, using leads of approximately the 8ame length an the leads on the component removed Be very careful to

protect the fine leads of tran*sla*tors and to prevent nicks, abrasions, or breaks in the leads of capacitors and resistors

APPENDIX A

REFERENCES

DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, (types 7, 8, and 9), Supply Bulletins and Lubrication Orders
DA PAM 310-7	Index of Current Modification Work Orders
SB 38-100	Preservation, Packaging and Packing Materials, Supplies, and Equipment Used by the Army
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment

APPENDIX B

MAINTENANCE ALLOCATION

Section I INTRODUCTION

B-1 General

This appendix provides a summary of the maintenance operations covered in the equipment literature It authorizes categories of maintenance for specific maintenance functions on reparable items and components and the tools and equipment required to perform each function This appendix may be used as an aid in planning maintenance operations

B-2 Maintenance Functions

Maintenance functions will be limited to and defined as follows'

a. INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards

b. TEST. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc. This is accomplished with external test equipment and does not include operation of the equipment and operator type tests using internal meters or indicating devices

c. SERVICE To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air If it is desired that elements, such as paint- mg and lubricating, be defined separately, they may be so listed

d. ADJUST. To rectify to the extent necessary to bring into proper operating range

e. ALIGN To adjust two or more components or assemblies of an electrical or mechanical system so that their functions are properly synchronized This does not include setting the frequency control knob of radio receivers or transmitters to the desired frequency

f. CALIBRATE. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard

g INSTALL. To set up for use in an operational environment such as an encampment, site, or vehicle

h. REPLACE. To replace unserviceable items with serviceable like items

t REPAIR. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition This function includes, but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes

j. OVERHAUL. Normally, the highest degree of maintenance performed by the Army in order to minimize timework in process is consistent with quality and economy of operation It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment Overhaul normally does not return an Item to like new, zero mileage, or zero hour condition

k. REBUILD. The highest degree of materiel maintenance It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards Rebuild is performed only when required by operational consideration or other paramount factors and then only at the depot maintenance category Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use

l. SYMBOLS. The uppercase letter placed in

the appropriate column indicates the lowest level at which that particular maintenance function is to be performed

B-3 Explanation of Format

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

b Column 2, functional group. Column 2 lists the noun names of components, assemblies, sub-assemblies and modules on which maintenance is authorized

c Column 3. maintenance functions Column 3 lists the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to per- form that function at higher categories. The codes used represent the various maintenance categories as follows:

Code	*Maintenance Category*
C	Operator/Crew
0	Organizational Maintenance
F	Direct Support Maintenance
H	General Support Maintenance
D	Depot Maintenance

d Column 4, tools and test equipment. Column 4 specifies, by code, those tools and test equipment required to perform the designated function. The numbers appearing in this column refer to specific tools and test equipment which are identified in table I

e Column 5, Remarks Self-explanatory

B-4 Explanation of Format of Table 1, Tool and Test Equipment Requirements

The columns in Table I, Tool and Test Equipment Requirements are as follows:

a Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the Maintenance Allocation Chart

The numbers indicate the applicable tool for the maintenance function

b Maintenance Category. The codes in this column indicate the maintenance category norm- ally allocated the facility

c Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions

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

e Tool Number. Not used

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	FUNCTIONAL GROUP COMPONENT ASSEMBLY	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
1	NOISE LEVEL-VU-MEASURING SET TTS-37B	F	H		H		B-3		F H				1 thru 5 1 thru 5 5 1 thru 5	Visual Repair by replacement of battery

TABLE I. TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE Recommended in Manual	NOMENCLATURE Available on Sight	FEDERAL STOCK NUMBER	TOOL NUMBER
1	H		VTM, HEWLETT PACKARD 400 L		
2	H		VTM, HEWLETT PACKARD 410 C		
3	H		SIGNAL GENERATOR, HEWLETT PACKARD 200 CD		
4	H		OSCILLOSCOPE, TEXTRONIX 561 A		
5	F,H		TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-605-0079	

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- USASTRATCOM (PAC) (10)
- USASTRATCOM-SIG-GP-T (5)
- USASTRATCOM-CONUS (5)
- USASTRATCOM-Sig Gp, Japan (3)
- USASTRATCOM Comm Op Bn, Korea (S)
- LOGCOMDS (5)
- Eighth USA (10)
- USARV (10)
- USASUPCOM-CRB (5)
- USASUPCOM-QN (5)
- USASUPCOM-SGN (5)
- USARYIS (6)
- ICC (3)
- 1st Sig Bde (10)
- Sig FLDMS (PAC) (1)
- SAAD (10)
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- USACSA (2)
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  - 110S
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  - 11--7
  - 11477
  - 1100(AA-AC)
  - 11-3l
  - 12-118
  - 29-1S4
  - 29-13
  - 2187
  - 11417

USNG: None
USAR : None
For explanation of abbreviations used, see AR 310-50

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