T.O. 31R2-2URR62-2

TECHNICAL MANUAL

SERVICE AND CIRCUIT DIAGRAMS

RADIO RECEIVER R-1555/URR-62

(RACAL RA6217E)

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CHAPTER 1

INTRODUCTION

1-1. Scope

This part of the AN/URR-62 manual describes Radio Receiver Model, R-1555/URR-62 (fig. 1-1) and provides instructions for operation, operators maintenance, troubleshooting and repair. Instructions are provided for the operator and the organizational repairman for installation, operation, preventive maintenance and replacement of parts available at organizational maintenance. Circuit functioning is included, for support of the maintenance instructions, together with instructions appropriate to organizational, field, and special maintenance, including troubleshooting, testing, adjusting, aligning and repairing the equipment. A separate illustrated parts breakdown is provided in T.O. 31R2-2URR62-4.

1-2. Specifications and Equipment Required But Not Supplied

a. Capabilities and Limitations. Table 1-1 lists the capabilities and limitations of the receiver.

b. Leading Particulars. Table 1-2 lists the leading particulars of the receiver.

c. Equipment Required But Not Supplied. Table 1-3 lists the equipment required for maintenance and operation of the receiver. Special tools or test equipment are not required for installation.

1-3. Description and Use

a. Receiver R-1555/URR-62 is a solid state general purpose receiver, capable of receiving radio frequency (RF) signals with amplitude modulation (AM), frequency modulation (FM), modulated continuous wave (MCW), and single-sideband (SSB), over a frequency range of from 980 kilohertz (KHz) to 30 megahertz (MHz). Note that the mechanical limit for the MHz dial is 30 MHz; however, the electrical limit is 29 MHz. The MHz setting should not exceed 29 MHz.

b. The receiver consists of a single rack-mounted chassis as shown in (fig. 1-1). The overall dimensions are 17 inches wide, 17 inches deep, and 3-1/2 inches high with a 19 inch front panel. The weight is approximately 25 pounds. AC Power Unit MA6302 is used with the receiver to operate from a 100-to 125-and 200-to 250-volt, 48-to 420-hertz (Hz) power source.

c. A signal input and output, a 16-volt direct current (DC) output, and an antenna connector are located on the rear of the R-1555/URR-62.

d. Controls required to operate the R-1555/URR-62 are located on the front panel. The input Voltage Selector Switch is located on the rear panel.

Table 1-1. CAPABILITIES AND LIMITATIONS

Frequency range	980 KHz to 30 MHz.
Reception modes	AM, FM, MCW, CW, SSB.
Tuning	Digital Readout in MHz and KHz with interpolation at 200-Hz intervals.
Frequency setting accuracy	Within 250 Hz, with an oscillator output for a digital counter.
Antenna input	75 ohms wide band or double-tuned in five bands, with VSWR 2:1 or better.
Sensitivity (3-KHz bandwidth)	CW, SSB, 0.5 uV for 15-dB S/N ratio; MCW, AM. (30% mod) 1.5 uV for 15-dB S/N ratio.
Sensitivity (13-KHz bandwidth)	FM (± -KHz deviation) 1 uV for 10-milliwatt AF output.
Stability	a. Long term: ± 50 Hz per 8-hour period at ambient temperature. b. Short term: ± 5 Hz at ambient temperature. c. Variation with temperature: Less than 50 Hz per degree C. d. Facilities are provided to enable injection of external standard oscillators, also master/slave operation in diversity systems.
Calibration	Internal calibration oscillator provides markers at 100-KHz intervals.
Selectivity	13-, 6.0-, 3.0, 1.0 KHz/s and 200-Hz, 3-dB points ±15% center frequency.
Shape factor (6 to 60 dB)	1:4 or better, 1:10 or better for 200-Hz bandwidth.
IF outputs:	a. 2- to 3-MHz spectrum output for panoramic display unit, type IP -935/URR-62. b. 1.6 MHz: 100 MV nominal to 75 ohms, after IF, selectivity. Optional converter units providing outputs at 455 KHz. Level 1.0 milliwatt nominal in 50 ohms.
Noise figure	Less than 10 dB throughout.
AGC	a. Input variation from 3 to 30,000 microvolts causes no more than 3-dB change in output level. b. Time constants (nominal): (1) Short charge, 16 milliseconds; discharge 30 milliseconds. (2) Medium charge, 50 milliseconds; discharge 200 milliseconds. (3) Long charge, 80 milliseconds; discharge 4 seconds.

Table 1-1. CAPABILITIES AND LIMITATIONS (cont)

BFO range	+ 8 KHz (variable) with fixed crystal control points at 1.5 KHz coarse and fine control facilities.
Meter indication:	a. RF LEVEL (S-scale dB ref 1 microvolt). b. AF LEVEL to line.
AF output:	a. 10 milliwatts to headphone jack and rear terminals, 600 ohms. b. Independent 1.0 -milliwatt output to rear terminal, 600 ohms.
AF response (overall)	To correspond with IF bandwidth in use and maintained to within 3 dB at 100 Hz. Optional bass cut at 300 Hz.
AF Distortion (overall)	Less than 2%.
RF input attenuator	0 to 40 dB nominal in 10-dB steps.
Spurious response to external signal	Better than 60 dB down for signals less than 5% off-tune; better than 80 dB for signals more than 5% off-tune.
Internally generated spurious signals	Below noise when measured 3-KHz bandwidth, except at 1.0 MHz where response is 5 dB above receiver noise.
Image rejection	90 dB or better.
Inband intermodulation distortion products	40 dB below two desired -15 DBM input signals within the receiver passband.
Out of band intermodulation distortion products (second order) with tuned input	-90 dB or better.
Cross modulation	For levels of wanted signal between 5 microvolts and 1.0 millivolt, an interfering signal 1.37% removed and modulated. 30% must have a level at least 46 dB greater than the wanted signal to produce a cross modulation of 3%. The ratio is improved up to 10% off-tune at the rate of approximately 2 dB per percent.
Oscillator radiation at antenna terminal	Less than 5 uV across 75 ohms.
Linearity	Output linear within 6% over a 40 dB dynamic range for inputs of from 0.25 microvolts to 30.0 millivolts.

Table 1-2. LEADING PARTICULARS

Power supply	MA6302: AC power unit. Line 100 to 125 and 200 to 250 volts. 48 to 420 Hz, 10 volt-amperes (va), approximately.
Environmental conditions	Operating +55°C to 0°C; Storage +70°C to -40°C.

Table 1-2. LEADING PARTICULARS (cont)

Dimensions	17 by 3-1/2 by 17 inches with 19-inch rack mount front panel.
Weight	Approximately 25 pounds.
Rear panel connections:	a. Power cord, integral with plug-in AC power supply, 8-foot cord, three-wire grounding plug. b. Antenna input, UG-1094/U mates with UG-88B/U c. Line audio output, -16-volt DC regulated, manual gain line, barrier strip. d. IF output (2 to 3 MHz), external 1-MHz standard input, AGC input and output, 1.6 MHz intermediate frequency (IF) output, (455 KHz) IF output, low frequency (IF), adapter input, panoramic adapter output, miniature connector UG-1619/U mates with UG-146/U.

Table 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Description	Qty
Counter, Frequency HP-5245L containing:	1
Converter, Electronic Frequency CV-2002/U	1
Audio Oscillator HP-200CD	1
Sweep Oscillator HP-H12-8690B containing:	1
RF Unit HP-8698B	1
Multimeter AN/PSM-6 ( )	1
Multimeter ME-26A/U	1
Oscilloscope Tektronix 454	1
Signal Generator HP-606A	1
AC VTVM HP-400H	1
Voltmeter, Electronic Boonton 91CAS4	1

Description	Qty
Suitable antenna or antenna system with a 75-ohm impedance	1
Speaker or headset (600 ohms)	1
600 ohms termination	1
600 ohms 10-MW dummy load	1
75 ohms termination	1
Screw driver (medium size)	1
Extender cable, 1MHz module, 2nd mixer module, and 2nd VFO module, Part No. A05386	1
Extender cable, 3rd mixer module, Part No. A05387	1
Extender cable, IF module, Part No. A05389	1
Extender cable, AC Power unit, Part No. A05388	1

CHAPTER 2

INSTALLATION

2-1. Unpacking and Checking Equipment

a. Remove the R-1555/URR-62 from packing case, and inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on the appropriate Report of Damage or Improper Shipment form.

b. Check to see that the equipment is complete. Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, see whether equipment has been changed. If the equipment has been modified, modification number may appear on the front panel near the nomenclature plate. Check to see whether the number (if any) and appropriate notations concerning the modification have been entered in the equipment manual.

2-2. Mounting Requirements

If the R-1555/URR-62 is used as part of a system, refer to the technical manual for that system. Instructions for installing the receiver for fixed and mobile use are listed in a and b below.

a. Fixed Installation. To install the receiver in a standard rack, remove one of the blank panels from the rack or cabinet and install the receiver. Secure the front panel to the rack or cabinet with the bolts removed from the blank panel. Insert the bolts in the elongated holes along the vertical edges of the receiver front panel, and secure them in place.

b. Mobile Installation. When the receiver is installed in a cabinet or rack for mobile operation, the cabinet must be securely bolted to the vehicle body. Allow enough room for access to the back panel connections and for removal of receiver for servicing.

2-3. Cable Connections

a. General. Cable connections that are necessary for normal and optional uses of the receiver are listed in (1) through (3) below, together with subparagraphs that describe connection procedures.

(1) AC Power Unit MA6302 (117-234-volt alternating current (AC) (b below)).

(2) Antenna input and audio output (c below).

(3) External 1-MHz standard (d below).

Caution: To avoid transistor damage, check to see that the function switch (fig. 3-1) is at OFF before making any power connections.

b. AC Power Unit MA6302.

(1) Check to see that the voltage selector switch (fig. 2-1) is in the proper position; up for 115 vac (115 is visible) and down for 230 vac (230 is visible).

(2) To change the position of the voltage selector switch, use a screwdriver or similar tool.

(3) Check to see that fuse F1301 is 0.5-ampere, fuse F1302 is 1-ampere.

(4) Plug the AC plug into a voltage socket that is to be used as the AC power source.

c. Antenna Input and Audio Output.

(1) Connect an antenna cable equipped with a UG-1094/U connector which mates with the UG-88B/U, RF INPUT jack J201.

Note: The RF INPUT jack is designed to match a 75-ohm unbalanced transmission line.

(2) Plug the 600-ohm headset into the PHONES jack located on the front panel. If the audio output is to be connected to the rear of the receiver, connect the cable leads to the terminal board; use 600-ohm 10 MW or 600-ohm 1 MW.

d. External 1-MHz Standard. When an external standard is used in the operation of the receiver, remove internal 1-MHz crystal Y601 before cable connections are made to the 1 MHz OUT and IN jacks.

e. Installation of equipment is now complete.

2-4. Preparation for Shipment (fig. 2-2)

a. Position and tape corrugated blocks at the corners of the Receiver.

b. Coil and tape the electrical cord to the rear panel of the Receiver.

c. Insert and seal Receiver in dust protection bag.

d. Place rubberized cushions in rear of inner corrugated carton.

e. Insert and seal Receiver in corrugated carton.

f. Place rubberized cushion in bottom of outer corrugated carton.

g. Place Receiver container in outer corrugated carton.

h. Insert rubberized cushion spacers around inner corrugated carton.

i. Place rubberized cushion on top of inner corrugated carton.

j. Seal outer corrugated carton.

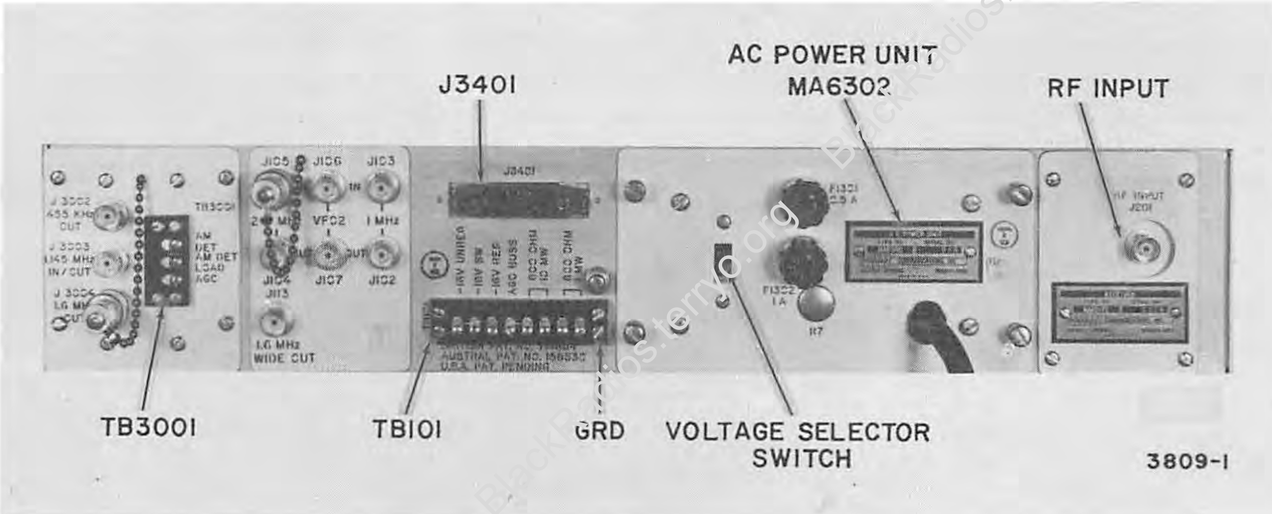


FIGURE 2-1 R-1555 REAR PANEL, WITH MA6302

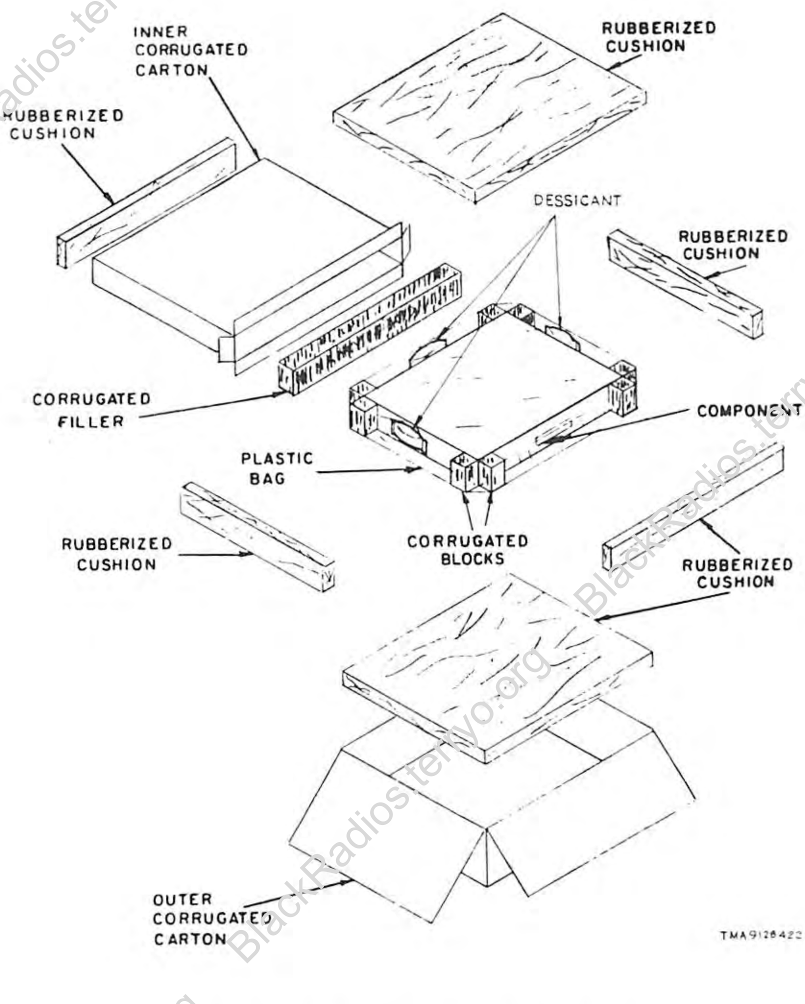


FIGURE 2-2 PACKAGING DIAGRAM

CHAPTER 3

OPERATING INSTRUCTIONS

3-1. General

Haphazard operation or improper setting of the controls can cause damage to the equipment. For this reason, it is important to know the function of every control. Controls and indicators, with the function of each, are listed in paragraph 3-2. Operating procedures are described in paragraphs 3-3 through 3-9.

3-2. Controls and Indicators (figs. 3-1 and 2-1)

The controls for the R-1555/URR-62 are located on the front panel. The controls for the power supply are located on the rear of the power supply chassis. Tables 3-1 and 3-2 below list the controls for the radio receiver and power supply with their functions.

a. Radio Receiver R-1555/URR-62 Controls and Indicators (fig. 3-1). Refer to table 3-1 below.

Table 3-1. R-1555/URR-62, CONTROLS AND INDICATORS

Control or Indicator	Function	
Function switch		When rotated to any position other than OFF, connects receiver to power source and selects desired receiver function. The positions and functions are as follows:
	Position	**Function**
	MAN	AGC is disabled; receiver operates normally with manual control of IF circuits by RF GAIN control.
	AGC SH	Receiver operates with automatic gain control (AGC) with short time constant. RF GAIN control operative but normally set at maximum.
	AGC MED	Receiver operates with AGC with medium time constant. RF GAIN control operative but normally set at maximum.
	AGC LG	Receiver operates with AGC with long time constant. RF GAIN control operative but normally set at maximum.
	CAL	In this position, 100-KHz markers provide an audio beat at each 100-KHz interval of the KHz digital readout. The readout scale may be corrected in the area of the nearest 100-KHz checkpoint by using the CALIBRATE/FINE TUNE control. (The DETECTOR MODE switch should be in the AM position.)

FIGURE 3-1. R-1555/URR-62 CONTROLS AND INDICATORS

Table 3-1. R-1555/URR-62, CONTROLS AND INDICATORS (con't)

Control or Indicator	Function	
Function switch con't	<u>Position</u>	<u>Function</u>
	CHECK BFO	In this position, the best frequency oscillator (BFO) frequency may be set to coincide with the IF center frequency by setting the DETECTOR MODE switch to the 0 position and adjusting BFO TUNE control.
RF ATTEN control		Provides control of the level of all incoming signals when unwanted signals are present which cannot be sufficiently rejected by tuning the antenna.
RF TUNE (inner control)		Tunes the antenna for maximum sensitivity of the desired signals. The presence of very strong signals anywhere within the spectrum may cause cross-modulation unless the antenna is tuned. <u>Caution:</u> Avoid tuning the input to interfering signals instead of the desired signal.
RF RANGE (Outer control)		Provides for the selection of any one of five frequency ranges or a wide band (WB) position. Two wide band positions are provided for ease of operation.
2ND VFO switch		Selects source of variable frequency oscillator (VFO).
	<u>Position</u>	<u>Function</u>
	INT	Internal 2nd variable frequency oscillator (VFO) is selected.
	EXT	External 3.6- to 4.6 MHz source from a master receiver is selected.
RF LEVEL - AF LEVEL switch		Switches the meter to monitor either RF or audio frequency (AF) signal levels.

Table 3-1. R-1555/URR-62, CONTROLS AND INDICATORS (con't)

Control or Indicator		Function
CALIBRATE/FINE TUNE control		Enables the KHz digital readout to be calibrated at discrete 100-KHz points or to correct small tuning errors when the KHz control is locked. (Internal 2nd VFO only.)
MHz control		This control selects the desired MHz frequency (0 to 30) as indicated on the first two digits of the readout (0 to 30 is indicated; however electrical limit is 29). Its setting should be checked periodically to insure that it is reasonably centered with respect to the band in use. This is indicated by a reduction in signal or noise on either side of the correct setting. This control can be locked by rotating the outer ring in a clockwise direction. When the MHz readout is set to zero, switches are actuated to permit use of the low frequency converter (when provided) to extend the frequency range down to 3 KHz.
KHz control		This control selects the last three digits of the readout (0 to 999). This control can be locked by rotating the outer ring in a clockwise direction. The remaining digit in the readout will indicate either a decimal point (.), a plus sign (+), or a minus sign (-). When the decimal point appears, the frequency can be read directly; when the minus sign appears, the true frequency can be determined by subtracting one from the unit digit on the MHz readout (first number to the left of the minus sign). Conversely, when the plus sign appears, the true frequency can be determined by adding one to the MHz units digit.
DETECTOR MODE switch		Selects circuit used for demodulation and range of BFO tuning for use in conjunction with BFO TUNE control. The positions and functions are as follows:
	Position	Function
	FM	Selects a frequency discriminator to demodulate a received FM signal.
	SSB +1.5	Selects the circuit required to demodulate the LSB of a received SSB signal.
	SSB -1.5	Selects the circuit required to demodulate the USB of a received SSB signal.
	AM	Selects diode demodulation for the detection of a received AM signal.
	BFO (+6 to -6)	These five positions are used in conjunction with the BFO TUNE control to provide a BFO tuning range of 8 KHz to demodulate keyed continuous wave (CW), frequency-shift-keying (FSK) facsimile, etc.

Table 3-1. R-1555/URR-62. CONTROLS AND INDICATORS (con't)

Control or Indicator	Function
BFO TUNE control	This control operates as a vernier for the five BFO coarse positions on the DETECTOR MODE switch and has a range of approximately ±3 KHz.
IF BW KHz switch	This control selects any one of five IF bandwidths which are determined by crystal filtering. The control setting, bandwidth, and its usual corresponding received signal are listed below: Setting — Bandwidth — Signal 0.2 — 0.2 KHz — CW 1 — 1.0 KHz — CW or FSK 3 — 3.0 KHz — AM or SSB 6 — 6.0 KHz — AM 13 — 13.0 KHz — FM or AM
AF LEVEL control	This screwdriver adjustment control sets the AF Level in separate stages for feeding a 600-ohm, 1-milliwatt line. It is unaffected by the position of the AF GAIN control. Caution: It is desirable that the AF LEVEL control never be turned toward its maximum position (fully clockwise) unless the output transformer is suitably terminated.
RF GAIN (inner control)	This control is operative both in the MAN and AGC positions of the function switch. In the MAN position, the control setting should always be at a minimum consistent with a satisfactory AF LEVEL setting. With the function switch in any of the three AGC positions, reducing the RF gain also reduces the AGC gain which degrades the AGC characteristics. Therefore, when the function switch is in any of the AGC positions, the RF GAIN control should be set to maximum. A possible exception to this occurs when receiving interrupted signals in which the carrier is periodically switched off. In this case, receiver noise could be troublesome during the intervals.
AF GAIN (outer control)	This control adjusts the gain to the headphones and the 10-milliwatt output on the rear panel.
DIMMER control	This screwdriver adjustment control adjusts the digital readout light intensity.
PHONES jack	Provides means of connecting a headset to the receiver.
Signal level meter	Monitors either RF or AF signal level, depending on position of RF LEVEL - AF LEVEL switch.

b. Power Supply MA6302 (fig. 2-1). Refer to table 3-2, below.

Table 3-2. POWER SUPPLY, CONTROLS AND INDICATORS

Switch and fuses	Function
117/234 VAC switch	Line voltage selector switch used to select either 117-volt AC or 234-volt AC primary circuit.
Fuse F1301-0.5 AMP	Line fuse.
Fuse F1302-1.0 AMP	Power transformer secondary.

3-3. Preliminary Operating Instructions (fig. 3-1)

To prepare the R-1555/URR-62 for normal operation, perform the procedure outlined in a through g below:

a. Insure that the voltage selector switch (fig. 2-1) is in the proper position (115 VAC or 230 VAC).

b. Set the RF ATTEN control to MIN.

c. Set the function switch to OFF.

d. Set the 2ND VFO switch to INT.

e. Place the RF LEVEL - AF LEVEL switch in the RF LEVEL position.

f. Set the RF GAIN control to its maximum clockwise position.

g. Set the AF GAIN control to its maximum clockwise position.

3-4. Calibration Check

Calibration of the frequency indicator is required to maintain the tuning accuracy of the R-1555/URR-62. Calibrate the frequency indicator at the 100-KHz checkpoint nearest the desired frequency. Calibration is accomplished as outlined in a through h below.

a. Set the RF RANGE switch to the desired frequency range position.

b. Set the DETECTOR MODE switch to AM.

c. Set the function switch to CAL.

d. Adjust the MHz control until the desired MHz is indicated on the frequency indicator.

e. Adjust the KHz control until the desired KHz, to the nearest 100-KHz is indicated on the KHz portion of the frequency indicator.

f. Adjust the CALIBRATE/FINE TUNE control for an aural zero beat indication in the headset or speaker.

g. Set the function switch to CHECK BFO.

h. Adjust the BFO TUNE control for an aural zero beat indication in the headset or speaker.

3-5. Reception of CW, FSK, and Facsimile Signals

a. Perform the procedures outlined in paragraphs 3-3 and 3-4.

b. Adjust the MHz and KHz controls until the desired frequency is indicated on the frequency indicator.

c. Set the IF BW KHz control to the 1 position.

d. Set the function switch to the AGC SH position.

e. Set the DETECTOR MODE switch to the BFO 0 position.

f. Adjust the CALIBRATE/FINE TUNE control for maximum signal level.

g. Adjust the RF TUNE control and RF ATTEN for maximum level of desired signal with attendent attenuation of adjacent channel signals.

h. Adjust the BFO TUNE control for the desired beat note.

i. For hand keyed CW signals it may be desirable to set the function switch to MAN and adjust the RF GAIN control for a reasonable output. The IF BW KHz control may be set to the 0 position to tune out interfering adjacent channel signals.

j. When a very stable BFO is required for reception of FSK or Facsimile signals the +1.5 or -1.5 BFO position of the DETECTOR MODE switch should be used. The KHz control should then be slightly offset to give the desired output.

3-6. Reception of Single-Sideband Signals

a. Perform the procedure in paragraphs 3-3 and 3-4.

b. Adjust the MHz and KHz controls until the desired frequency is indicated on the frequency indicator.

c. Set the DETECTOR MODE switch to SSB -1.5 or +1.5 as appropriate; -1.5 for reception of USB signals, +1.5 for reception of LSB signals.

d. Set the IF BW KHz control to the 3 position.

e. Set the function switch to the AGC LG position.

f. Adjust the CALIBRATE/FINE TUNE control to obtain a usable signal.

g. Adjust the RF TUNE control and RF ATTEN for maximum level of desired signal with attendant attenuation of adjacent channel signals.

3-7. Reception of AM and MCW Signals

a. Perform the procedures in paragraphs 3-3 and 3-4.

b. Adjust the MHz and KHz controls until the desired frequency is indicated on the frequency indicator.

c. Set the DETECTOR MODE switch to AM.

d. Set the IF BW KHz control to the 13 position.

e. Set the function switch to the AGC MED position.

f. Adjust the CALIBRATE/FINE TUNE control to obtain a usable signal.

g. Adjust the RF TUNE control and RF ATTEN for maximum level of desired signal with attendant attenuation of adjacent channel signals.

3-8. Reception of FM Signals

a. Perform the procedures in paragraphs 3-3 and 3-4.

b. Set the DETECTOR MODE switch to FM.

c. Perform the procedures in paragraph 3-7b, and d through g.

3-9. Stopping Procedure

Rotate the function switch counterclockwise to the OFF position.

CHAPTER 4

OPERATOR'S MAINTENANCE INSTRUCTIONS

4-1. Scope of Operator's Maintenance

The following is a list of maintenance duties normally performed by the operator of the R-1555/URR-62. These procedures do not require special tools or equipment.

a. Preventive maintenance (para 4-2).

b. Cleaning (para 4-3).

c. Operators' preventive maintenance checks and services (para 4-4).

d. Operational check (para 4-5).

4-2. 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 4-3 and 4-4 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 4-4) outlines functions to be performed at specific intervals. These checks and services are to maintain Air Force electronic equipment in a serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining serviceability, the charts indicate what to check, how to check and what the 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 of maintenance or repair is required.

4-3. Cleaning

a. Remove dust and other loose dirt from the exterior surface and front panel with a clean cloth. Dampen the cloth with water and mild soap to make the cleaning more effective.

WARNING: Prolonged breathing of cleaning compound is dangerous; make certain that adequate ventilation is provided. Cleaning compound is flammable; do not use near a flame. Avoid contact with the skin; wash off any that spills on your hands.

b. Remove grease, fungus, and ground-in dirt with a cloth dampened (not wet) with cleaning compound (FSN 7930-395-9542).

c. Remove dust and other dirt from plugs and sockets with a soft bristle brush:

4.4 Operator's Preventive Maintenance Checks and Services

Refer to table 4-1.

Table 4-1. OPERATOR'S PM CHECKS AND SERVICES

Sequence No.	Item to be inspected	Procedures	References
1.	Exterior surface	Clean the receiver panels, cables, and meter glass.	Para 4-3.
2.	Mounting	Tighten loose nuts or bolts. Replace missing hardware as required.	
3.	Intercabling and connectors.	Check all interconnecting cables and connectors for cracks and breaks. Replace cables that have cracks or broken connectors.	Para 2-3.
4.	Knobs, dials and switches.	While making the operational checks, check to see that the mechanical action of each knob, dial, and switch is smooth and free of binding.	Para 4-5
5.	Fuses	Check each fuseholder for a good fuse of the correct rating.	Para 3-2b.

4-5. Operational Check

Prepare the R-1555/URR-62 for operation as directed in paragraph 3-3. Proceed as directed in the Procedure column, as outlined in table 4-2. If an operation is normal as indicated in the Normal indication column, go on to the next procedure. If an abnormal condition results, refer to a higher category of maintenance, unless otherwise directed in the Corrective measures column.

Table 4-2. OPERATIONAL (MINIMUM PERFORMANCE STANDARD) CHECKS

Sequence No.	Procedure	Normal indications	Corrective measures
1.	Set function switch to MAN.	a. Dial lamps light. b. Rushing noise or signal is heard in headset or speaker.	a. Check power cable and fuses. b. Check headset or speaker cord and plug, or substitute known good headset or speaker.
2.	Tune MHz control.	Proper numbers appear in MHz frequency indicator window.	
3.	Tune MHz control.	Number 500 appears in KHz frequency indicator window.	
4.	Set function switch to CAL.	Tone is heard in the headset or speaker.	
5.	Vary CALIBRATE/FINE TUNE control.	Pitch of the tone should change.	
6.	Set DETECTOR MODE switch to BFO position O.		
7.	Tune KHz control	A whistle-like tone is heard as each station is tuned.	
8.	Turn BFO TUNE control	Pitch of the tone changes.	

CHAPTER 5

CIRCUIT FUNCTIONING

Section I. FUNCTIONAL SYSTEM OPERATION

5-1 Introduction

This chapter contains a block diagram description (para. 5-2) and detailed circuit functioning (para. 5-3 through 5-22) of the R-1555/URR-62. The block diagram is illustrated in figure 5-1; complete schematic diagrams are illustrated in Section II of Chapter 7.

5-2. Block Diagram Description (fig. 5-1)

a. Antenna Circuits. Input signals from the antenna are passed to the first RF amplifier through the 30 MHz low pass filter, variable RF attenuator, and selectable double-tuned antenna tuned circuits. The input circuits include a fuse and spark gap (not shown) to provide overload protection.

b. RF Amplifiers. Two stages of RF amplification are used with coupling networks, effective from 1 to 30 MHz. Gain is controlled by variable emitter degeneration to insure that the signal handling capability is not degraded, and the control is delayed to give an adequate overall signal-to-noise performance.

c. First Mixer. Two transistors are used in the first mixer which is balanced so that the first variable frequency oscillator (VFO) signal tends to cancel at the mixer signal input and IF output, thereby reducing the possibility of oscillator leakage along the signal paths. This configuration also discriminates against spurious responses which may arise due to harmonic production with large signals at even-order submultiples of the 40 MHz first IF. The 40 MHz filter consists of seven cascaded tuned circuits and is approximately 1.3 MHz wide at 6 decibles (dB) down. The extra bandwidth beyond the required 1.0 MHz, allows for drift of the first VFO without degradation of performance.

d. First VFO. Provides suitably buffered outputs to the first mixer (c above) and harmonic mixer M4 (f below). The oscillator operates over a frequency range of 41.5 to 69.5 MHz and enables the required input spectrum to be selected, together with an appropriate 37.5-MHz signal from the harmonic mixer. The variable element in the VFO circuit is a straight line frequency capacitor which is mechanically coupled, by antibacklash gearing (not shown), to the MHz control and frequency indicator.

e. Second Mixer and 37.5 MHz Amplifier. The second mixer combines the 39.5 to 40.5 MHz IF from the 40 MHz filter in the first mixer module (c above) with the 37.5 MHz signal from the 37.5-MHz amplifier to produce a 2- to 3-MHz spectrum. The 37.5 MHz signal is obtained from the harmonic generator and mixer (f below). The 2- to -3 MHz signal out of the second mixer is applied to the 2-to-3 MHz bandpass filter (BPF) and an output jack on the rear panel of the R-1555/URR-62. Also available at the input to the 2-to-3 MHz BPF is an input jack on the rear panel of the R-1555/URR-62. The output of the 2-to-3 MHz BPF is applied to the third mixer (g below).

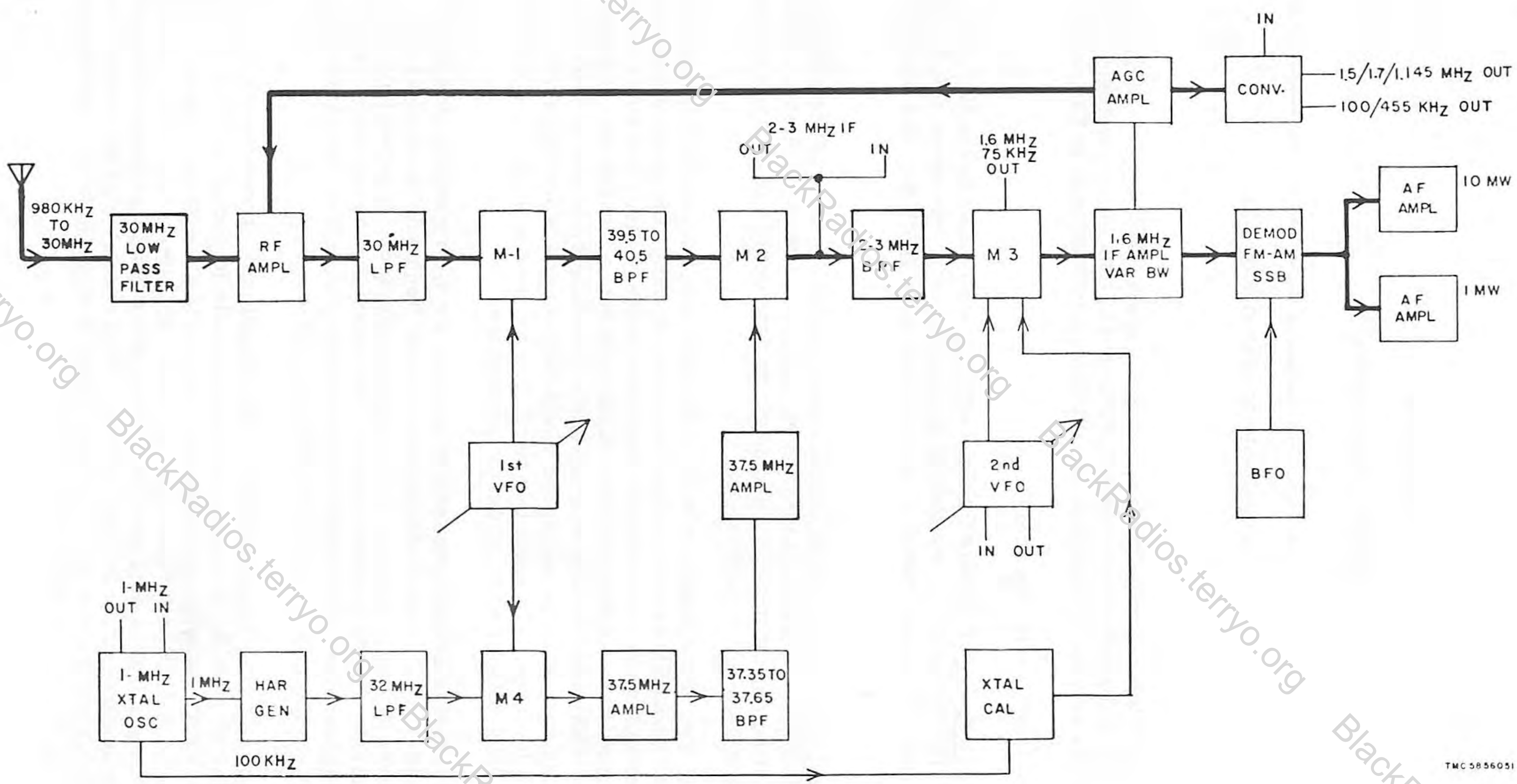


FIGURE 5-1 R-1555/URR-62 SIMPLIFIED BLOCK DIAGRAM

f. Harmonic Generator and Mixer. The 37.5-MHz signal used in the second mixer (e above) is produced in harmonic mixer M4 by combining the proper 1-to-32 MHz harmonic from the harmonic generator and the proper 41.5 to 69.5-MHz signal from the first VFO (d above). A transistor harmonic generator is used to produce the fundamental and harmonics of 1 to 32 MHz from the 1-MHz crystal oscillator (i below). The output of the harmonic generator is applied to harmonic mixer M4 through the 32-MHz harmonic low pass filter (LPF) which attenuates harmonics above 32 MHz that are not required in the frequency conversion. The 37.5-MHz output of harmonic mixer M4 is amplified in the 37.5-MHz generator amplifier, passed through the 37.5-MHz filter, then applied to the 37.5-MHz amplifier (e above).

g. Third Mixer. The third mixer includes a balanced diode ring mixer with large signal handling capacity. During normal operation, the 2- to -3MHz signal from the 2- to 3-MHz BPF (e above) is combined with a 3.6 - to 4.6 MHz signal from the second VFO (h below) to produce the 1.6 MHz IF. During calibration (function switch set to CAL.), the third mixer receives a strong 100-KHz signal from the calibrator (i below). Harmonics of the 100-KHz signal in the 2- to 3-MHz band are produced in the third mixer. These combine with the 3.6 to 4.6 MHz signal from the second VFO to provide accurate markers to calibrate the KHz frequency indicator.

h. Second VFO. The second VFO provides a variable frequency signal that is tuned from 3.6 to 4.6 MHz as the KHz control is rotated. This signal is applied to the third mixer (g above). Rear panel input and output connectors for the second VFO signal and available for diversity operation. The 2ND VFO switch controls the use of internal VFO. A CALIBRATE/FINE TUNE control, with a small multi-turn potentiometer, is provided for correcting KHz frequency indicator at 100 KHz checkpoints, or to fine tune the R-1555/URR-62, when the MHz and KHz controls are locked.

i. 1-MHz Crystal Oscillator, Amplifier, and Calibrator. The accuracy of the R-1555/URR-62 frequency conversion is controlled by the 1-MHz crystal oscillator. Facilities are provided for operation from an external 1-MHz standard source or connection for external output of the 1-MHz crystal oscillator signal for diversity operation. The 1-MHz crystal output is applied to 1-MHz buffers and amplifier for necessary amplification and isolation for use in the calibrator, harmonic generator (f above), and external output. The calibrator consists of a 10 to 2 regenerative divider, which can be switched into operation as required, to provide a 100 KHz standard for calibration of the second VFO (h above) and the BFO (m (3) below).

j. Crystal Filter Assemblies and First 1.6-MHz IF Amplifier. From the third mixer (g above), the 1.6-MHz IF passes through a wide band crystal filter (13 KHz) to the first 1.6-MHz IF amplifier. From the first 1.6-MHz IF amplifier, the signal passes through one of four bandwidth filters selected by the IF BW KHz switch (200 Hz, 1 KHz, 3 KHz, or 6 KHz). If the switch is set to 13, the bandpass is determined by the wideband crystal filter (13 KHz) that preceded the first 1.6-MHz IF amplifier. The output of the bandwidth selector switch is applied to the second 1.6 amplifier (k below).

k. The Second, Third, and Fourth 1.6-MHz IF Amplifiers. The second, third, and fourth 1.6-MHz IF amplifiers are connected in cascade to provide amplification of the 1.6-MHz IF following the bandwidth selector switch (j above). AGC is applied to the third 1.6-MHz IF amplifier and operates by emitter degeneration (as in the RF stages). It is arranged that the gain control contribution made by this stage occurs before the RF stages start to control, thereby providing optimum signal-plus-noise to noise ratio that improves as the signal increases to an acceptable level. The amplifiers are tuned, but heavily damped and relatively wideband compared with the crystal filter assemblies (j above). The amplified 1.6-MHz output from the third 1.6-MHz IF amplifier is applied to the AGC circuits (l below). The output from the fourth 1.6-MHz IF amplifier is applied to the demodulator circuits (m below).

l. AGC Circuits. Two 1.6-MHz amplifiers are included in the AGC circuit. The first AGC amplifier provides an amplified 1.6-MHz signal to the second AGC amplifier, the IF output converter, and the 1.6-MHz output terminal (75-ohms) on the rear panel. The second AGC amplifier provides a higher level 1.6-MHz IF output to the AGC diode detector and emitter follower. A low impedance output from the AGC detector circuit is provided by an emitter follower, which is coupled by diodes to the time-constant circuits and the AGC connection on the rear panel. From the time-constant circuits the detected signal is applied through a DC amplifier, emitter follower, and the RF GAIN control to the AGC output emitter follower. The AGC bus applies AGC voltage to the 3rd 1.6 MHz IF amplifier and both RF amplifiers.

m. Demodulator Circuits.

(1) AM Detection. To demodulate AM signals, the 1.6-MHz IF is connected from the fourth 1.6-MHz IF amplifier (k above) to the AM detector that consists of amplifier Q1201 and diode detector circuit (A1201. The output of the AM detector is applied to the audio input circuit by a shorting link across terminals 2 and 3 of TB-1 on the rear panel of the IF assembly.

(2) Product detector. The product detector is used during the demodulation of CW, FM, or SSB. The 1.6-MHz IF is connected from the fourth 1.6-MHz IF amplifier (k above) to the product detector. In CW operation, the product detector combines the 1.6-MHz IF with the BFO signal ((3) below) to produce an audio beat note that is applied to the audio input circuit (n below). In FM operation, the product detector combines the 1.6-MHz IF 1.72 MHz from the FM insertion oscillator ((4) below) to produce 120 KHz, plus and minus the FM which is applied to the FM discriminator ((4) below). In SSB operation, the product detector combines the 1.6-MHz IF with 1.5985 or 1.6015 MHz are depending on the setting of the DETECTOR MODE switch, from the SSB insertion oscillator, ((5) below) to produce an audio signal that is applied to the audio input circuit.

(3) BFO circuit. The BFO consist of a variable frequency oscillator capable of providing 1.6 MHz ±8 KHz, by the use of the DETECTOR MODE switch for coarse setting that provide from 0 to ±6 KHz, and by the use of the BFO TUNE control and provides ±2 KHz. The output of the BFO is applied to the product detector ((2) above) through a buffer amplifier and an emitter follower buffer.

(4) FM demodulation circuits. The FM insertion oscillator provides a frequency of 1.72 MHz to combine with the 1.6-MHz IF in the product detector ((2) above) to produce a 120-KHz signal for the FM limiter and discriminator circuits. The 120-KHz signal is at such a level that limiting always occurs, thereby eliminating amplitude variations in the incoming signal. The FM discriminator accepts the 120-KHz with FM deviations and produces audio that is applied to the audio input circuits.

(5) 1.5 and -1.5 insertion oscillators. Two oscillators are employed to demodulate SSB signals. When the DETECTOR MODE switch is set to SSB -1.5, an oscillator provides 1.5985 MHz for carrier reinsertion in the product detector to demodulate upper sideband signals. When the DETECTOR MODE switch is set to SSB +1.5, an oscillator provides 1.6015 MHz to demodulate lower sideband signals. The audio produced as a result of this process is applied to the audio input circuits.

n. Audio Circuits. From the AM detector (m (1) above), or the product detector (m (2) above), the audio signal is applied to emitter follower Q1901 that, in turn, applies the audio signal to the AF LEVEL meter and audio output stages. This emitter follower provides an audio level, adjustable by a front panel screwdriver control marked AF LEVEL. From Q1901, the audio signal is applied through the AF GAIN control to separate AF amplifiers that provide outputs for line and headphone operation. The 10-milliwatt (MW)headphone amplifier uses a preamplifier and push-pull output stage; the 1.0 MW line output employs a single stage amplifier. AF outputs are provided to rear terminals and a front panel headphone jack socket marked PHONES.

o. IF output Converter. This module houses a mixer together with suitable filter, amplifier, and crystal oscillator stages for the particular output frequency required. Standard modules provide outputs at 100 or 455 KHz. Inputs and outputs are available for Master and Slave operation if required; alternatively, an external heterodyne signal can be employed. The AC operated unit uses a conventional series stabilizer circuit which takes account of supply voltage and load variations and is temperature compensated; operation is at a nominal 117 or 234 volts ac. The mixer combines the 1.145 MHz with the 1.6 MHz IF signal to produce 455 KHz. The 455 KHz signal is applied to an IF output amplifier stage that is connected to an output jack on the rear panel.

p. Power Supply. The fused (F1) AC power supply operates from line voltages of 100-125 and 200-250 VAC 48-420 Hz, and requires approximately 10 voltamperes for normal operation. Capacitors C1 and C2 afford RF protection. Switch S1 connects the split primary windings of T1 in series for 234 VAC (nominal), or in parallel for 117 VAC (nominal) operation. The secondary winding is also fused (F2), and feeds two bridge-connected full-wave rectifiers CR1 (regulated) and CR5 (unregulated). The secondary winding also supplies 22.5 VAC to operate the front panel lights. CR1 and associated filter and regulator circuits supply 16 VDC to operate the receiver. CR5 and associated filter circuits supply 16 VDC to operate ancillary equipment.

Section II. FUNCTIONAL OPERATION OF ELECTRONIC CIRCUITS

5-3. RF Unit (fig. 2-1 and 7-13)

a. Antenna Circuits. The input impedance at the antenna socket (RF INPUT) J201 is nominally 75 ohms unbalanced; incoming signals are fed via a 500 MA. fuse F201 and 30 MHz low pass filter to the RF attenuator and TUNE RF RANGE switch and control. The fuse and associated spark-gap E201 serve as overload protection devices. The low filter attenuates signals above 30 MHz coming from the antenna and also helps to prevent unwanted leakage to the antenna from the receiver. The attenuator has five positions and provides a means of attenuating all incoming signals in nominal 10 dB steps over the range 0-40-dB.

b. RF RANGE switch and RF TUNE control. RF RANGE switch S202 has seven positions; in the two wideband positions signals are fed via the sideband transformer T205 and coupling capacitor C215 to the base of the RF amplifier Q201. Resistor R210 provides the correct terminating impedance for the antenna and low pass filter under these conditions. The five remaining switch positions are used to select double-tuned input circuits as required, using the coil assemblies T201 through T206 and the ganged variable capacitor C211 A and B. These circuits are aligned by means of adjustable ferrite cores in each coil and the trimming capacitors, C207, C208, C209, C210 and C212. C228 is a trimmer common to all secondary windings and is used to determine the frequency range covered by RF TUNE control C211. The tuned primary and secondary coil windings are tapped to provide the correct input and output impedances and also a satisfactory compromise between selectivity and overall sensitivity.

c. RF Stages. Two wideband RF amplifiers are contained on subassembly A210. The selected input signal spectrum is applied to the base of the first RF amplifier Q201 through coupling capacitor C215. Diode CR202 protects Q201 against accidental overload. AGC and/or manual gain control is provided by Q202 functioning as a variable impedance in the emitter circuit of Q201, with the impedance of Q202 depending upon existing DC circuit conditions. The DC conditions corresponding to maximum gain are set by the potentiometer R215 with -4 VDC applies to the AGC line. Under these conditions, Q202 has a low collector impedance and little degeneration occurs in the emitter of Q201. The action of the AGC circuits causes the AGC voltage to move toward zero, thereby increasing the collector impedance of Q202 and decreasing the gain of Q201. CR201, R217, and R212 with Zener diode VR201 form a clamper circuit which makes the control characteristic more linear. The operation of the second RF amplifier is identical to the first RF amplifier with Q204 functioning as a variable impedance in the emitter circuit of Q203. CR203, R224, and R223 with Zener diode VR201 make up the clamper circuit for the second RF amplifier stage.

d. 30 MHz Low Pass Filters. The output circuit of the first RF amplifier Q201 is a 30 MHz low pass filter (LPF) consisting of coil and capacitor assemblies A201 and A202, with terminating resistors R220 and R225. C223 couples the amplified input spectrum to the base of Q203. The output of the second RF amplifier Q203 is coupled by C225 through a 30 MHz IF to the first mixer stage. This type of interstage coupling enables the RF amplifiers to operate over the frequency range 1-30 MHz in the wideband mode and to give protection against first IF breakthrough at 39.5-40.5 MHz. It also provides protection against first mixer image frequencies in the range 80-110 MHz and maximum rejection of the first VFO fundamental and harmonics, preventing leakage back to the antenna.

5-4. First Mixer and 40-MHz Bandpass Filter (fig. 7-14)

a. First Mixer. Transistors Q301 and Q302 are arranged as a balanced mixer with the signal input and 40 MHz IF output circuits balanced. The first VFO heterodyne signal is applied unbalanced to the emitters. The VFO injection frequency tends to cancel at the signal input and output ports, and even-order input signal harmonics produced in the mixer tend to cancel at the output port. Resistor R311 functions as a mixer balance control. Signals from the RF amplifier module are applied to the primary of the unbalance to balance transformer T301. The secondary of T301 is loaded by R304 and R305 which provides an effective center tap for the balanced signal spectrum applied to the mixer. The collector load is balanced with respect to ground by C309 and C310 and forms the first section of the 40 MHz bandpass filter (first IF). DC is applied to the mixer collectors by R312 and the center tap on L301. The first heterodyne signal in the range of 41.5 to 69.5 MHz is applied in-phase to the respective emitters by C304 to C305 at such a level that mixing takes place. The required output spectrum in the range of 39.5 to 40.5 MHz is selected by the following bandpass filter.

b. 40-MHz Bandpass Filter. This filter consists of seven overcoupled tuned circuits in cascade, L301 through L308 and C309 through C318. The bandpass is made wider than the necessary 1 MHz to allow for possible drift in the first VFO and consequent shift of the required first IF spectrum. The skirt characteristics fall sharply to a very high level of ultimate attenuation. The filter input is balanced to match the first mixer requirements and an output is provided from a low impedance tap at the junction of C317 and C318 to the second mixer.

5-5. First Variable Frequency Oscillator (fig. 7-15)

The Hartley-type VFO (circuit card subassembly A410) consists of Q411, a variable inductance L411, capacitors C401 and C412, and trimmer C413 which oscillates over the frequency range of 41.5 to 69.5 MHz. Tuning is accomplished by varying C411, a straight line frequency capacitor which is mechanically coupled to the MHz control, alignment with the frequency indicator is accomplished by adjusting the core of L411 and trimming capacitor C413. The VFO output is amplified by buffer-amplifier, subassemblies A420 and A430 which are identical. Stage Q421 and Q422 of A420 provides a buffered output which is fed to the first mixer while stage Q431 and Q432 of A430 provides a buffered output that is fed to the harmonic mixer.

5-6. 1-MHz Amplifier and Oscillator-Calibrator (fig. 7-16)

a. 1-MHz Oscillator and Amplifier. The 1 MHz signal produced by crystal Y601 and its associated capacitors may be set precisely on frequency by adjusting trimmer capacitor C620. This signal is amplified by transistor Q604 and fed by low impedance coupling to two separate 1 MHz amplifiers, Q603 and Q602. The 1 MHz signal amplified by Q603 is then fed by coil assembly A601 to the harmonic generator while the other amplifier Q602 provides two outputs: one to the calibrator, and the other to a 1 MHz rear panel output. The coil of A601 is adjusted for a minimum signal at 1 MHz, allowing the useful harmonics appearing across R615 to be fed to the harmonic generator. Transistor Q601 provides suitable buffering for a 1 MHz signal from an external frequency standard.

b. Calibrator. This circuit consist of a 10 to 1 digital divider which provides a 100 KHz signal to the third mixer. The 1 MHz reference input signal is fed via R624 to pin 5 of the intergrated circuit digital divider ML1. R625 and R626 provide a suitable DC bias potential at pin 5. R627, R628, and C622 provide a filtered DC operating potential between pins 4 and 7. The 100 KHz square wave output from pin 1 is fed via R629, C625 and the diode switch CR601 to the third mixer module. C624 functions as a simple low-pass filter.

The calibrator circuit is brought into operation by the application of -16 VDC via the system switch to E616. R630, R631 provide a DC potential to the diode switch CR601.

5-7. 37.5 MHz Generator (fig. 7-17)

a. Harmonic Generator. The 1 MHz signal and its harmonics from the crystal oscillator are applied to transistor Q701 by diode CR701 and trimmer capacitor C728 which is used to equalize the relative amplitudes of the harmonic spectrum. The harmonics are further amplified and passed to the 32 MHz low pass filter.

b. 32 MHz Low Pass Filter (Harmonic LPF). The megahertz harmonics are fed through the four-section Darlington-type filter network to prevent unwanted harmonics from passing to the harmonic mixer. Resistor R704 and potential divider R705-R706 provide the correct termination impedances for the filter.

c. Harmonic Mixer. Transistors Q702 and Q705 are arranged as a balanced mixer so that the harmonic spectrum and the input from the first VFO tend to cancel in the output circuit. Balance adjustment is provided by R709. The harmonic signal is applied to the base of Q702 by potential divider R705, R706 and C717 and also to the emitter of Q705 by C720. The first VFO signal is fed to the base of Q705 by C719 and also the emitter of Q702 by C718. The required 37.5 MHz output is then fed by filter assembly A701 to the first 37.5 MHz amplifier.

d. 37.5 MHz Generator Amplifier. This tuned cascade amplifier, consisting of Q703 and Q704 and filter assembly A702 amplifies the desired 37.5 MHz signal while attenuating any unwanted products from the preceding mixer. The amplified signal is then fed by a low impedance link to the following 37.5 MHz bandpass filter assembly.

e. 37.5 MHz Filter. The bandpass filter (fig. 7-18), which consists of seven undercoupled tuned circuits in cascade, provides a high degree of attenuation to signals outside the nominal 300 KHz bandpass. A low impedance output feeding the second mixer module if provided from capacitor divider C807 and C808.

5-8. 2nd Mixer and 37.5 MHz Amplifier (fig. 7-19)

a. 37.5 MHz Amplifier. The filtered 37.5 MHz signal is amplified by the tuned cascade amplifier consisting of transistors Q501 and Q502. Tuned transformer assembly A501 couples the amplified signal at low impedance to the emitter of second mixer Q503.

b. 2nd Mixer. Transistor Q503 combines the 37.5 MHz signal with the 39.5 to 40.5 MHz first IF spectrum from the first mixer module to produce a wide band second IF output between 2 and 3 MHz. This wideband spectrum is then fed to the 2 to 3 MHz bandpass filter and the rear panel of the R-1555/URR-62.

c. 2 to 3 MHz Bandpass Filter (BPF). This filter limits the output spectrum from the second mixer to the required frequency band of 2 to 3 MHz and sharply attenuates frequencies outside this range. One of the rejection notches is arranged to occur at 1.6 MHz to reduce the possibility of breakthrough at the third intermediate frequency. The filter input termination is formed at resistor chain R511, R104, and the 75-ohm captive termination. (Resistor R104 and the captive terminations are mounted at the rear of the main chassis.) A low impedance feed to the third mixer module is provided from transformer assembly A508. Circuits in the third mixer module are arranged to correctly terminate the filter.

5-9. Second VFO (fig. 7-20)

a. The second variable frequency oscillator is of the Hartley-type and operates over a frequency range of 3.6 to 4.6 MHz. The oscillator consists of transistors Q1001, inductive elements L1001 in series with signal winding T1001, two fixed capacitors C1005 and C1006, trimming capacitor C1004, and variable capacitor C1003. Main tuning element C1003 is a straight line frequency capacitor assembly, mechanically coupled to the KHz control and frequency indicator. The CALIBRATE/FINE TUNE control consists of a 500-ohm potentiometer (R103) in series with the winding of T1001. Adjusting this potentiometer changes the effective DC in the control winding, thereby changing the inductance and frequency of the oscillator by virtue of the change in the permeability of the ferrite core of T1001. The DC supply to R103 and T1001 is stabilized by Zener diode VR1005.

b. The oscillator circuit is carefully temperature compensated, and Zener diode combination VR1001 through VR1004 guards against frequency change because of supply voltage variations.

c. The oscillator output is taken from a low impedance tap on L1001 by resistive potential divider R1007-R1008 and coupling capacitor C1007 to diode switching arrangement CR1001-CR1002. With the oscillator in operation, -16 volts DC is applied by the 2ND VFO switch on the front panel to terminal 5 on the connector, thereby supplying DC to the oscillator, forward-biasing CR1001 and reverse-biasing CR1002, to enable the oscillator to drive first buffer amplifier Q1002. When the second VFO signal is supplied from an external source the -16 volts DC is removed from terminal 5 and applied to terminal 4, thereby disabling Q1001, forward-biasing CR1002, reverse-biasing CR1001, and connecting input connector J1002 to first buffer amplifier Q1002.

d. Output buffer amplifiers Q1003 and Q1004 are fed from the tap on the collector load of Q1002.

e. Output buffer amplifier Q1003 provides a suitable output at 100-ohms impedance by connector J1003 to feed the third mixer, and Q1004 provides an output at 75-ohms impedance by connector J1004 to the rear panel suitable for driving a companion slave receiver or for other external use as required.

5-10. Third Mixer (fig. 7-21)

a. The 2-3 MHz spectrum from the output of the second mixer module is fed by input connector P904,low pass filter L908, C916, C917, and coupling capacitors C914, and C915 to pin 3 of the balanced diode mixer assembly. The function of the LPF is to discriminate against possible leakage of the 37.5 MHz and its harmonics from the second mixer. Resistor R917 terminates both the LPF and the 2-3 MHz bandpass filter in the second mixer module. When the R-1555/URR-62 function switch is in the CAL or CHECK BFO position, a 100 KHz signal from the calibrator circuit is introduced by input connector P905 and diode switch CR901 to junction C914-C915.

b. The 3.6 to 4.6 MHz heterodyne signal from the second VFO is fed by input connector P902 and a bandpass filter consisting of inductors L901 through L904 and capacitors C905, C907, C910, C911 to the primary winding of the unbalance-to-balance transformer T901. Inductor L904 is tapped to provide a low impedance output from the filter, and R907 determines the filter load. The center-tapped secondary winding of T901 provides a balanced signal drive to push-pull amplifier stage Q902, Q903, which, in turn, provides the switching signal to pins 1 and 2 of the mixer assembly.

c. The mixer output is taken from pin 5 of balanced mixer A901 by C912 to a 1.6-MHz double-tuned transformer consisting of inductors L905 and L906 and capacitors C906, C908, and C909. The inductors are both tapped to suit the respective source and load impedance.

d. Transistor Q901 operates as an amplifier with emitter degeneration provided by R904. The 1.6 MHz amplified signal appearing across collector load R902 is coupled by C902 to output terminal A902 and feeds a 1.6 MHz crystal filter which is external to the module and is used to determine the widest IF pass band.

e. With the function switch at CAL, the 100 KHz signal from the calibrator is fed by diode CR901 and capacitor C914 to pin 3 of balanced mixer A901. The strong 100 KHz signal causes useful calibration harmonics to be produced in the mixer. These harmonics (20th to 30th) provide markers at 100 KHz intervals across the 2-3 MHz spectrum and, when mixed with the second VFO signal, produce a 1.6 MHz signal which is passed to the IF amplifiers. The 16th harmonic of the 100 KHz calibration signal is fed simultaneously to the IF amplifiers and the AM detector to provide a reference signal which then beats with the 1.6 MHz signal produced by the mixing process and results in an audio output, reducing in frequency to zero beat as the VFO is tuned to the precise 100 KHz points.

5-11. First 1.6-MHz IF Amplifier and Filter Assemblies (fig. 7-22)

a. The IF signal from the third mixer is fed through wide band crystal filter FL3201, to amplifier stage Q1601 by coupling capacitor C1602. Resistor R1601 provides the correct termination for the filter. After amplification, the signal passes through tuned coil assembly A1601 which, by a dual-tapped arrangement, provides two 1.6 MHz outputs. One output is fed directly to the second IF amplifier by the IF BW KHz switch. The second output is fed at the correct impedance to separate sections of the IF BW KHz switch providing selection of the desired crystal filter.

b. Five crystal filters are normally provided as follows:

(1) 13 KHz (FL3201)

(2) 6 KHz (FL3205)

(3) 3 KHz (FL3204)

(4) 1 KHz (FL3203)

(5) 0.2 KHz (FL3202)

c. The appropriate filters are selected by the IF BW KHz switch on the front panel of the R-1555/URR-62.

5-12. Second, Third, and Fourth IF Amplifiers (fig. 7-23)

a. The second IF amplifier stage consists of Q1701, tuned coil assembly A1701, and associated circuitry. The 1.6 MHz signal is fed to Q1701 by coupling capacitor C1703. After amplification, it is fed at low impedance by signal tap 2 on the coil assembly and capacitor C1706 to the base of third amplifier Q1703. AGC is applied to this stage by Q1702, which provides variable emitter degeneration in a similar manner to that described for the RF stages. Initially, clamp diode CR1701 is biased off and the full AGC potential is applied to the base of Q1702; as the AGC voltage falls (with increasing signal level), the impedance of Q1702 increases and the gain of Q1703 is reduced. Most of the gain control contribution made by this stage is arranged to occur before the RF stages start to control, thereby providing for the R-1555/URR-62 overall signal plus-noise to noise ratio to improve with increasing signal to an acceptable level. When the AGC voltage has fallen to approximately 2.5 volts, CR1701 starts to conduct and, in conjunction with R1702, limits the effect of further AGC potential changes on the stage gain.

b. Tuned coil assembly A1702 provides two tapped outputs, one of which is fed to fourth IF amplifier Q1704 by capacitor C1710, and the other 1.6 MHz output, to the first AGC amplifier. Fourth IF amplifier Q1704 provides a buffered signal, which is then fed by tuned coil assembly A1703 at a suitable input level to both the AM, detector and product detector. The gain of Q1704 is preset by adjustment of R1719.

5-13. AGC Amplifier (fig. 7-24)

a. The 1.6 MHz signal from the third IF amplifier is applied through coupling capacitor C1402 to the first AGC amplifier Q1401. AGC threshold adjustment is provided by potentiometer R1403. The collector circuit of Q1401 is provided with a tuned coil assembly A1401 and capacitor divider network from which three outputs are tapped. One output is terminated in 75 ohms at a rear panel connector, another is fed out to the IF output converter, and the third is applied to second AGC amplifier Q1402. Tuned coil assembly A1402 is the collector load for Q1402, whose output is fed to diode detector CR1401 and emitter-follower Q1403. Resistors R1411 and R1412 and capacitors C1411 and C1412 form an RF filtering and averaging network. Emitter-follower Q1403 provides a low-impedance DC for the time-constant networks in the AGC line. When there is no RF signal, current flow through Q1403 produces a voltage-drop across R1413 so that diodes CR1402 and CR1403 are reverse-biased relative to the potential on the AGC time-constant network established by the adjustment of potentiometer R1415.

b. The function of the AGC detector is to produce a negative - going voltage at the base of Q1403 so that conduction is lessened and the voltage drop across R1413 is reduced. When the drop across R1413 is more negative than that on the time-constant network, diodes CR1402 and CR1403 will conduct, and a reduced potential will be applied to the base of DC amplifier Q1404. The voltage drop across collector load resistor R1420 will fall toward ground level. This change is applied to emitter-follower Q1405. The emitter circuit of Q1405 includes the RF GAIN potentiometer. The wiper voltage of the potentiometer is fed back to the base of emitter-follower Q1406, of which the output is applied to the AGC bus.

5-14. Detector Board (fig. 7-25)

a. AM Detector. The 1.6 MHz signals from the fourth IF amplifier are fed by coupling capacitor C1202 to amplifier Q1201 and then to diode detector assembly A1201. The detected AM signal is taken by RF choke L1201 and a rear panel link (TB1-2) to the DETECTOR MODE switch through detector load resistors R117 and R116. It is then fed to the emitter-follower audio input terminal E1903. Here audio gain and line level potentiometers are provided to adjust the signal level before it is fed to the audio amplifiers.

> Note: Two receivers may be connected for diversity operation by feeding the detected AM signals obtained in this stage to a common detector load and following stages in one of the two receivers.

b. Product Detector. The 1.6 MHz signal from the fourth IF amplifier is also fed to the base of product detector Q1202 by coupling capacitor C1204, while the BFO signals are applied to the emitter by emitter follower stage Q1203 and buffer amplifier Q1204, and then mixed in the product detector with the incoming 1.6 MHz signal to provide an output to the AF stages or at 120 KHz to the FM limiter and pulse counting discriminator stages.

c. Beat Frequency Oscillator. Three separate oscillators are available for CW and SSB operation. The BFO circuit, consisting of Q1205; capacitors C1220, C1221, and C1222; coil assembly A1202; and trimming capacitor C1219, uses varicap C1223 vernier (BFO TUNE) for the five BFO coarse positions on the DETECTOR MODE switch. The oscillator frequency is adjusted ±2 KHz by controlling the DC voltage at the varicap, using BFO TUNE control R3205. The coarse positions (+6 to -6) are selected by inserting suitable potential dividers in the DC control circuit using the DETECTOR MODE switch. Therefore, control of the variable oscillator is provided over the range of 1.6 MHz ±8 KHz.

d. SSB Insertion Oscillators. The crystal controlled insertion oscillator, consisting of Y1201, Q1206, and associated circuitry, provides a frequency of 1.5985 MHz which, when used with the incoming 1.6 MHz IF signal, provides a -1.5 KHz reinserted carrier to demodulate upper sideband signals (USB). Trimmer capacitor C1228 is used to pull the oscillator on frequency. In a similar manner, the crystal oscillator, consisting of Y1202, Q1207, and associated circuitry, provides a frequency of 1.6015 MHz which, when used with the 1.6 MHz IF provides a +1.5 KHz reinserted carrier to demodulate lower sideband signals (LSB). On-off control is provided by the DETECTOR MODE switch which switches the -16 volts to either oscillator. Diode CR1201 serves as an electronic switch to isolate the crystal oscillators from the variable BFO.

Note: The 3 KHz receiver bandwidth would normally be used for SSB.

5-15. Audio Input and Meter Zero (fig. 7-26)

a. When the RF LEVEL - AF LEVEL switch is in the RF LEVEL position, the signal level meter is connected between the AGC line and a point of preset potential determined by R1905, which is used to set the meter zero under no-signal conditions. The meter is calibrated to indicate signal strength in dB relative to 1-microvolt input.

Note: Only with the RF GAIN control set at maximum is the correct calibration on the signal level meter maintained.

b. When the RF LEVEL - AF LEVEL switch is in the AF LEVEL position, the signal level meter is connected across the 1 MW AF output by switch S104 and diode bridge CR101. The read line indicates an AF output of 1 MW into 600-ohms.

c. Emitter-follower stage Q1901 is fed from the diode, FM, or product detector, depending on the setting of the DETECTOR MODE switch. The stage presents a high impedance load to the appropriate detector and provides a low impedance output to feed AF GAIN control R3219B and line AF LEVEL preset potentiometer R3220.

5-16. Audio Amplifiers (fig. 7-27)

a. Line Output Stage. The AF input taken from the wiper of the preset AF LEVEL control potentiometer is fed by R1517 and C1511 to the base of Q1503. A link enables C1510 to be included in parallel with C1511 to obtain a response to the lower audio frequencies, if required. Negative feedback is provided from the collector to the base of Q1503 by R1513. Transformer T1502 couples the amplified (1 MW) AF signals to the line output terminals.

b. Audio Output Stages. An AF input taken from the wiper of the AF GAIN control potentiometer is applied through R1500 and C1501 to the base of Q1500. A link is provided to connect C1502 in parallel with C1501, when required, to obtain response to lower audio frequencies. Negative feedback is provided from the collector to the base of Q1500 by R1503. Transformer T1500 provides a balanced AF drive to push-pull output stage Q1501 and Q1502. Resistors R1508 and R1511 provide negative feedback for the push-pull amplifiers. Transformer T1501 provides a balanced load for the amplifier and a 600-ohm output impedance match for the AF output terminals and phone jack. A 10-milliwatt output is available.

5-17. FM Insertion Oscillator (fig. 7-28 and 7-25)

a. Transistor Q3101 is an oscillator with the frequency closely controlled by crystal Y3101 at 1.720 KHz. The 16-volt negative supply is applied when the DETECTOR MODE switch is set in the FM positions. The supply voltage is filtered by diode CR3101 and capacitor C3104. The negative DC supply is also applied through R3101 to the oscillator output, together with the 1.720 KHz output. This DC voltage causes diode CR1201 on the detector board (fig. 7-25) to conduct and apply the signal to product detector Q1202 through the buffer stages Q1203 and Q1204. Capacitor C1231, connected between the oscillator outputs and ground, functions as a low-pass filter for all three insertion oscillators.

b. The product detector output centered on 120 KHz (1.720-1.600 KHz) is fed to input terminal E2903 of the FM discriminator board.

5-18. FM Discriminator (fig. 7-29)

The frequency modulated RF output centered on 120 KHz is fed by 1.6 MHz trap circuit (L2901, C2917, C2901) to the base of buffer amplifier Q2901. The output from Q2901 drives amplifier Q2902 so that amplitude limiting occurs. Capacitor C2906 bypasses residual 1.6 MHz leakage to ground. Positive pulses appearing at the collector of Q2902 are fed by C2909 and CR2901 to trigger monostable multivibrator Q2903, Q2904. The time constant governing the output duration is set by C2910, C2912, and R2913. Resistor R2913 is adjustable and is set for optimum discriminator linearity. The output pulses are taken from the collector of Q2904 by C2912 and CR2902 and tent to charge C2913 to an extent proportional to the number of pulses. Since the number of pulses varies with the frequency modulation, an AF component appears across C2913, and this is fed by filter network R2918, R2919, R2920, C2914, C2915, C2916 to output terminal E2905.

5-19. IF Output Converter (fig. 7-30)

a. The 1.6 MHz IF input signal derived from the AGC amplifier board is fed to the base of mixer Q1803. Capacitor C1808 forms part of a signal potential divider and determine the correct input signal level. Crystal oscillator Q1801, Y1801 operates at 1.145 MHz and can be adjusted to the precise frequency by C1806. A low impedance output to drive following buffer amplifier Q1802 is provided from capacitive divider C1804-C1805. If required, an output can be obtained from this point by C1802 and input/output connector J3003 to drive a companion receiver. Conversely, an external signal can be fed to J3003, in which case, the crystal oscillator should be stopped by the removal of Y1801.

b. Buffer amplifier Q1802 functions to provide isolation between J3003 and mixer Q1803, also to provide a suitable heterodyne signal level to the emitter of Q1803 by C1810. The wanted output from the mixer at 455 KHz (1.6 and 1.145 MHz) is selected by double-tuned filter A1801, A1802, C1815 in the collector of Q1803. The filter coils are tapped to provide the correct input and output impedance levels and C1815 is used to couple the tuned circuits.

c. Output amplifier stages Q1804 and Q1805 are fed by C1818 and R1819. Negative feedback is provided by R1820 to insure good linearity. Output tuned circuit A1803 is tapped to suit the collector and output impedance requirements.

5-20. AC Power Unit MA6302 (fig. 7-31)

a. The fused (F1301) AC power supply is filtered by capacitors C1301 and C1302 and taken to voltage selector switch S1301. The switch connects the split primary windings of T1301 in series for 234-volt operation or in parallel for 117-volt operation. The secondary winding in also fused (F1302) and feeds two bridge-connected full wave rectifiers CR1301 (regulated) and CR1305 (unregulated).

b. Bridge rectifier CR1301 feeds resistor-capacitor filter R1302, C1303, C1304 and then feeds a pre-regulator comprised of Q1301, CR1302, CR1303, CR1304. The pre-regulator provides a constant current to the collector of DC comparison amplifier Q1303 and the base of control amplifier Q2. Comparison element Q1303 takes a sample of the output voltage derived from VR1301 and produces a signal proportional to the difference.

c. This signal is amplified by Q1302 and applied to series regulator Q1304 to control the output voltage. Potentiometer R1307 is used to adjust the output voltage to 16 volts. In the event of regulator failure, the receiver is protected by Zener diode VR1302 (18 volts) from serious voltage overload.

d. Second bridge rectifier CR1305 provides 16 volts unregulated for ancillary equipment.

5-21. Auxiliary Wideband 1.6 MHz IF Amplifier (fig. 7-21)

An auxiliary IF output centered at 1.6 MHz with a 75-KHz bandwidth is provided by the 1.6 MHz amplifier assembly A904 (fig. 7-21). The signal source is taken at terminal E901 at the output of the double-tuned transformer L905, L906 in the 3rd mixer assembly and led to amplifiers Q904 and Q905 which are connected in cascade to ensure stability. From Q905 the signal is applied through emitter-follower Q906 and the filter L910, C927, C928, and C929 to the auxiliary 1.6 MHz WIDE OUT connector on the rear panel. An output of 1 millivolt at 50 ohms impedance is available.

5-22. Control Assembly/Antenna Filter Preselector (fig. 7-32 and 7-33)

The antenna filter contains 21 separate filter modules; 19 filters are approximately 1-MHz in bandwidth, and cover the range 1-20 MHz. The two remaining filters are 5-MHz in bandwidth and cover the range 20-30 MHz. This gives the receiver RF input a 1-MHz bandwidth from 1 to 20 MHz and a 5-MHz bandwidth from 20 to 30 MHz.

a. Control Switch. The relay-controlled filter modules in the antenna filter assembly are selected by Control Assembly switch S107 (fig. 7-32). Switch S107 is a 30-position rotary type, mounted on the receiver chassis and is gear driven by the MHz control. A negative 16-volt potential on the rotor is applied to the selected filter control circuit.

b. Line Filter. The control voltage selected by S107 is applied through control lines between the receiver and the antenna filter assembly. These control lines pass through a line filter (fig. 7-33) at each end of the line; one line filter is mounted in the antenna filter assembly and the other on the receiver chassis. The line filter consists of capacitors C3401 through C3428 and inductors L3401 through L3414 connected as PI filters to eliminate noise and hum from the control lines.

CHAPTER 6

TROUBLESHOOTING AND REPAIR

6-1. Troubleshooting Techniques

a. General. The first procedure in servicing a defective R-1555/URR-62 is to sectionalize the fault. Sectionalization consists of tracing the fault to a subchassis or group of circuits responsible for the abnormal operation of the receiver. The second procedure is localization of the fault. Localization means tracing the fault to a circuit in the subchassis or group of circuits. In the third procedure, isolation, the defective part is isolated by voltage and resistance measurements. The unit numbering method used in the receiver is described in paragraph 6-12. A chart is included therein with references to schematic diagrams for the main chassis of the receiver.

b. Sectionalization. Listed in (1) and (2) below is a group of tests arranged to help locate the defect to a subchassis or group of circuits.

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

(a) Check to see that all connections are properly seated. Repair or replace any connections or cables that are broken or otherwise defective.

(b) Inspect fuses, and replace, if necessary, with fuses of correct rating and type. Whenever a blown fuse is found, check for short circuits.

(c) Check to see that the MHz and KHz controls turn freely. Rough operation or binding indicates a damaged tuning mechanism or need for cleaning.

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

(e) Inspect for loose or missing screws, specifically, those that fasten modules in place.

(2) Operational tests. Operational tests frequently indicate the general location of trouble. In many instances the test will help in the determination of the exact nature of the fault. The operator's preventive maintenance checks (para 4-4) and operational checks (para 4-5) provide a good operational test.

c. Localization. After the trouble has been sectionalized (b above), methods listed in (1) and (2) below will aid in localizing the trouble to a subchassis or group of circuits.

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

(2) Signal substitution. Signal substitution (para 6-4) procedures enable the repairman to localize a trouble quickly to a subchassis or group of circuits. A signal generator,

an audio oscillator, and an oscilloscope are units of test equipment (para 6-2) that may be used in signal substitution procedures. Become acquainted with the repair procedures so that damage to transistors may be avoided.

d. Isolation. After the trouble has been localized (c above), the methods in (1) and (2) below will aid in isolating the trouble to a defective circuit element.

(1) Voltage measurements. This equipment is transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin the transistor. Use the same or an equivalent of either the AC VTVM or the RF voltmeter specified in paragraph 6-2.

(2) Resistance measurements. Resistance measurements should be made with care. Where transistors are in the circuit under test, be sure to use the RX10 scale for low signal-type transistors; other scales may contain battery voltages that will cause excessive current to flow through the transistor. Measurements must be taken with test leads first in one direction (red lead on the transistor element, black lead nearest ground or common); then reverse the position of the leads for another reading. This is necessary because of the diode action of the transistor.

6-2. Test Equipment Requirements

The test equipments required to align (chapter 7), test, and troubleshoot the receiver are listed in table 6-1. Also included are the common names as used in this manual. All test equipments are required as listed, or equivalent.

Table 6-1. MAINTENANCE TEST EQUIPMENT

TEST EQUIPMENT	COMMON NAME	REQUIRED CHARACTERISTICS
Counter, Frequency HP-5245L	Frequency counter	Frequency range: 0 to 50 MHz. Also shall contain the Frequency Converter listed below.
Converter, Electronic Frequency CV-2002/U	-	Frequency range: 50 to 512 MHz; plugs into the Frequency Counter
Audio Oscillator, HP-200CP	Audio oscillator	Frequency range: 0 to 1000Hz Output level: 150 Millivolts
Sweep Oscillator HP-H12-8690B	Sweep generator	Marker Frequency: 40 MHz. Also shall contain the RF Unit listed below.
RF Unit HP-8698B	-	Frequency range: 400 KHz to 110 MHz; plugs into the Sweep Generator
Multimeter AN/PSM-6( )	Multimeter	DC Voltage Range: 0 to -4 volts
Multimeter ME-26A/U	VTVM	DC Voltage Range: 0 to -10 volts
Oscilloscope Tektronix 454	Oscilloscope	Vertical Channel Range: 0 to 150 MHz
Signal Generator HP-60A	Signal generator	Frequency Range: 850 KHz to 47 MHz Output Voltage: 0.1 u-volt to 0.1 volt, into 50-ohm load Modulation Frequency: 400 and 1000 cps (internal) or 100 to 15,000 cps

Table 6-1. MAINTENANCE TEST EQUIPMENT (cont)

TEST EQUIPMENT	COMMON NAME	REQUIRED CHARACTERISTICS
		Modulation Amplitude: 0 to 50% (internal)
Extender Cable Part No. A05388	Extender cable	Extends AC power unit
AC VTVM HP-400H	AC VTVM	AC voltage range: .001 to 30V (RMS)
Voltmeter, Electronic Boonton 91CAS4	RF voltmeter	Voltage Range: 7.5mv to 2V
Extender Cable Part No. A05386	Extender cable	Extends 2nd Mixer, 1 MHz module and 2nd VFO module
Extender Cable, Part No. A05387	Extender Cable	Extends 3rd Mixer module
Extender Cable, Part No. A05389	Extender cable	Extends IF module
Resistor, 600 ohm	600 ohm termination	600 ohm, ±5 per cent 1/2 watt
Resistor, 75 ohm	75 ohm termination	75 ohms, ±5 per cent 1/2 watt
Resistor, 600 ohm	600 ohm, 10-MW dummy load	600 ohm, ±5 per cent 1 watt
Screwdriver	Screwdriver	Medium size, length approx. 6 inches
Speaker or Headset	Speaker or headset	600 ohms
Antenna	Antenna	Antenna with a 75-ohm impedance

6-3. Troubleshooting Chart

Refer to Table 6-2, which follows.

Table 6-2. TROUBLESHOOTING CHART

Item No.	Symptom	Probable Cause	Corrective Measure
1.	MHz indication does not agree with frequency received.	1ST VFO not aligned properly.	Realign 1ST VFO (para 6-10).
2.	KHz indication does not agree with frequency received.	2ND VFO not aligned properly.	Realign 2ND VFO (para 6-11).
3.	Receiver does not operate in CAL position of function switch; otherwise normal.	Defective calibrator circuit.	Check Q602, Q605, Q606 and associated circuitry; repair as necessary.
4.	Receiver does not operate in AM position of DETECTOR MODE switch; otherwise normal.	Defective AM detector.	Check Q1201 and associated circuitry; repair as necessary.
5.	Receiver does not operate in any position of DETECTOR MODE switch except AM.	Defective product detector.	Check Q1202, Q1203 through Q1205, and associated circuitry; correct as necessary.
6.	Receiver does not operate in FM position of DETECTOR MODE switch; otherwise normal.	Defective FM insertion osc or discriminator circuit.	Check Q1301, Q2901 through Q2904, and associated circuitry; correct as necessary.
7.	Receiver does not operate in SSB -1.5 position of DETECTOR MODE switch; otherwise normal.	Defective -1.5 KHz SSB insertion osc.	Check Q1205 and associated circuitry; correct as necessary.
8.	Receiver does not operate in SSB +1.5 position of DETECTOR MODE switch; otherwise normal.	Defective ± 1.5-KHz SSB insertion osc.	Check Q1206 and associated circuitry; correct as necessary.
9.	Receiver does not operate in any BFO position of DETECTOR MODE switch; otherwise normal.	Defective BFO	Check Q1205 and associated circuitry; correct as necessary.
10.	RF GAIN control operates normally with function switch in MAN position but is abnormal with function switch in AGC positions.	Defective AGC circuits	Check Q1401 through Q1403 and associated circuits; correct as necessary.

Table 6-2. TROUBLESHOOTING CHART (cont)

Item No.	Symptom	Probable Cause	Corrective Measure
11.	No. 1145-MHz output	Defective 1.145-MHz osc.	Check Q1801, Y1801, and associated circuits; correct as necessary.
12.	No. 455-KHz output	Defective IF converter circuits.	Check Q1802 through Q1805, and associated circuits; correct as necessary.
13.	Receiver has poor sensitivity or is completely inoperative.	Defective circuit is signal path, or defective power supply.	Check power supply (fig. 6-5), or use signal substitution (para 6-4); correct as necessary.

6-4. Signal Substitution and Oscillator Measurements

a. General. Trouble may be localized to a subchassis or group of circuits by the substitution of an appropriate signal in the signal path of the receiver. This is accomplished by starting as near the output of the receiver as possible. Internally generated signals may be checked by a measurement of frequency and signal level. The chart in c below lists normal signal levels at various places in the signal path and at the output of internally generated signals. Also included are types of test equipment required with input and output points that can be used to inject the substitute signal and measure the output signal. The receiver is set up for normal operation on a suitable working surface. Perform the checks in the order given.

b. Test Equipment Requirements. The following test equipments are required to perform signal substitution on the R-1555/URR-62.

(1) Audio oscillator.

(2) AC VTVM.

(3) RF voltmeter.

(4) Signal generator.

(5) A 600-ohm termination.

(6) A 75-ohm termination.

(7) A 600-ohm, 10-MW dummy load.

c. Signal Substitution Chart. Refer to table 6-3 for signal substitution and minimum performance standards.

Table 6-3. SIGNAL SUBSTITUTION (MINIMUM PERFORMANCE STANDARDS)

Circuit	Input: Test Equipment	Input: Location	Input: Frequency (Hz)	Input: Level	Output: Test Equipment	Output: Location	Output: Frequency (Hz)	Output: Level
Q1500, Q1501, and Q1502	Audio oscillator	Between E1502 and ground	1,000	150 MV	AC VTVM terminated 600 ohms	Between 5 and 6 TB101	1,000	10 MW
					600-ohm, 10-MW dummy load	Between 7 and 8 TB101		
Q1503	Audio oscillator	Between E1502 and ground	1,000	150 MW	AC VTVM terminated 600-ohms	Between 7 and 8 TB101	1,000	1 MW
					600-ohm, 10-MW dummy load	Between 5 and 6 TB101		
Q1701 through Q1703 and Q1401	Signal generator	J3005	1.6 MHz unmodulated	100 uV	RF voltmeter terminated 75-ohms	J3004 (1.6 MHz Out)	1.6 MHz	90 MW
	Adjust RF GAIN				Multimeter	1 of TB1 to ground	AGC voltage	-4.0V
Q1704 and Q1201	Signal generator	J3005	1.6 MHz mod 30% 1,000 Hz	100 uV	RF voltmeter terminated 39K	2 of TB1 to ground	Audio	212 MV
	Adjust RF GAIN				Multimeter	1 of TB1 to ground	AGC voltage	-4.0V
Q1901	Signal generator	J3005	1.6 MHz mod 30% 1,000 Hz	100 uV	AC VTVM terminated 600-ohms	Across 5 and 6 TB101	Audio	
					600-ohms, 10-MW dummy load	4 across 7 and 8 TB101		

Table 6-3. SIGNAL SUBSTITUTION (MINIMUM PERFORMANCE STANDARDS) (cont)

	Input				Output			
Circuit	Test Equipment	Location	Frequency (Hz)	Level	Test Equipment	Location	Frequency (Hz)	Level
Q1601 and BPF	Signal generator	J1601	1.6 MHz unmodulated	300 uV	RF voltmeter terminated in 75-ohms	J3005	1.6 MHz	2 MW
Q1001 through Q1003					RF voltmeter terminated 600-ohms	A2 of J1	3.6 -4.6 MHz	1 V
Q1004					RF voltmeter terminated 75-ohms	A3 of J1	3.6 -4.6 MHz	300 MV
Q901 through Q903 and 2- to 3-MHz BPF	Signal generator	2-3 MHz IN	2.4 MHz unmodulated	45 uV	RF voltmeter	E904	2.4 MHz	7.5 MV
Q604					RF voltmeter	E612	1 MHz	100 MV
Q601 through Q603					RF voltmeter	E701	1 MHz	1.4 V
Q701 and harmonic 1 pt					RF voltmeter	E706	1-32 MHz	2.0 V
Q401 through Q405	Set MHz to 01				RF voltmeter	P402	41.5 MHz	100 MV
						P401	41.5 MHz	100 MV
Q702 through Q705 37.5-MHz filter					RF voltmeter	TP501	37.5 MHz	50 MV
Q501 and Q502								

Table 6-3. SIGNAL SUBSTITUTION (MINIMUM PERFORMANCE STANDARDS) (cont)

	Input				Output			
Circuit	Test Equipment	Location	Frequency (Hz)	Level	Test Equipment	Location	Frequency (Hz)	Level
Q503 and 2-to 3-MHz BPF	Signal generator	E507	2.5 MHz	60 MV	RF voltmeter	E506	2.5 MHz	10 MV
All circuits from antenna input to output of 40-MHz filter	Signal generator (Tune receiver to corresponding frequency)	J201	1-30 MHz	1-1.5 uV	AC VTVM terminated 600-ohms	Between 5 and 6 of TB1	Audio	10 MW

6-5. Replacement and Repair Techniques

Caution: Careless wiring, soldering, and replacement of parts often cause new faults. Before performing parts replacement or repair, review the description of replacement and repair techniques in a through d below.

a. Printed Circuit Parts Replacement. Apply heat to the component lead on the component side of the board. Remove the component with a straight outward pull. Use a toothpick or a suitable wooden splinter to clean the hole where the component lead is removed. Solder the replacement component from the conductor side of the board.

b. Soldering Iron. Use a pencil-type soldering iron with a 50-watt maximum rating. If the AC iron must be used, use an isolation transformer between the iron and the AC line. Do not use a soldering gun; damaging voltages can be induced in the transistors.

c. Soldering Techniques. When soldering transistor leads, use a well-tinned iron, and solder quickly. Whenever lead length permits, use a heat sink (such as a pair of long-nose pliers) between the soldering joint and the body of the transistor.

d. Lead Dress. Before replacing parts, note the position of the part, lead length, and dress, so that the replacement part will be positioned the same as the part replaced, and the lead length and dress remains the same.

6-6. IF Assembly Removal and Replacement

a. Removal.

(1) Remove the top cover from the receiver.

(2) Disconnect P2 from J3005 (fig. 6-1).

(3) Remove the mounting screw on the bottom of the receiver (fig. 6-2).

(4) Remove the four screw on the rear of the IF Assy that secure it to the receiver.

(5) Slide the IF Assy straight back and completely out of the receiver main chassis.

b. Replacement.

(1) Slide the IF Assy straight into its position in the receiver main chassis; check to see that P3001 mates with J1.

(2) Replace and tighten the mounting screw on the bottom of the receiver.

(3) Replace and tighten the four screws that secure the IF Assy to the receiver.

(4) Connect P2 to J3005.

(5) Replace the top cover on the receiver.

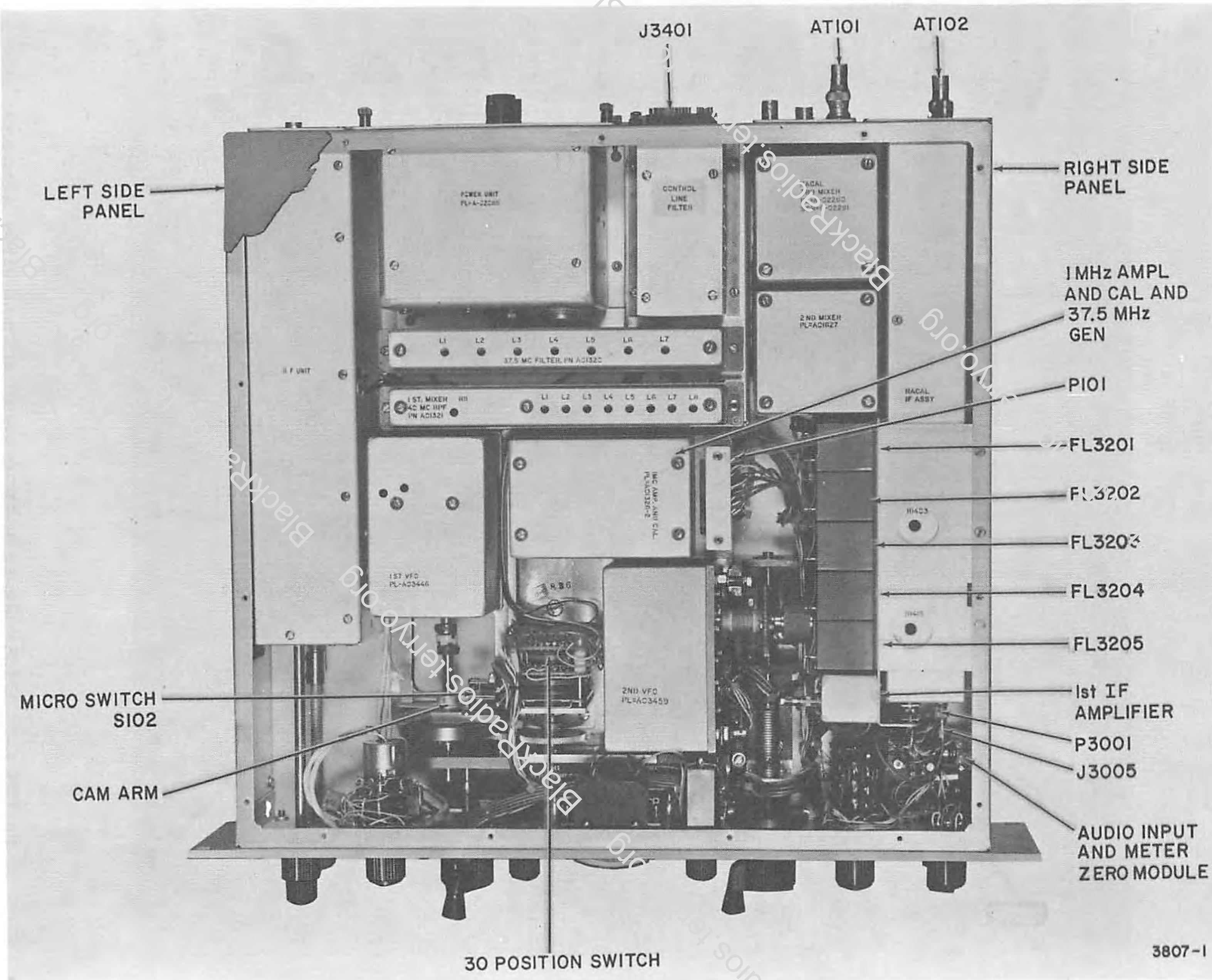


FIGURE 6-1 R-1555/URR-62 TOP VIEW, COVER REMOVED

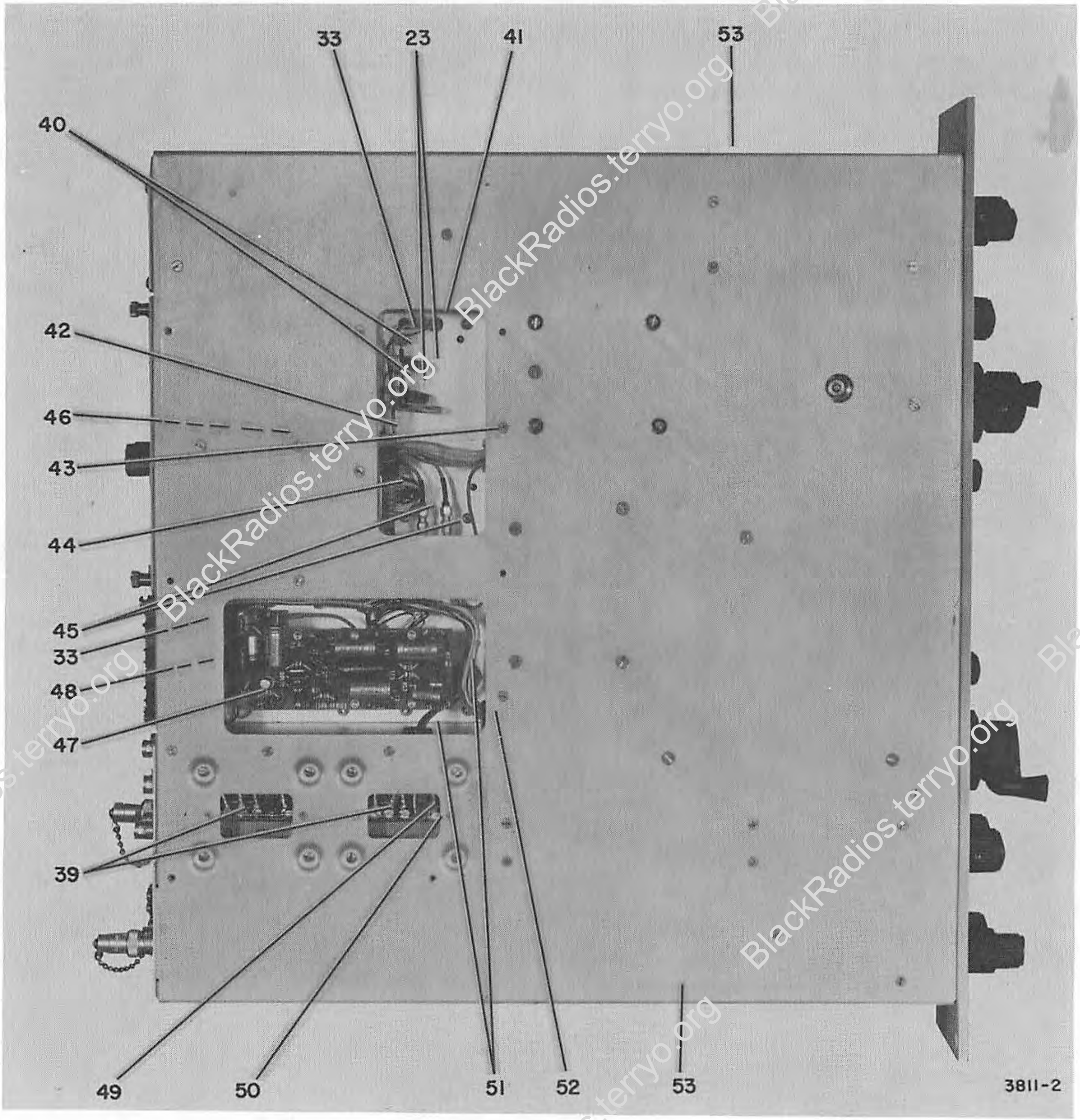


FIGURE 6-2 R1555/URR-62 BOTTOM VIEW, ACCESS PANEL REMOVED

6-7. Removal and Replacement of 3rd Mixer Module

a. Removal.

(1) Remove the receiver top cover.

(2) Remove the access panel from the bottom of the receiver.

(3) Remove the four 3rd Mixer Module mounting screws (fig. 6-2).

(4) Lift the 3rd Mixer Module straight out of the receiver.

b. Replacement.

(1) Carefully insert the module straight into the receiver making sure that P901 mates properly with J110.

(2) Replace and tighten the four 3rd Mixer Module mounting screws (fig. 6-2).

(3) Replace the bottom access panel and the top cover of the receiver.

6-8. Removal and Replacement of 2nd Mixer Module

a. Removable.

(1) Remove the receiver top cover.

(2) Remove the access panel from the bottom of the receiver.

(3) Remove the four 2nd Mixer Module mounting screws (fig. 6-2).

(4) Lift the 2nd Mixer Module straight out of the receiver.

b. Replacement

(1) Carefully insert the 2nd Mixer module into the receiver. Check to see that P501 mates properly with J101.

(2) Replace and tighten the four 2nd Mixer module mounting screws (fig. 6-2).

(3) Replace the bottom access panel and the top cover on the receiver.

6-9. Removal and Replacement of 1 MHz AMP and OSC-CAL and 37.5 MHz Generator Module

a. Removal

(1) Remove the receiver top cover.

(2) Disconnect P101 from J601.

(3) Remove the access panel from the bottom of the receiver.

(4) Remove four 1 MHz amp and osc-cal and 37.5 MHz Generator module mounting screws.

(5) Lift the module straight out of the receiver.

b. Replacement

(1) Carefully insert the 1 MHz amp and osc-cal and 37.5 MHz Generator module in the receiver.

(2) Replace and tighten the four mounting screws removed in a (4) above.

(3) Replace the access panel on the bottom of the receiver.

(4) Connect P101 to J601.

(5) Replace the receiver top cover.

6-10. Mechanical Alignment of 1st VFO

The mechanical alignment of the 1st VFO should not be necessary unless the 1st VFO module is replace. To mechanically align the 1st VFO: remove the assembly cover, loosen the align-set screw that couples the tuning shaft to the capacitor rotor shaft. Then align as directed in a through d below.

a. Rotate the MHz control fully counterclockwise until the MC frequency indicator indicates 00.

b. Set the microswitch (fig. 6-1) as follows:

(1) Loosen allen screw securing the Cam Arm and rotate the Cam Arm until the microswitch is operated.

(2) Continue to rotate the Cam Arm about one thirty-second of an inch beyond where the microswitch operates, and secure the Cam Arm to the shaft.

c. Check to see that the MHz frequency indicator indicates 00, and set the 1st VFO capacitor as shown in A, figure 6-3.

d. Secure the shaft to the coupling with no pressure on the 1st VFO capacitor shaft.

6-11. Mechanical Alignment of 2nd VFO

The mechanical alignment of the 2nd VFO should not be required unless the 2nd VFO module is replaced. To mechanically align the 2nd VFO: remove the assembly cover, loosen the align-set screw that couples the tuning shaft to the capacitor rotor shaft. Then align as directed in a through c below.

a. Rotate the KHz control toward maximum indication on the frequency indicator until it reaches its mechanical stop.

b. Set the 2nd VFO capacitor as shown in B, figure 6-3.

c. Secure the coupling to the shaft with the 2nd VFO capacitor positioned as in b above.

6-12. Reference Designations

a. A series number has been assigned to the main chassis and each subchassis. These numbers are in hundreds series and are used to prefix the individual number of each subchassis element. For example, RF unit (series 200) resistors are identified as R201, R202, etc.

b. Refer to the IPB (T.O. 31R2-2URR62-4) for complete list and location identification of all reference designation.

c. Table 6-4, below lists the reference designation series for each unit of the R-1555/URR-62. Figure references are also included.

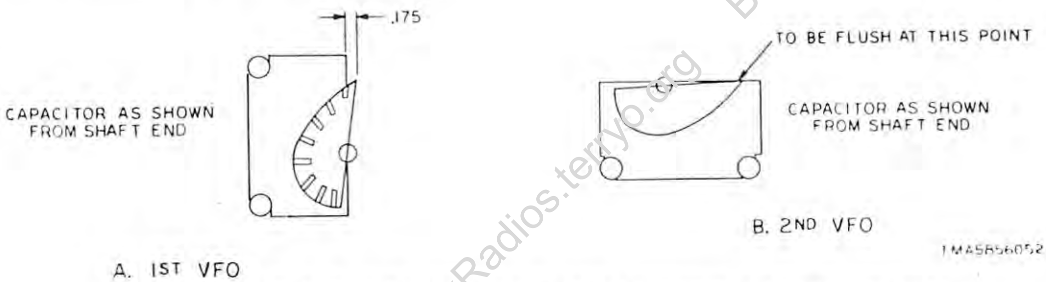


FIGURE 6-3 1ST AND 2ND VFO INITIAL ADJUSTMENTS

Table 6-4. EQUIPMENT REFERENCE DESIGNATIONS

Unit	Series Number	Figure
Main chassis	100	7-11
RF UNIT	200	7-13
1st MIXER and 40 MHz Filter	300	7-14
1st VFO	400	7-15
2nd MIXER and 37.5 MHz AMPL	500	7-19
1 MHz AMPL and OSC-CAL	600	7-16
37.5 MHz GENERATOR	700	7-17
37.5 MHz FILTER	800	7-18
3rd MIXER	900	7-21
2nd VFO	1000	7-20
Detector board	1200	7-25
AC Power Unit MA6302	1300	7-31
AGC circuits	1400	7-24
AUDIO AMPL	1500	7-27
1st 1.6 MHz IF AMPL	1600	7-22
2nd, 3rd, and 4th 1.6 MHz IF AMPL	1700	7-23
IF Converter	1800	7-30
Audio input and meter zero	1900	7-26
FM discriminator	2900	7-29
IF Assembly	3000	7-12
FM insertion oscillator	3100	7-28
Crystal filter and IF ASSY	3200	7-11
Line filter	3400	7-33

CHAPTER 7

ALIGNMENT PROCEDURES AND CIRCUIT DIAGRAMS

Section I. ALIGNMENT

7-1. General

Under normal conditions, the R-1555/URR-62 will maintain the factory alignment over a long period of time, consequently, any other causes of trouble should be eliminated before realignment is undertaken. If it becomes necessary to realign any part of the receiver, only small angular adjustments of any trimmers or tuning slugs should be necessary. When replacing access covers, module shields, etc., make sure that all screws are tightly secured to prevent any spurious signals from degrading equipment operation. Alignment procedures are given in the paragraphs as listed in a through i below.

a. IF ASSY (para 7-2).

b. 3RD MIXER (para 7-3).

c. 2ND MIXER (para 7-4).

d. 1 MHz AMP AND OSC-CAL and 37.5 MHz GENERATOR modules (para 7-5).

e. 37.5 MHz FILTER (para 7-6).

f. 1ST MIXER and 40 MHz BPF (para 7-7).

g. 2ND VFO (para 7-8).

h. 1ST VFO (para 7-9).

i. RF UNIT (para 7-10).

7-2. IF ASSY Alignment (fig. 7-1 through 7-9)

a. Test Equipment Required.

(1) Signal generator.

(2) VTVM

(3) Oscilloscope.

(4) RF voltmeter.

(5) Frequency counter.

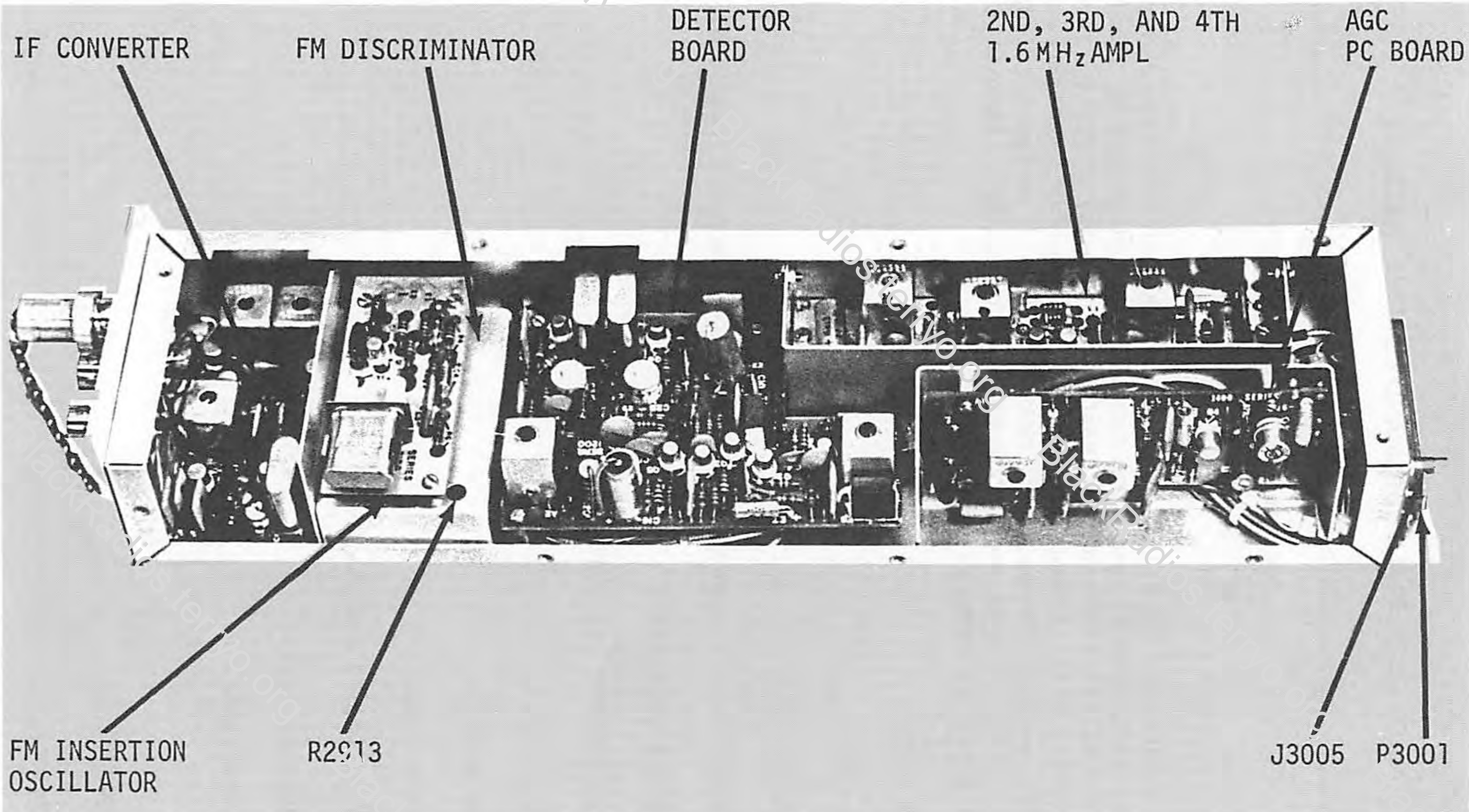


FIGURE 7-1 IF ASSEMBLY, COVER REMOVED

b. Control Settings. Make the following control settings before proceeding with the IF ASSY alignment:

(1) Set the function switch to MAN.

(2) Turn the RF GAIN control to maximum (clockwise).

(3) Set the DETECTOR MODE switch to AM.

c. Procedure. Complete alignment of the IF ASSY is described in d through h below. If repairs are made to any one of the subassemblies, alignment of the repaired subassembly may be performed separately without complete alignment of the IF ASSY. The separate subassemblies with reference to the procedures are listed below:

(1) 2ND, 3RD, AND 4TH 1.6 MHz and IF AMPL alignment (d below).

(2) AGC amplifier alignment (e below).

(3) Detector board alignment (f below).

(4) IF converter alignment (g below).

(5) FM insertion oscillator alignment (h below).

d. 2ND, 3RD, and 4TH 1.6 IF AMPL

(1) Remove the IF ASSY (para 6-6).

(2) Remove the cover from the IF ASSY.

(3) Connect an IF extender cable from P3001 to J1.

(4) Connect the signal generator to J3005.

(5) Connect the VTVM to the junction of CR1403 and R1413.

(6) Set the function switch to AGC MED.

(7) Tune the signal generator to 1.6 MHz, and adjust the output until a reading of -6.5 volts DC is obtained on the VTVM.

(8) Adjust A1701 and A1702 for maximum indication on VTVM; readjust the signal generator output to maintain -6.5 volts DC on the VTVM.

(9) Adjust A1401 and A1402 for maximum indication on VTVM; readjust the signal generator output to maintain -6.5 volts DC on the VTVM.

(10) Connect the RF voltmeter to the junction of C1202 and R1205.

(11) Set the signal generator for 100-uV input, and adjust A1703 for a maximum indication on the RF voltmeter.

(12) Adjust R1719 for 8 millivolts on the RF voltmeter.

(13) Remove the RF voltmeter from detector board.

e. AGC Amplifier.

(1) Switch the function switch to AGC LG, and connect AT102* to the 1.6-MHz OUT jack (J3004).

(2) Connect the VTVM to E1413, and adjust R1415 for a reading of -4.0 volts DC on the VTVM.

(3) Connect the signal generator to J3005.

(4) Connect the VTVM to the junction of CR1403 and R1413, and adjust the output of the signal generator until a reading of -6.5 volts DC is obtained on the VTVM.

(5) Adjust A1401 and A1402 for a maximum indication on VTVM.

Note: The RF GAIN control may have to be decreased in order to maintain a reading on the VTVM.

(6) Set the RF GAIN control to maximum, and adjust the signal generator for a 120-uV output.

(7) Connect the VTVM to E1413, and adjust R1403 until the -4.0 volts obtained in (2) above begins to go less negative.

Note: The correct setting for R1403 is reached when any increase in signal generator output causes the -4.0 volts obtained in (2) above to go less negative.

f. Detector Board.

(1) Connect the signal generator to J3005.

(2) Set the function switch to MAN.

(3) Adjust the signal generator for a frequency of 1.6 MHz with 30 percent AM modulation at 1,000 Hz and an output level of 1,000-uV.

(4) Connect the oscilloscope to the AM DET terminal.

Note: Be sure that the AM DET and AM DET LOAD terminals are shorted with the shorting link.

(5) Adjust A1201 for a maximum indication on the oscilloscope.

(6) Connect the frequency counter to the 1.6 MHz WIDE OUT jack.

(7) Adjust the frequency of the signal generator for a 1.6-MHz indication on the frequency counter.

(8) Disconnect the frequency counter from the 1.6 MHz WIDE OUT jack, and connect it to the AM DET terminal.

*Attached to rear of IF ASSY.

(9) Set the DETECTOR MODE switch to +1.5, and adjust C1233 for a frequency indication of 1601.5 KHz on the frequency counter.

(10) Set the DETECTOR MODE switch to -1.5, and adjust C1228 for a frequency indication of 1598.5 KHz on the frequency counter.

(11) Connect the VTVM to the junction of R1228 and C1224.

(12) Adjust the BFO TUNE control for -7.4 volts DC on the VTVM.

(13) Set the DETECTOR MODE switch to 0, and adjust C1219 for 0 on the frequency counter.

g. IF Converter

(1) Connect the frequency counter to the 1.145 MHz IN/OUT jack.

(2) Adjust C1806 until the frequency counter indicates 1.145 MHz.

(3) Connect the signal generator to J3005, and adjust the signal generator for a frequency of 1.6 MHz with an output of 1,000-uV.

(4) Set the function switch to AGC MED.

(5) Connect the RF voltmeter, terminated with 50 ohms, to the 455 KHz OUT jack.

(6) Adjust A1801, A1802, and A1803 for a maximum indication on the RF voltmeter.

h. FM Insertion Oscillator. (fig. 7-2).

(1) Connect the RF voltmeter to the junction of R3103 and C3101.

(2) Set the DETECTOR MODE switch to FM. The indication on the RF voltmeter should be at least 100 millivolts.

(3) Connect the signal generator to J3005, and adjust the signal generator for a frequency of 1.6 MHz with an output of 1,000-uV.

(4) Set the function switch to AGC MED.

(5) Connect the oscilloscope to E1903.

(6) Adjust R2913 so that, when the signal generator frequency is shifted ±6 KHz, the DC output from the discriminator varies .25 volts peak-to-peak (displayed on the oscilloscope).

7-3. 3RD MIXER Alignment (fig. 7-3)

a. Test Equipment Required.

(1) Signal generator (two required).

(2) RF voltmeter.

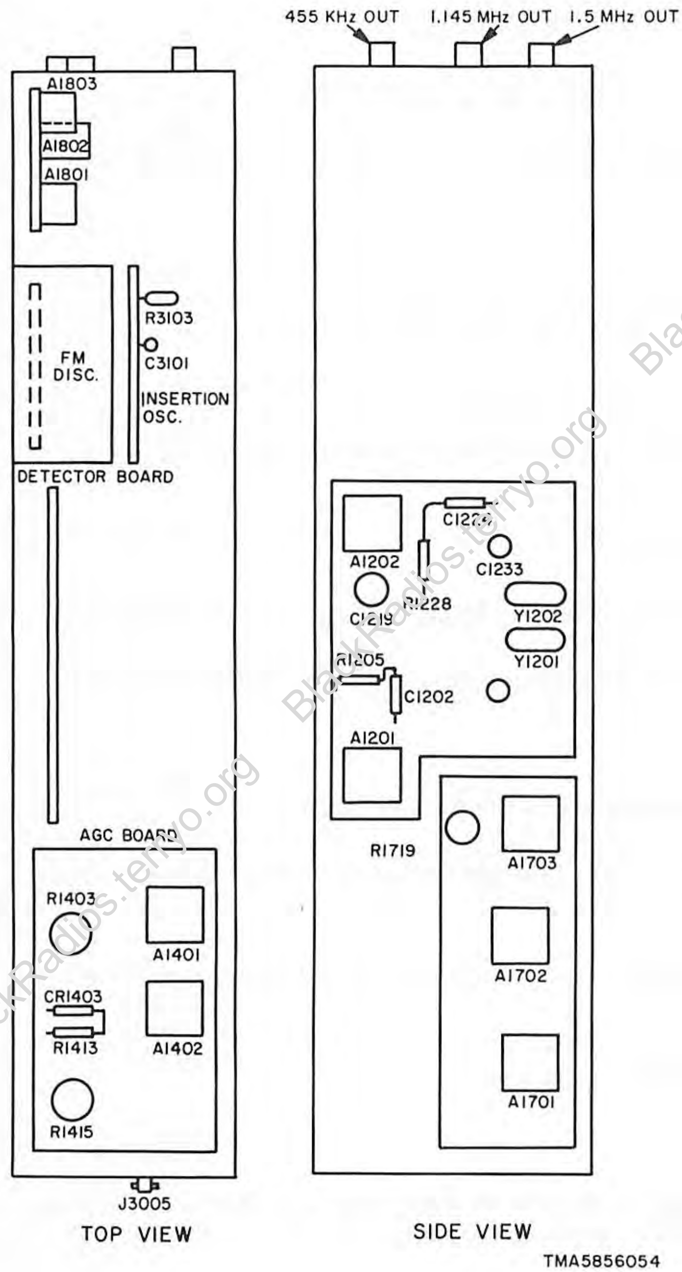


FIGURE 7-2 IF ASSEMBLY ALIGNMENT
PARTS LOCATION

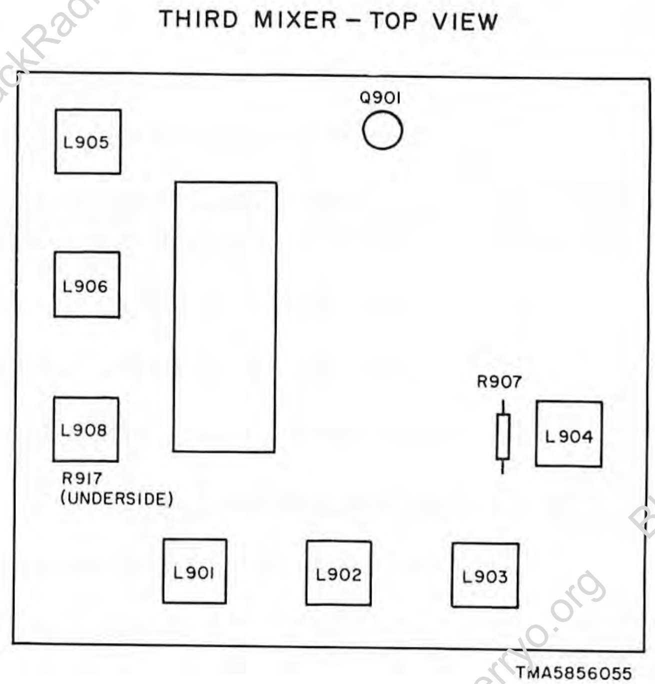


FIGURE 7-3 3RD MIXER ALIGNMENT
PARTS LOCATION

b. Control Settings. Make the control settings in (1) through (3) below before proceeding with the 3RD MIXER alignment.

(1) Set the function switch to MAN.

(2) Set the 2ND VFO switch to EXT.

(3) Adjust the MHz control until 00 is indicated on the MHz frequency indicator.

c. Procedure.

(1) Remove the 3RD MIXER module.

(2) Connect the extender cable from P901 (bottom of 3RD MIXER module) to J110.

(3) Remove the cover from the 3RD MIXER module.

(4) Connect the signal generator to the VFO2 IN jack on the rear panel.

(5) Connect the RF voltmeter, set to indicate 50 MV, across R907.

(6) Adjust the signal generator for a frequency of 5.6 MHz and an output for a convenient reading on the RF voltmeter.

(7) Adjust L903 for a minimum indication on the RF voltmeter.

(8) Adjust the signal generator for a frequency of 3 MHz, and adjust L902 for a minimum indication on the RF voltmeter.

(9) Adjust the signal generator for a frequency of 3.6 MHz, and adjust L901 for a maximum indication on the RF voltmeter.

(10) Adjust the signal generator for a frequency of 4.6 MHz, and adjust L904 for a maximum indication on the RF voltmeter.

(11) Repeat the procedures in (6) through (10) above until the response is flat within 3 dB from 3.6 MHz to 4.6 MHz.

(12) Connect the signal generator to the 2-3 MHz IN jack.

(13) Connect the RF voltmeter across R917.

(14) Adjust the signal generator for a frequency of 3 MHz with the output set to obtain an indication of 50 millivolt on the RF voltmeter.

(15) Adjust L908 for a maximum indication on the RF voltmeter.

(16) Tune the signal generator from 2 to 3 MHz, and check to see that the indication on the RF voltmeter does not decrease from the reading obtained in (15) above.

(17) Connect a second signal generator to the VFO2 IN jack, and adjust the signal generator for a frequency of 4 MHz with a 1-volt output.

(18) Adjust the signal generator that is connected to the 2-3 MHz IN jack ((12) above) for a frequency of 2.5 MHz with a 100-uV output.

(19) Connect the RF voltmeter to the base of Q901.

(20) Adjust L905 and L906 for a maximum indication on the RF voltmeter.

(21) Connect the RF voltmeter to E904.

(22) Check to see that 10mV at 2.5 MHz produces approximately 10mV at the output E904 on RF voltmeter.

7-4. 2ND MIXER Alignment (fig. 7-4)

a. Test Equipment Required.

(1) Signal generator.

(2) RF voltmeter.

b. Control Settings. Make the following control settings before proceeding with the second mixer alignment.

(1) Set the function switch to MAN.

(2) Adjust the MHz control until 00 is indicated on the MHz frequency indicator.

c. Procedure.

(1) Remove the covers from the following modules (fig. 6-1)

(a) 37.5 MHz FILTER.

(b) 1 MHz AMP AND CAL.

(c) 2ND MIXER.

(2) Remove 1-MHz crystal Y601 (fig. 7-5) from the 1 MHz AMP AND CAL module.

(3) Connect the RF voltmeter to TP501 (fig. 7-4)

(4) Connect the signal generator to E803.

(5) Adjust the signal generator for a frequency of 37.5 MHz with an output of 1200-uV.

(6) Adjust A501 for maximum on the RF voltmeter. The reading should be approximately 30 millivolts.

(7) Connect the RF voltmeter to E506.

(8) Connect the signal generator to the 2-3 MHz IN jack.

(9) Adjust the signal generator to 3.66 MHz, and tune A503 for a minimum indication on the RF voltmeter.

(10) Adjust the signal generator for a frequency of 1.6 MHz, and adjust A504 for a minimum indication on the RF voltmeter.

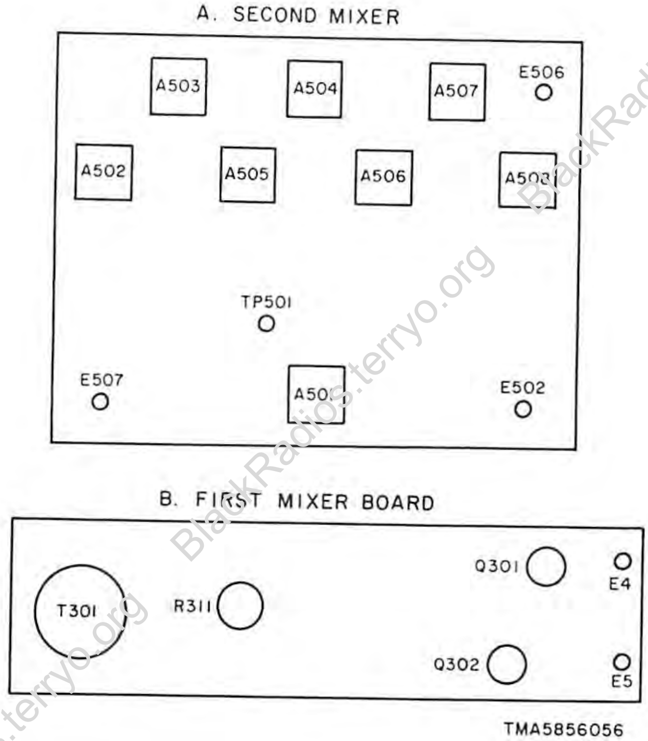


FIGURE 7-4 1ST AND 2ND MIXER ALIGNMENT PARTS LOCATION

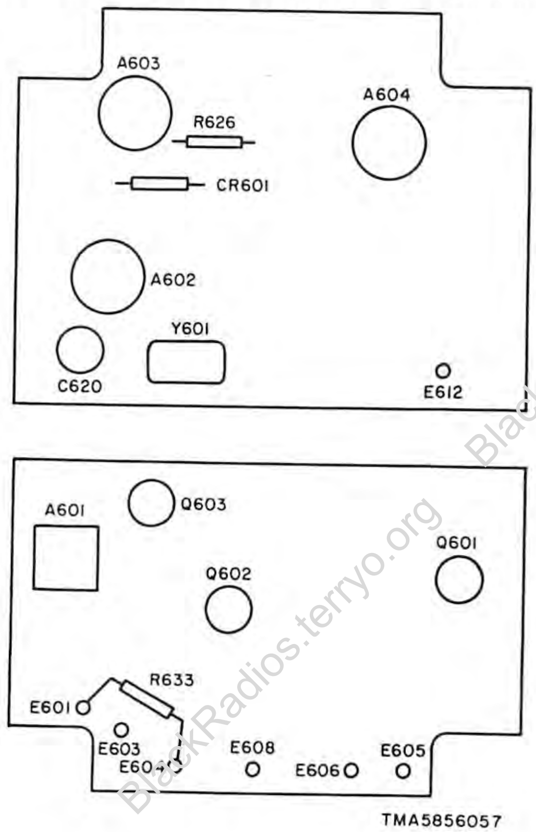


FIGURE 7-5 1 MHZ AMPL AND CALIBRATOR ALIGNMENT PARTS LOCATION

Note: The signal generator output may have to be increased as the minimum is approached to obtain a reading on the RF voltmeter.

(11) Adjust the signal generator for a frequency of 1.3 MHz, and adjust A507 for a minimum indication on the RF voltmeter.

(12) Adjust the signal generator for a frequency of 4.5 MHz, and adjust A506 for a minimum indication on the RF voltmeter.

(13) Adjust the signal generator for a frequency of 2.5 MHz, and adjust A502 to A508 for a maximum indication on the RF voltmeter.

(14) Adjust the signal generator for a frequency of 2.1 MHz, and adjust A505 for a maximum indication on the RF voltmeter.

(15) Repeat the procedures in (9) through (11) above until a response is obtained which is flat, within 3 dB, from 2 to 3 MHz.

(16) Adjust the signal generator for a frequency of 2.5 MHz with a 60 millivolt output; check to see that the indication on the RF voltmeter is approximately 10 millivolts.

7-5. 1 MHz AMP AND CAL and 37.5 MHz GENERATOR Alignment

a. Test Equipment Required.

(1) Signal generator.

(2) RF voltmeter.

(3) Frequency counter.

(4) Oscilloscope.

b. Control Settings. Set the function switch to MAN.

c. 1-MHz AMP AND CAL Module (fig. 7-5).

(1) Remove the 1 MHz AMP AND CAL module and the 37.5 MHz GENERATOR module. (para 6-9)

(2) Connect the extender cable from P101 to J601.

(3) Remove the cover from the 1 MHz AMP AND CAL module.

(4) Connect the RF voltmeter to E612, and check to see that an indication of approximately 120 millivolt is obtained on the RF voltmeter.

(5) Connect the frequency counter to the 1 MHz OUT jack.

(6) Adjust C620 until a 1 MHz indication is obtained on the frequency counter.

(7) Connect the RF voltmeter to E601.

(8) Adjust A601 for a maximum indication on the RF voltmeter. This indication should be approximately 4 volts.

(9) Connect the RF voltmeter to E603, and check that the 1-MHz level is approximately 120 mV.

(10) Remove crystal Y601, and connect the signal generator to E605.

(11) Adjust the signal generator for a frequency of 1-MHz with an output of 100 millivolts.

(12) Connect the RF voltmeter to E612 and check to see that approximately 100 millivolts is indicated.

(13) Replace crystal Y601; disconnect the RF voltmeter and signal generator.

(14) Connect the oscilloscope to the junction of CR601 and CR602.

(15) Waveform observed should be as illustrated in A, figure 7-6.

(16) Disconnect the oscilloscope, and connect the RF voltmeter to the junction of CR606 and CR605. Check to see that approximately 1.5 volts is indicated.

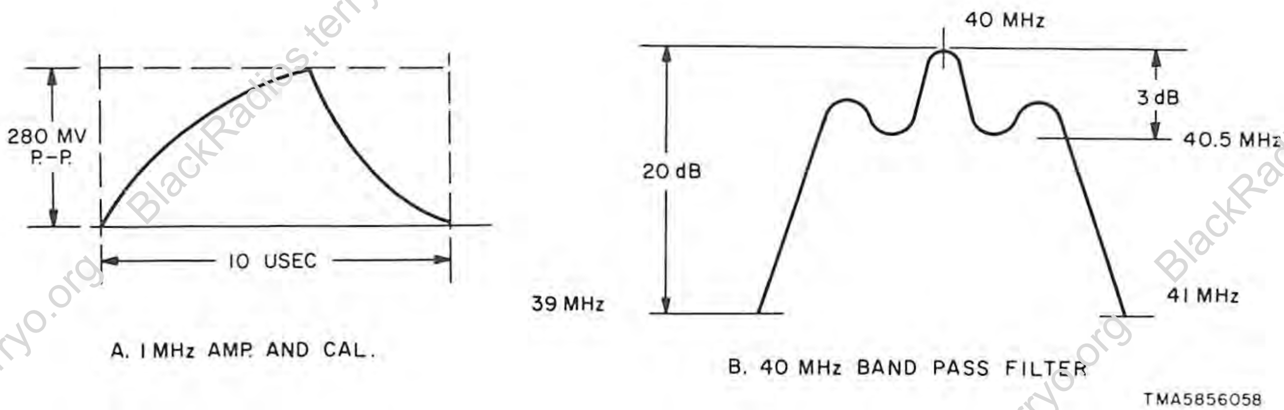


FIGURE 7-6 ALIGNMENT WAVE SHAPES

d. 37.5-MHz GENERATOR Module (fig. 7-7).

(1) Connect the RF voltmeter to E701, and check to see that approximately 1.4 volts is indicated at 1.0 MHz.

(2) Disconnect the lead at the feedthrough end of the lead that connects from E704 to the feedthrough.

(3) Connect a 390-ohm resistor from the output of the signal generator to the feedthrough.

(4) Connect the RF voltmeter to E705.

(5) Adjust the signal generator for a frequency of 1 MHz with an output of 250 millivolts at 1-MHz.

(6) Tune the signal generator through the 2 to 32 MHz band, and observe the indication on the RF voltmeter. Adjust C708, C710, C713, and C715 to obtain a reading with a 2-dB indication of 100 millivolts across the band. Continually check to see that the signal generator output is 250 millivolt across the band.

(7) Connect the signal generator to E709, and connect the RF voltmeter to E710.

(8) Adjust the signal generator for a frequency of 37.5 MHz with an output of 3 millivolts.

(9) Adjust A701 for an indication of at least 30 millivolts on the RF voltmeter.

(10) Connect the RF voltmeter to E713, and adjust A702 for an indication of approximately 100 millivolts on the RF voltmeter.

(11) Re-connect the lead that was disconnected in (2) above.

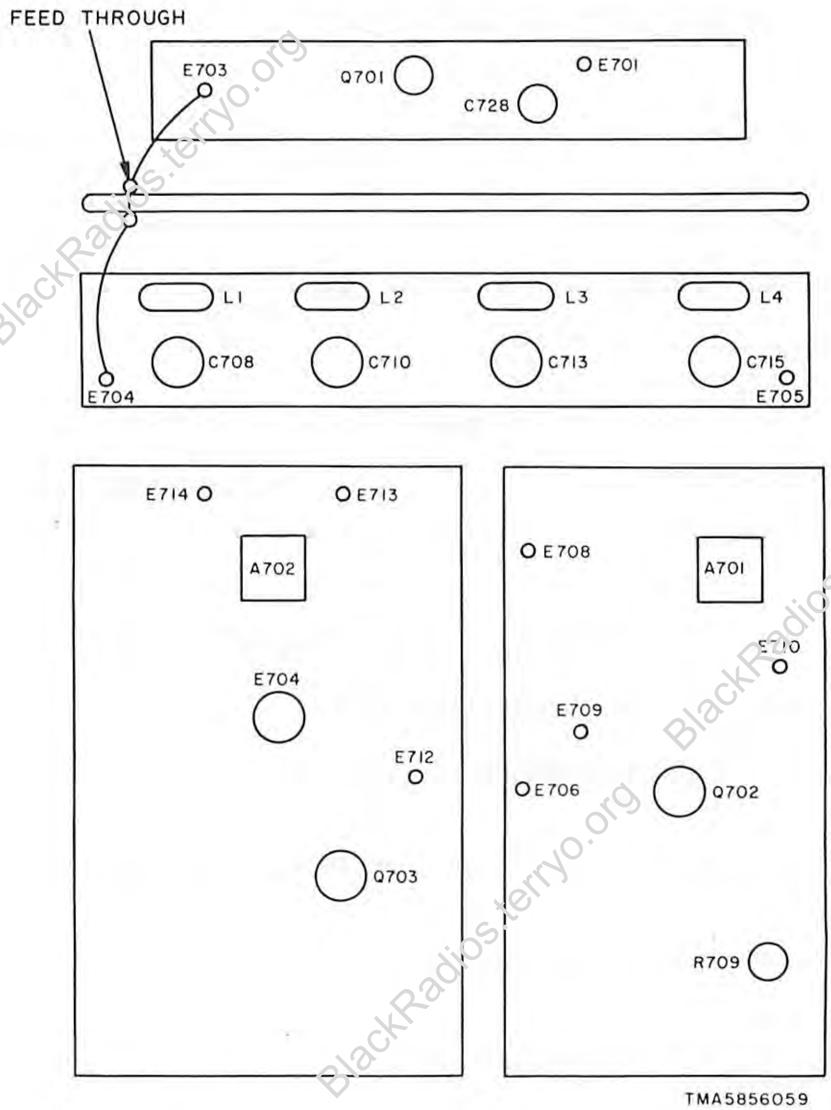


FIGURE 7-7 37.5 MHZ GENERATOR ALIGNMENT PARTS LOCATION

(12) Connect the RF voltmeter to E706, and check to see that approximately 2 volts is indicated on the RF voltmeter.

(13) Disconnect J111 from P402.

(14) Connect the signal generator to J111 and adjust the signal generator for a frequency of 37.5 MHz.

(15) Connect the RF voltmeter to E710, and adjust R709 until a minimum indication is obtained on the RF voltmeter.

(16) Disconnect all test equipment, and reconnect J111 to P402.

7-6. 37.5 MHz FILTER Alignment (fig. 7-7).

a. Test Equipment Required.

(1) Signal generator.

(2) RF voltmeter.

b. Control Settings. Make the following control settings before proceeding with the alignment of the 37.5 MHz FILTER:

(1) Set the function switch to MAN.

(2) Set the MHz control between any MHz frequency indication.

c. Procedure.

(1) Remove the 1 MHz AMP AND CAL, and the 37.5 MHz GENERATOR modules (para 6-9).

(2) Connect the extender cable from J601 to P101).

(3) Remove the covers from the following modules:

(a) 1 MHz AMP AND CAL.

(b) 37.5 MHz GENERATOR.

(c) 2ND MIXER.

(d) 37.5 MHz FILTER.

(4) Remove 1-MHz crystal Y601).

(5) Connect the signal generator to E801.

(6) Connect the RF voltmeter to TP501 (fig. 7-4).

(7) Adjust the signal generator for a frequency of 37.5 MHz with an output that will provide a usable indication on the RF voltmeter.

Note: If no output is obtained, it may be necessary to connect the RF voltmeter to L802 and to adjust L801 for a maximum RF voltmeter indication; then connect the RF voltmeter to each successive coil on the 37.5-MHz band-pass filter (BPF) and adjust the preceding coil for maximum. This procedure may have to be performed until an output is indicated at TP501.

(8) Adjust L801 through L807 for a maximum indication on the RF voltmeter.

(9) Disconnect the signal generator, and replace crystal Y601.

(10) Adjust the MHz control until the frequency indicator indicates 1 MHz and a maximum reading is indicated on the RF voltmeter.

(11) Readjust A701, A702, L801 through L807, and A501 until a maximum indication is indicated on the RF voltmeter.

(12) Adjust R709 for a maximum indication on the RF voltmeter.

(13) Tune the MHz control to all the MHz positions from 1 to 30, and check to see that at each position at least 50 millivolt is indicated on the RF voltmeter.

Note: The indication on the RF voltmeter should dip between all MHz positions.

7-7. 1ST MIXER and 40 MHz BPF Alignment (fig. 7-4)

a. Test Equipment Required.

(1) Sweep generator.

(2) Signal generator.

(3) RF voltmeter.

(4) Oscilloscope.

b. Control Settings. Make the following control settings before proceeding with the alignment of the 1ST MIXER and 40 MHz BPF:

(1) Set the function switch to MAN.

(2) Set the RF RANGE switch to WB.

(3) Adjust the MHz control for 05 on the MHz frequency indicator.

c. Procedure.

(1) Remove the covers from the 2ND MIXER and the 1-MHz and 40 MHz BPF modules.

(2) Disconnect J112 from P401 (fig. 6-2).

(3) Connect signal generator to J112, and adjust for a frequency of 20 MHz.

(4) Connect the RF voltmeter to E507 (fig. 7-4).

(5) Adjust signal generator output until a usable reading is obtained on the RF voltmeter.

Note: If a usable reading cannot be obtained on the RF voltmeter, move the RF voltmeter to any coil on the 40 MHz BPF which gives a usable reading.

(6) Adjust R311 for a minimum indication on RF voltmeter.

(7) Disconnect the signal generator from J112 and the RF voltmeter from E507.

(8) Reconnect J112 to P401.

(9) Connect the sweep generator to RF input jack J201.

(10) Connect the oscilloscope input through a 5-picofarad capacitor to E507.

(11) With the MHz control set to provide 05 on the MHz frequency indicator, adjust the sweep generator and oscilloscope until a usable display is obtained on the oscilloscope.

(12) Set the marker (provided by internal or external source) to 40 MHz.

(13) Adjust L301 through L308 on the 40 MHz BPF to produce the waveform shown in B of figure 7-6.

7-8. 2nd VFO Alignment (fig. 7-8)

a. Test Equipment Required.

(1) Frequency counter.

(2) RF voltmeter.

b. Control Settings. Make the following control settings before proceeding with the alignment of the 2nd VFO:

(1) Set the 2ND VFO switch to INT.

(2) Set the function switch to MAN.

(3) Set the RF RANGE switch to WB.

c. Procedure.

(1) Connect the RF voltmeter to the VFO2 OUT jack on rear panel. The output should be greater than 250 MV.

(2) Connect the counter to the VFO2 out jack and set the KHz control to 1000 KHz (+000). The frequency measured on counter should be 3.6 MHz ±500 Hz.

(3) Adjust the KHz control until .500 appears in the KHz portion of the frequency indicator, rotate the CALIBRATE/FINE TUNE control to its maximum counterclockwise position, and note the frequency indication on the frequency counter.

(4) Rotate the CALIBRATE/FINE TUNE control to its maximum clockwise position, and note the frequency indication on the frequency counter.

(5) Set the CALIBRATE/FINE TUNE control to the midrange frequency between those noted in (3) and (4) above.

(6) Set the KHz control to 0 KHz and measure the frequency with the counter. The frequency should be 4.6 MHz ±500 Hz. If the frequency is incorrect, adjust the trimmer capacitor C4 at the high end of the band.

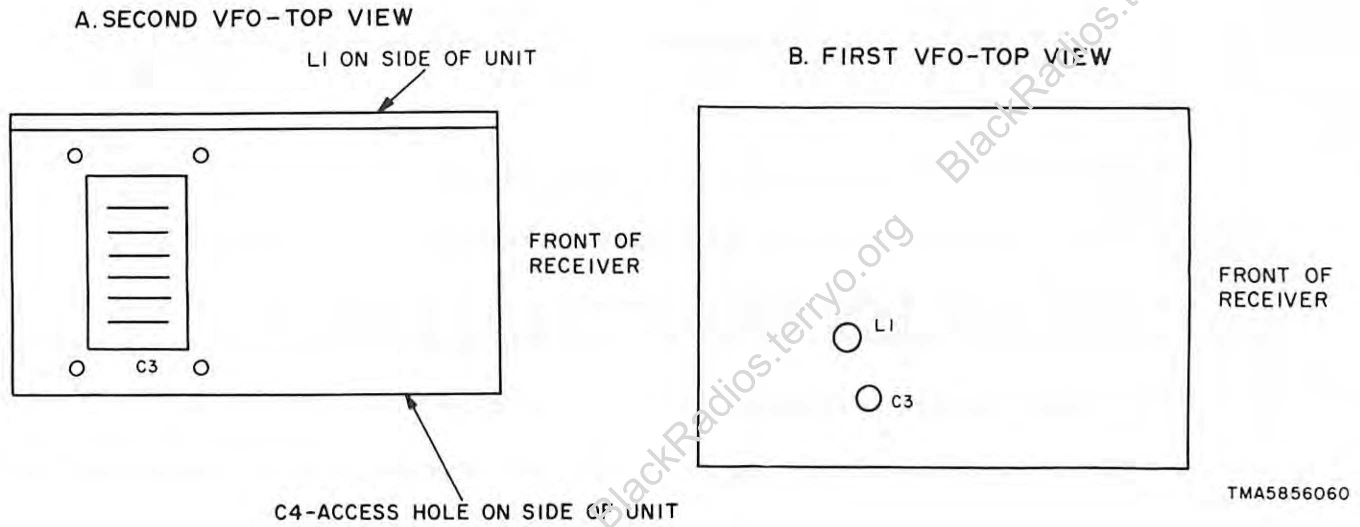


FIGURE 7-8 1ST AND 2ND VFO ALIGNMENT PARTS LOCATION

(7) Return the KHz control to 1000 KHz (+000). Adjust mechanical coupling to C3 for the correct frequency. Repeat steps 3 and 4 until the correct frequency is obtained at both ends of the band. Do not adjust coil L1 as it has been locked in place and no adjustment of this coil should be necessary.

(8) When both ends of the band are at the correct frequencies, tune the KHz control to each 100 KHz point on the dial. If the frequency varies from the desired frequency (i.e., 4.6 - frequency on dial ±500 Hz) the individual blades on C3 may have to be adjusted. This should not be necessary in most cases. A chart of frequency indicator as opposed to 2ND VFO frequencies are listed in table 7-1.

Table 7-1. 2ND VFO ALIGNMENT CHART

Frequency indicator	2ND VFO frequency in MHz
.000	4.6
.100	4.5
.200	4.4
.300	4.3
.400	4.2
.500	4.1
.600	4.0
.700	3.9
.800	3.8
.900	3.7
+000	3.6

(9) When all frequency points on the dial are correct, set the function switch to CAL and check for a zero beat at all 100 KHz points on the dial. Also, tune the CALIBRATE/FINE TUNE control and note that the frequency of the VFO varies approximately 8 KHz from one end of the fine tune control to the other.

7-9. 1st VFO Alignment (fig. 7-8)

a. Test Equipment Required.

(1) Frequency counter.

(2) RF voltmeter.

b. Control Settings. Make the following control settings before proceeding with the alignment of the 1ST VFO:

(1) Set the function switch to MAN.

(2) Adjust the MHz control until 01 is indicated on the MHz portion of the frequency indicator.

c. Procedure.

(1) Check to see that C401 is in proper mechanical alignment (para 6-10).

(2) Disconnect J111 from P402 and J112 from P401 (fig. 6-2).

(3) Measure the output at P402 with the RF voltmeter. An indication of approximately 200 millivolts is normal.

(4) Connect the frequency counter to P402, and adjust L401 (fig. 7-8) for an indication of 41.5 MHz on the frequency counter.

(5) Adjust the MHz control for an indication of 30 on the MHz portion of the frequency indicator.

(6) Adjust C403 for an indication of 70.5 MHz on the frequency counter.

(7) Repeat the procedures in (4) above at 01 on the frequency indicator and those in (6) above at 30 on the frequency indicator until the correct frequencies are obtained.

7-10. RF Unit Alignment (fig. 7-9)

a. Test Equipment Required.

(1) RF voltmeter.

(2) Signal generator.

(3) VTVM.

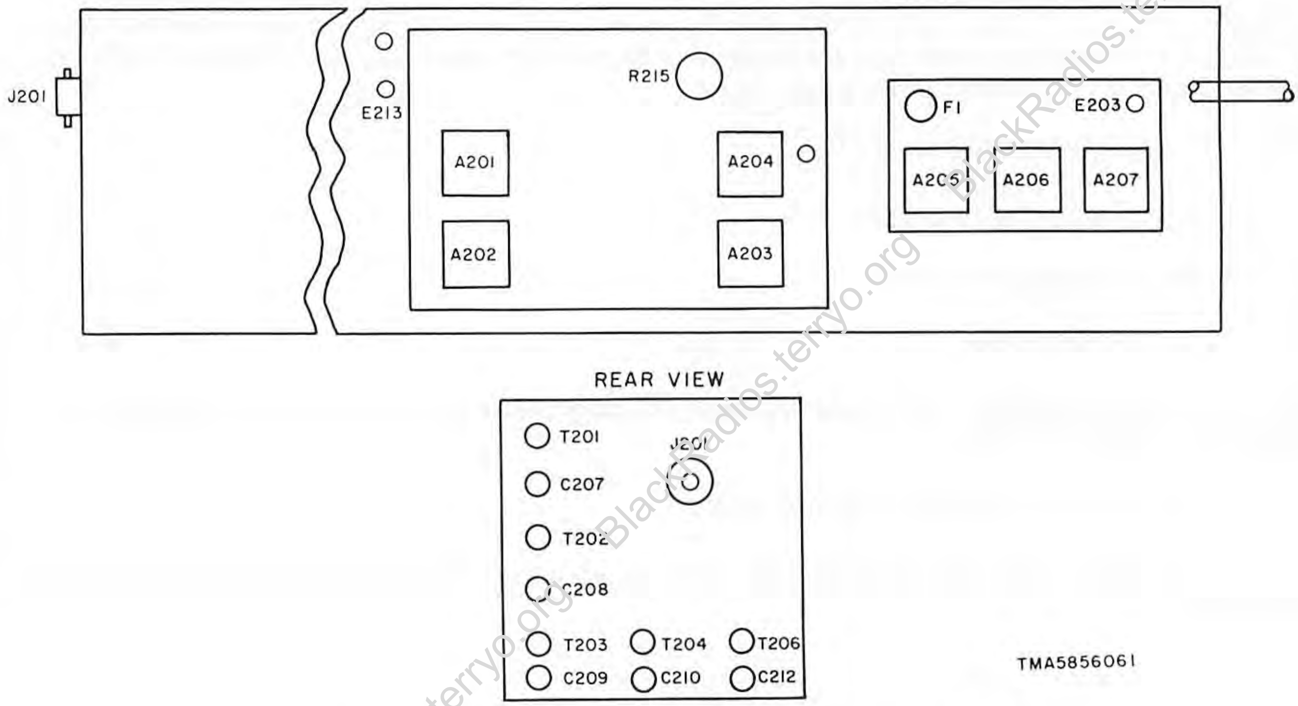


FIGURE 7-9 RF UNIT ALIGNMENT PARTS LOCATION

b. Control Settings. Make the following control settings before proceeding with the alignment of the RF UNIT:

(1) Set the function switch to MAN.

(2) Adjust the MHz control for 01 on the MHz frequency indicator.

(3) Set the RF RANGE switch to WB.

(4) Set the RF ATTEN control to MIN.

(5) Set the RF GAIN control to its maximum clockwise position.

c. Procedure.

(1) Remove the left side panel of receiver.

(2) Remove the RF UNIT cover.

(3) Remove the rear cover plate of RF UNIT (fig. 2-1).

(4) Connect the signal generator to J201 (fig. 7-9).

(5) Connect the RF voltmeter to E203.

(6) Connect the VTVM to E213. An indication of -4 volts DC should be obtained on the VTVM.

(7) Adjust the signal generator for a frequency of 37.5 MHz with an output of 10 millivolts.

(8) Adjust A205 and A207 for a minimum indication on the RF voltmeter.

(9) Adjust the signal generator for a frequency of 47.0 MHz, and adjust A206 for minimum on the RF voltmeter.

(10) Connect the RF voltmeter to E207.

(11) Adjust the signal generator for a frequency of 30 MHz.

(12) Adjust A201, A202, A203, and A204 for a maximum indication at 30 MHz on the RF voltmeter, the output should be down 40dB at 40 MHz.

(13) Tune the signal generator from 29.5 to 30.5 MHz, and check to see that the output indicated on the RF voltmeter does not vary more than 4 dB.

(14) Adjust the signal generator to a frequency of 5.5 MHz with an output of 3 millivolt. The indication on the RF voltmeter should be greater than 30 millivolts.

(15) Adjust the RF GAIN control for a reading of -2 volts DC on the VTVM at terminal E213 (AGC basis).

(16) Adjust R215 so that the indication on the RF voltmeter is 20 dB down from the maximum gain condition ((14) above).

(17) Set the RF RANGE switch to the 1-2 position.

(18) Readjust the RF GAIN control to its maximum clockwise position (-4 volts).

(19) Adjust the signal generator for a frequency of 850 KHz with an output of 10 millivolts.

(20) Check to see that the RF TUNE control is set to its maximum clockwise position.

(21) Remove the outer tuning slug from T201, and adjust the inner tuning slug to the first maximum indication on the RF voltmeter.

(22) Insert the outer tuning slug removed in (21) above, and adjust for a maximum indication on the RF voltmeter.

(23) Adjust the signal generator to a frequency of 2 MHz and adjust the RF TUNE control for a maximum indication on the RF voltmeter.

(24) Adjust C207 for a maximum indication on the RF voltmeter.

(25) Repeat the procedures in (17) through (24) above for the remaining frequencies by adjusting the corresponding tuning slugs and capacitors listed in (a) through (d) below, using the corresponding frequencies indicated:

(a) RF RANGE 2-4;

T202 at 1.45 MHz;

C208 at 4.0 MHz.

(b) RF RANGE 4-8;

T203 at 2.8 MHz;

C209 at 8.0 MHz.

(c) RF RANGE 8-16;

T204 at 6.5 MHz;

C210 at 16.0 MHz.

(d) RF RANGE 16-30;

T206 at 13.5 MHz;

C212 at 30.0 MHz.

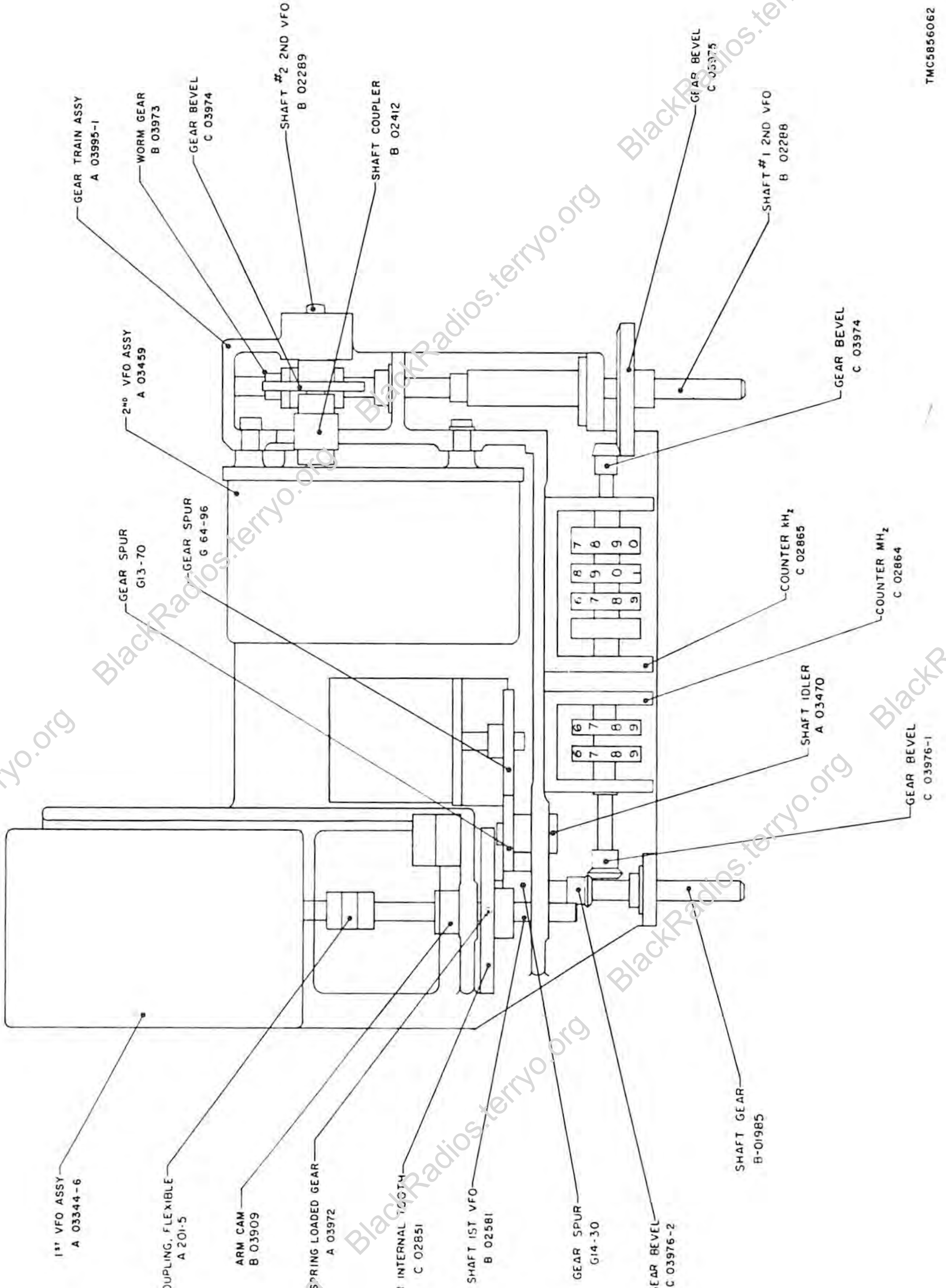


FIGURE 7-10 TUNING ASSEMBLY PARTS LOCATION

Section II. CIRCUIT DIAGRAMS

7-11. Introduction

This Chapter contains the diagrams required to support maintenance instructions presented in Chapter 5.

7-12. Index of Diagrams

The circuit diagrams within this chapter are arranged as follows:

7-11	R-1555/URR-62 interunit wiring diagram (2 sheets).
7-12	IF ASSEMBLY interunit wiring diagram (series 3000).
7-13	RF UNIT schematic (series 200).
7-14	1st MIXER and 40-MHz Filter schematic (series 300).
7-15	1st VFO schematic (series 400).
7-16	1 MHz AMPL and OSCILLATOR-CALIBRATOR schematic (series 600).
7-17	37.5 MHz GENERATOR schematic (series 700).
7-18	37.5 MHz FILTER schematic (series 800).
7-19	2nd MIXER and 37.5 MHz AMPL schematic (series 500).
7-20	2nd VFO schematic (series 1000).
7-21	3rd MIXER schematic (series 900).
7-22	1st 1.6 MHz IF AMPL schematic (series 1600).
7-23	2nd, 3rd, and 4th 1.6 MHz IF AMPL schematic (series 1700).
7-24	AGC Circuits schematic (series 1400).
7-25	DETECTOR BOARD schematic (series 1200).
7-26	AUDIO INPUT and METER ZERO schematic (series 1900).
7-27	AUDIO AMPLIFIER, schematic (series 1500).
7-28	FM INSERTION OSCILLATOR schematic (series 3100).
7-29	FM DISCRIMINATOR schematic (series 2900).
7-30	IF CONVERTER, schematic (series 1800).
7-31	AC Power Unit MS6302 schematic (series 1300).

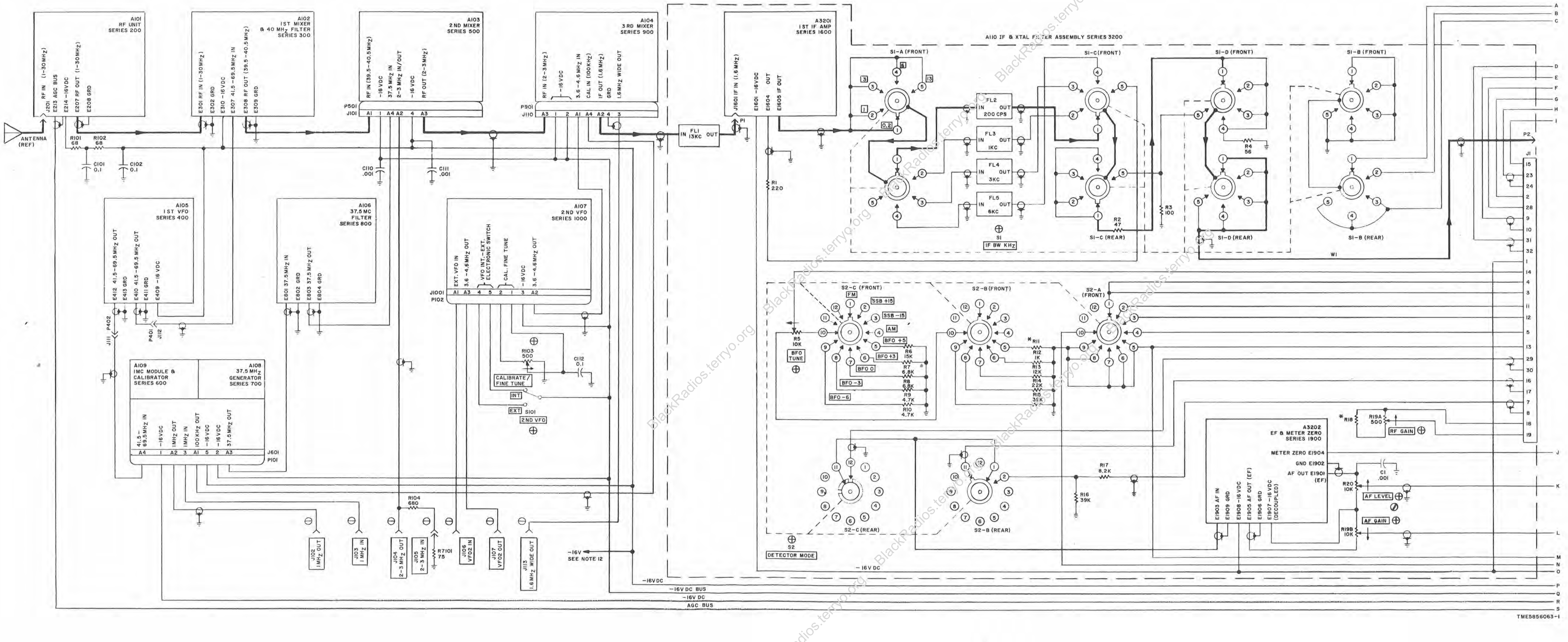
7-32 Antenna Filter Control Diagram.

7-33 Line Filter Schematic (series 3400).

Notes: 1. The unit numbering method used in the R-1555/URR-62 is not in accordance with American Standard Electrical and Electronics Reference Designation Y32.16-1965. A series number has been assigned to the main chassis and each subchassis. These numbers are in hundreds series and are used to prefix the individual number of each subchassis. Standard class designation letters are used to identify the item name. For example, RF unit (series 200) resistors are identified as R201, R202, etc.

2. Note that some components mounted on the main chassis are part of other assemblies. For example, some of the front panel controls are part of the IF and crystal filter assembly (series 3200).

3. Each module or subassembly within each series subchassis has also been assigned a reference prefix. For example, A410 is a subassembly in the 400 series subchassis; component parts are identified as R411, R412, C411, C412, etc. For some subchassis series, part designations are assigned consecutively within the series rather than within each subassembly of the series. Reference designation assignment is identified on each circuit diagram. (Refer to the IPB (T.O. 31R2-2URR62-4) for complete reference designation listing.) Some circuit diagrams contain complete reference designations adjacent to part symbols; others contain abbreviated designations. Where designations are abbreviated, it will be so annoted on the circuit diagram.



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
5. HEAVY LINE SIGNIFIES SIGNAL PATH
6. RESISTORS MARKED THUS * ARE CHOSEN ON TEST
7. SHORT BETWEEN 2 & 3 MUST BE IN POSITION FOR CORRECT OPERATION OF RECEIVER
8. SWITCH ACTIVATED BY MH_Z DRIVE WHEN MH_Z IS TUNED TO 00 MH_Z
9. ⊕ INDICATES FRONT PANEL LOCATION
10. ⊖ INDICATES REAR PANEL LOCATION
11. ⊘ INDICATES SCREWDRIVER ADJUSTMENT
12. TO 30 POSITION SWITCH SELECTION A COMMON REF
13. ▭ DENOTES EQUIPMENT MARKING
14. COMPONENT-PART REFERENCE DESIGNATIONS WITHIN SERIES 3200 ABBREVIATED. COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (3200) EXAMPLE: S1 IS S3201; FL4 IS FL3204; R18 IS R3218; ETC.

FIGURE 7-11 R-1555/URR-62 INTERUNIT WIRING DIAGRAM (SHEET 1 OF 2)

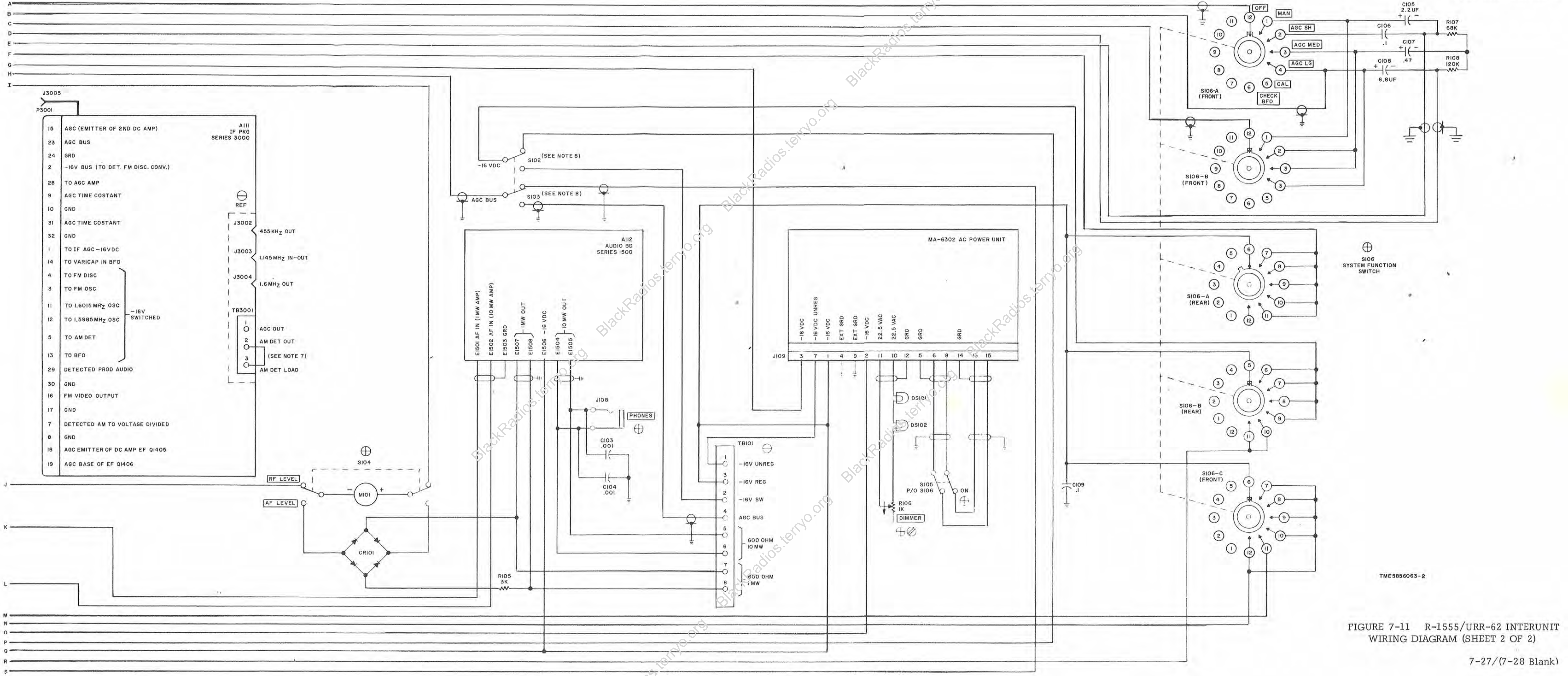
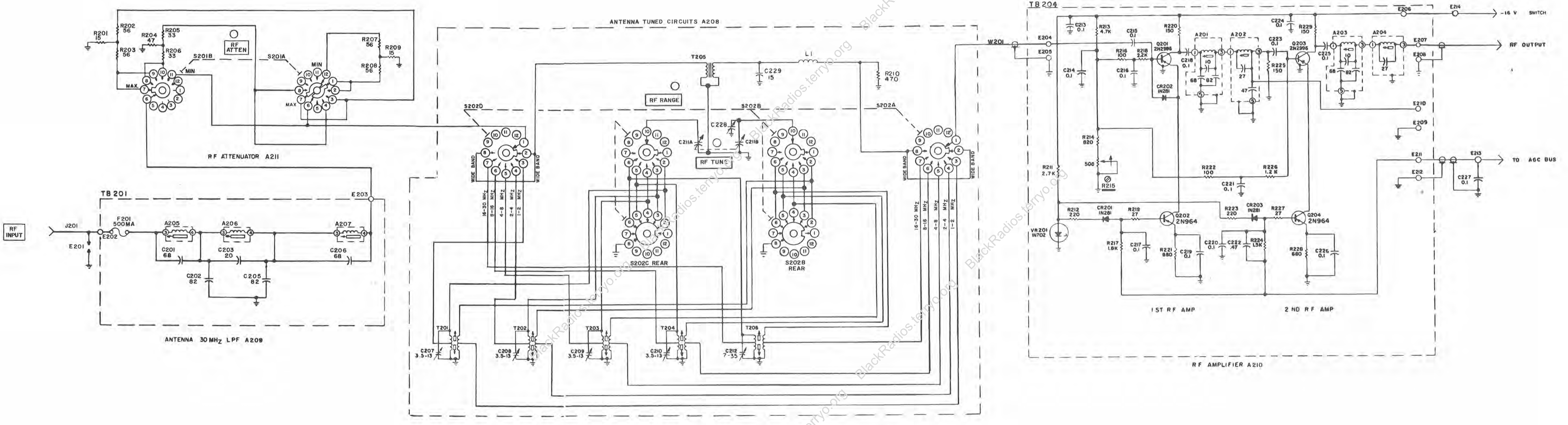


FIGURE 7-11 R-1555/URR-62 INTERUNIT WIRING DIAGRAM (SHEET 2 OF 2)

FIGURE 7-12 IF ASSEMBLY INTERUNIT WIRING DIAGRAM (SERIES 3000)



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UNLESS OTHERWISE NOTED:

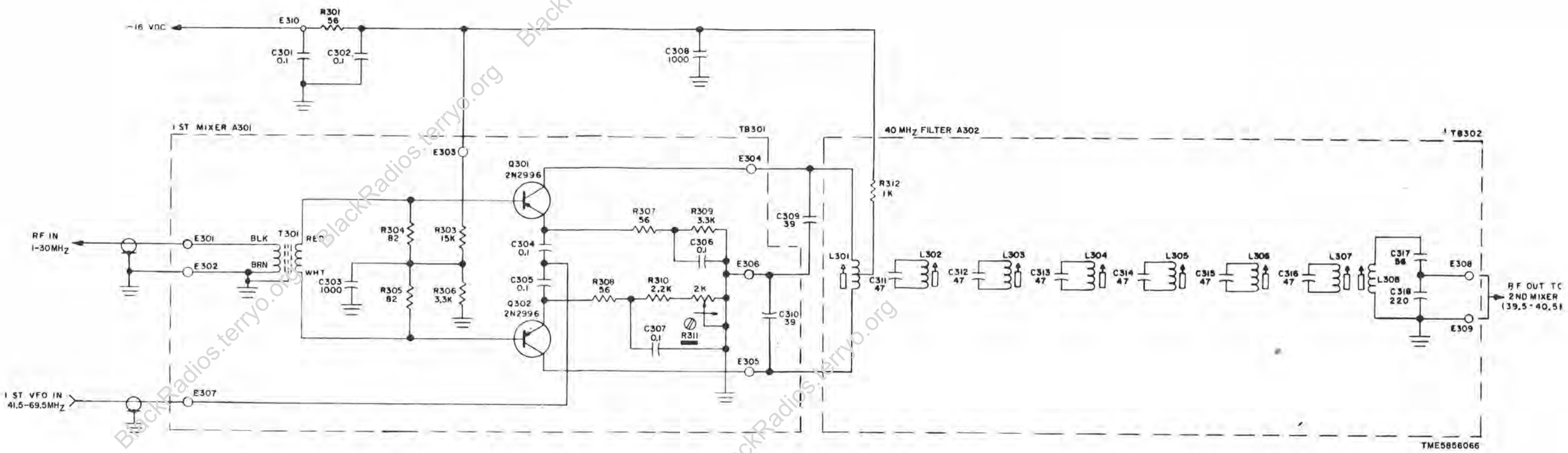
1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
5. ⊘ INDICATES SCREWDRIVER ADJUSTMENT
6. ▭ DENOTES EQUIPMENT MARKING
7. ○ INDICATES FRONT PANEL CONTROL

FIGURE 7-13 RF UNIT SCHEMATIC (SERIES 200)

	E	B	C
Q1	-1.85	-11.3	-2.13
Q2	-1.85	-11.3	-2.13

UNLESS OTHERWISE INDICATED ALL VOLTAGE READINGS WERE TAKEN WITH NO SIGNAL INPUT AND SWITCH AND CONTROL SETTINGS AS FOLLOWS:

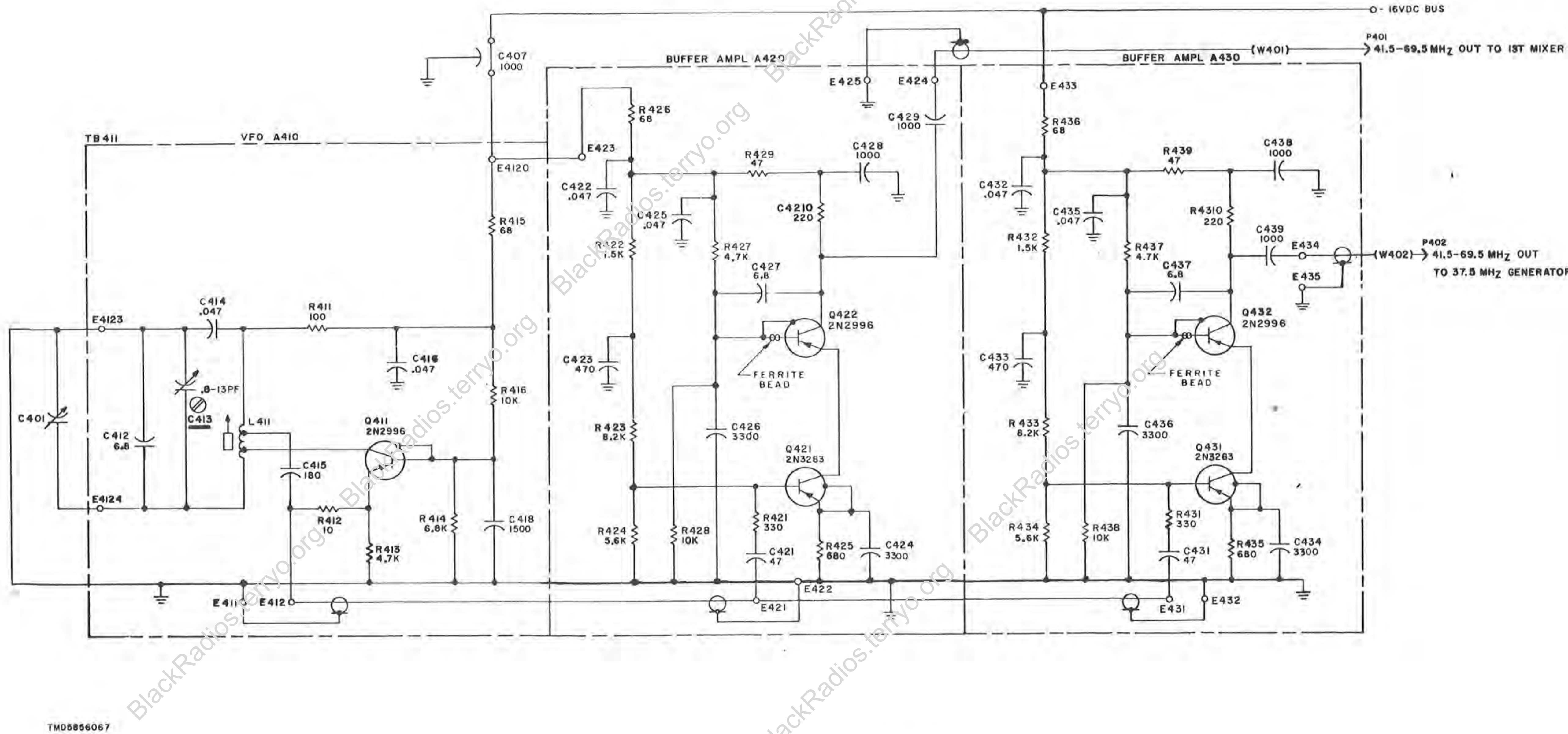
FUNCTION SWITCH A.G.C. - MED
2ND V.F.O. EXT. - INT. SWITCH - INT.
DET. B.F.O. MODE SWITCH - AM
R.F. GAIN CONTROL - MINIMUM
R.F. ATTENUATOR - MAXIMUM ATTENUATION



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
   INDICATED SCREWDRIVER ADJUSTMENT

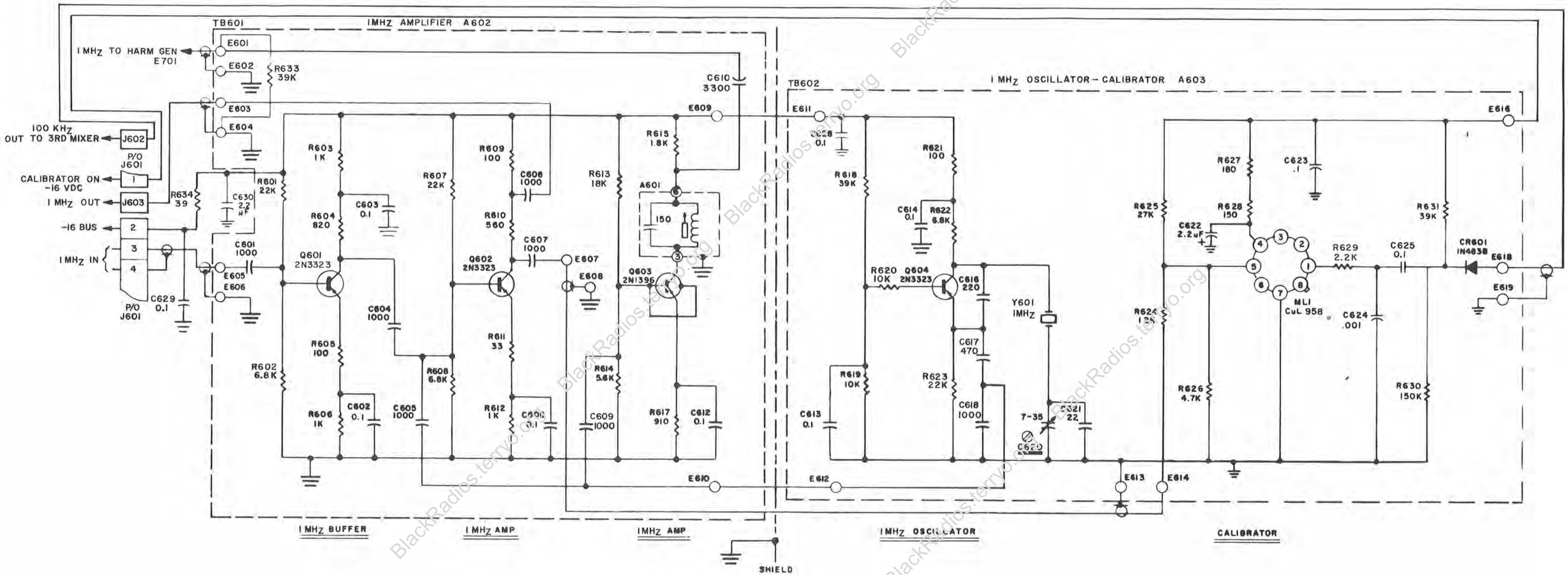
FIGURE 7-14 1ST MIXER AND 40-MHZ FILTER SCHEMATIC (SERIES 300)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. ⊘ INDICATES SCREWDRIVER ADJUSTMENT

FIGURE 7-15 1ST VFO SCHEMATIC (SERIES 400)



UNLESS OTHERWISE NOTED:

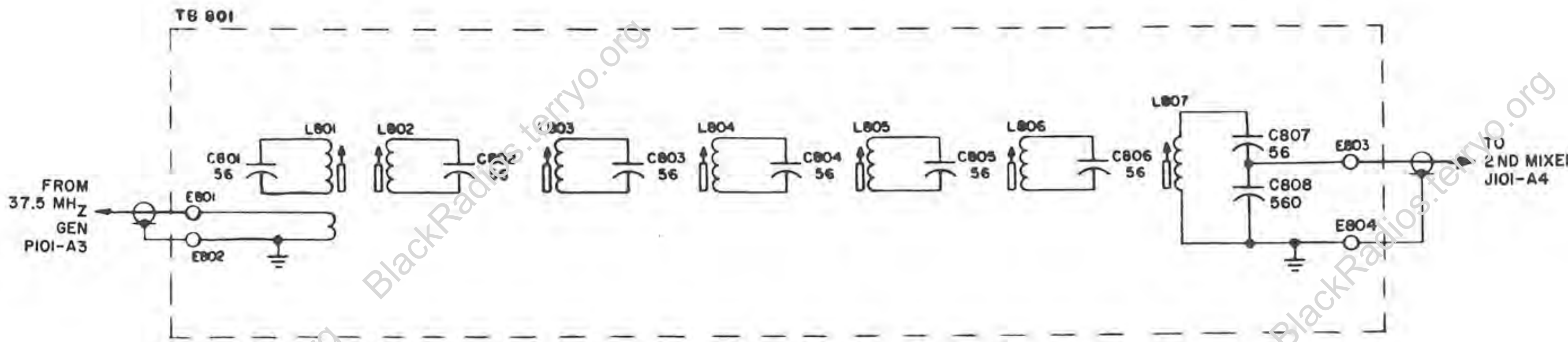
1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. ⊘ INDICATES SCREWDRIVER ADJUSTMENT

FIGURE 7-16 1ST MHZ AMPL AND OSCILLATOR CALIBRATOR SCHEMATIC (SERIES 600)

UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5. ALL COMPONENTS INSIDE BROKEN LINES ARE MOUNTED ON PC BOARD

FIGURE 7-17 37.5 MHZ GENERATOR SCHEMATIC (SERIES 700)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.

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FIGURE 7-18 37.5 MHZ FILTER SCHEMATIC (SERIES 800)

	E	B	C
Q1	-0.97	-1.31	-4.01
Q2	-4.01	-4.28	-11.0
Q3	-4.08*	-4.39	-15.8

*TP 501

UNLESS OTHERWISE INDICATED ALL VOLTAGE READINGS WERE TAKEN WITH NO SIGNAL INPUT AND SWITCH AND CONTROL SETTINGS AS FOLLOWS:

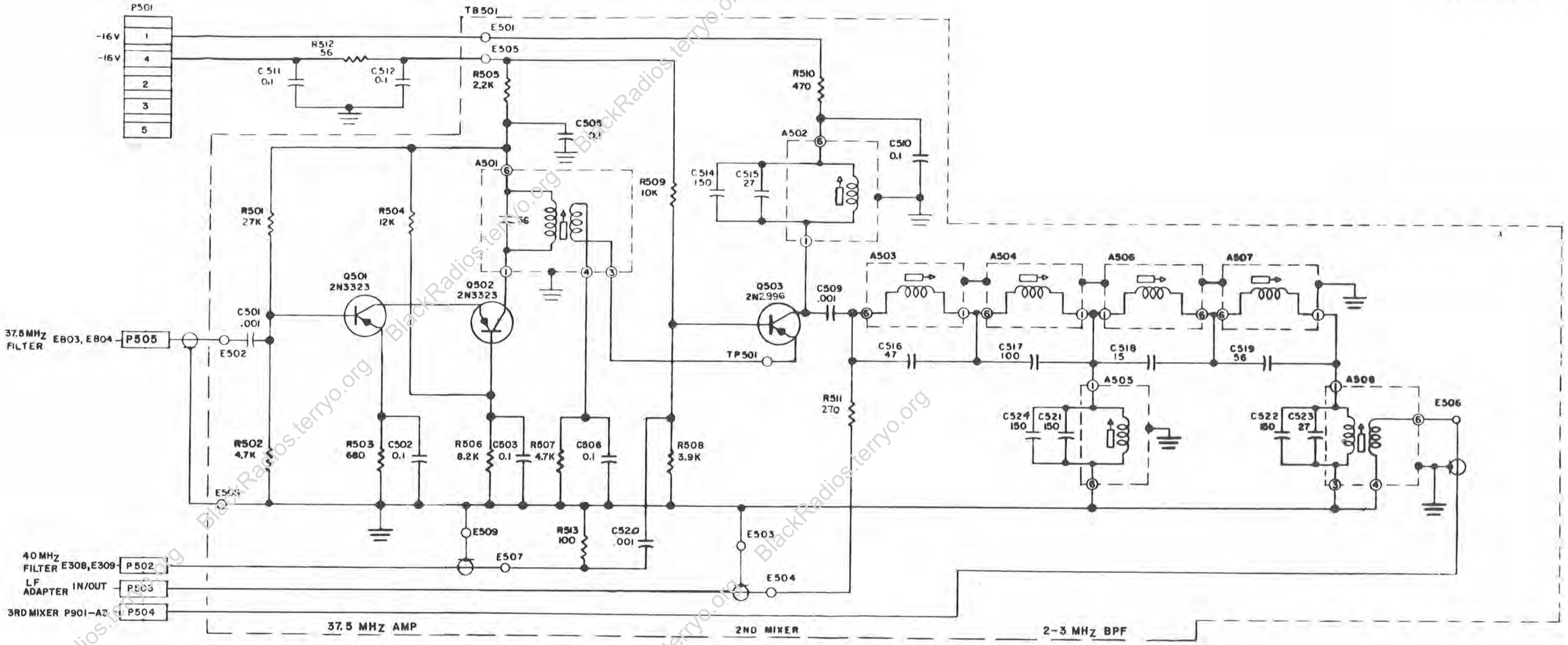
FUNCTION SWITCH A.G.C. - MED

2ND V.F.O. EXT. - INT. SWITCH - INT.

DET. B.F.O. MODE SWITCH - AM

R.F. GAIN CONTROL - MINIMUM

R.F. ATTENUATOR - MAXIMUM ATTENUATION



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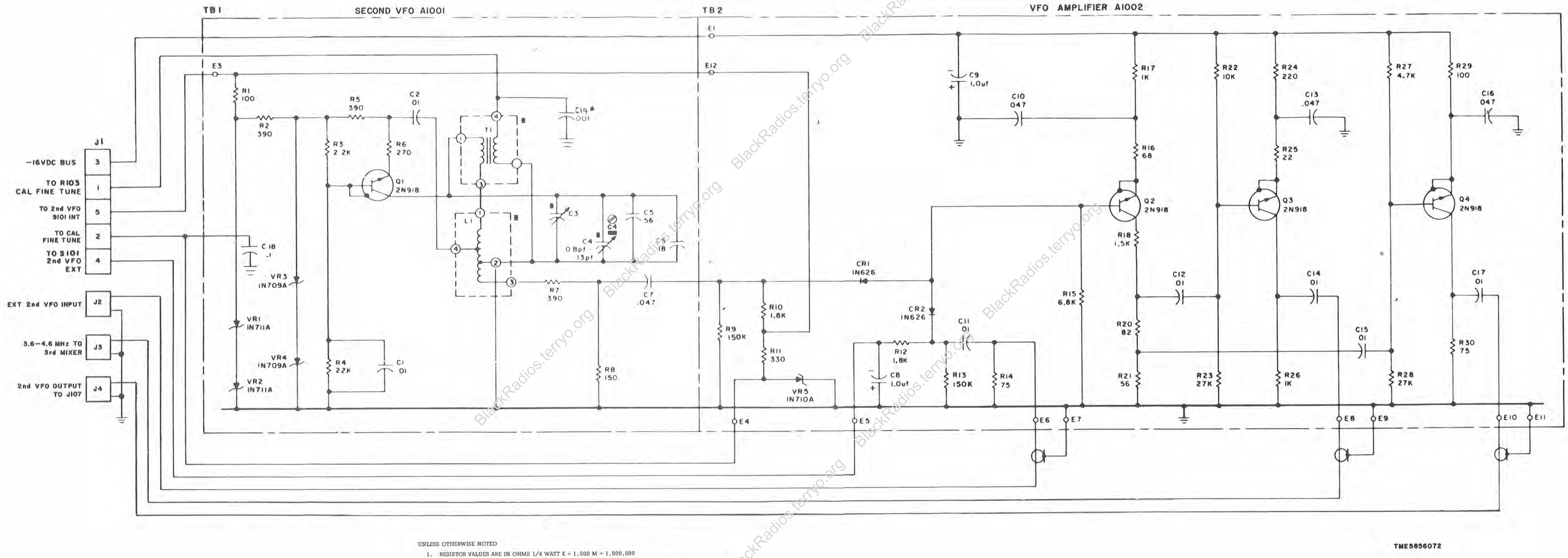
UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.

FIGURE 7-19 2ND MIXER AND 37.5 MHZ AMPL SCHEMATIC (SERIES 500)



UNLESS OTHERWISE NOTED

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED FOR COMPLETE DESIGNATION COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (1000) EXAMPLE: Q1 IS Q1001, R1 IS R1001, Q4 IS Q1004, C17 IS C1017

*PRESENCE OF ASTERISK INDICATES COMPONENT IS NOT MOUNTED ON THE BOARD

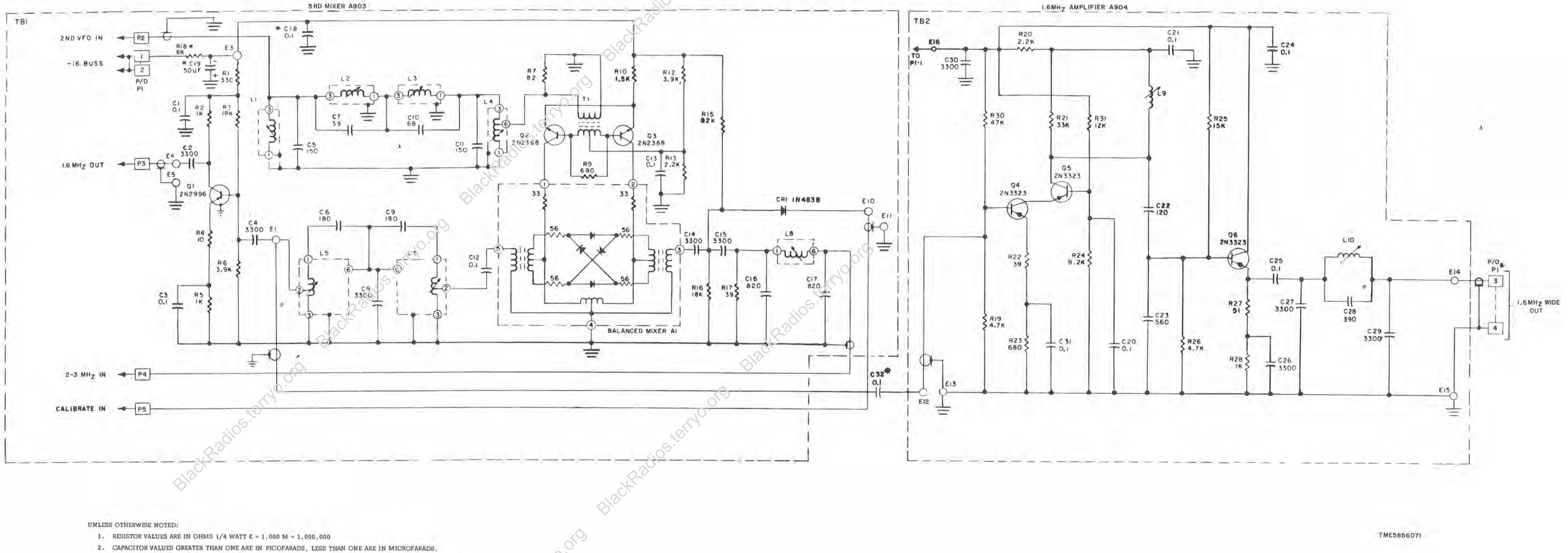
FIGURE 7-20 2ND VFO SCHEMATIC (SERIES 1000)

A903

	E	B	C
Q1	-2.08	-12.5	-2.40
Q2	-6.02	-5.02	-0.09
Q3	-6.02	-5.02	-0.10

UNLESS OTHERWISE INDICATED ALL VOLTAGE READINGS WERE TAKEN WITH NO SIGNAL INPUT AND SWITCH AND CONTROL SETTINGS AS FOLLOWS:

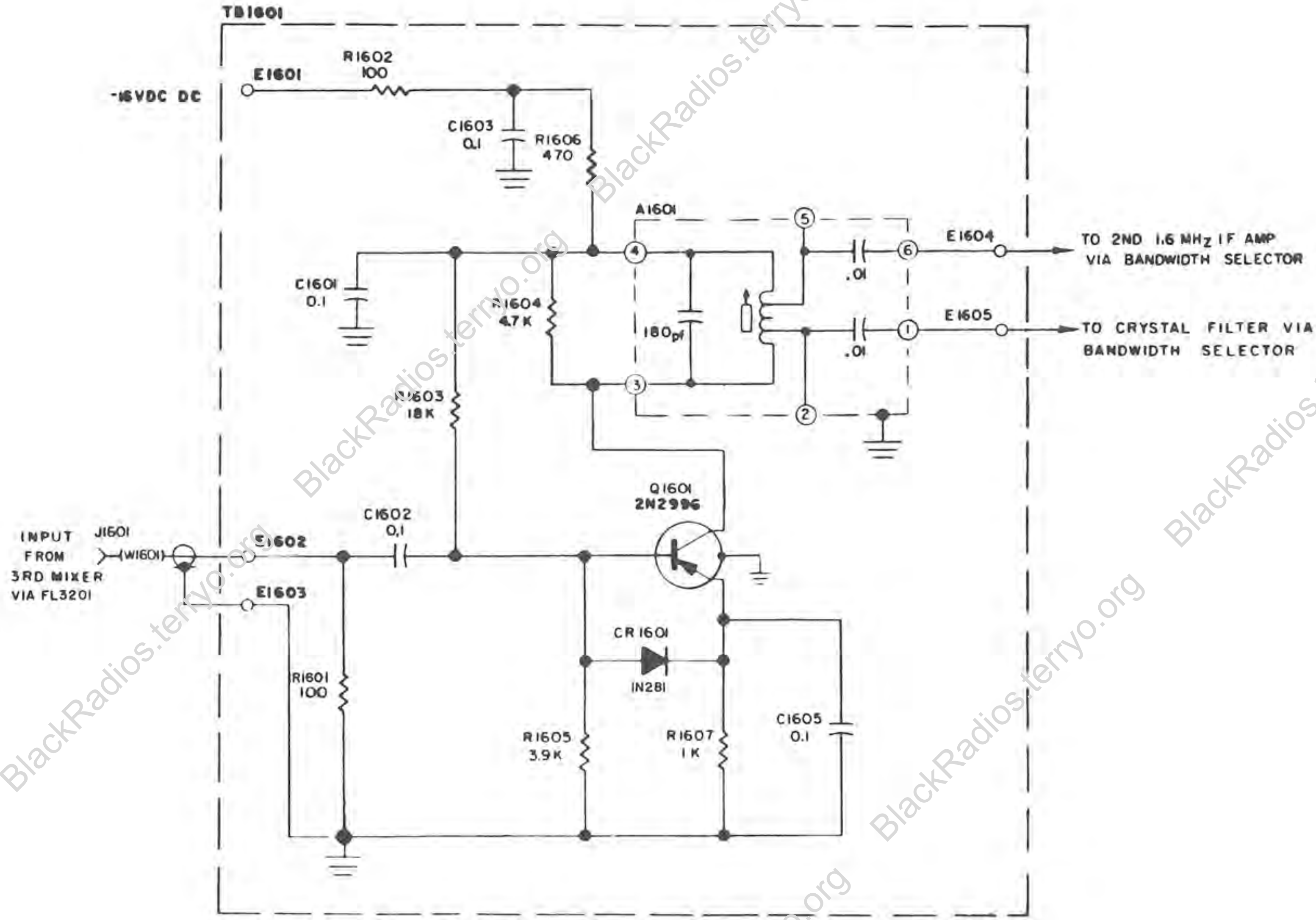
FUNCTION SWITCH A.G.C. - MED
2ND V.F.O. EXT. - INT. SWITCH - INT.
DET. B.F.O. MODE SWITCH - AM
R.F. GAIN CONTROL - MINIMUM
R.F. ATTENUATOR - MAXIMUM ATTENUATION



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED FOR COMPLETE DESIGNATION COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (900) EXAMPLE: Q1 IS Q901, R4 IS R904 L8 IS L908, C27 IS C927, ETC.
5. ALL COMPONENT ARE MOUNTED ON TB1 & TB2 EXCEPT THOSE MARKED THUS*

FIGURE 7-21 3RD MIXER SCHEMATIC (SERIES 900)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.

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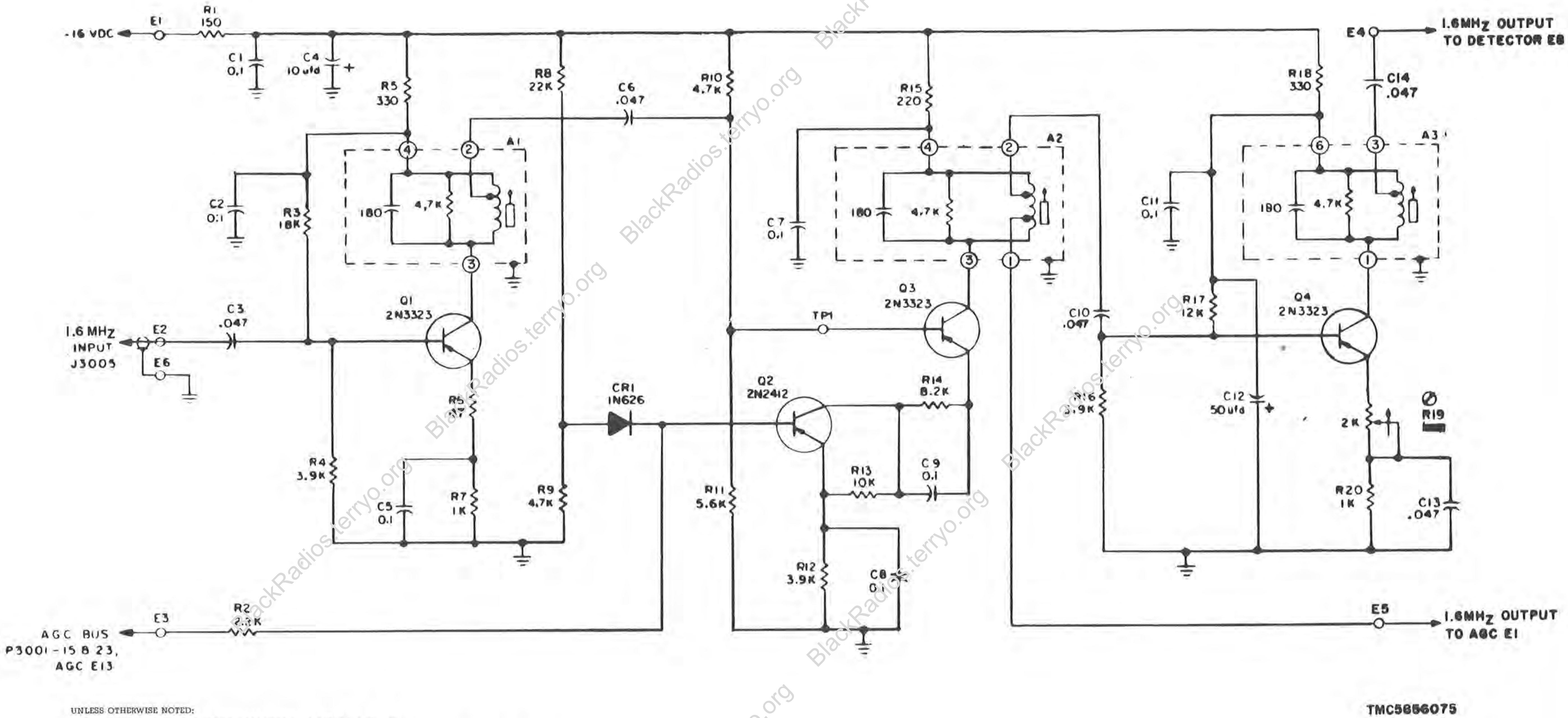
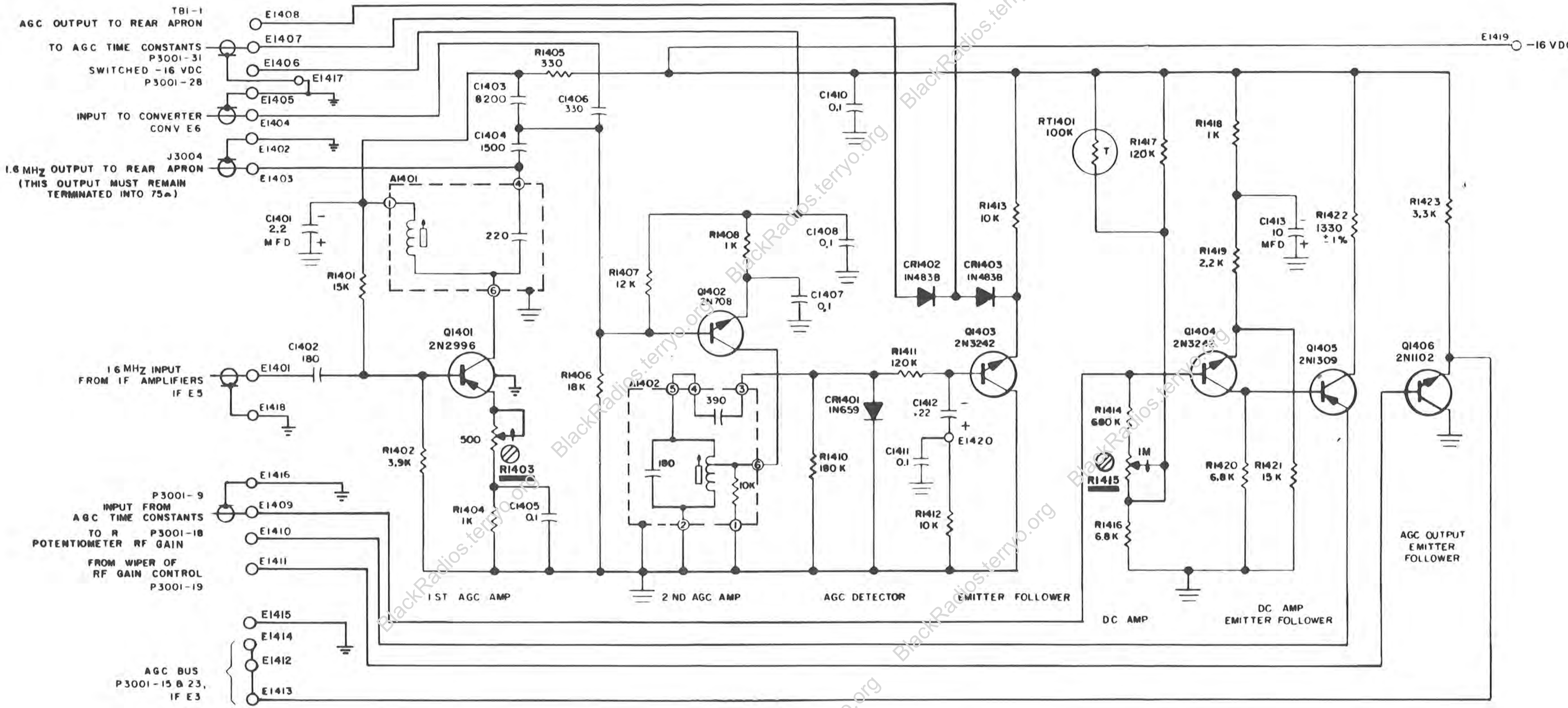
FIGURE 7-22 1ST 1.6-MHZ IF AMPL SCHEMATIC (SERIES 1600)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5. ALL COMPONENTS ARE ASSEMBLED ON PC BOARD NO. TB1
6. COMPONENT PART REFERENCE DESIGNATIONS ARE ABBREVIATED, FOR COMPLETE DESIGNATION COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (1700). EXAMPLE: Q1 IS Q1701; R6 IS R1706; C13 IS C1713, ETC.

FIGURE 7-23 2ND, 3RD, AND 4TH 1.6 MHZ IF AMPL SCHEMATIC (SERIES 1700)



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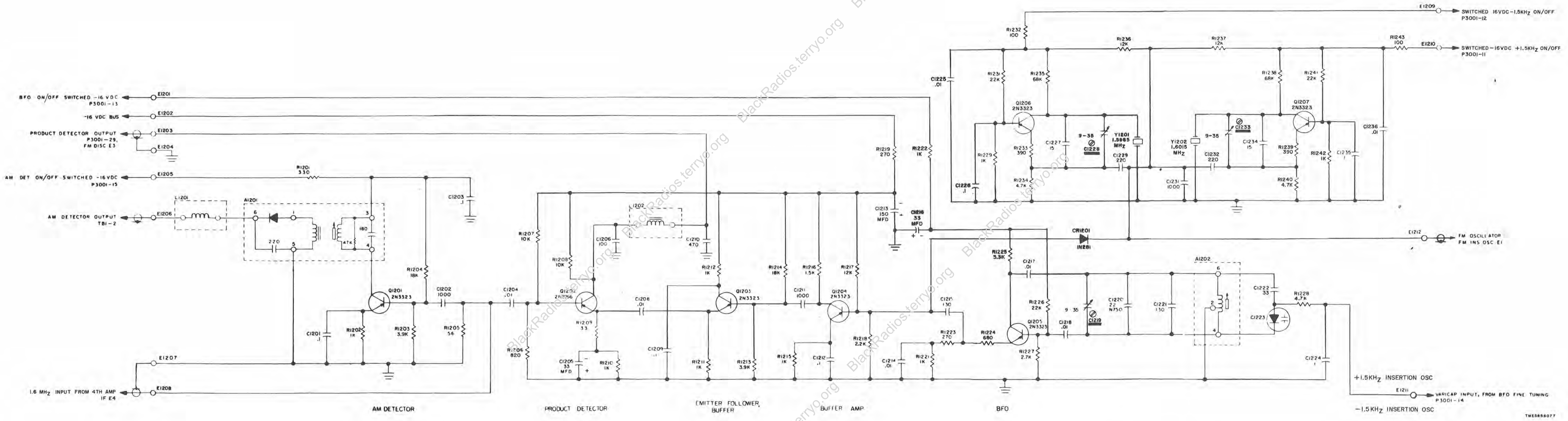
UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
   INDICATES SCREWDRIVER ADJUSTMENT

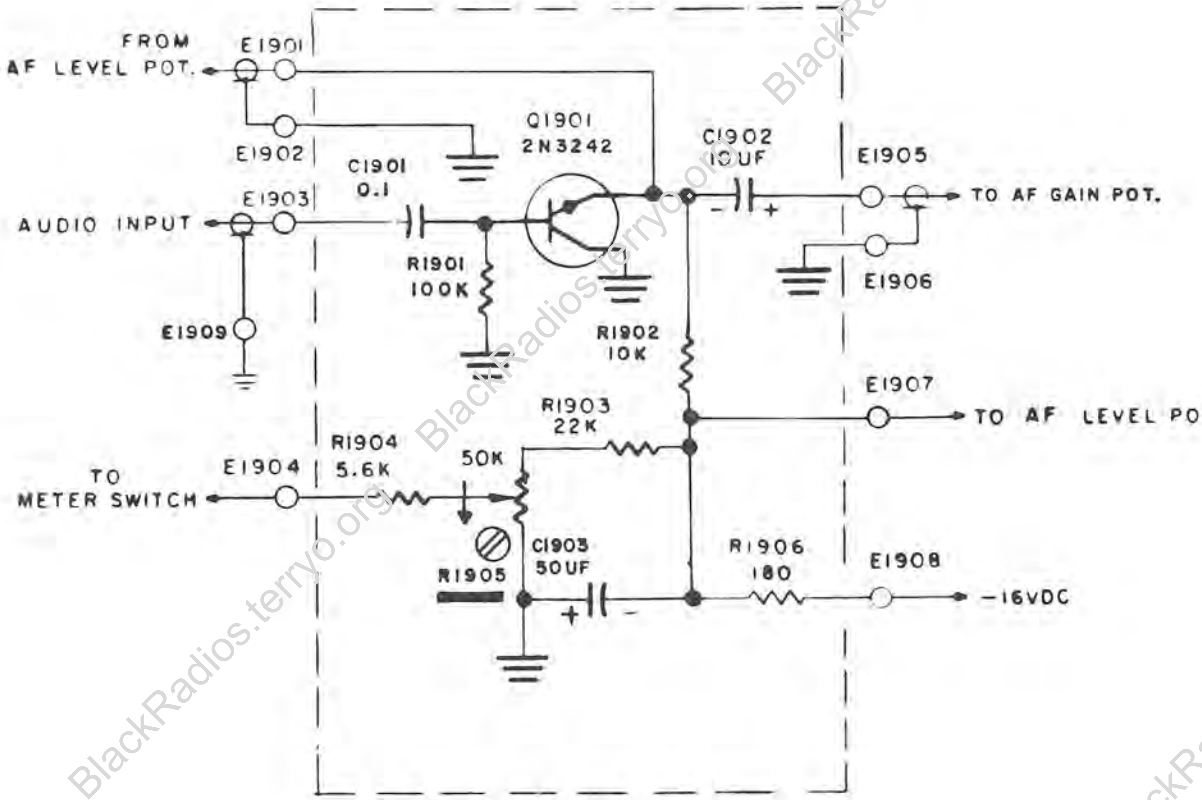
FIGURE 7-24 AGC CIRCUITS SCHEMATIC (SERIES 1400)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. ⊘ INDICATES SCREWDRIVER ADJUSTMENT

FIGURE 7-25 DETECTOR BOARD SCHEMATIC (SERIES 1200)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT

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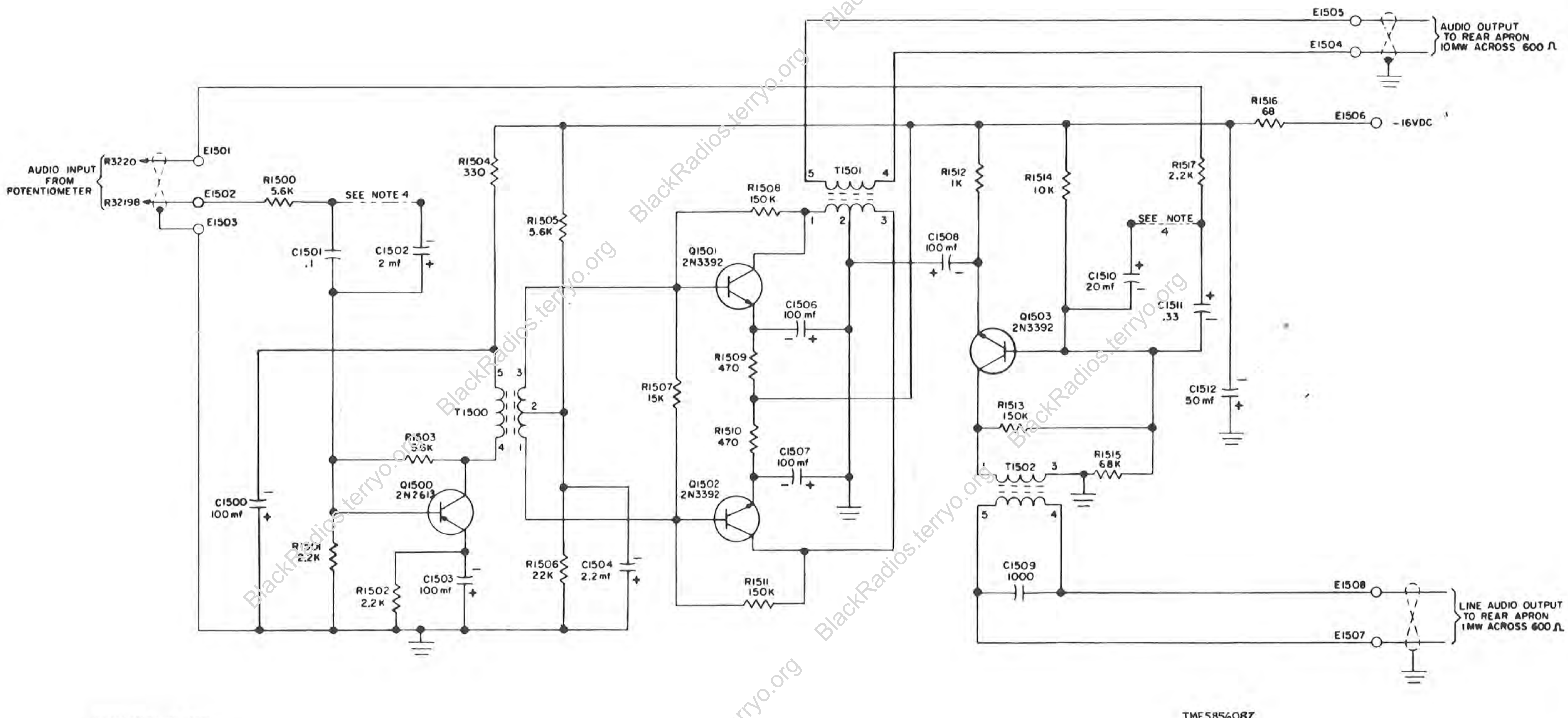
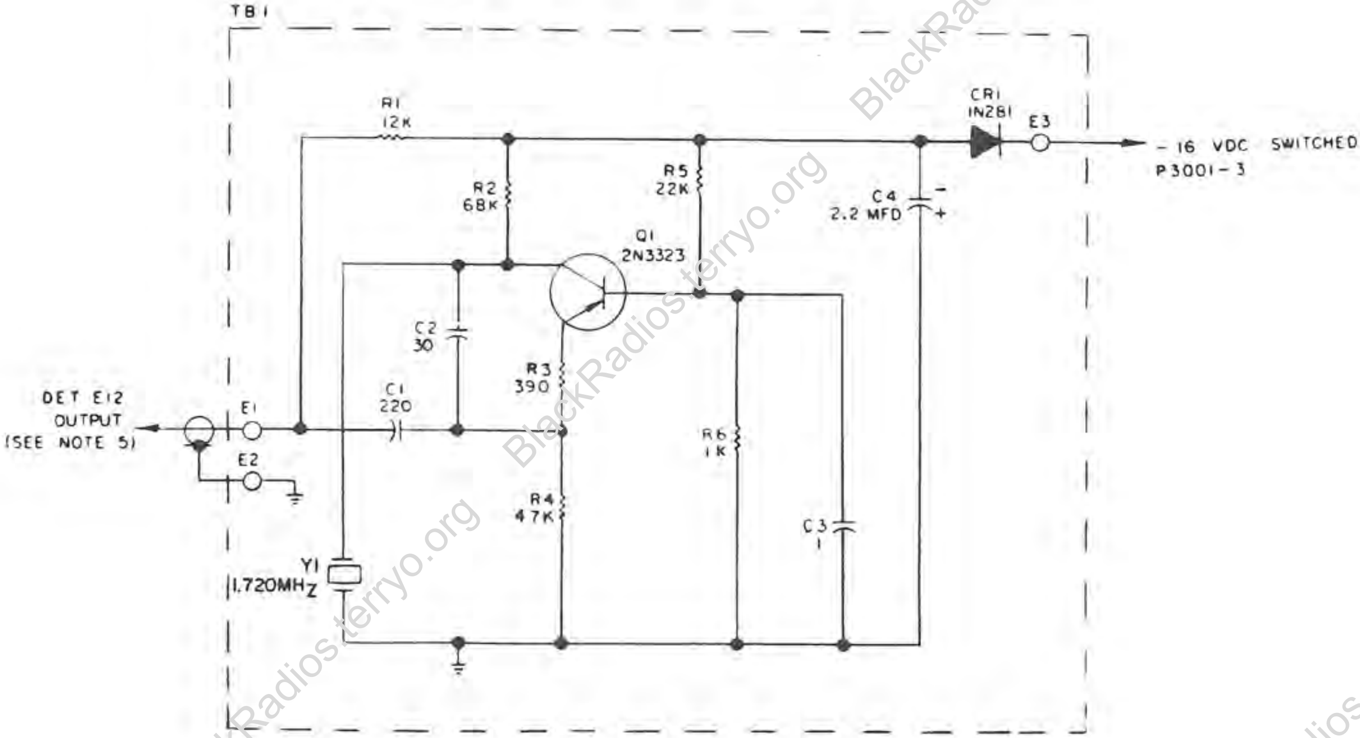
FIGURE 7-26 AUDIO INPUT AND METER ZERO SCHEMATIC (SERIES 1900)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. LINK CONNECTED GIVES AUDIO RESPONSE DOWN TO 50 H_Z

FIGURE 7-27 AUDIO AMPLIFIER SCHEMATIC (SERIES 1500)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED; COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (3100) EXAMPLE: Q1 IS Q3101; R2 IS R3102; C3 IS C3103, ETC.
5. THIS CIRCUIT WILL NOT OSCILLATE PROPERLY UNTIL LOADED WITH 1000PF CAPACITOR

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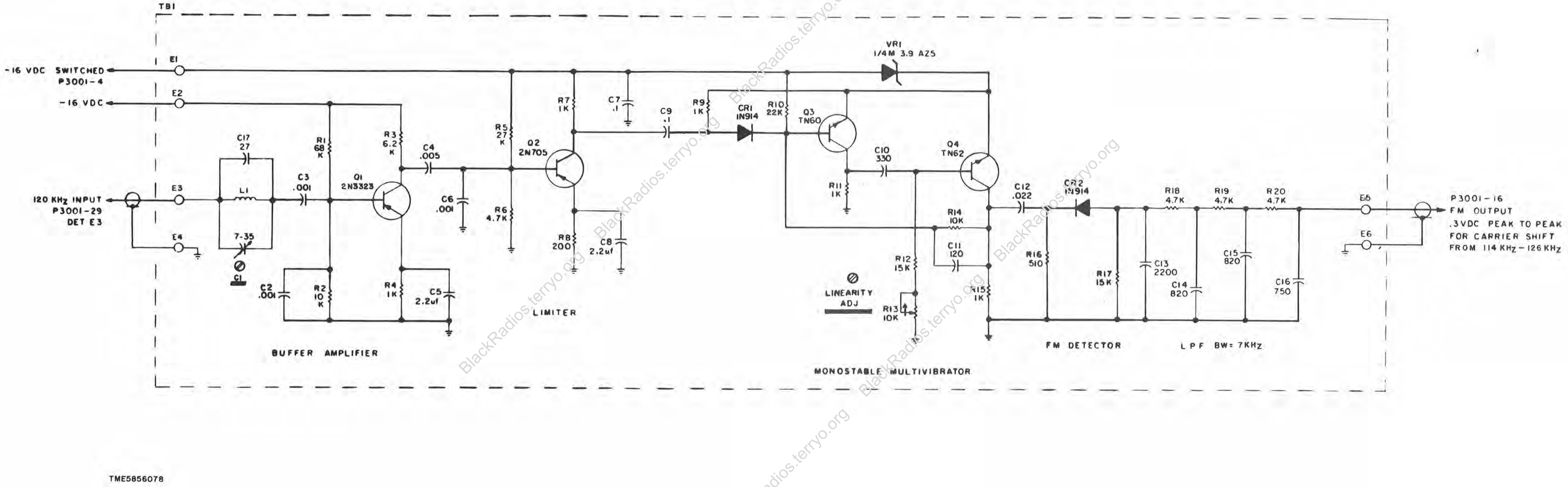
FIGURE 7-28 FM INSERTION OSCILLATOR SCHEMATIC (SERIES 3100)

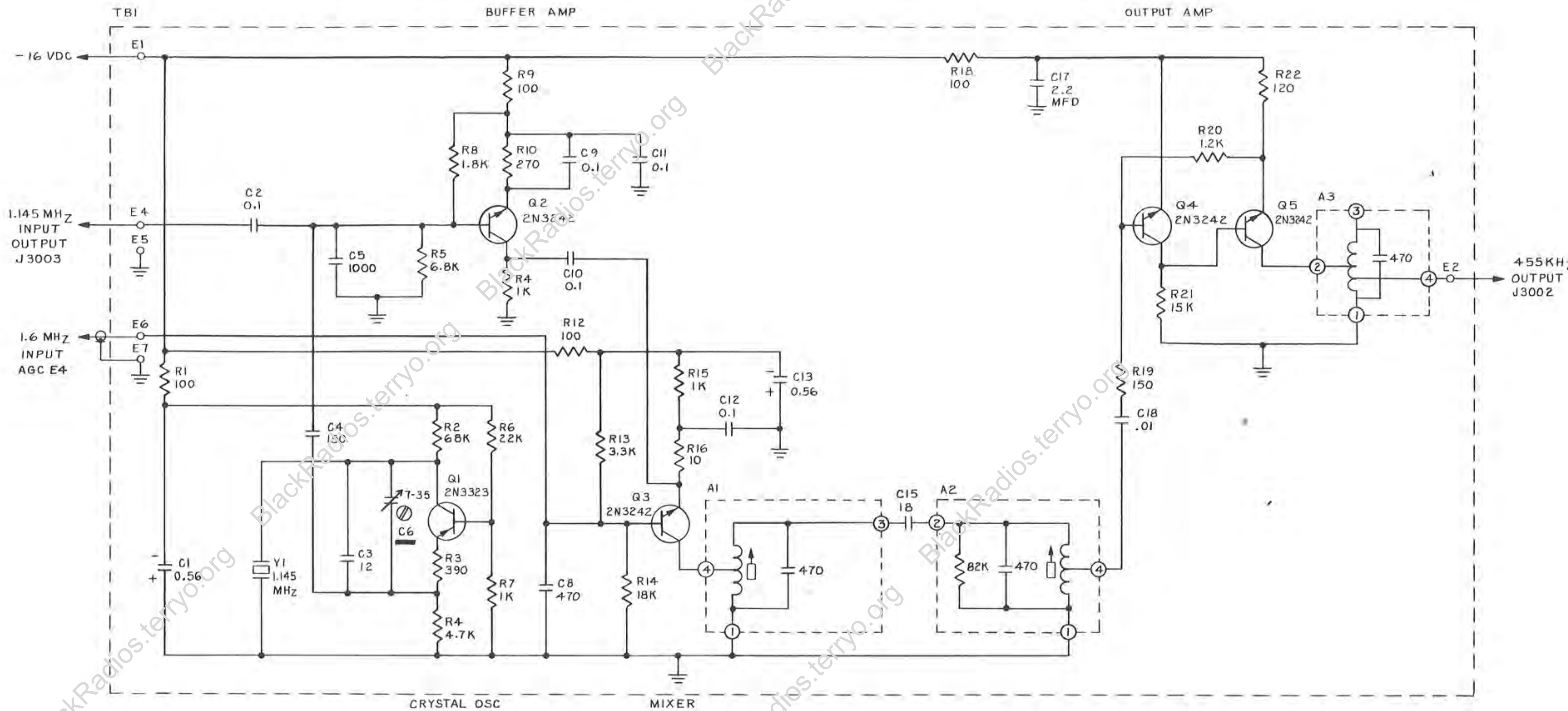


UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION

   ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED; COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (2900). EXAMPLE: Q1 IS Q2901; R3 IS R2903; C12 IS C2912; ETC.

FIGURE 7-29 FM DISCRIMINATOR SCHEMATIC (SERIES 2900)



UNLESS OTHERWISE NOTED:

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES, LESS THAN ONE ARE IN MILLIHENRIES.
4. ⊘ INDICATES SCREWDRIVER ADJUSTMENT.
5. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED. COMBINE COMPONENT PART DESIGNATION WITH SERIES NO. (1800). EXAMPLE: Q1 IS Q1801, R5 IS R1805, C15 IS C1815 ETC.

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FIGURE 7-30 IF CONVERTER SCHEMATIC (SERIES 1800)

	E	B	C
Q1	-26.6	-26.1	-16.5
Q2	-16.1	-16.5	-27.3
Q3	5.98	-6.60	-16.5
Q4	-16.1	-16.3	-27.3

UNLESS OTHERWISE INDICATED ALL VOLTAGE READINGS WERE TAKEN WITH NO SIGNAL INPUT AND SWITCH AND CONTROL SETTINGS AS FOLLOWS:

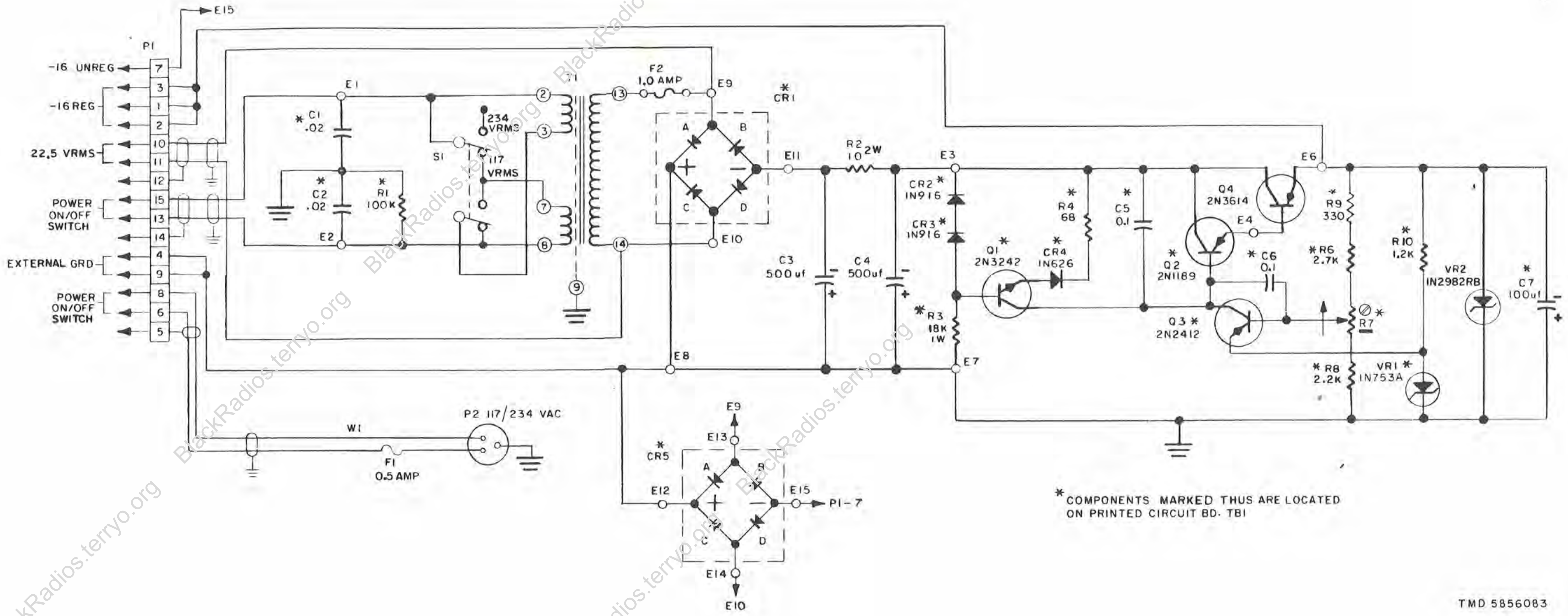
FUNCTION SWITCH A.G.C. - MED

2ND V.F.O. EXT. - INT. SWITCH - INT.

DET. B.F.O. MODE SWITCH - AM

R.F. GAIN CONTROL - MINIMUM

R.F. ATTENUATOR - MAXIMUM ATTENUATION



UNLESS OTHERWISE NOTED;

1. RESISTOR VALUES ARE IN OHMS 1/4 WATT K = 1,000 M = 1,000,000
2. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS, LESS THAN ONE ARE IN MICROFARADS.
3. INDUCTANCE VALUES GREATER THAN ONE ARE IN MICROHENRIES. LESS THAN ONE ARE IN MILLIHENRIES.
4. PRESENCE OF ARROW INDICATES CLOCKWISE ROTATION

   ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED COMBINE COMPONENT-PART DESIGNATIONS WITH SERIES NO. (1300). EXAMPLE: Q1 IS Q1301; R10 IS R1310 C7 IS C1307; ETC.

FIGURE 7-31 AC POWER UNIT MA6302 SCHEMATIC (SERIES 1300)

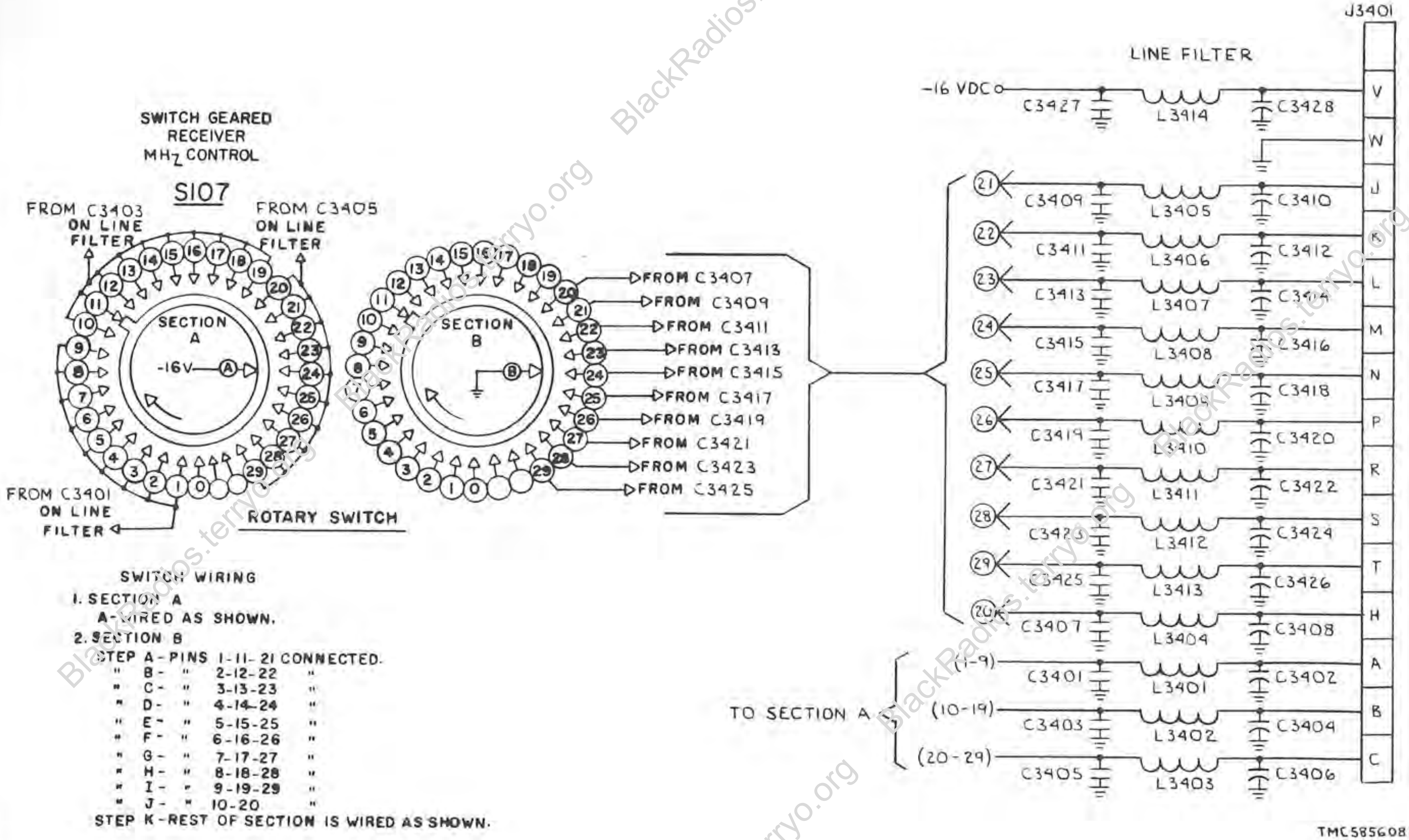
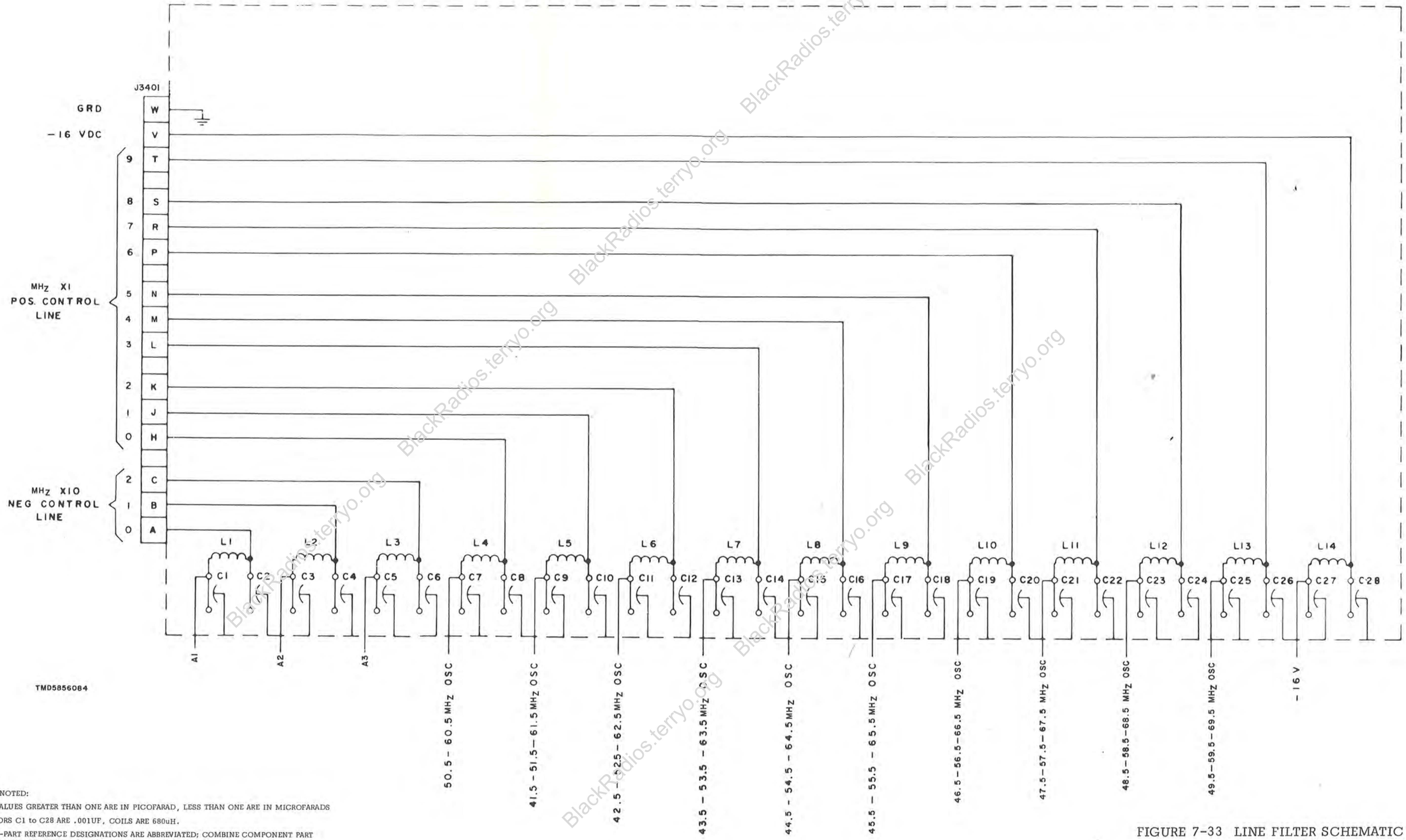


FIGURE 7-32 ANTENNA FILTER CONTROL DIAGRAM



UNLESS OTHERWISE NOTED:

1. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARAD, LESS THAN ONE ARE IN MICROFARADS
2. ALL CAPACITORS C1 to C28 ARE .001UF, COILS ARE 680uH.
3. COMPONENT-PART REFERENCE DESIGNATIONS ARE ABBREVIATED; COMBINE COMPONENT PART DESIGNATION WITH SERIES NO. (3400). EXAMPLE: L1 IS L3401; C12 IS C3412; ETC.

FIGURE 7-33 LINE FILTER SCHEMATIC
(SERIES 3400)

ALPHABETICAL INDEX

ALPHABETICAL INDEX (cont)

ALPHABETICAL INDEX (cont)

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