

FOR TYPE HH-11 TUNING HEAD

WATKINS—JOHNSON COMPANY 700 Quince Orchard Road Gaithersburg, Maryland 20760

WARNING

The receiver used in conjunction with this tuning head employs voltages which are dangerous and may be fatal if contacted. Exercise caution when working on the receiver with any of the protective covers removed.

ADDENDA HH-11 AND HH-11-1

The following changes should be incorporated into the Instruction Manual for the HH-11 and HH-11-1 Tuning Heads.

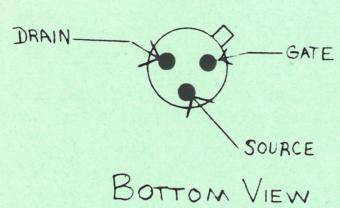
- 1. Section IV Maintenance
 - A. Page 4-6, Paragraph 4.5.4.1 Change, in step (2) reference designation A4A3C3 to: A4A2C3.
- 2. Section V Replacement Parts List
 - A. Page 5-17, Paragraph 5.4.3; Type 79844-9 Shaping Amplifier Change C2 to: 1000 pF, 10%, 200V; Part Number CK05BX102K; Mfr. Code 81349; Recommended Vendor 56289.
 - B. Page 5-17 and 5-18, Paragraph 5.4.3; Type 79844-9 Shaping Amplifier.
 Add an asterisk to the following: R4, R6, R7, R15, R24, R25, R26, R28, R29, R30, R31, R33, R34, R35, R36, R38, R39, R40, R41, R43, R44, R45, R46, and R48. Add the following supporting note on Page 5-18. * Nominal value; final value factory selected.

12 November 1975 DLM:dwf

- C. Page 5-14, Paragraph 5.4.2; Type 71334 RF Tuner (2-30 MHz). Change T3 to: 23558-1 Transformer Assembly; Mfr. Code 14632.
- 3. Page 6-3; Figure 6-1; Type 71334 RF Tuner (2-30 MHz) (A1) Schematic Diagram.

Add detail C and Note 5 as shown on page 2 of this addenda.

DETAIL C

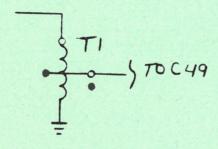


NOTES:

5. FOR PIN LOCATIONS OF QI SEE DETAIL C (CP651)

Add Pin Numbers to T3 as shown below:

Add black dot to T1 as shown below:



CONTENTS

TABLE OF CONTENTS

Paragraph	SECTION I GENERAL DESCRIPTION	Page
1. 1 1. 2 1. 3 1. 4	Electrical Characteristics	1-1 1-1 1-1 1-1
	SECTION II CIRCUIT DESCRIPTION	
2.1 2.2 2.3	General Functional Description Circuit Description	2-1 2-1 2-1
	SECTION III INSTALLATION AND OPERATION	
3.1 3.2 3.3 3.4	Unpacking And Inspection	3-1 3-1 3-1 3-1
	SECTION IV MAINTENANCE	
4.1 4.2 4.3 4.4 4.5 4.6	General	4-1 4-1 4-1 4-2 4-3 4-10
	SECTION V REPLACEMENT PARTS LIST	
5.1 5.2 5.3 5.4	Unit Numbering Method	5-1 5-1 5-1 5-3

SECTION VI SCHEMATIC DIAGRAMS CONTENTS HH-11

LIST OF ILLUSTRATIONS

Illustration		rage
Figure 1-1 Figure 2-1 Figure 3-1 Figure 4-1 Figure 4-2 Figure 4-3 Figure 4-5 Figure 4-6 Figure 4-7 Figure 4-7 Figure 4-9 Figure 4-10 Figure 4-11 Figure 5-1 Figure 5-1 Figure 5-2 Figure 5-3 Figure 5-5 Figure 5-6 Figure 5-7 Figure 5-7 Figure 5-8 Figure 5-9 Figure 5-10 Figure 5-11 Figure 5-12 Figure 5-12 Figure 5-13 Figure 6-1 Figure 6-2 Figure 6-3 Figure 6-5 Figure 6-5 Figure 6-5 Figure 6-6	Type HH-11 Tuning Head, Functional Block Diagram Type HH-11 Tuning Head, Critical Dimensions Equipment Connections, RF Alignment Typical VSWR Response Equipment Connections, First IF Alignment Typical of 7.8 MHz IF Response Curve Equipment Connections, First LO Alignment Equipment Connections, First LO Alignment Equipment Connections, Second LO Crystal Oscillator Equipment Connections, Second LO Crystal Oscillator Equipment Connections, T1.4 MHz Trap Adjustment Typical 71.4 MHz Trap, Response Curve Test Equipment Connections, Shaping Amplifier Alignment Equipment Connections, Overall Gain and AGC Range Tests Equipment Connections, LO Output Level Test Equipment Connections, Sensitivity Check Type HH-11 Tuning Head, Front View, Location of Components Type HH-11 Tuning Head, Rear View, Location of Components Type HH-11 Tuning Head, Rottom View, Location of Components Type 71334 RF Tuner (2-30 MHz) (A1), Location of Components Type 71334 RF Tuner (2-30 MHz) (A1), Location of Components Type 71334 RF Tuner (2-30 MHz) (A1), Location of Components Type 7844-9 Shaping Amplifier (A2), Location of Components Type 7858 Tuning Drive Assembly (A3), Exploded View Type 7835 67, 8-21.4 MHz Converter (A4), Location of Components Part 16545-1 Crystal Oscillator (A4A2), Location of Components Type 71335 67, 8-21.4 MHz Converter (A4), Location of Components Type 71335 67, 8-21.4 MHz Converter (A4), Schematic Diagram Type 71335 67, 8-21.4 MHz Converter (A4), Schematic Diagram Type 71335 67, 8-21.4 MHz Converter (A4A), Schematic Diagram Type 71335 67, 8-21.4 MHz Converter (A4A), Schematic Diagram Type 71335 67, 8-21.4 MHz Converter (A4A), Schematic Diagram Type 71335 67, 8-21.4 MHz Converter (A4A), Schematic Diagram Type 71335 67, 8-21.4 MHz Converter (A4A), Schematic Diagram Type 711 Mixer/IF Amplifier (A2A), Schematic Diagram Type 711 Tuning Head, Main Chassis Schematic Diagram	1-0 2-0 3-2 4-4 4-5 4-5 4-6 4-6 4-7 4-7 4-8 4-11 4-12 5-4 5-6 5-6 5-10 5-12 5-15 5-16 5-21 5-26 6-3 6-7 6-9 6-11 6-13
	LIST OF TABLES	
Table		Page
Table 1-1 Table 4-1 Table 4-2 Table 4-3	Type HH-11 Tuning Head, Specifications	v 4-2 4-9 4-13

HH-11 Table 1-1

Table 1-1. Type HH-11 Tuning Head, Specifications

Tuning Range	2-30 MHz
Input Impedance	50 ohms, nominal
Input VSWR	2:1, maximum
Noise Figure	10 dB, maximum
Gain x Noise Figure Product	30 ±3 dB
Image Rejection	80 dB, minimum
IF Rejection	80 dB, minimum
Gain Control Range	30 dB, minimum
RF Bandwidth	100 kHz
Local Oscillator Radiation	$2~\mu\mathrm{V}$, maximum
Intermediate Frequencies:	
1st IF	67.8 MHz
2nd IF	21.4 MHz
3rd Order Intercept Point*	≥ 10 dBm
LO Output Level	50 mV, minimum, across 50 ohm load
LO Output Frequency	67.8 MHz above center frequency
Tuning Voltage:	
Low Band Edge	+10V
High Band Edge	-10V
Linearity (volts-versus-frequency)	$\pm 1\%$ of tuning band
Tape Accuracy	$\pm 2\%$ of the operating frequency
Weight	3.7 lbs., approximately
* Referenced to input (in band)	

Figure 1-1 HH-11

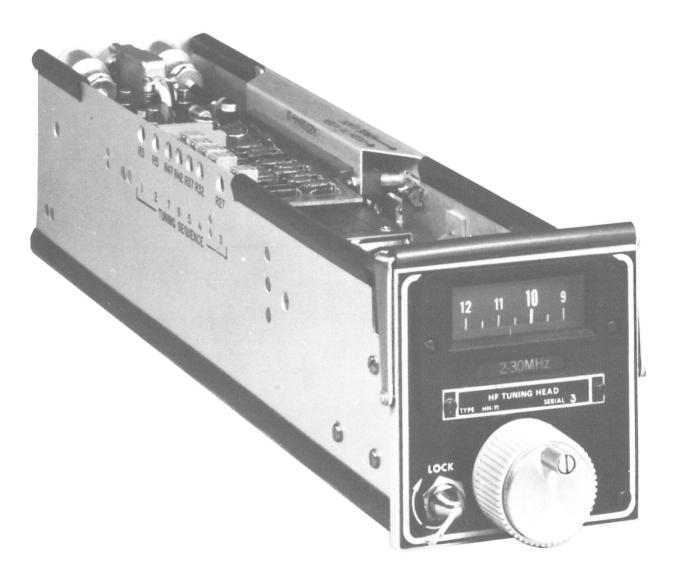


Figure 1-1. Type HH-11 Tuning Head

GENERAL DESCRIPTION

SECTION I GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

- 1.1.1 The Type HH-11 Tuning Head is designed to operate as a plug-in module with the 205 Series Receivers. The HH-11 tunes the frequency range of 2 to 30 MHz and provides a 21.4 MHz IF output for the receiver. The tuning head can be manually or electrically tuned depending upon the operating mode and a tuning voltage range of +10.3 to -10.3 volts from the receiver will tune the unit from the low band limit to the high band limit.
- 1.1.2 The tuning head is a double conversion type containing a voltage tuned first converter, crystal controlled second converter and circuits to shape the tuning voltage input from the 205-(X) Receiver to a linear volts-versus-frequency tuning characteristic for the first converter. In addition to the 21.4 MHz IF output, buffered local oscillator output and a five wire code are provided for operation of the accessory DRO-308 Frequency Counter, DRX-308 Digital Readout Extender, and VH-105/106 Marker Accessory. Additional jumper wires in the HH-11 select the appropriate IF bandwidths for both the PAN and SECTOR operating modes of the 205 Receiver.

1.2 MECHANICAL CHARACTERISTICS

- 1.2.1 The HH-11 Tuner is designed as a plug-in modular unit for the 205 Series Receivers. All electrical connections to the unit are provided by plug-in connectors on the HH-11 rear panel. Figure 5-2 illustrates the rear panel connectors. Front panel controls consist of the manual tuning knob and tape dial. The HH-11 front panel is illustrated in Figure 5-1.
- 1.2.2 The HH-11 Tuner frame is constructed of aluminum with a 3.0×2.125 inch aluminum front panel. The front panel is finished with gray enamel and is overlaid with a black etched bezel. The 2 to 30 MHz RF tuner subassembly (a1) is constructed of brass which has been plated with precious metals to increase conductivity and durability. Shaping amplifier (A2) is constructed on a plug-in etched circuit board. The tape dial and tuning drive assembly (A3) are constructed as a unit and mount on the RF tuner subassembly and the HH-11 front panel.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type HH-11 Tuning Head only. The domensions and weight are given in Table 1-1.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The HH-11 is designed to operate with the 205 Series Receivers. It is not capable of independent operation. In addition, to perform any maintenance on the HH-11 while it is operating, a Type EC-205 Extender Cable unit is required.

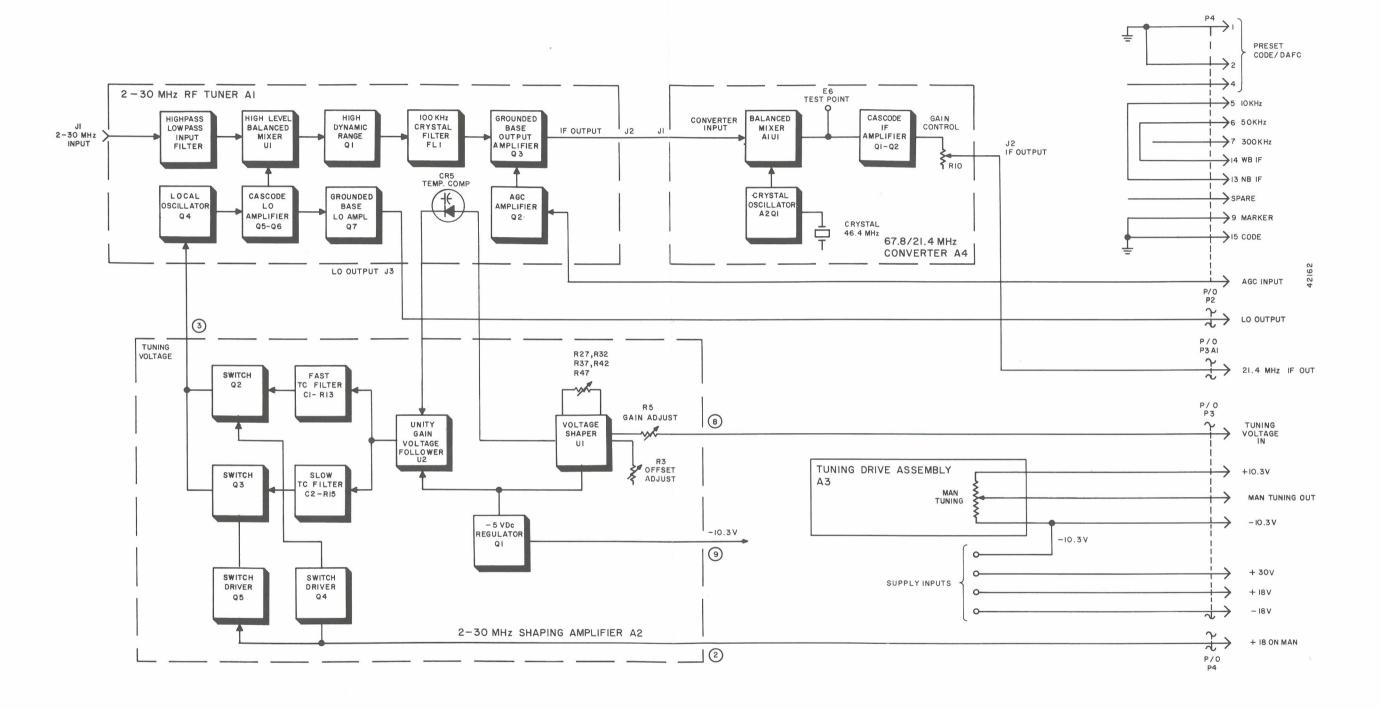


Figure 2-1. Type HH-11 Tuning Head, Functional Block Diagram

CIRCUIT DESCRIPTION

SECTION II CIRCUIT DESCRIPTION

2.1 GENERAL

Operation of the various circuits in the HH-11 Tuner are described in the following paragraphs using the functional block diagram, Figure 2-1, and the schematic diagrams in Section VI of this manual. The unit numbering method is used for electrical components. This means that parts on subassemblies carry a prefix before the class letter and number of the item, i.e., A1Q1 and A3R4. These subassembly prefixes are omitted on illustrations and in the text, except where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

- 2.2.1 Figure 2-1 illustrates the functional interconnections between the various subassemblies in the HH-11. The HH-11 is voltage tuned by a voltage applied to varactor diodes in the local oscillator A1Q4. Input signals are applied to a high pass low pass filter having a low frequency cutoff at approximately 1.9 MHz and a high frequency cutoff at 31.0 MHz. The output of this filter is connected to a high level balanced mixer, A1A1U1. The output of voltage tuned oscillator A1Q4 is amplified by cascode amplifiers A1Q5 and A1Q6 and coupled into the second input of mixer A1A1U1. Local oscillator A1Q4 is voltage tuned over the range of 69.8 MHz to 97.8 MHz (2-30 MHz plus 67.8 MHz IF) by the tuning voltage from the 2-30 MHz shaping amplifier, A2. Sum and difference of the RF and LO signals applied to A1A1U1 are taken from its output. The balanced configuration of the device suppresses the two original input signals. The difference output signals (67.8 MHz) are amplified by junction FET A1Q1 tuned to this frequency. Amplified 67.8 MHz signals are further filtered by A1FL1, a 67.8 MHz center frequency, 100 kHz bandwidth crystal filter. First IF outputs from FL1 are amplified further by A1Q3 before being applied to the converter module. Transistor A1Q2 is an AGC amplifier which applies AGC control voltages to A1Q3. The output from the local oscillator, A1Q4, besides going to the mixer A1U1, is coupled to A1Q7, amplified, and connected to the LO output jack A1J3.
- 2.2.2 Converter module A4 consists of two subassemblies: First, a mixer IF amplifier, A4A1, and secondly, a crystal controlled oscillator, A4A2. This converter module receives the 67.8 MHz first IF output and mixes it with a 46.4 MHz crystal controlled frequency to result in a 21.4 MHz second IF output. This double conversion in the tuner is done to provide the necessary 21.4 MHz IF output to the 205-(X) Receiver.
- 2.2.3 Shaping amplifier A2 provides the tuning voltage for the varactor diodes in the local oscillator in subassembly A1. It consists of circuits which receive a linear ramp and summed manual tuning voltage, or manual tuning voltage from the 205-(X) Receiver, depending upon the operating mode of the receiver, and shapes the voltage to provide a linear volts-versus-frequency tuning characteristic for the HH-11. Operational amplifier A2U1 shapes the tuning voltage from the receiver. Its output voltage is applied through temperature compensation diode A1CR5 to another operational amplifier, A2U2. Unity gain amplifier, A2U2, drives two R-C filters which are used to remove noise from the tuning voltage output. Transistor stages A2Q2-Q5 are switching circuits to select the tuning voltage from the filter. Transistor A2Q1 functions as a voltage regulator which supplies a -5 Vdc reference voltage for A2U1 and A2U2.

2.3 CIRCUIT DESCRIPTION

- 2.3.1 Type 71334 2 to 30 MHz Tuner. Figure 6-1 is the schematic diagram for this subassembly; its reference designation prefix is A1. Input signals to the module are applied to jack A1J1. The RF input is then coupled through a 30 MHz wide bandpass multipole filter to the high level balanced mixer, U1.
- 2.3.1.1 Local Oscillator. Local oscillator Q4 is a modified Colpitts oscillator. Emitter-to-base regeneration to sustain oscillation is developed by voltage divider C45 and C44. The tank circuit of the oscillator consists of C47, CR3A, CR3B, and T1. Capacitors C46 and C49 are employed to prevent dc-operating voltages from reacing the varactor diodes. The local oscillator frequency tracks 67.8 MHz above the incoming signal frequency. Operating voltages for the first local oscillator are taken from the +18V supply through R14 and R15 to the collector. Bias voltage for the base is taken from a voltage divider, R17 and R18. The output from local oscillator Q4 is coupled through C49 to the base of Q5, one-half of a cascode amplifier. The second-half of the cascode amplifier consists of grounded base amplifier Q6. Output from the stage is taken from the top of broadband

CIRCUIT DESCRIPTION HH-11

transformer T3 and coupled through C52 to mixer A1U1. Biasing for cascode amplifier Q5 and Q6 is taken from the +18V and -18V supplies. Transistor Q5 is forward biased by -18V through divider R21 and R22 to the base, R23 and R24 to the emitter, and through R25, T2, and R26 to the collector. Broadband transformer T2, also provides minus voltage for the emitter of Q6. Positive voltage for the collector of Q6 is taken from the +18V supply through L12, T3, and R27. Capacitors C50, C51, and C53 decouple the operating voltages. Mixer A1U1 heterodynes the RF and the LO signals to produce the 67.8 MHz first IF. Transistor Q7 has its emitter connected to the center tap of T3 through the blocking capacitors C52 and C54 and parasitic suppressor R30. Grounded base amplifier Q7 amplifies the local oscillator signal, couples it through C56 dc-blocking capacitor and high-pass filter C58, L18 and R34 to the LO output, J3. Bias voltages for Q7 are derived from the -18V supply to the emitter and +18V supply to the collector.

- 2.3.1.2 First IF Amplifier Network. The first IF amplifier network consists of transistors Q1, Q2, and Q3 and crystal filter FL1. Transistors Q1 and Q3 amplify the 67.8 MHz IF signal. Crystal filter FL1, which has a 100 kHz bandwidth centered at 67.8 MHz, provides the selectivity for the HH-11 Tuner. Transistor Q2 amplifies the AGC from the 205-(X) Receiver and applies it through L9 to the source of Q3, the output stage of the first IF amplifier. Transistor Q1 is a high dynamic range IF amplifier. The output from mixer A1U1 is coupled to the source of Q1 through the filter consisting of L6, C28, and C29. Outputs from the drain of Q1 are injected into FL1 through tuned matching network C31 and T4. Capacitor C32 blocks the dc-bias voltage to Q1 from entering the mixer, likewise, C34 prevents the AGC voltage from feeding back into the mixer output. FET output IF amplifier Q3, the only AGC regulated stage in the tuner front end, responds to the AGC voltage applied to produce a relatively constant IF output level at J2. Variable capacitor C39 is tuned to peak the output at 67.8 MHz.
- 2.3.2 Converter Module. This module consists of two parts. First the mixer/IF amplifier and secondly the second local oscillator. The schematic for this module is shown in Figure 6-2 and the two subassemblies are shown in Figures 6-3 and 6-4.
- 2.3.2.1 Crystal Oscillator. The second local oscillator, A4A2, consists of one transistor, a 46.4 MHz crystal and the tuned filter tank circuit. The schematic for this subassembly is Figure 6-3. Biasing voltages for Q1 are taken from the -18V supply through L2 and voltage divide R3 and R4 to the base, and L2 and R2 to the emitter. The oscillator functions as a grounded base oscillator with collector-to-emitter feedback through crystal Y1 and impedance step down through divider capacitors C4 and C5. Values of the frequency determining components in the tank circuit are found in the table on the schematic in Section VI of this manual. The output of the second LO is connected to E1 of the mixer IF amplifier card.
- 2.3.2.2 Mixer/IF Amplifier. Mixer/IF amplifier, A4A1, consists of the second mixer, U1, and two transistors for IF amplification. The mixer/IF amplifier schematic is Figure 6-4. The first IF signal from tuner A1 is connected to E2 on the mixer card and is then coupled through an input filter matching network to the input, pin 6, of the balanced mixer. Also, the second local oscillator signal from A4A2 is coupled through E1 of this card to pin 1 of the mixer. Mixer output, pin 4, is connected to the base of Q1 through C3. Transistor Q1 is biased at a high current level and R3 and C4 provide a large feedback to reduce the gain. This is done to reduce third order intermodulation. The output of Q1 is taken from the center tap of T1 and coupled through R6 to the emitter of grounded base amplifier Q2 where it is amplified and applied to the tuned output filter. Capacitor C8 is peaked at 21.4 MHz. Variable resistor R10 adjust the second IF output level to J2, the IF output to the 205-(X) Receiver.
- 2.3.3 Type 79656 2 to 30 MHz Shaping Amplifier. Figure 6-5 is the schematic diagram for the shaping amplifier; its reference designation prefix is A2. This circuit is constructed on a plug-in etched circuit board. It receives a +10.3 to -10.3 volt tuning voltage from the 205-(X) Receiver and provides a shaper +5 to +20 volt output which complements the voltage-versus-capacitance characteristics of the varactor diodes used in the 2 to 30 MHz tuner subassembly. The diode characteristics are such that for a given reverse bias change, a greater change occurs in the maximum capacity region than at the minimum capacity region. The shaped voltage output from this subassembly provides linear tuning over the range of 2 to 30 MHz. As shown in the functional block diagram, Figure 2-1, the circuit consists of voltage shaper U1, unity gain voltage follower U2, R-C filters, filter switching transistors Q2 and Q3, switch drivers Q4 and Q5, and -5 Vdc regulator transistor Q1.
- 2.3.3.1 The voltage shaping circuit consists of integrated circuit operational amplifier U1 and its associated feedback network. Figure 2-2 simplifies the voltage shaper circuit by showing only a portion of its feedback network. Operational amplified U1 amplifies the difference between its two inputs. The non-inverting input (pin 3)

HH-11 CIRCUIT DESCRIPTION

of the IC is returned to ground through R8, which balances current flow through both inputs of the amplifier. The tuning voltage is applied to the inverting input (pin 2) through R5 and R6. Also connected to the inverting input is an OFFSET ADJUST voltage applied through R3 and R4. Negative feedback voltage applied through R7, and negative feedback voltage applied through CR7, CR5, and R25. The voltage gain of the operational amplifier is determined by the ratio of total input resistance to total feedback resistance. The network consisting of R25 through R28 and CR6 is a biasing network for "break" diode CR7. To illustrate the circuit operation, assume that the low band edge tuning voltage (+10.3V) is applied to the shaper. At this point, the output voltage from U1 is approximately +5 volts. The first break point for the output voltage curve is determined by the setting of R27 which applies a positive voltage to the cathode of CR6. The voltage drop across R25 is such that the voltage applied to the anodes of CR7 and CR5 is sufficiently positive to forward bias them. However, CR6 is reverse biased due to the voltage applied to it through R27. Now the feedback across U1 consists of the voltage developed across R27 and the voltage from the initial +5 volt level. The output of U1 changes linearly with respect to its input until it reaches the point where CR6 becomes forward biased. When CR6 begins to conduct, the voltage at the junction of CR5, CR6, and CR7 is clamped by current flow through CR6. At this point CR7 becomes reverse biased with any further positive increase at the output of U1. When CR7 becomes reverse biased, the negative feedback loop consisting of CR7, CR5, and R24 is broken, increasing the gain of U1. Diodes CR5 through CR19 and associated circuitry, as shown in the schematic diagram, are all components of the gain modifying (feedback) network. When the output voltage of U1 reaches the level set by R32 the next gain curve "break" takes place and the feedback across U1 is further reduced, increasing the voltage gain of U1 and further changing the slope of the output voltage curve. The "break" point potentiometers are all adjusted to provide linear tuning over the range of 2 to 30 MHz. Diode CR1 is included across the "permanent" feedback resistor, R7, to protect the varactor diodes in the 2-30 MHz tuner subassembly. Should the output voltage from U1 ever to negative, which would forward bias the varactor diodes and possibly damage then, diode CR1 conducts. With CR1 conducting a direct negative feedback path is provided which will hold the output voltage from U1 around zero volts.

- 2.3.3.2 The shaped output voltage from U1 is applied to operational amplifier U2 through varactor diode CR5 in the 2-30 MHz tuner subassembly. Diode CR3 is forward biased by the tuning voltage. Variations in the contact potential of the tuning diodes caused by temperature changes are cancelled by the drop across A1CR3 whose contact potential varies a similar amount. Operational amplifier U2 is used as a unity gain voltage follower to provide isolation from the voltage shaper. The shaped voltage coupled through A1CR5 is applied to the non-inverting input (pin 3) of the amplifier. Negative feedback to the inverting input (pin 2), and positive feedback taken from the junction of R11 and R12 and coupled through R10, set the stage gain at one. Supply voltages for the operational amplifiers are provided by the +30 Vdc applied to pin 21 of the shaping amplifier board and the -5 Vdc supplied by Q1. Transistor Q1 functions as a series regulator. Bias for the base is taken from the junction of R1 and R2.
- 2.3.3.3 The output voltage from U2 is applied through R-C filters to FET switches A2 and A3. The filters remove noise from the tuning voltage output. Resistor R13 and C1 form the slow time constant filter used in the MAN mode of operation. A faster time constant filter formed by R15 and C2 is used when the 205-(X) Series Receivers are operated in the PAN or SECTOR sweeping modes. Transistors Q4 and Q5 provide the switching voltage for the FET's. Positive 18 volts is applied to pin 2 of the shaping amplifier board in the MAN mode. In this mode, the base bias on Q5 is not sufficiently negative to cause the transistor to conduct. With Q5 off, the base voltage on Q4 goes sufficiently negative to cause it to conduct due to the voltage drop across R20, R19, and R21. The collector voltage of Q5, the non-conducting transistor, is approximately -8 Vdc which causes CR3 to conduct clamping the voltage at the gate of Q3 low and tuning the transistor off. However, the positive voltage at the collector of Q4, the conducting transistor, reverse biases CR2 allowing the gate of Q3 to approach the source voltage and Q3 conducts. With Q3 conducting, the output voltage from the shaper board is coupled through the fast R-C filter. In the absence of the +18V on MAN voltage, these conditions reverse selecting the slow, sweep mode filter.
- 2.3.4 Type HH-11 Tuning Head. Figure 6-6 is the schematic diagram for the main chassis of the HH-11. This drawing illustrates the overall connections between the subassemblies of the tuner. Module A3 is a Type 8588 Tuning Drive. It consists of the manual tuning precision potentiometer and the necessary tuning drive and tape frequency dial to drive it. An exploded view of the tuning drive is included in Section V of this manual. Multipin connector P3 located on the HH-11 rear panel supplies IF output, tuning voltage inputs and outputs and power supply inputs. The manual tuning voltage output is linear, -10.3 volts at the low band limit and +10.3 volts at the high band limit. It is inverted in the 205-(X) Receiver and returned to the HH-11 in the MAN mode. In the PAN or SECTOR modes, the MAN tuning voltage is inverted and summed with the ramp voltage in the receiver

Courtesy of http://BlackRadios.terryo.org

CIRCUIT DESCRIPTION HH-11

and then applied to the HH-11. Rear panel plugs P1 and P2 provide RF input and local oscillator output connections respectively. Control inputs other than tuning voltage are provided through rear panel plug P4. Pins 1, 2, 4, 9, and 15 provide a code output which is used by the DRO-308 Frequency Counter, the DRX-308 Frequency Extender, and the VM-105/106 Marker Accessory units. Pins 5, 6, 7, 8, 14, and 13 provide connections which select the proper bandwidth IF amplifiers in the 205-(X) Receiver for the PAN and SECTOR modes. Pin 12 supplies the mode control voltage for shaping amplifier A2 and pin 10 provides the AGC connection to the 2 to 30 MHz tuner subassembly.

SECTION III INSTALLATION AND OPERATION

3.1 UNPACKING AND INSPECTION

- 3.1.1 Examine the shipping carton for damage during the unpacking of the equipment. If the carton has been damaged, notify the carrier's agent. Retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment has occurred.
- 3.1.2 See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, Rockville, or your Watkins-Johnson representative with details of any shortage.

3.2 INSTALLATION

The HH-11 Tuning Head is a plug-in unit designed to operate exclusively with the 205-(X) Series Receivers. All operating voltages and RF signals are provided by rear-panel connectors on the tuner, which mate with the 205-(X) Series Receivers.

3.3 OPERATION

Operation of the HH-11 Tuning Head is controlled entirely by the associated 205-(X) Receiver with the exception of the front-panel manual tuning $knob_{\bullet}$

3.4 PREPARATION FOR RESHIPMENT AND STORAGE

- 3.4.1 If the unit must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be reused to a large extent or will at a minimum provide guidance for the repackaging effort.
- 3.4.2 Conditions during storage and shipment should normally be limited as follows:
 - (1) Maximum humidity: 95% (no condesnation)
 - (2) Temperature range: -30°C to +85°C.

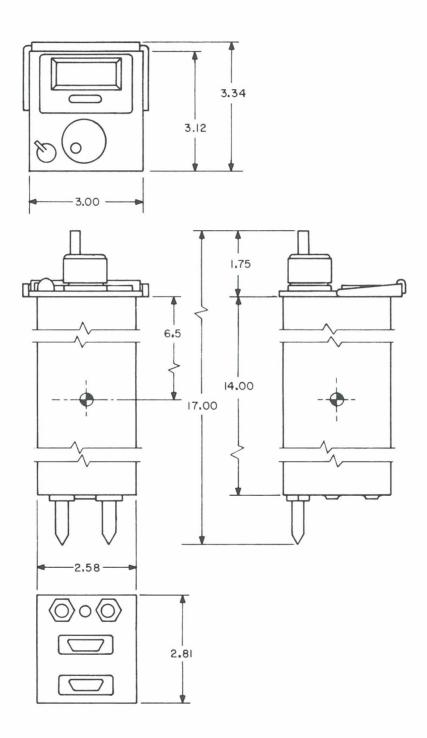


Figure 3-1. Type HH-11 Tuning Head, Critical Dimensions

MAINTENANCE

SECTION IV MAINTENANCE

4.1 GENERAL

The HH-11 Tuning Head has been designed to operate for extended periods of time with only routine maintenance. The unit requires no special care and normally requires only cleaning and occasional tuning drive lubrication. Alignment of the tuner requires a thorough understanding of the function of each subassembly and should be attempted only after repairs which affect the alignment and then only be experienced personnel in a well-equipped shop.

4.2 PLUG-IN MODULE

The printed circuit shaping amplifier board can be removed by unsnapping the hinge lock located on the side of the tuner and carefully swinging the board up where it can be unplugged. Careful removal and installation of the shaper board will not disturb the HH-11 alignment.

4.3 MAINTENANCE OF TUNING DRIVE ASSEMBLY

Figure 5-10 is an exploded view of the tuning drive assembly. The tuning drive assembly require little maintenance except for the occasional application of a few drops of light oil to the shaft bearings and removal of any dust or dirt that may accumulate.

- 4.3.1 <u>Dial Lamp Replacement</u>. To replace a burned out dial lamp, proceed as follows:
 - (1) Remove the two screws that hold the dial escutcheon. Remove the escutcheon (refer to Figure 5-10).
 - (2) Remove the two screws that hold the light bar to the tuning drive.
 - (3) Gently pull the light bar and printed circuit light board away from the tuning drive. It may be necessary to remove some lacing cord from the wires that feed the lamps.
 - (4) Remove the two screws that hold the light board to the light bar.
 - (5) Unsolder the burned out lamp and replace it with a new lamp. It is advisable to replace all lamps if parts are available.
 - (6) Reassembly the unit by reversing steps (1) through (4).
- 4.3.2 <u>Alignment of Tape Dial.</u> A calibrated steel tape is used as the tuning dial. It is geared to the assembly in such a manner that it is unlikely it will ever get out of position. However, to check the alignment or to mechanically realign the tape, follow the steps given below:
 - (1) Turn the tuning knob counterclockwise until the tape dial stops moving.
 - (2) The mark to the left of the arrow should line up the dial pointer. If it does not, proceed with the next step.
 - (3) Loosen the setscrew on gear No. 43 (Figure 5-10).
 - (4) Remove the dial escutcheon as described in paragraph 4.3.1, step (3) if necessary.
 - (5) Hold the shaft of potentiometer No. 51 to prevent it from turning while using the front panel tuning knob to adjust the mark on the tape to coincide with the dial pointer.
 - (6) Tighten the setscrew on gear No. 43 and replace the dial escutcheon.
 - (7) Tune from one end of the dial to the other to determine if binding occurs in the tuning drive. If some binding is present, loosen the setscrew on gear No. 27 and slightly readjust its vertical position.

MAINTENANCE HH-11

4.3.3 Removal and Disassembly of Tuning Drive and Tape Dial. - The tuning drive and tape dial assembly may be removed from the tuner by performing the steps listed below. Once removed, the tuning drive may be disassembled using Figure 5-10 as a guide.

- (1) Remove the main tuning knob.
- (2) Remove the two screws that hold the dial escutcheon. Remove the escutcheon.
- (3) Remove the two screws that hold the light board to the light bar.
- (4) Unsolder the wire providing input voltage to the lights.
- (5) Unsolder the wires connected to the tuning potentiometer. Tag each of the leads.
- (6) Turn the tuner assembly upside down and loosen the two screws which mount the RF tuner subassembly to the tuning drive.
- (7) Remove the three screws from both sides of the tuner wrap-around which hold the tuning drive. Gently pull the tuning drive assembly from the tuner.
- (8) Further disassembly should not be required. However, the front-panel may be removed from the tuning drive by removing the tuner mechanical lock, the screw in the lower right corner of the front panel, and the two screws underneath the panel bezel.
- (9) To reassemble, reverse the above procedure.

4.4 TROUBLESHOOTING

Troubleshooting or repairs of the HH-11 Tuning Head while the unit is operating requires the use of an EC-205 Extender Cable. After interconnecting the HH-11 and 205-(X) Series Receiver using the EC-205, initial investigation should be directed toward localizing the malfunction to a specific subassembly. A troubleshooting diagram is provided in Table 4-1 which will aid the technician in troubleshooting efforts. A thorough understanding of the circuit operations as detailed in Section II of this manual will enable the technician to repair the faulty subassembly once it is isolated. In addition, typical transistor element voltages are provided in Table 4-3.

Table 4-1. Troubleshooting Information

TROUBLE INDICATION	PROBABLE FAULT	DIAGNOSTIC PROCEDURE
1. HH-11 totally inoperative.	Power supply failure in the 205-(X) Receiver	1. Check all power supply inputs as follows: Set the 205 Receiver function switch to the MAN position and check for +18V on XA2 pin 2; -18V on XA2 pin 4, +30V on XA2 pin 21 and +10.3V and -10.3V on the CW and CCW ends of the manual tuning potentiometer, R1, respectively.
2. Power supply inputs normal HH-11 totally inoperative.	Malfunction in shaping amplifier.	1. Tune the HH-11 from 2 to 30 MHz while observing the voltage at XA2 pin 3. The voltage should vary from approximately +5.0V at 2 MHz to +20V at 30 MHz. Refer to shaper alignment in section 4.5 for alignment procedure.
3. Shaping amplifier okay, HH-11 inoperative.	First local oscillator or converter module mal-function.	a. Connect RF voltmeter to LO output A1J3 and check for 50 mV minimum output across the band.

HH-11 MAINTENANCE

TROUBLE INDICATION	PROBABLE FAULT	DIAGNOSTIC PROCEDURE
		b. Connect the frequency counter to the IF output on the rear of the 205 Receiver, connect the HP-606A signal generator to J1 (antenna input) with a 15 MHz, 20 mV, CW output. Tune the HH-11 to 15 MHz and check the counter reading. It should be 21.4 MHz. If the 21.4 MHz IF output is not present, connect the RF VTVM to A1J2 and check for an approximately 40 mV or higher RF level. If this level is not present the RF signal is not getting through the input bandpass filter or A1Q1 or A1Q3 is not functioning.

- 4.4.1 Equipment Required. The following test instruments, or their equivalents are required to troubleshoot the HH- $\overline{11}$.
 - (1) Frequency Counter, Computer Measurements Company, Type CMC-738A with CMC Type 735C Plug-In.
 - (2) Digital Voltmeter, Dana Type 5500/112.
 - (3) Signal Generators, Hewlett Packard HP-606A.
 - (4) RF Voltmeter, Boonton 91DA-S5 with model 91-12E RF probe and TEE adapter Model 91-14A.
 - (5) 50 ohm terminations, adapters, cables, etc.
- 4.4.2 Localization of Faults. The primary methods of localizing faulty modules are discussed below.
- 4.4.2.1 Visual Inspection. A thorough visual inspection may be sufficient to locate the source of trouble. Carefully inspect the HH-11 for broken wires, improperly mated connectors, and damaged components on the shaping amplifier board (A2).
- 4.4.2.2 Use of the Troubleshooting Chart. Table 4-1 provides a detailed listing of possible failure indications with procedures to be followed in diagnosing faults. The first step is to decide which of the failure symptoms listed on the left side of the chart is applicable. Follow the procedure given to isolate the defective module. Voltage measurements and injection and detection of applicable signals should then isolate the defective stage and component.

4.5 ALIGNMENT

The alignment procedures provided in this subsection are satisfactory for alignment of the HH-11 after a major component replacement. Varactor diodes in the 2 to 30 MHz tuner subassembly are matched components. If a failure of a diode occurs, its replacement may not match the characteristics of the remaining units. To obtain satisfactory performance from the HH-11 all varactor diodes will have to be replaced with a matched set. Alignment of the HH-11 should be attempted only by trained and experienced technicians thoroughly familiar with the unit. If the alignment procedures detailed in the following paragraphs do not provide satisfactory performance from the HH-11, a factory alignment is required.

4.5.1 Equipment Required. - The following test instruments, or their equivalents, are required to align and test the $\overline{HH-11}$ Tuner.

Figure 4-1 HH-11

- (1) Frequency Counter, Computer Measurements Company Type CMC-738A.
- (2) Digital Voltmeter, Dana Type 5500/112.
- (3) Signal Generators, Hewlett Packard Type HP-606A and HP-608E.
- (4) Sweeping Signal Generator, Wavetek Type 2001.
- (5) Oscilloscope, Tektronix Type 503.
- (6) Regulated Variable Power Supply 0-30 Vdc, Hewlett Packard Type 6206B.
- (7) Extender Cable, Watkins-Johnson Type EC-205.
- (8) 50 ohm Detector, Telonic XD-3A.
- (9) Assorted Cables, Connectors, and Alignment Tools.
- (10) Rho-tector, Telonic Type TRB-54

4.5.2 RF Alignment of the HH-11. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-1.

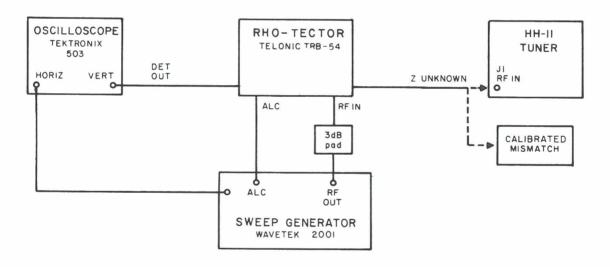


Figure 4-1. Equipment Connections, RF Alignment

- (2) Calibrate the sweeper and oscilloscope as follows:
 - a. Connect the 2.5:1 mismatch to the leg of the Rho-tector designated Z unknown and calibrate the scope and sweeper as necessary to display a convenient reference such as full or half scale.
 - b. Remove the mismatch from the Rho-tector and connect the HH-11 Tuner to this leg.
- (3) Adjust L1 and L2 at the lower band frequencies and C18, C20 and C23 at the upper band frequencies to achieve a response curve equal to or less than your reference level across the band.
- (4) A typical response curve is shown in Figure 4-2. Referenced to 2.5:1 mismatch for full scale deflection.



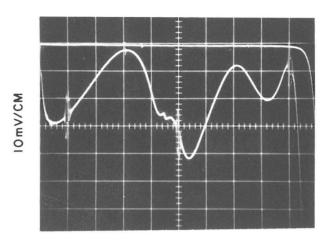


Figure 4-2. Typical VSWR Response

- (5) Disconnect the Rho-tector from J1 and unsolder C26 from A1E2.
- (6) Interconnect the equipment as shown in Figure 4-3.

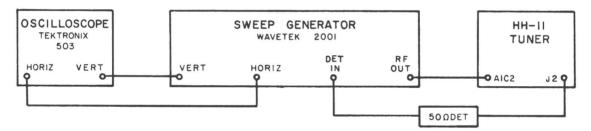


Figure 4-3. Equipment Connections, First IF Alignment.

(7) Adjust the scope and sweeper to display an approximate 110 kHz wide response and adjust C31 and C33 for the best response peaked at 67.8 MHz. Refer to Figure 4-4.

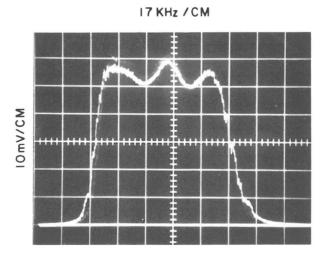


Figure 4-4. Typical 67.8 MHz IF Response Curve

Figure 4-5 Figure 4-6

HH-11

4.5.3 First Local Oscillator Alignment. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-5.

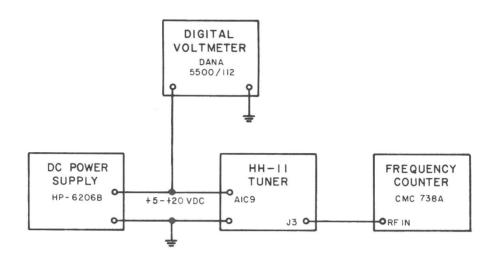


Figure 4-5. Equipment Connections, First LO Alignment.

- (2) Set the dc power supply for approximately +20 Vdc and adjust C47 for 97.8 MHz.
- (3) Next set the dc power supply for approximately +5 Vdc and adjust T1, by spacing the turns, for 69.8 MHz.
- (4) Repeat steps 2 and 3 until interaction is minimized.
- 4.5.4 <u>Converter Module Alignment</u>. This alignment is in three parts, part one is the second LO crystal oscillator alignment, part two is the second mixer/second IF alignment, and part three is the 71.4 MHz trap.
- 4.5.4.1 Second LO Crystal Oscillator. Proceed as follows:
 - (1) Connect the equipment as shown in Figure 4-6.

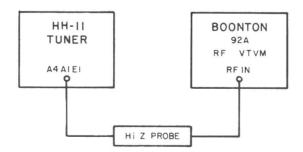


Figure 4-6. Equipment Connections, Second LO Crystal Oscillator

(2) Adjust A4A3C3 for a peak as read on the RF VTVM, and rock the adjustment back and forth to insure that it is peaked.

4.5.4.2 71.4 MHz Trap Adjustment. - Proceed as follows:

(1) Connect the equipment per Figure 4-7.

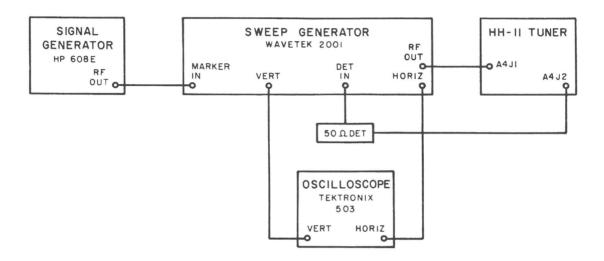


Figure 4-7. Equipment Connections, 71.4 MHz Trap Adjustment.

- (2) Set the sweep generator and scope to display an approximate 8 MHz wide response curve.
- (3) Adjust A4C4 fully CW.
- (4) Adjust A4A1C8 to peak the response at 67.8 MHz.
- (5) Now tune A4C4 to center the trap at the 71.4 MHz marker as shown in Figure 4-8.

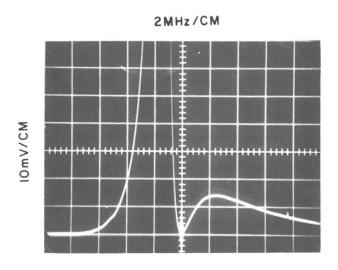


Figure 4-8. Typical 71.4 MHz Trap, Response Curve.

4.5.4.3 Second Mixer/Second IF Alignment. - Proceed as follows:

- (1) Disconnect the sweep generator from the A4 subassembly.
- (2) Connect the HP-608E signal generator to the Boonton 92A RF VTVM and adjust the HP-608E output level for a -30 dBm reference level on the RF VTVM.

Figure 4-9

- (3) Set the RF gain control on the 205 Receiver to maximum clock-wise.
- (4) Connect the HP608E to the RF input jack (J1) of the 205 Receiver, and connect the RF VTVM to the IF output, J5, on the EC-205 Extender Cable.
- (5) Adjust A4A1R10 for 15 dB gain. This sets the gain x noise figure product at the 30 ± 3 dB specification.
- (6) It may be necessary to make a slight readjustment of A4A1C8 to achieve this gain.
- (7) Reconnect the RF subassembly, A1, to the second mixer/second IF subassembly, A4.
- 4.5.5 Shaping Amplifier Alignment. The shaping amplifier receives a+10.3 Vdc to -10.3 Vdc tuning voltage from the 205-(X) Receiver and provides a+5 Vdc to +20 Vdc voltage output that is shaped to complement the characteristics of the varactor tuning diodes in the RF tuner, Al. Accurate alignment of the shaping amplifier will provide tuning linearity greater than the 1% specification. This alignment procedure is complex and should be attempted only when absolutely necessary. Proceed as follows:
 - (1) Connect the test equipment as shown in Figure 4-9.

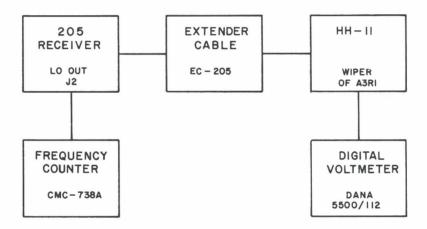


Figure 4-9. Test Equipment Connections, Shaping Amplifier Alignment.

- (2) Set the 205-(X) Receiver controls as follows:
 - a. FINE TUNING Midrange
 - b. Reception Mode AM MAN
 - c. Tuning Mode MAN

NOTE

Controls not specifically referred to may be left in any position, and will not effect the alignment procedure.

Manually tune the HH-11 for a voltmeter reading of -10.00 Vdc and note the frequency counter readout. Compare the readout obtained to the LO frequency specified in Table 4-2. Tune the HH-11 over the entire range of 2-30 MHz, stopping at 1 volt (tuning voltage) intervals and comparing the LO readouts obtained to Table 4-2. If the readouts obtained are within the ±280 kHz tolerance, no alignment should be attempted. If the readouts obtained are out of tolerance, proceed to step (4) and perform a complete shaping amplifier alignment.

Table 4-2. Tuning Voltage Versus Frequency

	Tuning Voltage	Tuned Frequency MHz	LO Frequency MHz	
	-10.00	2.00	69. 80	Set R5
	- 9.50	2.70	70.50	
3	- 9.00	3.40	71.20	
	- 8.50	4. 10	71.90	
	- 8.00	4.80	72.60	
	- 7.50	5.50	73.30	
	- 7.00	6. 20	74.00	
	- 6.50	6. 90	74.70	
	- 6.00	7.60	75.40	
	- 5.50	8.30	76. 10	
	- 5.00	9. 00	76.80	
	- 4.50	9. 70	77.50	
	- 4.00	10. 40	78. 20	
	- 3.50	11. 10	78.90	
. 11	- 3.00	11.80	79.60	
12	- 2.50	12.50	80.30	
13	- 2.00	13.20	81.00	
13	- 1.50	13.90	81.70	
14	- 1.00	14.60	82.40	
15	- 0.50	15.30	83. 10	
16	0.00	16.00	83.80	Set R3
16	+ 0.50	16.70	84.50	500 100
17	+ 1.00	17.40	85.20	
18	+ 1.50	18. 10	85. 90	
	+ 2.00	18.80	86.60	
19	+ 2.50	19.50	87.30	
20	+ 3.00	20. 20	88.00	Set R27
20	+ 3.50	20. 90	88.70	Det 1027
	+ 4.00	21.60	89.40	Set R32
22	+ 4.50	22.30	90. 10	500 1002
	+ 5.00	23.00	90.80	
	+ 5.50	23.70	91.50	
24	+ 6.00	24.40	92.20	
	+ 6.50	25. 10	92. 90	
	+ 7.00	25. 80	93. 60	Set R32
	+ 7.50	26. 50	94. 30	DEL 1132
	+ 8.00	27. 20	95.00	
	+ 8.50	27. 90	95. 70	
	+ 9.00	28. 60	96.40	Co4 D 40
	+ 9.50	29. 30	97. 10	Set R42
	+10.00	30. 00	97. 10	Cot D47
00			77.00	Set R47

⁽⁴⁾ Tune the HH-11 for a voltmeter reading of 0.00 Vdc and adjust A2R3 for a counter readout of 83.800 MHz.

Tune for a voltmeter reading of -10.00 Vdc and adjust A2R5 for a counter readout of 69.80 MHz.

⁽⁶⁾ Repeat steps (4) and (5) making adjustments which correct one-half the counter readout error until the low band-half limits are correctly set.

⁽⁷⁾ Tune for a voltmeter reading of +3.00 Vdc and adjust A2R27 for a counter readout of 88.00 MHz.

⁽⁸⁾ Tune for a voltmeter reading of +4.00 Vdc and adjust A2R32 for a counter readout of 89.00 MHz.

MAINTENANCE HH-11

- (9) Tune for a voltmeter reading of +7.00 Vdc and adjust A2R37 for a counter readout of 93.60 MHz.
- (10) Tune for a voltmeter reading of +9.00 Vdc and adjust A2R42 for a counter readout of 96.40 MHz.
- (11) Tune for a voltmeter reading of +10.00 Vdc and adjust A2R47 for a counter readout of 97.80 MHz.
- Tune the HH-11 in 1 volt steps from -10.00 Vdc to 0.00 Vdc comparing the frequency readouts obtained with Table 4-2. If the frequencies obtained exceed the specified tolerances over this range, make compromise adjustments between A2R3 and A2R5 until tracking of the lower bandhalf is obtained.
- (13) Tune the HH-11 in 1 volt steps from 0.00 Vdc to +10.00 Vdc noting the displayed frequencies at each point and compare to Table 4-2. If the frequency tolerances specified are exceeded, adjust the appropriate controls as noted in Table 4-2. Make the adjustments starting at the lowest voltage reading and proceed in increasing voltage sequence to +10.00 Vdc. Making adjustments in this manner will result in minimum interaction between the adjustments.
- (14) Repeat step (13) until the high band-half tracking is obtained.

4.6 PERFORMANCE CHECKS

Selected tests are presented in subsequent paragraphs which can be used to determine the relative performance of the HH-11. The following test instruments or their equivalents are required:

- (1) Signal Generator, HP-606A and HP-608E
- (2) Extender Cable, WJ, EC-205
- (3) Signal Monitor, WJ, SM-7301(A)
- (4) RF Voltmeter, Boonton 91DA-S5 with a 91-14A TEE
- (5) Misc. Cables, connectors, adapters, etc.
- (6) Oscilloscope, Tektronix, Type 503
- (7) AC VTVM Hewlet Packard, Type 400FL
- (8) 50Ω Detector, Telonic XD-3A
- (9) Sweep Generator, Wavetek Type 2001

4.6.1 Overall Gain and AGC Range. - Proceed as follows:

- (1) Connect the test equipment as shown in Figure 4-10.
- (2) Set the following 205-(X) controls:
 - a. Reception mode AM/MAN
 - b. Tuning mode MAN
 - c. RF GAIN MAX CW
- (3) Set the SM-7301(A) controls as follows:
 - a. SWEEP WIDTH kHz 500
 - b. VERT DISPLAY LOG
 - c. CENTER FREQ. Activate marker and center; switch marker off
 - d. GAIN MAX CW
- (4) With no signal input to the HH-11 note the signal monitor noise level, i.e., height of "grass" deflection. Remove the plug connected to J5 on the EC-205 and connect the signal generator to the plug using an appropriate adapter. Tune the generator to 21.4 MHz and adjust the controls for a CW output signal centered on the signal display screen with an amplitude equal to the

HH-11 Figure 4-10

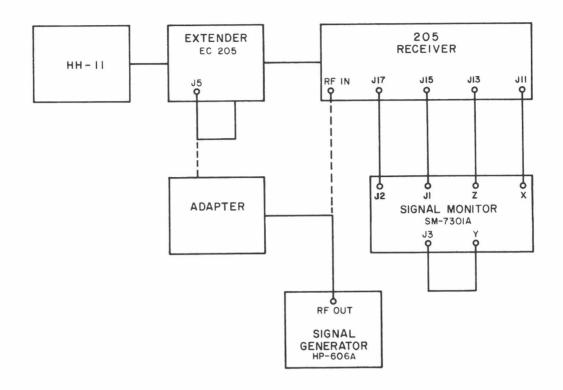


Figure 4-10. Equipment Connections, Overall Gain and AGC Range Tests

- (4) noise level noted previously. Increase the signal generator output level 20 dBm and record the attenuator dBm setting. Adjust the signal monitor gain control for a convenient reference level of the displayed signal. Note the reference line and do not disturb the gain control after setting.
- (5) Remove the signal generator connection from the EC-205 plug and return the plug to J5 on the adapter. Connect the signal generator to the RF INPUT jack on the 205-(X) rear panel. Adjust the signal generator for a 2 MHz CW output and center the displayed signal on the SM-7301(A).
- (6) Decrease the signal generator attenuator setting until the displayed signal amplitude equals the reference noted in step (4).
- (7) Record thé attenuator dBm reading and subtract the reading noted in step (4). The difference should be approximately 20-26 dB.
- (8) Set the 205-(X) RF GAIN control to MAX CCW.
- (9) Increase the signal generator attenuator until the displayed signal returns to the signal display reference. Record the attenuator dBm reading. Subtract the attenuator reading from the reading recorded in step (7). The difference should be greater than 30 dB.
- (10) Set the 205-(X) RF GAIN to MAX CW and repeat steps (5) through (9) checking the HH-11 gain and AGC range at 2, 14, and 30 MHz.

4.6.2 LO Output Level. - Proceed as follows:

- (1) Connect the equipment as shown in Figure 4-11.
- (2) Tune the HH-11 slowly over the range of 2-30 MHz checking the LO output level. The levels should be greater than 50 mV.

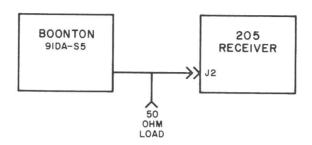


Figure 4-11. Equipment Connections, LO Output Level Test

4.6.3 Sensitivity Check. - Proceed as follows:

- (1) Set the receiver controls to:
 - a. Reception mode AM AGC
 - b. Tuning mode MAN
 - c. Bandwidth 1 MHz
- (2) Set the HP-608E signal generator to 14 MHz and 50% AM modulation at a 1 kHz rate and a RF output level of -87 dBm.
- (3) Interconnect the equipment as shown in Figure 4-12.

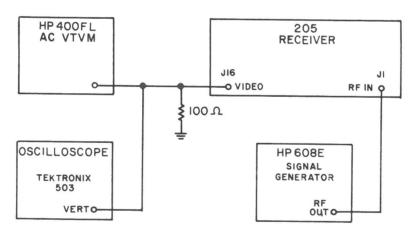


Figure 4-12. Equipment Connections, Sensitivity Check

- (4) Adjust the video gain control for a convenient reference level on the AC VTVM.
- (5) Remove the modulation from the HP-608E and note the decrease in level on the AC VTVM.
- (6) This decrease should be a minimum of 12 dB.

Table 4-3. Typical Semiconductor Element Voltages

Integrated Circuit Pin Numbers 1 2 3 4 5 6 7	3	4		Integrated Circuit Pin 5 6	Circuit Pin 6		Numbers 7	8	6	10
Field	P	fect	Transistor Pins	1					Transistor Elements	ments
Drain Gate 2	Gate	2	Gate 1	Source				Emitter	Base	Collector
17.7			0	2.6						
								0	0	3,5
17.9	1		0	3.7					,	,
								7.6	8.0	16.7
								-14.0	-13, 1	-0.7
								9.0 -	0	-17.6
								- 0.7	0	16.9
								- 4.9	- 5,5	-17.4
14.5			4.7	14.5						
14.5			-6.5	14.5						
								30.0	29, 5	29.9
						,		30.0	29,5	8 • 9 -
0	0		0	- 4.9	!	14.9	30,0	-		
14.3			-14.3	- 4.9	1	14.3	30,0	!		
								-14.8	-13,9	- 1,4
								9.0 -	0	17.4
								-11.6	0,4	- 0.2

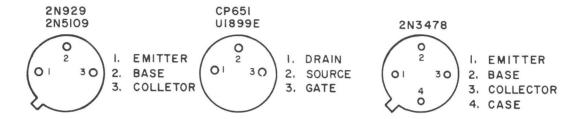
* Field Effect Transistor Pin Connections

readings positive with respect to ground unless otherwise specified. Measurements taken with a Dana Type 5500/112 Digital Voltmeter. TEST CONDITIONS: 205-(X) Receiver in MAN mode, 115 Vac input; HH-11 tuned to 20 MHz, no signal input; all

NOTE: Transistor and integrated circuit pin configurations are shown on page 4-14.

Table 4-3 HH-11

Table 4-3. Typical Semiconductor Element Voltages (Continued)



µA741



- I. OFFSET NULL
- 2. INVERTING INPUT
- 3. NON-INVERTING INPUT
- 4. Vcc -
- 5. Vcc +
- 6. OUTPUT
- 7. OFFSET NULL
- 8. N C

2N2907



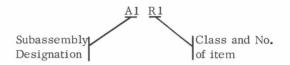
- I. EMITTER
- 2. BASE
- 3. COLLECTOR

REPLACEMENT PARTS LIST

SECTION V REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules), and parts. An example of the unit method follows:



Identify from right to left as: First (1) resistor (R) of first (1) subassembly (A)

As shown on the main chassis schematic, components which are an integral part of the main chassis have no sub-assembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Reference Designation Prefixes are provided on drawings and illustrations in parenthesis within the figure titles.

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address	Mfr. Code	Name and Address
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53212	04941	Walsco Electronics Corporation 4 South Wyman Rockford, Illinois 61101
01351	Dynamic Gear Company, Incorporated 175 Dixon Avenue Amityville, New York 11701	07263	Fairchild Camera and Instrument Corp. Semiconductor Division 464 Ellis Street Mountain View, California 94040
02114	Ferroxcube Corporation Post Office Box 359 Mt. Marion Road Saugerties, New York 12477	12498	Teledyne Crystalonics 147 Sherman Street Cambridge, Massachusetts 02140
02735	RCA Corporation Solid State Division Route 202 Somerville, New Jersey 08876	14482	Watkins-Johnson Company 3333 Hillview Avenue Palo Alto, California 94304
04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530	14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, Maryland 20760
04713	Motorola Semiconductor Products, Inc. 5005 East McDowell Road Phoenix, Arizona 85008	15818	Teledyne Semiconductor 1300 Terra Bella Avenue Mountain View, California 94040

Mfr.	Name and Address	Mfr. Code	Name and Address
16179	Omni-Spectra, Incorporated 24600 Hallwood Court Farmington, Michigan 48024	72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
19505	Applied Engineering Products Company Division of Samarius Incorporated 26 East Main Street Ansonia, Connecticut 06401	73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
25088	Siemens America, Incorporated 350 5th Avenue New York, New York 10001	73734	Federal Screw Products, Inc. 3917 North Kenzie Avenue Chicago, Illinois 60618
26805	Americon Microwave Industries, Inc. 87 Rumford Avenue Waltham, Massachusetts 02154	74306	Piezo Crystal Company 100 K Street Carlisle, Pennsylvania 17013
56289	Sprague Electric Company Marshall Street North Adams, Massachusetts 01247	74868	Bunker Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810
70417	Chrysler Corporation Amplex Division 6501 Harper Avenue Detroit, Michigan 48211	75042	IRC Division of TRW Incorporated 401 North Broad Street Philadelphia, Pennsylvania 19108
71279	Cambridge Thermionic Corporation 445 Concord Avenue Cambridge, Massachusetts 02138	79136	Waldes Kohinoor Incorporated 47-16 Austel Place Long Island City, New York 11101
71468	ITT Cannon Electric 666 East Dryer Road Santa Ana, California 92702	80058	Joint Electronic Type Designation System
71590	Centralab Electronics Division of Globe-Union Incorporated 5757 North Green Bay Avenue Milwaukee, Wisconsin 53201	80131	Electronic Industries Association 2001 Eye Street, N. W. Washington, D. C. 20006
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640	81312	Winchester Electronics Division Litton Industries, Incorporated Main Street & Hillside Avenue Oakville, Connecticut 06779
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624	81349	Military Specifications
72136	Electro Motive Manufacturing Company, Inc. South Park & John Streets Willimantic, Connecticut 06226	83086	New Hampshire Ball Bearings, Inc. Peterborough, New Hampshire 03458

REPLACEMENT PARTS LIST

HH-11

Mfr. Code	Name and Address	Mfr. Code	Name and Address
88044	Aeronautical Standards Group Department of the Navy and Air Force Silver Spring, Maryland	93332	Sylvania Electric Products, Inc. Semiconductor Products Division 100 Sylvan Road Woburn, Massachusetts 01801
91293	Johanson Manufacturing Company Post Office Box 329 Boonton, New Jersey 07005	96906	Military Standards
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646	99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, New York 14052
91737	Gremar Manufacturing Company Woburn, Massachusetts	99848	Wilco Corporation 4030 West 10th Street Post Office Box 22248 Indianapolis, Indiana 46222

5.4 PARTS LIST

The parts list which follows contains all electrical parts used in the equipment and certain mechanical parts which are subject to unusual wear or damage. When ordering replacement parts from the Watkins-Johnson Company, specify the type and serial number of the equipment and the reference designation and description of each part ordered. The list of manufacturers provided in paragraph 5.3 and the manufacturer's part numbers for components are included as a guide to the user of the equipment in the field. These parts may not necessarily agree with the parts installed in the equipment, however the parts specified in this list will provide satisfactory operation of the equipment. Replacement parts may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original indicated part. In the case of components defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

NOTE

As improved semiconductors become available it is the policy of CEI Division to incorporate them in proprietary products. For this reason some transistors, diodes, and integrated circuits installed in the equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

Figure 5-1 Figure 5-2

HH-11

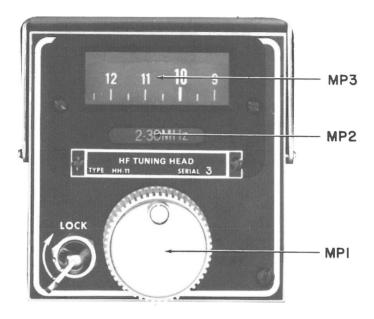


Figure 5-1. Type HH-11 Tuning Head, Front View, Location of Components

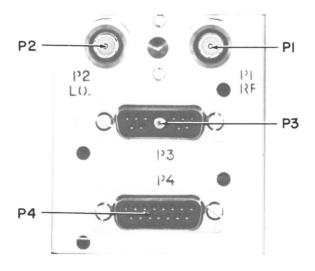


Figure 5-2. Type HH-11 Tuning Head, Rear View, Location of Components

REPLACEMENT PARTS LIST

5.4.1 Type HH-11 Tuning Head, Main Chassis

REF DESIG	DESCRIPTION		QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
A1	RF TUNER (2-30 MHz)		1	71334	14632	
A2	SHAPING AMPLIFIER		1	79844-9	14632	
А3	TUNING DRIVE ASSEMBLY		1	8588	14632	
A4	67.8-21.4 MHz CONVERTER		1	71335	14632	
J1	CONNECTOR, RECEPTACLE		1	SRE14SNSS	81312	
J2	CONNECTOR, RECEPTACLE		1	SM3SN	81312	
MP1	CRANK ASSEMBLY		1	11755-5	14632	
MP2	WINDOW		1	11448-4	14632	
MP3	WINDOW		1	11449-1	14632	
P1	CONNECTOR, PLUG	Part of W3	2	19699-1	91737	
P2	Same as P1	Part of W2				
Р3	CONNECTOR, PLUG		1	DAM11W1P	71468	
P3A1	CONNECTOR, PLUG, INSERT	Part of W1	1	DM53740-5001	71468	
P4	CONNECTOR, PLUG		1	DAM15P	71468	
P5	CONNECTOR, PLUG	Part of W3	2	521-3	16179	
P6	CONNECTOR, PLUG	Part of W2	1	501-3	16179	
P7	Same as P5	Part of W4				
P8	CONNECTOR, PLUG	Part of W4	2	UG1465/U	80058	74868
P9	Same as P8	Part of W1				
W1	CABLE ASSEMBLY		1	30020-1550	14632	
W2	CABLE ASSEMBLY		1	30020-1551	14632	
W3	CABLE ASSEMBLY		1	30020-1552	14632	
W4	CABLE ASSEMBLY		1	30020-1553	14632	
XA2	CONNECTOR, PRINTED CIRCUIT CARI)	1	250-22-30-170	71785	

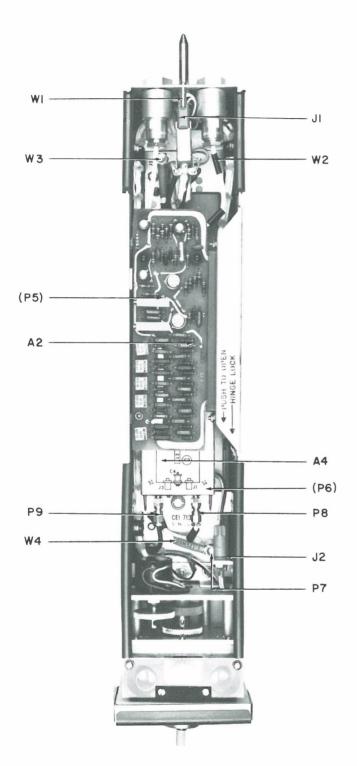


Figure 5-3. Type HH-11 Tuning Head, Top View, Location of Components

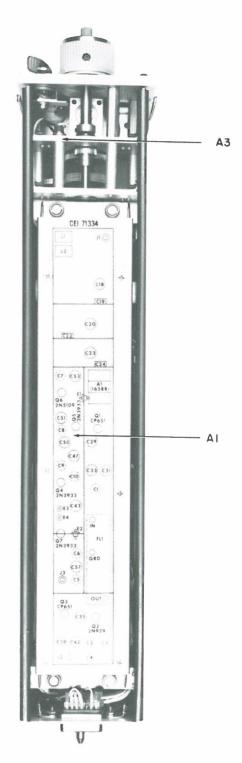


Figure 5-4. Type HH-11 Tuning Head, Bottom View, Location of Components

REPLACEMENT PARTS LIST

5.4.2 Type 71334 RF Tuner (2-30 MHz)

CR1 NOT CR2 NOT CR3 CAP CR4 NOT CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	ne as C1 T USED ne as C1	PER ASSY. 1 1 9	MANUFACTURER'S PART NO. 16588 15780-6 BB109 FA5C102W	MFR. CODE 14632 14632 25088	RECM. VENDOR
CR1 NOT CR2 NOT CR3 CAP CR4 NOT CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	T USED T USED PACITOR, VARIABLE, VOLTAGE T USED DDE, VARICAP T USED PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V The as C1 T USED THE USED THE USED THE USED THE USED	1	15780-6 BB109	14632 25088	
CR1 NOT CR2 NOT CR3 CAP CR4 NOT CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	T USED T USED PACITOR, VARIABLE, VOLTAGE T USED DDE, VARICAP T USED PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V The as C1 T USED THE USED THE USED THE USED THE USED	1	15780-6 BB109	14632 25088	
CR2 NOT CR3 CAP CR4 NOT CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	PACITOR, VARIABLE, VOLTAGE T USED DDE, VARICAP T USED PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V The as C1 T USED THE BOTTON COMMENT OF THE	1	BB109	25088	
CR3 CAP CR4 NOT CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	PACITOR, VARIABLE, VOLTAGE T USED DE, VARICAP T USED PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V ne as C1 T USED ne as C1	1	BB109	25088	
CR4 NOT CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	T USED DDE, VARICAP T USED PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V The as C1 T USED T USED The as C1	1	BB109	25088	
CR5 DIO CR6 NOT C1 CAP 5000 C2 Sam C3 NOT	DDE, VARICAP T USED PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V ne as C1 T USED ne as C1				
CR6 NOT CAP 500V C2 Sam C3 NOT	PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V ne as C1 T USED ne as C1				
C1 CAP 500V C2 Sam C3 NOT	PACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, V ne as C1 T USED ne as C1	9	FA5C102W	01121	
C2 Sam C3 NOT	V ne as C1 T USED ne as C1	9	FASC102W	01121	
C3 NOT	r used ne as C1				
	ne as C1			I	
1 1					
C4 Sam					
C5 Sam	ne as C1				
C6 Sam	ne as C1				
C7 Sam	ne as C1				
C8 Sam	ne as C1				
C9 Sam	ne as C1				
	ne as C1				
	PACITOR, MICA, DIPPED: 1600 pF, 5%, 500V	1	CM06FD162J03	81349	72136
	PACITOR, MICA, DIPPED: 6800 pF, 5%, 500V	1	DM19-682J	72136	
1	PACITOR, MICA, DIPPED: 1000 pF, 5%, 500V	1	CM06FD102J03	81349	72136
C14 CAF	PACITOR, MICA, DIPPED: 2400 pF, 5%, 500V	1	CM06FD242J03	81349	72136
C15 CAF	PACITOR, MICA, DIPPED: 2700 pF, 5%, 500V	1	CM06FD272J03	81349	72136
1 1	PACITOR, MICA, DIPPED: 62 pF, 5%, 500V	1	CM05ED620J03	81349	72136
1 1	PACITOR, MICA, DIPPED: 68 pF, 5%, 500V	1	CM05ED680J03	81349	72136
C18 CAF	PACITOR, VARIABLE, CERAMIC: 2.5-11 pF, 350V	3	538-000.B2.5-11	72982	
C19 CAF	PACITOR, FIXED, MICA: 200 pF, 5%, 250V	2	2933-000-201J	72982	
C20 Sam	ne as C18				
C21 CAF	PACITOR, MICA, DIPPED: 10 pF, ±0.5 pF, 500V	2	CM05CD100D03	81349	72136
C22 Sam	ne as C19				
	ne as C18				
1 1	PACITOR, FIXED, MICA: 130 pF, 5%, 250V	1	2933-000-131J	72982	
C25 CAI	PACITOR, MICA, DIPPED: 270 pF, 5%, 500V	2	CM05FD271J03	81349	72136
	PACITOR, CERAMIC, DISC: 0.01 μ F, 20%, 100V	5	C023B101F103M	56289	
C27 NOT	T USED				
C28 CAI	PACITOR, MICA, DIPPED: 24 pF, 5%, 500V	1	CM04ED240J03	81349	72136

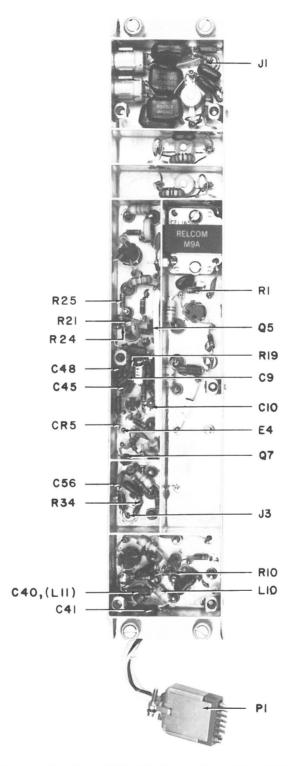


Figure 5-5. Type 71334 RF Tuner (2-30 MHz) (A1), Location of Components

REPLACEMENT PARTS LIST

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
C29	CAPACITOR, CERAMIC, STANDOFF: 1000 pF, GMV, 500V	8	SS5D102W	01121	
C30	NOT USED				
C31	CAPACITOR, VARIABLE, AIR: 0.8-10 pF, 250V	3	2954	91293	
C32	CAPACITOR, CERAMIC, TUBULAR: 3.0 pF, ± 0.25 pF, $500V$	1	301-000C0J0-309C	72982	
C33	Same as C29				
C34	Same as C26				
C35	NOT USED				
C36	NOT USED				
C37	NOT USED				
C38	CAPACITOR, MICA, DIPPED: 30 pF, 5%, 500V	1	CM04ED300J03	81349	72136
C39	Same as C31				
C40	Same as C21				
C41	CAPACITOR, MICA, DIPPED: 22 pF, 5%, 500V	1	CM05ED220J03	81349	72136
C42	Same as C29				
C43	Same as C29				
C44	CAPACITOR, MICA, DIPPED: 33 pF, 5%, 500V	1	CM04ED330J03	81349	
C45	CAPACITOR, MICA, DIPPED: 36 pF, 5%, 500V	1	CM05ED360J03	81349	72136
C46	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ±0.5 pF, 500V	1	301-000C0H0-100D	72982	
C47	Same as C31				
C48	Same as C25				
C49	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 1000V	2	B470PFM	91418	
C50	Same as C29				
C51	Same as C29				
C52	Same as C26				
C 53	Same as C29				
C54	Same as C26				
C55	Same as C49				
C56	Same as C26				
C57	Same as C29		G) (OF GD 120200	0.040	T010
C58	CAPACITOR, MICA, DIPPED: 12 pF, 5%, 500V	1	CM05CD120J03	81349	1 1
C59	CAPACITOR, MICA, DIPPED: 300 pF, 5%, 500V		CM05FD301J03	81349	
E1	TERMINAL, FEEDTHRU, INSULATED	4	SFU16	04013	
E2	Same as E1				
E3	Same as E1				

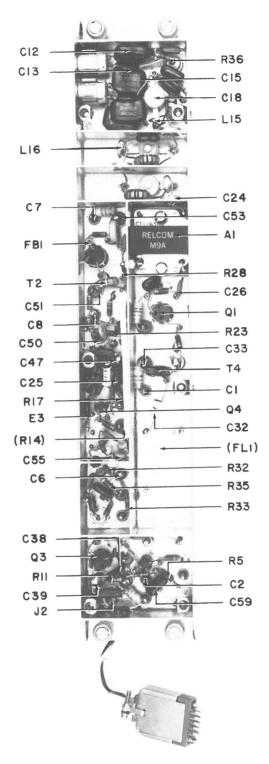


Figure 5-6. Type 71334 RF Tuner (2-30 MHz) (A1), Location of Components

REPLACEMENT PARTS LIST

REF	DESCRIPTION	QTY. PER	MANUFACTURER'S	MFR.	RECM.
DESIG		ASSY.	PART NO.	CODE	VENDOR
E4	Same as E1				
FB1	FERRITE BEAD	2	56-590-65-4A	02114	
FB2	NOT USED				
FB3	Same as FB1				
FLI	FILTER	1	16962-1	14632	
J1	CONNECTOR, RECEPTACLE	3	2058-0000	26805	
J2	Same as J1				
Ј3	Same as J1				
L1	COIL, VARIABLE: 2.97-3.63 μH	1	31662-17	14632	
L2	COIL, VARIABLE: 5.1-6.14 μH	1	31662-19	14632	
L3	COIL, TOROIDAL	3	20681-72	14632	
L4	Same as L3				
L5	Same as L3				
L6	COIL, FIXED: 0.15 μ H, 20%	1	1537-00	99800	
L7	COIL, FIXED: 3.9 μ H, 10%	5	1537-26	99800	
L8	NOT USED				
L9	Same as L7				
L10	Same as L7				
L11	INDUCTOR	1	21210-124	14632	
L12	Same as L7				
L13	Same as L7				
L14	COIL, FIXED: 1.0 μ H, 10%	1	1537-12	99800	
L15	INDUCTOR	3	22292-44	14632	
L16	Same as L15				
L17	Same as L15		1		
L18	COIL, FIXED: 0.24 μ H, 15%	1	200-11	99848	
MP1	COVER	1	22865-1	14632	
P1	CONNECTOR, PLUG	1	SRE14PNSSH13	81312	
Q1	TRANSISTOR	2	CP651	12498	
Q2	TRANSISTOR	1	2N929	80131	04713
Q3	Same as Q1				
Q4	TRANSISTOR	3	2N3478	80131	02735
Q5	Same as Q4				
Q6	TRANSISTOR	1	2N5109	80131	02735
Q7	Same as Q4				
R1	RESISTOR, FIXED, COMPOSITION: 20 Ω , 5%, 1/4W	1	RCR07G200JS	81349	01121

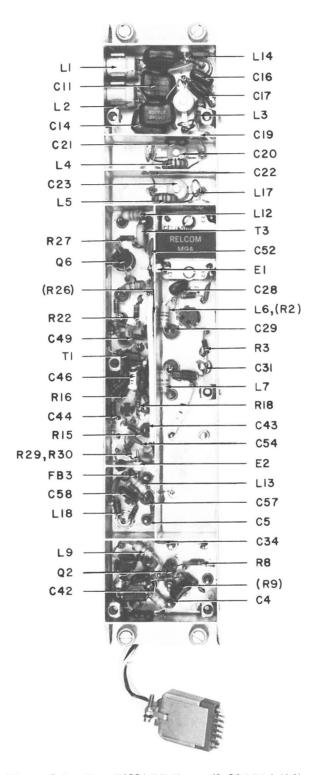


Figure 5-7. Type 71334 RF Tuner (2-30 MHz) (A1), Location of Components

REPLACEMENT PARTS LIST

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
R2	RESISTOR, FIXED, COMPOSITION: 120 Ω , 5%, 1/4W	1	RCR07G121JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	5	RCR07G100JS	81349	01121
R4	NOT USED				
R5	RESISTOR, FIXED, FILM: 1.21 k Ω , 1 $\%$, 1/4 $\%$	1	RN60D1211F	81349	75042
R6	NOT USED				
R7	NOT USED				
R8	RESISTOR, FIXED, COMPOSITION: 82 Ω , 5%, 1/4W	1	RCR07G820JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 3.3 k Ω , 5%, 1/4W	1	RCR07G332JS	81349	01121
R10	RESISTOR, FIXED, FILM: $10.0~\mathrm{k}\Omega$, 1% , $1/4\mathrm{W}$	1	RN60D1002F	81349	75042
R11	RESISTOR, FIXED, COMPOSITION: $10 \text{ k}\Omega$, 5% , $1/4\text{W}$	1	RCR07G103JS	81349	01121
R12	NOT USED				
R13	NOT USED				
R14	RESISTOR, FIXED, COMPOSITION: 270 Ω , 5%, 1/4W	1	RCR07G271JS	81349	01121
R15	Same as R3				
R16	RESISTOR, FIXED, COMPOSITION: 1.8 k Ω , 5%, 1/4W	1	RCR07G182JS	81349	01121
R17	RESISTOR, FIXED, COMPOSITION: $18 \text{ k}\Omega$, 5% , $1/4\text{W}$	2	RCR07G183JS	81349	01121
R18	Same as R17				
R19	RESISTOR, FIXED, COMPOSITION: 2.2 k Ω , 5%, 1/4W	1	RCR07G222JS	81349	01121
R20	RESISTOR, FIXED, COMPOSITION: 24 k Ω , 5%, 1/4W	1	RCR07G243JS	81349	01121
R21	Same as R11				
R22	RESISTOR, FIXED, COMPOSITION: 20 k Ω , 5%, 1/4W	1	RCR07G203JS	81349	01121
R23	Same as R3				
R24	RESISTOR, FIXED, COMPOSITION: 330 Ω , 5%, 1/4W	3	RCR07G331JS	81349	01121
R25	RESISTOR, FIXED, COMPOSITION: 1.0 k Ω , 5%, 1/4W	1	RCR07G102JS	81349	01121
R26	Same as R3				
R27	Same as R3				
R28	RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W	1	RCR07G471JS	81349	01121
R29	Same as R24				
R30	RESISTOR, FIXED, COMPOSITION: 43 Ω , 5%, 1/4W	1	RCR07G430JS	81349	01121
R31	NOT USED				
R32	RESISTOR, FIXED, COMPOSITION: 5.1 k Ω , 5%, 1/4W	1	RCR07G512JS	81349	01121
R33	Same as R24				
R34	RESISTOR, FIXED, COMPOSITION: 100Ω , 5% , $1/4$ W	1	RCR07G101JS	81349	01121
R35	RESISTOR, FIXED, COMPOSITION: 910 Ω , 5%, 1/4W	1	RCR07G911JS	81349	01121
R36	RESISTOR, FIXED, COMPOSITION: 200 Ω , 5%, 1/4W	1	RCR07G201JS	81349	01121
T1	INDUCTOR, TAPPED	1	11464-75	14632	

REPLACEMENT PARTS LIST

HH-11

DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
TRANSFORMER, TOROIDAL	1	21278-8	14632	
TRANSFORMER, TOROIDAL	1	21428-22	14632	
INDUCTOR, TAPPED	1	11464-76	14632	
,	TRANSFORMER, TOROIDAL TRANSFORMER, TOROIDAL	DESCRIPTION PER ASSY. TRANSFORMER, TOROIDAL 1 TRANSFORMER, TOROIDAL 1	DESCRIPTION PER ASSY. PART NO. TRANSFORMER, TOROIDAL 1 21278-8 TRANSFORMER, TOROIDAL 1 21428-22	DESCRIPTION PER ASSY. PART NO. CODE TRANSFORMER, TOROIDAL 1 21278-8 14632 TRANSFORMER, TOROIDAL 1 21428-22 14632

Figure 5-8

5.4.2.1 Part 16588 Balanced Mixer

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
E1	TERMINAL	3	1019-2	71279	
E2	Same as E1				
E3	Same as E1				
U1	MIXER, BALANCED	1	M9A	14482	

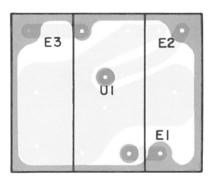


Figure 5-8. Part 16588 Balanced Mixer (A1A1), Location of Components

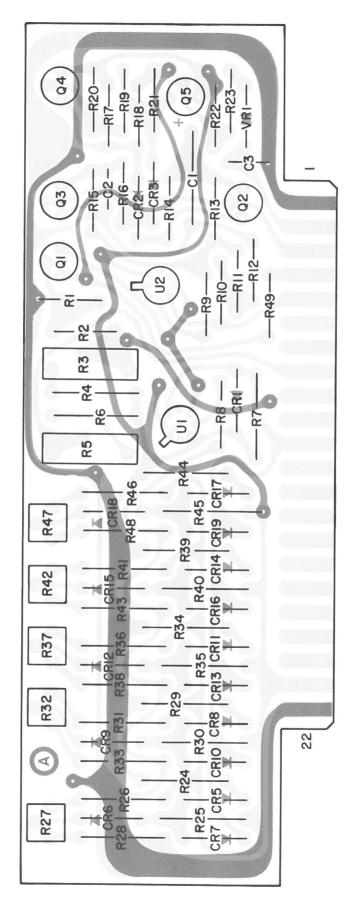


Figure 5-9. Type 79844-9 Shaping Amplifier (A2), Location of Components

REPLACEMENT PARTS LIST

5.4.3 Type 79844-9 Shaping Amplifier

		T = ===	KEF DESIG PKE	T	T
REF DESIG	DESCRIPTION	PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
CR1	DIODE	18	1N458A	80131	93332
CR2	Same as CR1			00101	70002
CR3	Same as CR1				
CR4	NOT USED				
CR5 thru CR19	Same as CR1				
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 $\mu \text{F},$ 10%, 100V	1	109D475X9100C2	56289	
C2	CAPACITOR, CERAMIC, DISC: 1000 pF, 20%, 1000V	1	DA 141-333	71590	
С3	CAPACITOR, CERAMIC, DISC: 5000 pF, 20%, 100V	1	C023B101E502M	56289	
Q1	TRANSISTOR	3	2N2907	80131	04713
Q2	TRANSISTOR	2	U1899E	15818	
Q3	Same as Q2				
Q4	Same as Q1				
Q5	Same as Q1				
R1	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, $1/4W$	1	RCR07G562JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, $1/4W$	1	RCR07G472JS	81349	01121
R3	RESISTOR, VARIABLE, FILM: 5 kΩ, 10%, 3/4W	2	89PR 5K	73138	
R4	RESISTOR, FIXED, FILM: 7.15 k Ω , 1%, 1/4W	1	RN60D7151F	81349	75042
R5	Same as R3				
R6	RESISTOR, FIXED, FILM: $16.2 \text{ k}\Omega$, 1% , $1/4\text{W}$	1	RN60D1622F	81349	75042
R7	RESISTOR, FIXED, FILM: $36.5 \text{ k}\Omega$, 1% , $1/4\text{W}$	1	RN60D3652F	81349	75042
R8	RESISTOR, FIXED, COMPOSITION: 12 k Ω , 5%, 1/4W	1	RCR07G123JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: $10 \text{ k}\Omega$, 5% , $1/4\text{W}$	1	RCR07G103JS	81349	01121
R10	RESISTOR, FIXED, COMPOSITION: $1.0 \text{ M}\Omega$, 5% , $1/4\text{W}$	4	RCR07G105JS	81349	01121
R11	Same as R10				
R12	RESISTOR, FIXED, COMPOSITION: 100Ω , 5% , $1/4W$	2	RCR07G101JS	81349	01121
R13	RESISTOR, FIXED, COMPOSITION: 2.7 k Ω , 5%, 1/4W	1	RCR07G272JS	81349	01121
R14	RESISTOR, FIXED, COMPOSITION: 22 MΩ, 5%, 1/4W	2	RCR07G226JS	81349	01121
R15	RESISTOR, FIXED, COMPOSITION: 330 Ω , 5%, 1/4W	1	RCR07G331JS	81349	01121
R16	Same as R14				
R 1 7	RESISTOR, FIXED, COMPOSITION: 3.9 M Ω , 5%, 1/4W	2	RCR07G395JS	81349	01121
R18	Same as R10				
R19	Same as R17				
R20	RESISTOR, FIXED, COMPOSITION: 470 k Ω , 5%, 1/4W	2	RCR07G474JS	81349	01121
R21	Same as R10				

REF DESIG PREFIX A2

HH-11

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
R22	Same as R20				
R23	RESISTOR, FIXED, COMPOSITION: 2.2 M Ω , 5%, 1/4W	1	RCR07G225JS	81349	01121
R24	RESISTOR, FIXED, FILM: $100 \text{ k}\Omega$, 1% , $1/4\text{W}$	1	RN60D1003F	81349	75042
R25	RESISTOR, FIXED, FILM: 82.5 k Ω , 1%, 1/4W	1	RN60D8252F	81349	75042
R26	RESISTOR, FIXED, FILM: 8.25 k Ω , 1%, 1/4W	1	RN60D8251F	81349	75042
R27	RESISTOR, VARIABLE, FILM: 2 kΩ, 10%, 1/2W	5	62PAR2K	73138	
R28	RESISTOR, FIXED, FILM: 4.64 k Ω , 1%, 1/4W	1	RN60D4641F	81349	75042
R29	RESISTOR, FIXED, FILM: 215 k Ω , 1 $\%$, 1/4W	1	RN60D2153F	81349	75042
R30	RESISTOR, FIXED, FILM: 150 k Ω , 1%, 1/4W	1	RN60D1503F	81349	75042
R31	RESISTOR, FIXED, FILM: 7.50 kΩ, 1%, $1/4$ W	3	RN60D7501F	81349	75042
R32	Same as R27				
R33	RESISTOR, FIXED, FILM: 5.11 kΩ, 1%, 1/4W	3	RN60D5111F	81349	75042
R34	RESISTOR, FIXED, FILM: 68.1 k Ω , 1 $\%$, 1/4W	1	RN60D6812F	81349	75042
R35	RESISTOR, FIXED, FILM: 46.4 kΩ, 1%, $1/4$ W	1	RN60D4642F	81349	75042
R36	Same as R31				
R37	Same as R27				
R38	Same as R33				
R39	RESISTOR, FIXED, FILM: 56.2 kΩ, 1%, $1/4$ W	1	RN60D5622F	81349	75042
R40	RESISTOR, FIXED, FILM: 26.1 kΩ, 1%, $1/4$ W	1	RN60D2612F	81349	75042
R41	RESISTOR, FIXED, FILM: 6.81 kΩ, 1%, $1/4$ W	1	RN60D6811F	81349	75042
R42	Same as R27				
R43	Same as R41				
R44	RESISTOR, FIXED, FILM: 75.0 kΩ, 1%, $1/4$ W	1	RN60D7502F	81349	75042
R45	RESISTOR, FIXED, FILM: 24.3 k Ω , 1%, 1/4W	1	RN60D2432F	81349	75042
R46	Same as R33				
R47	Same as R27				
R48	Same as R31				
R49	Same as R12				
U1	INTEGRATED CIRCUIT	2	U5B7741393	07263	
U2	Same as U1				
VR1	DIODE	1	1N759A	80131	04713

Courtesy of http://BlackRadios.terryo.org

HH-11

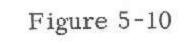
REPLACEMENT PARTS LIST

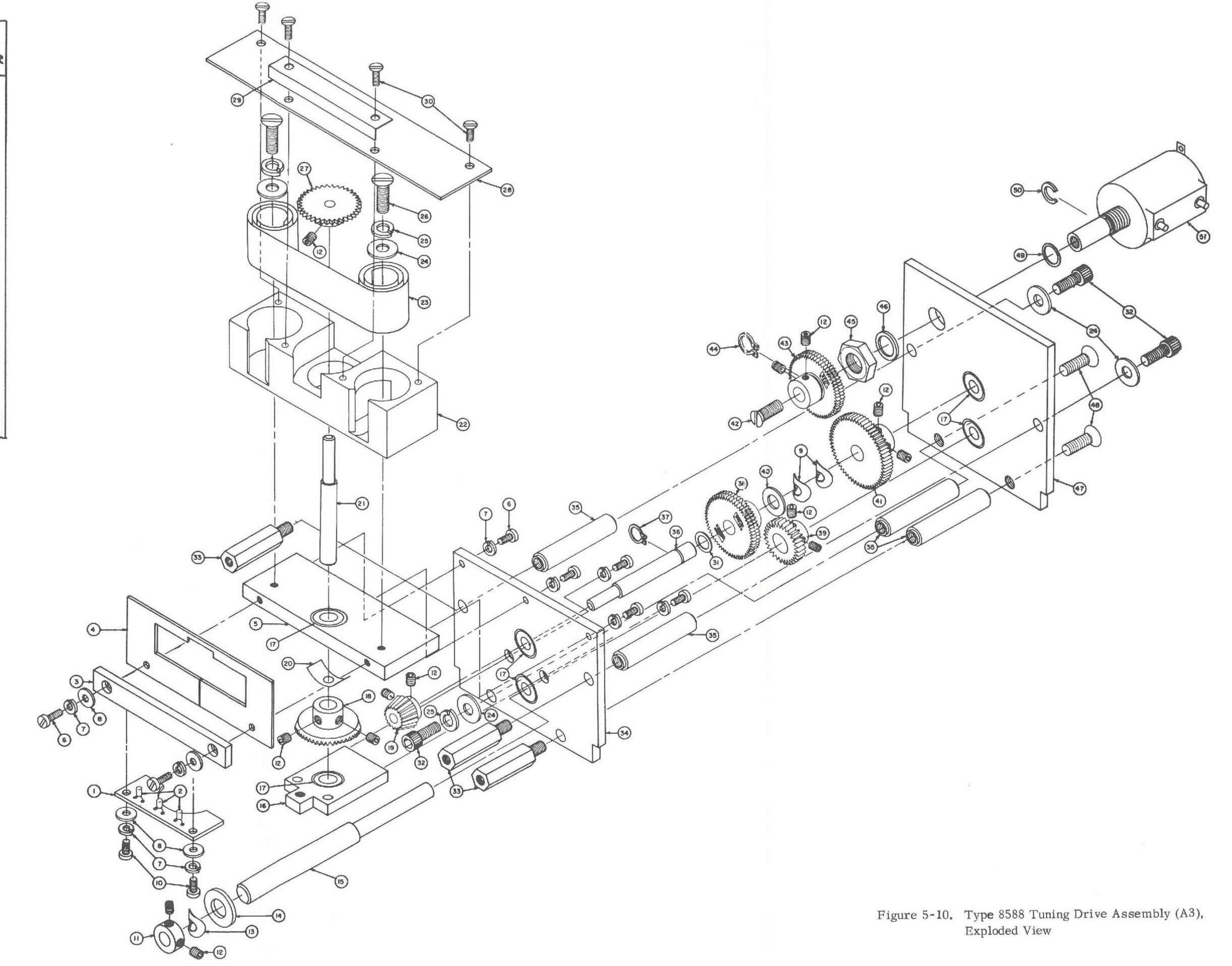
5.4.4 Type 8588 Tuning Drive Assembly

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
DS1	LAMP, INCANDESCENT	3	CM8-683	71744	
DS2	Same as DS1				
DS3	Same as DS1				
R1	RESISTOR, VARIABLE, PRECISION: 10 k Ω , 10%, 2W	1	8106-R10K-L.25	73138	
	Note: For Mechanical Parts, See Exploded View				

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
1	LIGHT BOARD ASSEMBLY	1	15531	14632	
2	LAMP, INCANDESCENT	REF	CM8-683	71744	
3	LIGHT BAR	1	13963	14632	
4	GUIDE PLATE	1	14122-1	14632	
5	TOP GEAR PLATE	1	15652-1	14632	
6	#2-56 x 1/4 PAN HEAD MACHINE SCREW	7	MS35233-3	96906	73734
7	#2 LOCKWASHER	9	MS35338-78	96906	73734
8	#2 FLAT WASHER	3	MS15795-802	96906	73734
9	TENSION SPRING	2	7752	04941	
10	#2-56 x 1/4 FILLISTER HEAD MACHINE SCREW	2	AN500D2-4	88044	73734
11	COLLAR	1	11581-10	14632	
12	#4-40 x 1/8 SETSCREW	13	AN565DC4-2	88044	73734
13	TENSION SPRING	1	7754	04941	
14	THRUST WASHER	1	TT504	70417	
15	SHAFT	1	15641-1	14632	
16	SUPPORT PLATE	1	15655-1	14632	
17	BEARING	6	SFR-33MM	83086	
18	BEVEL GEAR	1	11135-2	14632	
19	PINION BEVEL GEAR	1	11136-1	14632	
20	TENSION SPRING	1	15654-1	14632	
21	SHAFT	1	12974 - 7	14632	
22	TAPE CHAMBER	1	15356-1	14632	
23	DIAL, TAPE	1	32864-1	14632	
24	#6 FLAT WASHER	5	MS15795-805	96906	73734
25	#6 LOCKWASHER	3	MS35338-79	96906	73734
26	#6-32 x 1/4 PAN HEAD MACHINE SCREW	2	MS35233-26	96906	73734
27	TAPE DRIVE GEAR	1	14065	14632	
28	GUIDE PLATE	1	14122-1	14632	
29	ANGLE PLATE	1	15357-1	14632	
30	#2-56 x 1/4 FLAT HEAD MACHINE SCREW	4	MS35249-10	96906	73734
31	SHIM	1	SSS-23	01351	
32	#6-32 x 3/8 HEXAGON SOCKET CAP SCREW	3	MS35457-7	96906	73734
33	SHOULDER SPACER	3	20755-71	14632	
34	FRONT GEAR PLATE	1	22245-1	14632	
35	SPACER	4	20757-32	14632	
36	SHAFT	1	12974-8	14632	

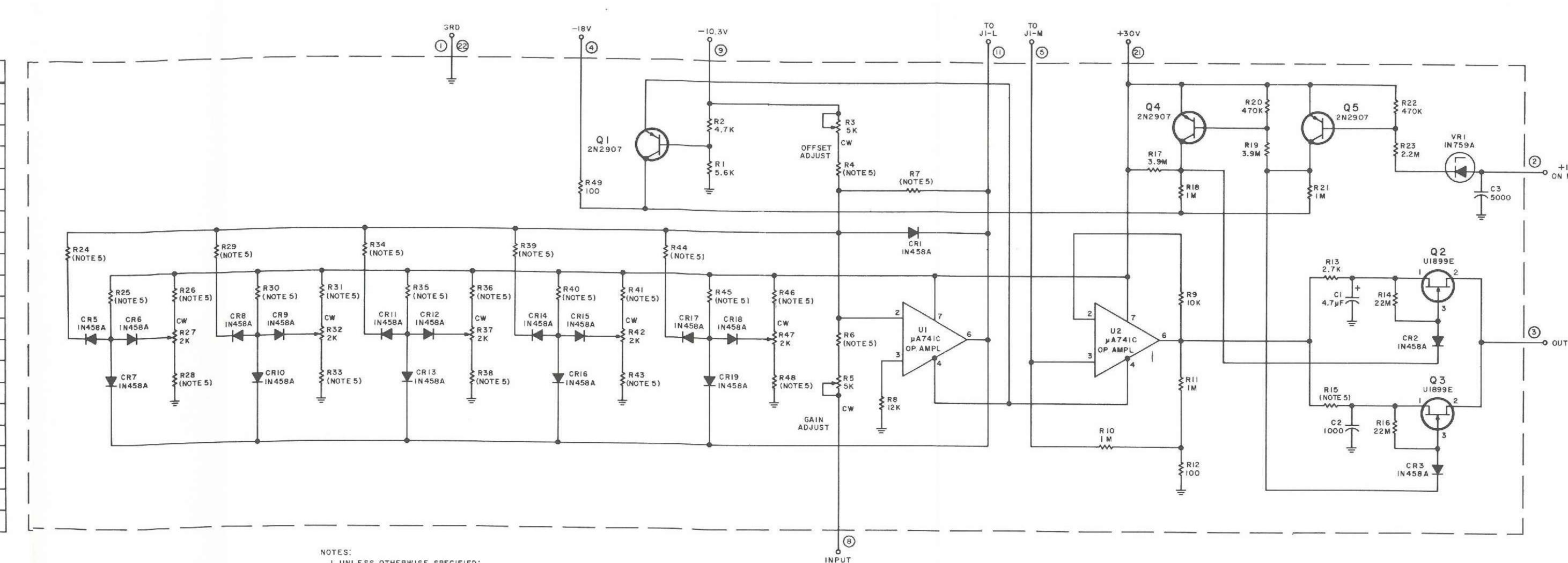
REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
37	RETAINING RING	1	5100-18	79136	
38	ANTIBACKLASH GEAR, 64P-60T	1	20178-2	14632	
39	SPUR GEAR, 64P-30T	1	20189-16	14632	
40	CLUTCH BEARING	1	11582-7	14632	
41	SPUR GEAR, 64P-60T	1	20189-18	14632	
42	SCREW	REF	Part of Potentiometer	-	
43	ANTIBACKLASH GEAR, 64P-60T	1	20178-3	14632	
44	RETAINING RING	REF	Part of Potentiometer	-	
45	NUT	REF	Part of Potentiometer	-	
46	WASHER	REF	Part of Potentiometer	-	
47	REAR GEAR PLATE	1	22246-1	14632	
48	#6-32 x 1/2 FLAT HEAD MACHINE SCREW	2	MS35249-37	96906	73734
49	SPACER	REF	Part of Potentiometer	_	
50	RETAINING RING	REF	Part of Potentiometer	-	
51	POTENTIOMETER	REF	8106R-10K-L.25	73138	





5-21

INIT NO. REQ RANGE	TYPE	R 4	R6	R7	R24	R25	R26	R28	R29	R30	R31	R33	R34	R35	R36	R38	R39	R40	R41	R43	R44	R45	R46	R48	R15
VH-16)-80MHz	-1	IOK	18.2K	60.4K	68.1K	75K	8.06K	5.IIK	75K	36.5K	6.81K	5.36K	130K	51.1K	5.36K	7.15K	127K	34.8K	4,12K	8.45K	274K	51.1K	2.80K	IOK	330
VH-12 D-120MHz	-2	12.1K	19.6K	60.4K	100К	IOOK	8.25K	5.IIK	IOOK	56.2K	6.81K	6.81K	90.9K	56.2K	5.36K	7.15 K	127K	36.5K	4.75K	8.45K	150K	18.2K	2.94K	IOK	330
VH-13)-180MHz	-3	12.IK	18.2K	68.IK	68.IK	86.6K	12.1K	1.50K	75K	56.2K	9.09K	4.12K	68.IK	39.2K	8.06K	5.36K	75 K	36.5K	6.81K	7.15 K	100K	30.IK	5.11K	9.09К	330
VH-14 0-300MHz	-4	12.1K	19.6K	150K	100К	150K	12.1 K	2.05K	90.9K	61,9K	8.06K	5.11K	68.1K	30. łK	6.8IK	6.81K	86.6K	21.5K	5.IIK	8.06K	75K	IOK	2.61K	12.1 K	330
UH-II 0-500MHz	-5	12.1K	18.2K	127K	127K	210K	IOK	2.94K	100K	56.2K	6.8IK	6.81K	68.IK	24.3K	5.36K	8.06K	90.9K	21.5K	3.92K	9.09K	68.IK	IOK	2.61K	IOK	2.7
0H-12	-6	12.1K	18.2K	100K	127K	90.9K	7.15K	5.36K	75K	36.5K	6.81K	6.81K	100K	36.5K	5.36K	7.15K	100K	24.3K	4.02K	9.09K	100 K	18.2K	2.94K	IOK	2.71
VH-II	-7	12.1K	18.2K	56.2K	100 K	68.1K	8.0 6K	5.11K	90.9K	56.2K	7.15K	5.36K	121K	56.2K	6.81K	6.8IK	100 K	34.8K	5.11K	8.06K	150K	30.1K	3.24K	10K	330
VH-15 0-40MHz	-8	10 K	18.2K	68.IK	75K	150K	12.1K	1,82K	75K	68.1K	8.45K	4.12 K	юок	56.2K	7.15K	5.36K	90.9K	36.5K	5,36K	7.15 K	90.9K	18.2K	2.74K	IOK	330
HH-11 2- 30 MHz	-9	7.15K	16.2K	36-5K	100K	82.5K	8.25K	4.64K	2 15K	150K	7.5 K	5.IIK	68.1K	46.4K	7.5 K	5.II K	56.2K	26.IK	6.BIK	6-8IK	75 K	24,3K	5.IIK	7.5K	330
VH-17 50-100MHz	-2	12.IK	19.6K	60.4K	100 K	ю	8.25K	5.IIK	100К	56.2K	6.8IK	6.8IK	90.9K	56.2K	5.36K	7.15K	127K	36.5K	4.75K	8.45K	150K	18.2K	2.94K	юк	330
	_												g												
										-															
	-																								
				-																					
					and a second																				



NOTES:

I. UNLESS OTHERWISE SPECIFIED:

a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.

b) CAPACITANCE IS MEASURED IN pF,

2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

3. CW ON POTENTIOMETERS DENOTE CLOCKWISE ROTATION OF ACTUATOR.
4. FOR UI,U2 PIN ARRANGEMENT, SEE DETAILA.

5. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK. ALL VALUES ARE NOMINAL; FINAL VALUES TO BE FACTORY SELECTED. ALL RESISTANCES IN TABULATION BLOCK ARE IN OHMS, ±1%, 1/4w.

6. SHAPING AMPLIFIERS WITH PREVIOUSLY ASSIGNED TYPE NUMBERS ARE LISTED BELOW WITH THEIR CORRESPONDING

79844 SERIES NUMBER THESE OLD TYPE NUMBERS ARE

TUNING HEAD TYPE 79844VH-II 79618 -7
VH-I2 79655 -2
VH-I3 79656 -3
VH-I4 79658 -4
VH-I6 79844 -1
UH-II 79871 -5

LISTED FOR REFERENCE ONLY.

BOTTOM VIEW

Figure 6-2. Type 79844-9 Shaping Amplifier (/ Schematic Diagram

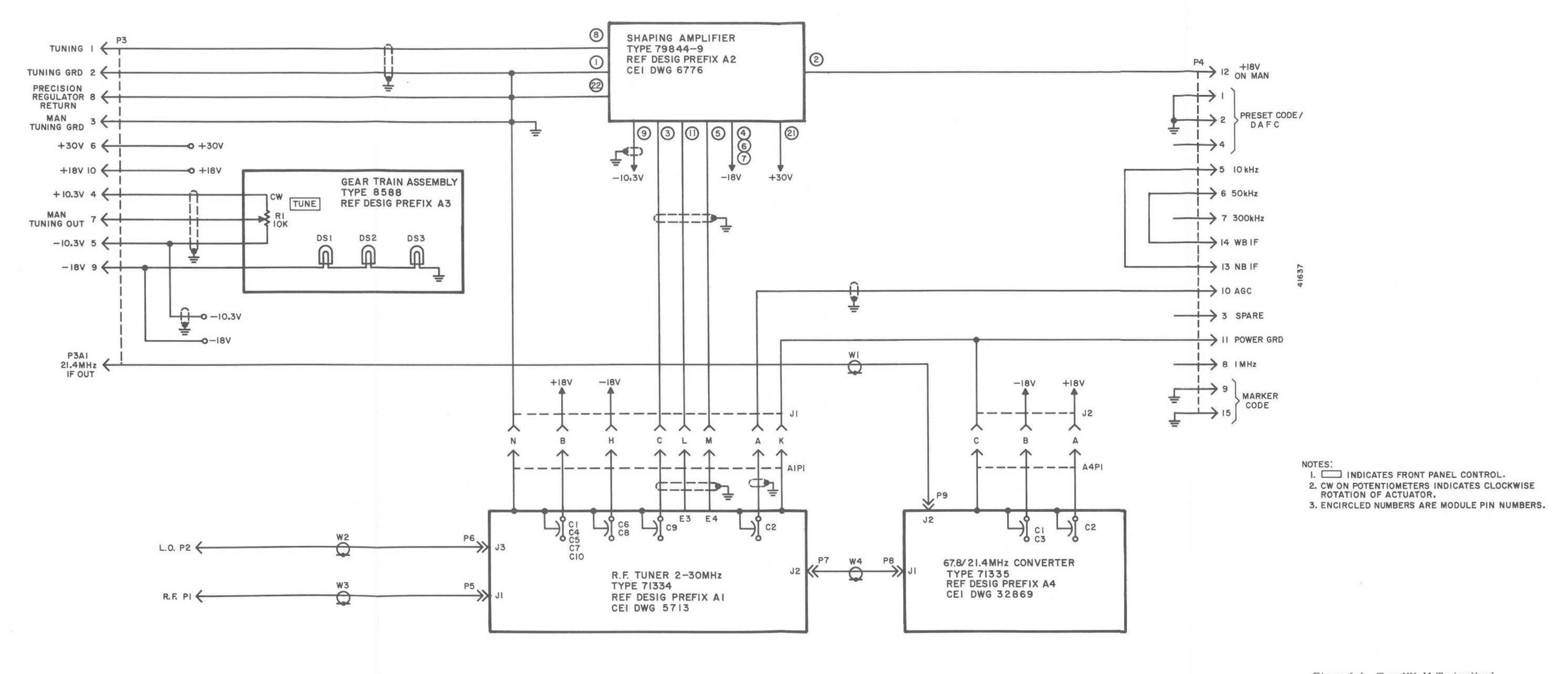


Figure 6-6. Type HH-11 Tuning Head,
Main Chassis Schematic Diagram

REPLACEMENT PARTS LIST

5.4.5 <u>Type 71335 67.8-21.4 MHz Converter</u>

R E F D E S I G	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
A1	MIXER/IF AMPLIFIER	1	16544-1	14632	
A2	CRYSTAL OSCILLATOR	1	16545-1	14632	
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V	3	FA5C102W	01121	
C2	Same as C1				
C3	Same as C1				
C4	CAPACITOR, VARIABLE, AIR: 0.8-10 pF, 250V	1	2954	91293	
C5	CAPACITOR, CERAMIC, TUBULAR: 10 pF, ±0.5 pF, 500V	1	301-000C0H0-100D	72982	
J1	CONNECTOR, RECEPTACLE	2	10-0104-002	19505	
J2	Same as J1				
L1	COIL, FIXED: 8.2 μ H, 10%	2	1537 -34	99800	
L2	Same as L1				
L3	INDUCTOR	1	21210-125	14632	
P1	CONNECTOR, PLUG	1	SM3P	81312	
R1	RESISTOR, FIXED, COMPOSITION: 2.7 Ω , 5%, 1/4W	1	RCR07G2R7JS	81349	01121

Figure 5-11 HH-11

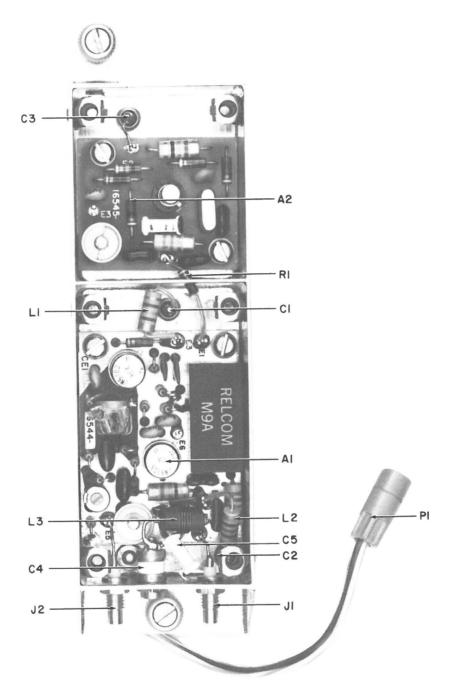


Figure 5-11. Type 71335 67.8-21.4 MHz Converter (A4), Location of Components

REPLACEMENT PARTS LIST

HH-11

5.4.5.1 Part 16544-1 Mixer/IF Amplifier

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
C1	CAPACITOR, MICA, DIPPED: 33 pF, 5%, 500V	2	CM04ED330J03	81349	72136
C2	Same as C1				
C3	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	3	SM1000PFP	91418	
C4	Same as C3				
C5	CAPACITOR, CERAMIC, DISC: 0.01 μ F, 20%, 200V	3	8131A200Z5U0-103M	72982	
C6	Same as C5				
C7	Same as C3				
C8	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350V	1	538-011D9-35	72982	
C9	CAPACITOR, MICA, DIPPED: 36 pF, 5%, 500V	1	CM04ED360J03	81349	72136
C10	Same as C5				
C11	CAPACITOR, MICA, DIPPED: 110 pF, 5%, 500V	1	CM04FD111J03	81349	72136
E1	TERMINAL, FORKED	6	140-1941-02-01	71279	
E2 thru E6	Same as E1				
L1	COIL, FIXED: 0.15 μ H, 20%	1	1537 -00	99800	
L2	COIL, FIXED: 1.0 μ H, 10%	1	1537-12	99800	
Q1	TRANSISTOR	2	2N5109	80131	02735
Q2	Same as Q1				
R1	RESISTOR, FIXED, COMPOSITION: 5.1 k Ω , 5%, 1/4W	1	RCR07G512JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 1.5 k Ω , 5%, 1/4W	1	RCR07G152JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 360Ω , 5% , $1/4W$	1	RCR07G361JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: 15 Ω , 5%, 1/4W	1	RCR07G150JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 180 Ω , 5%, 1/4W	1	RCR07G181JS	81349	01121
R6	RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/4W	1	RCR07G470JS	81349	01121
R7	RESISTOR, FIXED, COMPOSITION: 33 Ω , 5%, 1/4W	1	RCR07G330JS	81349	01121
R8	RESISTOR, FIXED, COMPOSITION: 2.7 Ω , 5%, 1/4W	1	RCR07G2R7JS	81349	01121
R9	RESISTOR, FIXED, COMPOSITION: 220 Ω , 5%, 1/4W	1	RCR07G221JS	81349	01121
R10	RESISTOR, VARIABLE, FILM: 100 Ω, 10%, 1/2W	1	62PR 100	73138	
R11	RESISTOR, FIXED, COMPOSITION: 51 Ω , 5%, 1/4W	1	RCR07G510JS	81349	01121
Т1	TRANSFORMER	1	22295-19	14632	
U1	MIXER, BALANCED	1	M9A	14482	

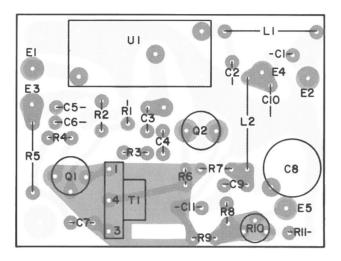


Figure 5-12. Part 16544-1 Mixer/IF Amplifier (A4A1), Location of Components

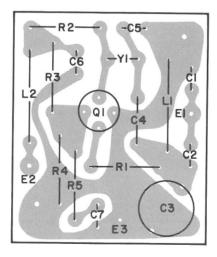


Figure 5-13. Part 16545-1 Crystal Oscillator (A4A2), Location of Components

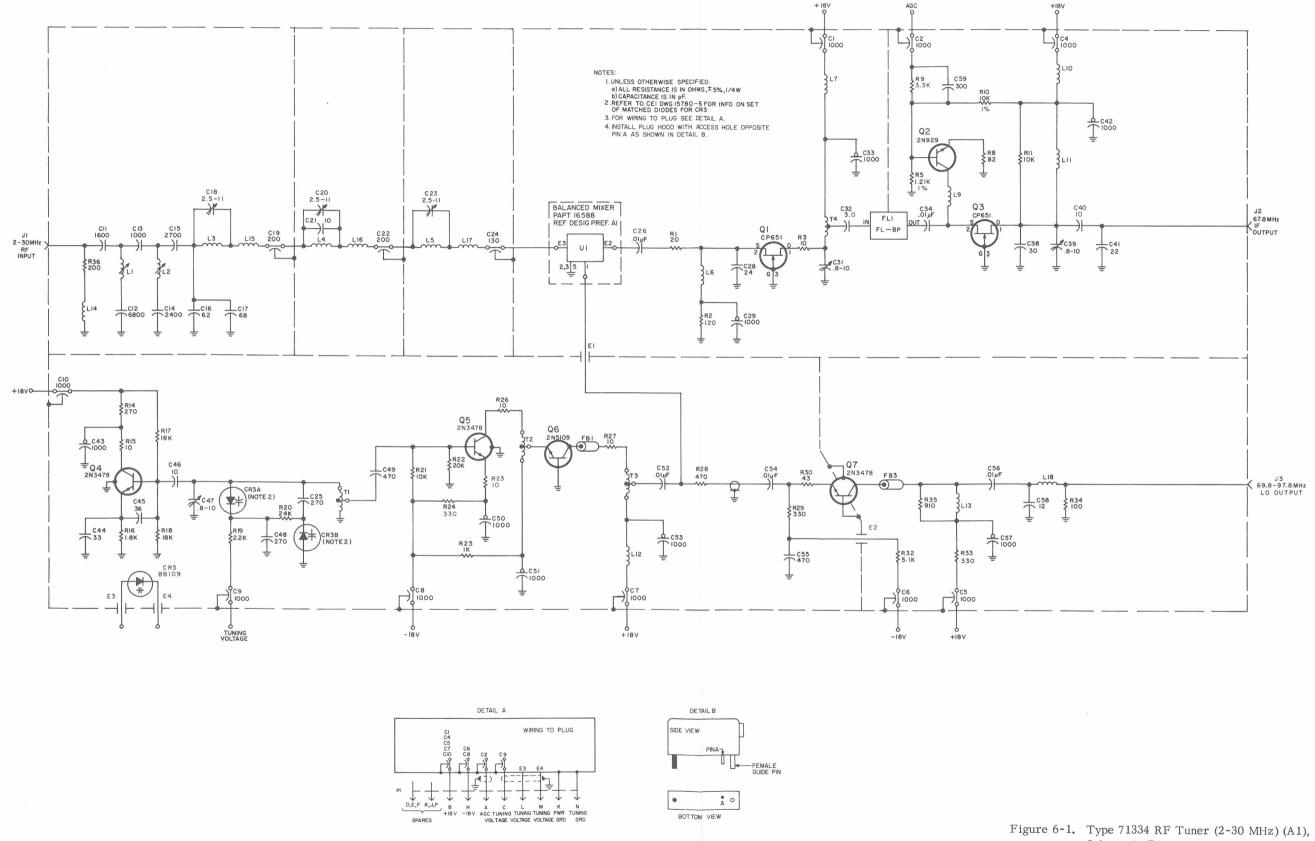
REPLACEMENT PARTS LIST

5.4.5.2 Part 16545-1 Crystal Oscillator

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR.	RECM. VENDOR
C1	CAPACITOR, MICA, DIPPED: 33 pF, 5%, 500V	1	CM04ED330J03	81349	72136
C2	CAPACITOR, MICA, DIPPED: 12 pF, 5%, 500V	1	CM04CD120J03	81349	72136
C3	CAPACITOR, VARIABLE, CERAMIC: 5.5-18 pF, 350V	1	DV11PS18A	72982	
C4	CAPACITOR, CERAMIC, TUBULAR: 8.2 pF, ±0.5 pF, 500V	1	301-000C0H0-829D	72982	
C5	CAPACITOR, MICA, DIPPED: 39 pF, 5%, 500V	1	CM04ED390J03	81349	72136
C6	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	2	SM1000PFP	91418	
C7	Same as C6				
E1	TERMINAL, FORKED	3	140-1941-02-01	71279	
E2	Same as E1				
E3	Same as E1				
L1	COIL, FIXED: 0.33 μ H, 20%	1	1537 -04	99800	
L2	COIL, FIXED: 1.0 μ H, 10%	1	1537-12	99800	
Q1	TRANSISTOR	1	2N3478	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 22 Ω , 5%, 1/4W	1	RCR07G220JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 750 Ω , 5%, 1/4W	1	RCR07G751JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 6.8 k Ω , 5%, 1/4W	1	RCR07G682JS	81349	01121
R4	RESISTOR, FIXED, COMPOSITION: $10 \text{ k}\Omega$, 5% , $1/4\text{W}$	1	RCR07G103JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 10 Ω , 5%, 1/4W	1	RCR07G100JS	81349	01121
Y1	CRYSTAL, QUARTZ	1	CR-76/U(46.400 MHz	z) 81349 L	74306

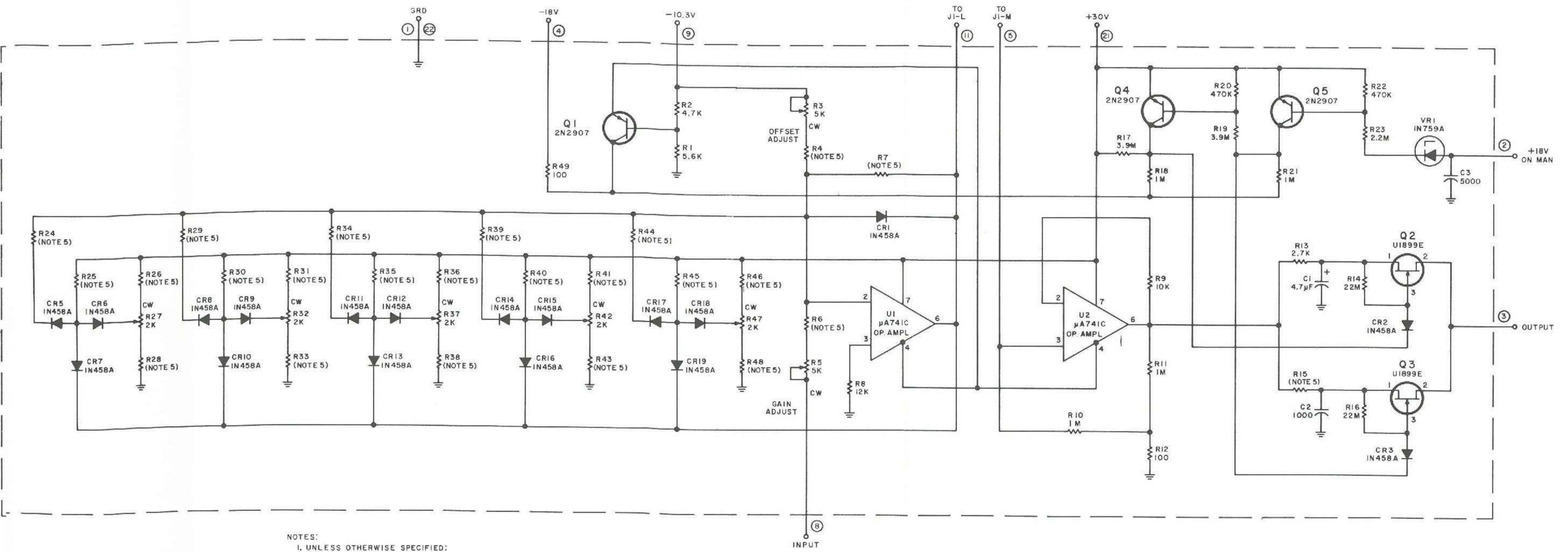
SCHEMATIC DIAGRAMS

SECTION VI SCHEMATIC DIAGRAMS



Schematic Diagram

JNIT NO. REQ RANGE	TYPE	R 4	R6	R7	R24	R25	R26	R28	R29	R30	R31	R33	R34	R35	R36	R38	R39	R40	R41	R43	R44	R45	R46	R48	R15
VH-16)-80MHz	-1	IOK	18.2K	60.4K	68.1K	75 K	8.06K	5.11K	75K	36.5K	6.81K	5.36K	130K	51.IK	5.36K	7.15K	127K	34.8K	4,12K	8.45K	274K	51.1K	2.80K	юк	330
VH-12 -120MHz	-2	12.1K	19.6K	60.4K	100K	ююк	8.25K	5.IIK	100K	56.2K	6.81K	6.81K	90.9K	56.2K	5.36K	7.15K	127K	36.5K	4.75K	8.45K	150K	18.2K	2.94K	IOK	330
VH-I3 0-I80MH≥	-3	12.1K	18.2K	68.IK	68.IK	86.6K	12.1K	1.50K	75K	56.2K	9.09К	4.12K	68.IK	39.2K	8.06K	5.36K	75 K	36.5K	6.81K	7.15 K	100K	30.IK	5.11K	9.09K	330
VH-14 0-300MHz	-4	12.1K	19.6K	150K	100K	150K	12.1 K	2.05K	90.9K	61,9K	8.06K	5.11K	68.1K	30. IK	6.81K	6.8IK	86.6K	21.5K	5.IIK	8.06K	75K	IOK	2.61K	12.1 K	330
UH-II 0-500MHz	-5	12.1K	18.2K	127K	127K	210K	IOK	2.94K	IOOK	56.2K	6.BIK	6.81K	68.IK	24.3K	5.36K	8.06K	90.9K	21.5K	3.92K	9.09K	68.IK	IOK	2.61K	IOK	2.7K
UH-12 0-1000MHz	-6	12.1K	18.2K	100K	127K	90.9K	7.15K	5.36K	75K	36.5K	6.8IK	6.81K	IOOK	36.5K	5.36K	7.15K	IOOK	24.3K	4.02K	9.09K	100K	18.2K	2.94K	IOK	2.7K
VH-II 0-60MHz	-7	12.1K	18.2K	56.2K	100 K	68.1K	8.06K	5.11K	90.9K	56.2K	7.15K	5.36K	121K,	56.2K	6.81K	6.81K	100K	34.8K	5.11K	8.06K	150K	30.1K	3.24K	IOK	330
VH-15 O-40MHz	-8	юк	18.2K	68.IK	75K	150K	12.1K	1,82K	75K	68.1K	8.45K	4.12 K	юок	56.2K	7.15K	5.36K	90.9K	36.5K	5.36K	7.15 K	90.9K	18.2K	2.74K	IOK	330
HH-11 2- 30 MHz	-9	7.15K	16.2K	36-5K	100K	82.5K	8.25K	4.64K	2 15K	150K	7.5 K	5.IIK	68.1K	46.4K	7,5 K	5.II K	56 2 K	26.IK	6-81K	6-8IK	75 K	24,3K	5.IIK	7.5K	330
VH-17 50-100MHz	-2	12.IK	19.6K	60.4K	100 K	юок	8.25K	5.IIK	тоок	56.2K	6.8IK	6.8IK	90.9K	56.2K	5.36K	7.15K	127K	36.5K	4.75K	8.45K	150K	18.2K	2.94K	IOK	330
																1 1									
														7											
																									- 2
				of the second of	1877				·																
						TO CHEST CO.																			



a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W. b) CAPACITANCE IS MEASURED IN pF,

2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. CW ON POTENTIOMETERS DENOTE CLOCKWISE ROTATION OF ACTUATOR.

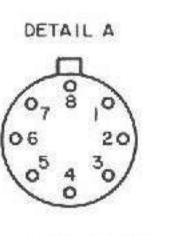
4. FOR UI, UZ PIN ARRANGEMENT, SEE DETAILA.

Courtesy of http://BlackRadios.terryo.org

5. DIFFERENCE BETWEEN TYPES IS SHOWN IN TABULATION BLOCK. ALL VALUES ARE NOMINAL; FINAL VALUES TO BE FACTORY SELECTED. ALL RESISTANCES IN TABULATION BLOCK ARE IN OHMS, ±1%, 1/4w.

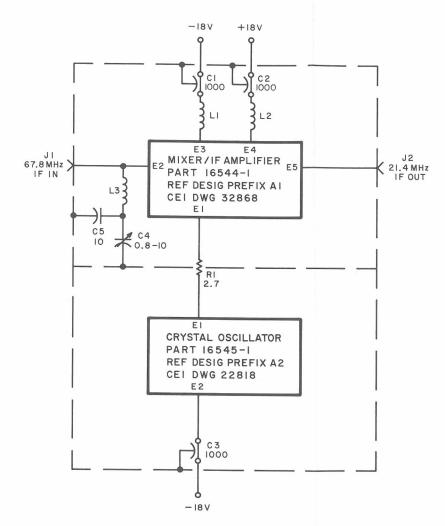
6. SHAPING AMPLIFIERS WITH PREVIOUSLY ASSIGNED TYPE NUMBERS ARE LISTED BELOW WITH THEIR CORRESPONDING 79844 SERIES NUMBER THESE OLD TYPE NUMBERS ARE LISTED FOR REFERENCE ONLY.

TUNING HEAD	OLD TYPE	79844-
VH-II	79618	-7
VH-12	79655	-2
VH-13	79656	-3
VH-14	79658	-4
VH-16	79844	-1
UH-II	79871	-5



BOTTOM VIEW

Figure 6-2. Type 79844-9 Shaping Amplifier (A2), Schematic Diagram



NOTE:

- I. UNLESS OTHERWISE SPECIFIED:
 a) RESISTANCE IS IN OHMS, ±5%,1/4W.
 b) CAPACITANCE IS IN pF.
- 2. FOR WIRING TO PLUG, SEE DETAIL A.

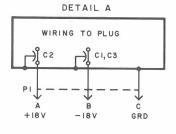
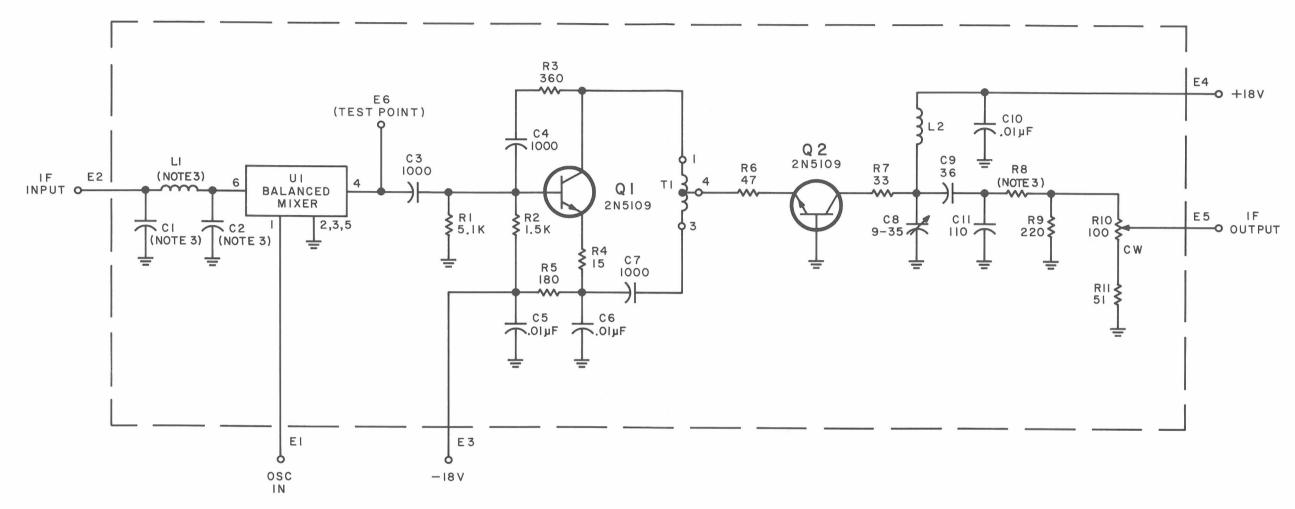


Figure 6-3. Type 71335 67.8-21.4 MHz Converter (A4), Schematic Diagram



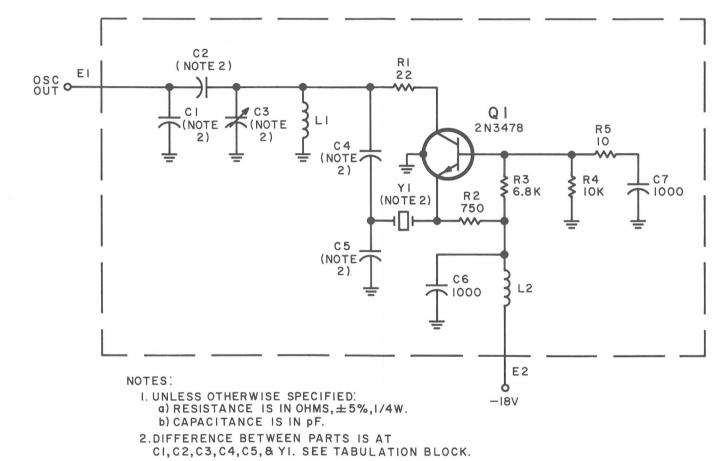
NOTES:

- I. UNLESS OTHERWISE SPECIFIED:

 a) RESISTANCE IS IN OHMS, ± 5%, 1/4 W.
 b) CAPACITANCE IS IN pF.
- 2. CW ON RIO DENOTES CLOCKWISE ROTATION OF ACTUATOR.
- 3. DIFFERENCE BETWEEN PARTS IS AT CI,C2,R8 & LI, SEE TABULATION BLOCK.

PART	CI	C2	R8	LI
16544-1	33	33	2.7	0.15
16544-2				
16544-3				
16544-4				

Figure 6-4. Part 16544-1 Mixer/IF Amplifier (A4A1), Schematic Diagram



PART	CI	C2	C3	C4	C5	ΥI
16545-1	33	12	5.5-18	8.2	39	46.4MHz
16545-2						
16545-3						
16545 -4						
16545-5						

Figure 6-5. Part 16545-1 Crystal Oscillator (A4A2), Schematic Diagram

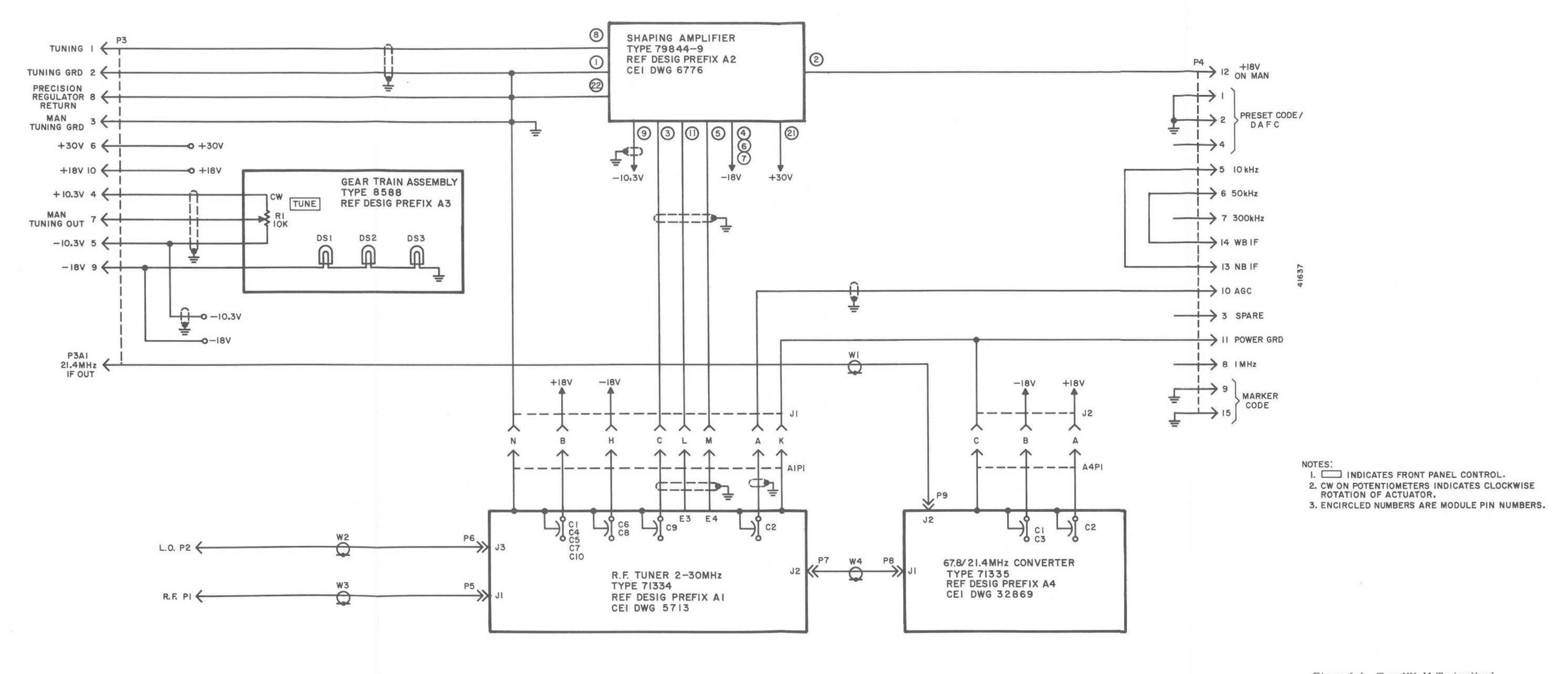


Figure 6-6. Type HH-11 Tuning Head,
Main Chassis Schematic Diagram

