INSTRUCTION MANUAL

FOR

TYPE VH-103 TUNING HEAD

WATKINS-JOHNSON COMPANY
CEI DIVISION
6006 EXECUTIVE BOULEVARD
ROCKVILLE, MARYLAND 20852

C/200/6/10/71/CRA

WARNING

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

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Table 1-1. Type VH-103 Tuning Head

RF Range	90-260 MHz
RF Bandwidth	3 MHz
Input Impedance	50 ohms, nominal
Input VSWR	3:1, maximum
Noise Figure	7 dB, maximum
Gain	23 ±3 dB
Frequency Stability	LO frequency drifts less than 20 kHz per hour at constant temperature after initial one-hour warm-up
Tape Dial Accuracy	1.0%
Fine Tuning Range	.05%
IF Rejection	60 dB, minimum
Image Rejection	60 dB, minimum
LO to Antenna Conduction	-95 dBm, maximum
Dimensions	5 inches wide, 3.25 inches high and 16 inches deep
Weight	4 lbs., approximately

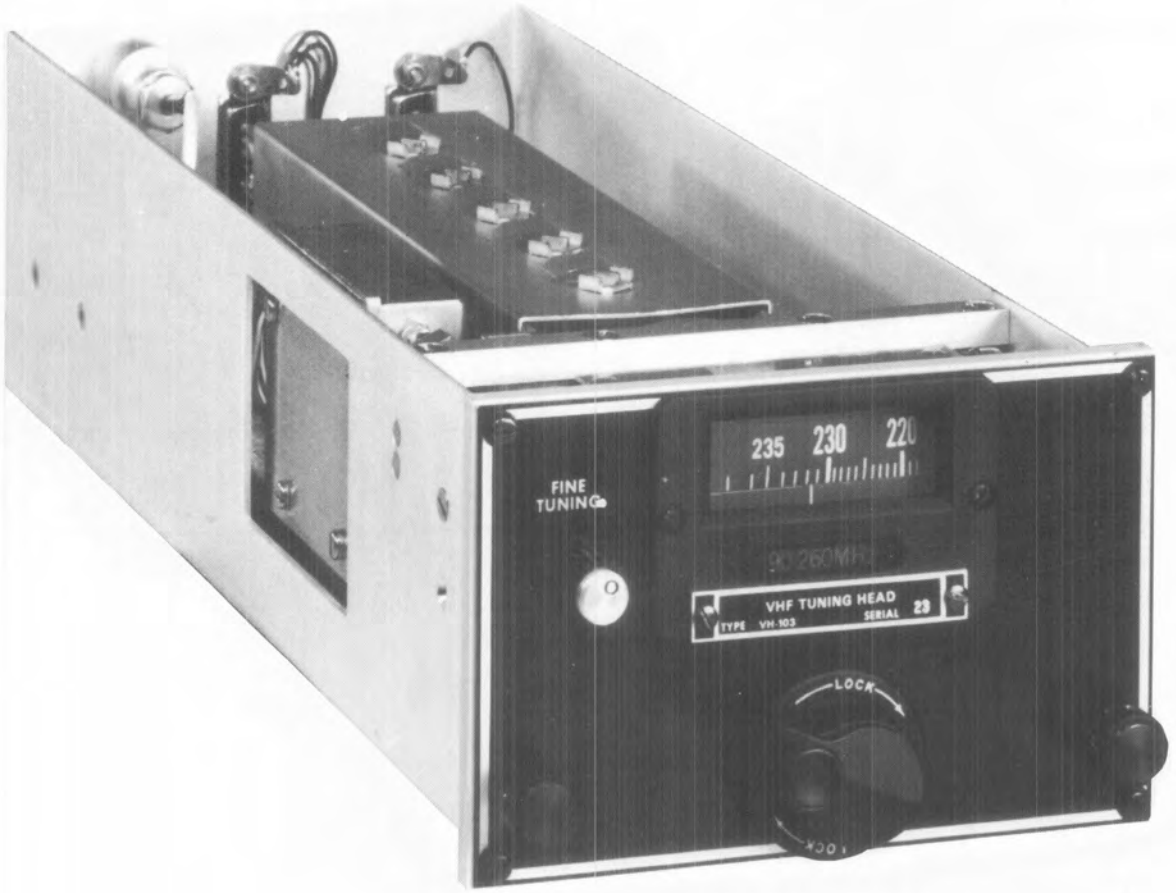


Figure 1-1. Type VH-103 Tuning Head

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The Type VH-103 Tuning Head is a single-channel, single-conversion, superheterodyne unit designed for operation with the Types 560 and 565-Series Receivers. The VH-103 provides frequency coverage of the 90 to 260-MHz range in a single band. It converts RF signals within this range to a 21.4-MHz IF output. The 560 Receiver provides AM, FM, and CW reception while the 565 Receiver provides reception of AM, FM, CW, and pulse-modulated signals.

1.1.2 Operating power for the VH-103 is supplied by the associated receivers through multipin connectors which are mounted on the rear apron of the tuning head. These connectors mate with receptacles on the receiver where the tuning head is installed.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The front panel and the main chassis are constructed of aluminum. The front panel is finished with grey enamel and is overlaid with a black-anodized etched bezel. Mounted on the front panel are the main tuning knob and tape dial, the FINE TUNING control, and the two black knobs that are used to lock the tuner into position in the receiver.

1.2.2 The rear apron of the tuner mounts two multipin Deutsch connectors, plus two push-on coaxial plugs. The threaded alignment rods also protrude from the rear apron. Alignment holes found just above the rods, mate with pins which are hard mounted at the rear of the tuner housing in the receiver and ensure that the head is properly aligned before the connectors are mated.

1.2.3 The VH-103 consists of a 90-260 MHz RF tuner and a tuning drive. Mounted on the RF tuner chassis is a smaller brass enclosure which houses the mixer/IF amplifier board. The tuner chassis and the subassembly are constructed of brass and are plated with precious metals to resist tarnishing and to increase conductivity. Overall dimensions of the VH-103 are 5.0 inches wide, 3.25 inches high, and 16 inches deep. The tuner weighs approximately 4 pounds

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type VH-103 Tuning Head only.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The VH-103 is incapable of independent operation and requires either a Type 560 Receiver or a Type 565 Receiver. Either one of these receivers will supply the required signal inputs and outputs plus the voltages necessary for proper operation.

Figure 2-1

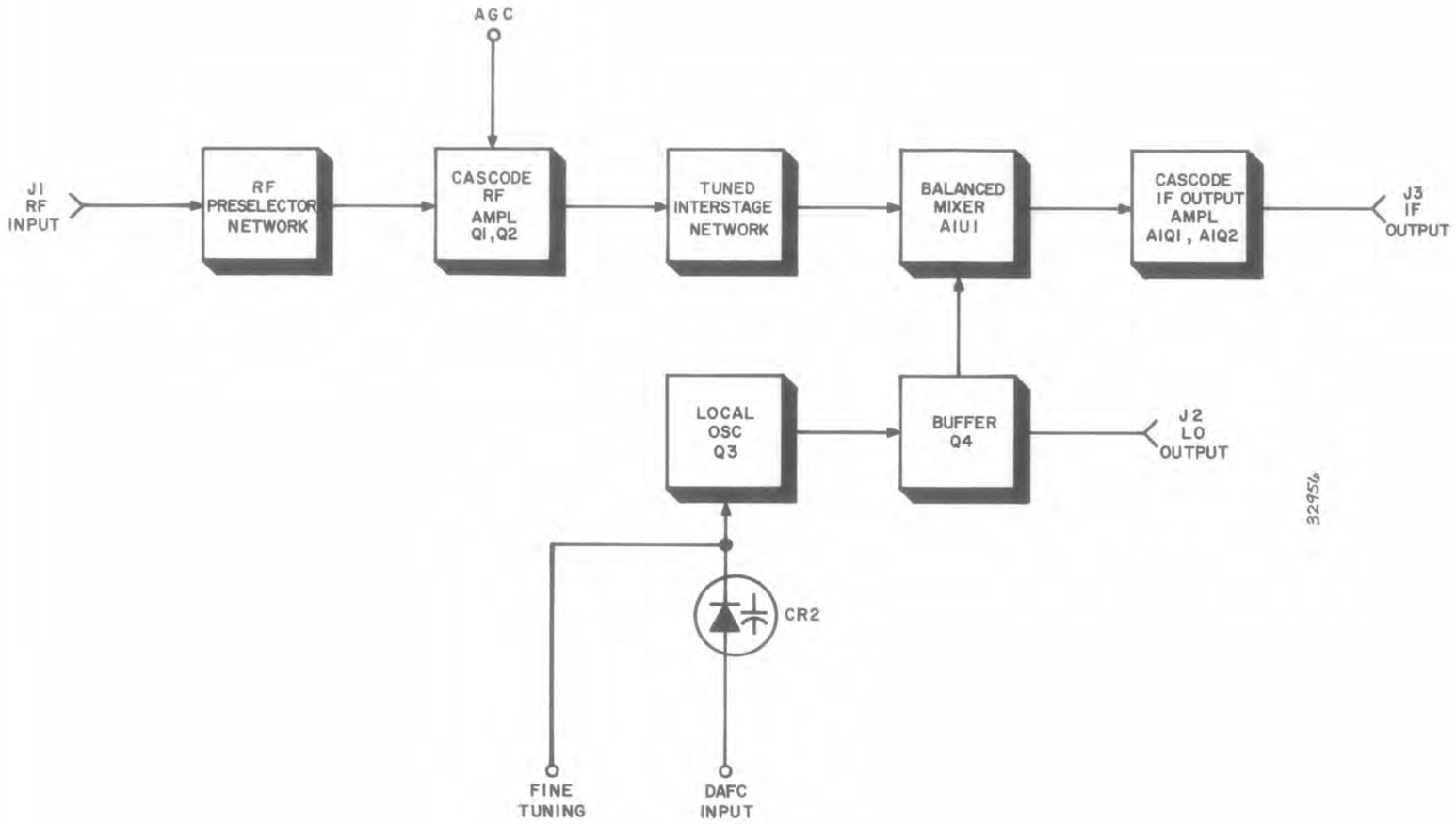


Figure 2-1. Type VH-103 Tuning Head, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

The following paragraphs contain functional and electrical descriptions of the circuits in the Type VH-103 Tuning Head. The functional description is oriented to the block diagram level, whereas the detailed circuit descriptions are oriented to the schematic diagram level. A functional block diagram of the VH-103 is shown in Figure 2-1. The schematic diagrams for the tuner are shown in Figures 6-1 and 6-2. Note that the unit numbering method is used for electrical components. This means that parts on the subassembly in the tuner carry a prefix before the usual class letter and number of the item (such as A1U1 and A1C3). These prefixes are omitted in the detailed descriptions and in the illustrations except in some cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

2.2.1 The Type VH-103 Tuning Head is a single-conversion, superheterodyne unit designed to receive, amplify and convert RF signals in the 90 to 260-MHz frequency range to a 21.4-MHz IF output. This tuning head is designed for use with the Types 560-Series and 565-Series Receivers. The associated receiver provides demodulation of the IF signal obtained from the VH-103.

2.2.2 Incoming RF signals to the tuning head are received from an RF limiter subassembly located on the rear apron of the associated receiver. A coaxial cable connects the signals from the limiter to a plug-in receptacle in the rear of the tuner housing. When the VH-103 is installed, this receptacle mates with jack J1 on the rear of the unit. From the input connector, the RF signals are fed through a preselector network, essentially a double-tuned bandpass filter. Output signals from this network are coupled to the RF amplifier stage in the tuner. It consists of a dual-gate field-effect transistor, Q1, connected to Q2, a junction field-effect type. These two stages form a cascode amplifier. The input stage is gain-controlled by the application of AGC voltage to one of the gates. A double-tuned interstage network forms the output load for the RF amplifier and develops the input signal which is fed to the balanced mixer.

2.2.3 The mixer, A1U1, is a self-contained double-balanced type that suppresses the RF and local oscillator inputs and produces only sum and difference frequencies. Since the output stages in the tuner and the IF input stages in the receiver are tuned to the difference frequency of 21.4-MHz, only it is passed. This output is amplified by a second cascode circuit made up of A1Q1 and A1Q2, before it is applied to the output connector.

2.2.4 The local oscillator in the tuner, Q3, operates over a frequency range which is 21.4-MHz higher than the tuned frequency, in this case 111.4 MHz to 281.4 MHz. Buffer transistor Q4 isolates the oscillator from changing load conditions and supplies a second local oscillator signal which is applied to output jack J2. Small changes in the frequency to which the receiver is tuned can be made by rotating the front-panel FINE TUNING control. This potentiometer applies a bias to a varactor diode (CR2) in the circuit which varies the LO frequency. An externally supplied DAFC voltage can be applied through a connector on the associated receiver to the same varactor to lock the local oscillator to a particular frequency. Intermediate frequency signals from the output cascode circuit are fed to rear-apron jack J3.

2.3 TYPE 71337 TUNING ASSEMBLY

The RF section in the VH-103 consists of two subassemblies: a Type 71318 90-260-MHz RF Tuner and a Type 8595 Tuning Drive Assembly. These two components make up the Type 71337 Tuning Assembly. This packaging arrangement permits the RF section to be replaced as a unit, independent of the tuning head chassis. An exploded view of the tuning drive is shown in Section V.

2.3.1 Type 71318 90-260-MHz RF Tuner. - The schematic diagram for the RF tuner is Figure 6-1; its reference designation prefix is A1.

2.3.1.1 RF Preselector. - Incoming RF signals to jack J1 are fed directly to an impedance-matching network made up of voltage-dividing capacitors C10 and C11. Resistor R1 returns to ground any static charge that may

built up on the antenna. Signals from the divider are fed to a tunable preselection network, a double-tuned, band-pass filter. Input and output sections are tuned by inductors L1A and L1B, respectively. These two components are the first and second sections of a five-section inductuner. The low-frequency response center-frequency is set by variable capacitors C12 and C15. End inductors L3 and L4 provide vernier adjustment at the high end. These inductors, along with L2 and L5, serve to compress the range of the inductuner into that covered by the tuning head. Signal coupling between the sections is provided by C13 and C14 with C14 having most of its effect at the low end of the band. Capacitor C16 couples the signals from the preselector to the RF amplifier stage and performs the functions of impedance matching and dc blocking.

2.3.1.2 RF Amplifier. - Transistor Q1, a dual, insulated-gate, field-effect type (IGFET) functions as the first RF amplifier. It is connected to Q2, a junction type field-effect in a cascode configuration. The input stage is operated in a common source circuit while Q2 is operated in a grounded gate configuration. The latter transistor is housed within a brass compartment for maximum input-to-output isolation, thereby eliminating the need for neutralization. The source of transistor Q1 is held at RF ground potential by C19. Capacitor C17 provides this function for gate no. 2 (pin 2). Incoming RF signals are applied to gate no. 1 (pin 3) of Q1. Amplified signals are taken from pin 1, the drain connection. Gain control of the cascode circuit is accomplished by applying a varying voltage to gate no. 2 of Q1 through R6 and R8. Before AGC action begins, the gate voltage at pin 2 is approximately +3.4V as determined by R5 through R7, and diode CR1. Up to the time that AGC action begins, Q1 is operating at maximum gain. Once gain control action begins, this positive bias is decreased and the gain of the stage is reduced. Signals taken from pin 1 are fed through inductor L6 and blocking capacitor C21 to the source connection of the cascode output stage, Q2. A pi-network is formed by the output capacitance of Q1, inductor L6, and the input capacitance of Q2 that increases the gain of the RF amplifier at the high frequency end to compensate for losses sustained in the circuit at this end of the tuning range. Amplified RF signals from the drain, pin 1, of Q2 are fed through parasitic suppressor R12 to the interstage network.

2.3.1.3 Interstage Network. - A double-tuned, tunable bandpass filter forms the interstage network in the VH-103. Inductuner sections L1C and L1D tune the input and output sections, respectively. Variable capacitors C23 and C30 set the low-end response center frequency while end inductors L8 and L10 affect the high-end center frequency. The high-end bandwidth is adjusted by capacitor C26. Capacitor C28 increases the coupling at the low end of the tuning range. These two components, in conjunction with L9 and L11, also help compress the range of these particular inductuner sections into that covered by the tuning head. Loading of the input section at the low end of the tuning range is by resistor R35. Coupling capacitor C29 feeds RF signals from the interstage network to the mixer.

2.3.1.4 Local Oscillator and Buffer. - The local oscillator in the tuner, Q3, operates in a Colpitts circuit at a frequency 21.4-MHz above the incoming RF signal. The oscillator is tuned by inductuner section L1E. Regenerative feedback to sustain oscillation is taken from the emitter and fed through R15 and voltage divider capacitors C32-C33 to the base. The resistor, in conjunction with C32 and C33, sets the feedback level. Variable capacitor C37, connected across the oscillator tank circuit, provides a means of adjusting the frequency at the center of the range for precise dial tracking. Transformer T1 performs this function for high-end adjustments. Shunt inductor L12 sets the low-frequency point. Vernier and DAFC tuning of the oscillator is accomplished through the use of varactor CR2. This is a semiconductor device whose capacitance varies inversely with the reverse bias applied across it. This bias is derived from two sources: the front-panel FINE TUNING control, R2, and an associated frequency counter when DAFC is used. The FINE TUNING control can be adjusted over a range of approximately 3.5 volts. For example, if R2 is rotated in the clockwise direction, the reverse bias is increased. The capacitance of the diode will be decreased and the oscillator frequency will be increased. Operation of the VH-103/560 or 565 Receiver combination with the optional frequency counter permits the use of DAFC. The DAFC voltage is applied to capacitor C6 and fed through R21 to the varactor anode. The level of the DAFC correction voltage, and thus the amount of frequency change is a function of the amount of LO drift sensed by the external counting circuits. Coupling of the varactor into the tank circuit is by means of capacitor C35. Output signals from the oscillator tank are fed to the base of buffer amplifier Q4 through parasitic suppressor R22 and a capacitive impedance matching network, C38-C39. The buffer isolates the oscillator from the balanced mixer and from the LO output jack to prevent changing load conditions from affecting the frequency. Torroid transformer T2 forms the collector load for Q4. It is tapped to provide the proper impedance transformation between it and the following network. Coupling between T2 and transformer T3 is through capacitor C41. Transformers T2 and T3, in conjunction with resistor R28, form a hybrid power splitter. A portion of the LO signal is taken from T3, pin 2 and is fed through a coaxial cable to the mixer. The remaining LO output from T3, pin 3 is fed through a 50-ohm attenuator made up of R29 through R31 to jack J2. Capacitor C44 helps to reduce the amount of higher order harmonics being fed out of jack J2.

2.3.2 Part 16311 Mixer/IF Amplifier. - This board carries the complete reference designation prefix A1A1. It mounts the balanced mixer and a cascode IF output stage.

2.3.2.1 Mixer. - A completely sealed module, U1, is used as the mixer. It is a balanced type which suppresses the RF and LO inputs, producting predominantly only sum and difference signals. Since the following circuit is tuned to the difference frequency of 21.4 MHz, only it is passed. The RF signal is applied to pin 8 of U1 and the LO signal is connected to pin 5. Difference signals are taken from pins 3 and 7, and are coupled through blocking capacitor C1 to the IF amplifier stage.

2.3.2.2 Cascode IF Output Amplifier. - Transistors Q1 and Q2 form a cascode IF output amplifier network. Transistor Q1 is connected in a common emitter circuit whereas Q2 operates as a grounded base amplifier. By feeding back out-of-phase signals from collector to base through C2 and R2 the dynamic range and input impedance are optimized. Output signals at 21.4-MHz are developed across a tuned tank circuit formed by variable capacitor C4 and inductor L14. The inductor is tapped to provide the proper impedance match between the amplifier circuit and the input of the IF circuits in the associated receiver. Coupling of IF signals from the tank circuit to the output gain control (R7) is through blocking capacitor C6. The arm of the potentiometer feeds the output signals to terminal E7 on the board and then to output jack J3.

SECTION III

INSTALLATION AND OPERATION

3.1 UNPACKING AND INSPECTION

3.1.1 Examine the shipping carton for damage before the equipment is unpacked. If the carton has been damaged, try to have the carrier's agent present when the equipment is unpacked. If not, retain the shipping cartons and padding materials for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

3.1.2 See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, CEI Division, or your Watkins-Johnson representative with details of any shortage.

3.1.3 The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. It is therefore, ready for use upon receipt. After uncrating and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. Inspect the internal components for apparent damage. Check the internal cables for loose connections and the printed wiring board for loose hardware.

3.2 INSTALLATION

The VH-103 Tuning Head is a plug-in unit designed to operate exclusively with the Types 560 and 565-Series Receivers. Operating voltages as well as RF input and output signals are applied to the head through rear-apron connectors that mate with receptacles in the tuning head housing in the receiver. To install the tuning head, insert it into the housing in the receiver and slide it all the way back until the connectors are fully seated. Tighten the two locking knobs by rotating them fully clockwise.

3.3 OPERATION

Selection of the desired frequency is made with the main tuning knob. Vernier adjustment of the frequency can be made with the FINE TUNING control. The tape dial is illuminated when the receiver is turned on and it displays the frequency selected in easy to read white numerals.

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 If time permits, contract packing and packaging firms can be found in many cities. Based on an examination of the equipment and the proposed method of shipment, these firms can usually perform a reliable repackaging service.

3.4.3 As a minimum, cover the painted surface of the unit with wrapping paper. Pack the unit securely in a strong corrugated container (350 lb/sq inch bursting test) with 2-inch rubberized hair pads placed along all surfaces of the equipment. If rubberized hair is not available, use a 6-inch layer of excelsior. If neither of these filler materials are available, use crumpled paper, rags, or any other available materials to provide as much cushioning as possible.

3.4.4 Conditions during storage and shipment should normally be limited as follows:

(1) Maximum humidity: 95% (no condensation).

(2) Temperature range: -30°C to +85°C.

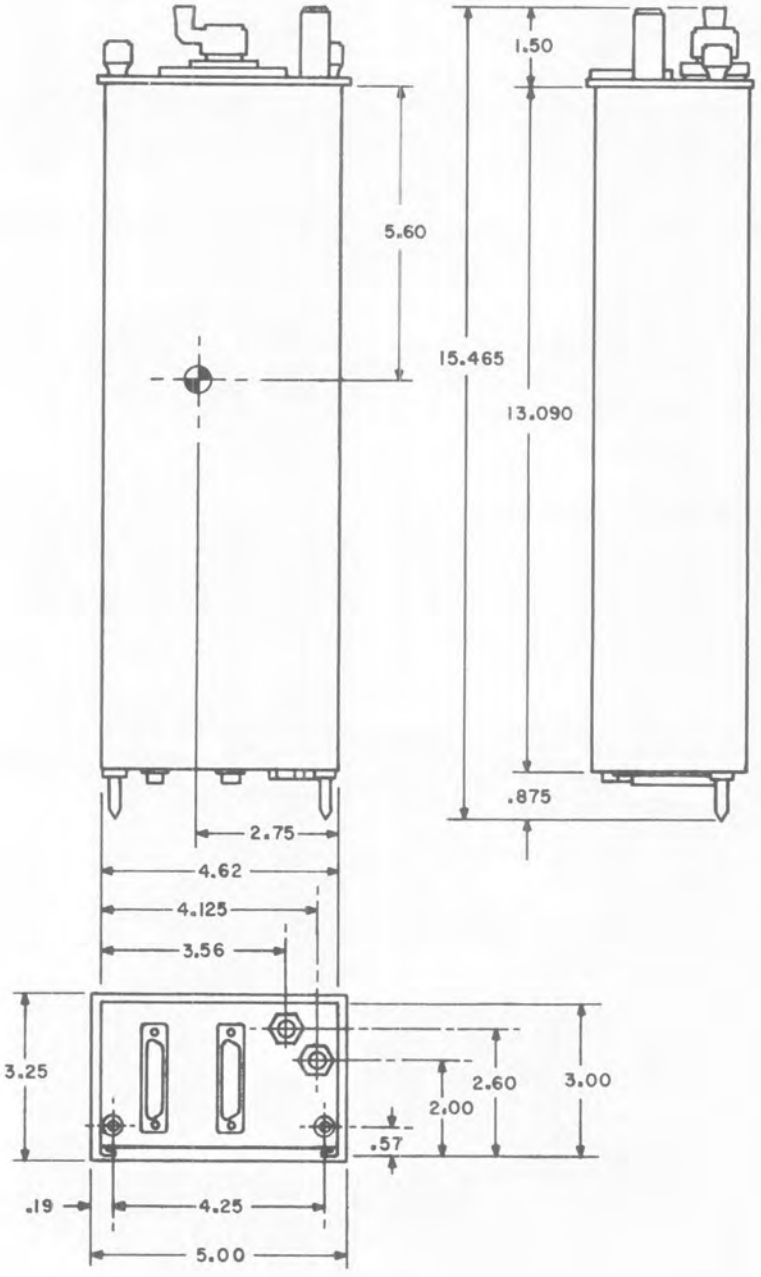


Figure 3-1. Type VH-103 Tuning Head, Critical Dimensions

SECTION IV
MAINTENANCE

4.1 GENERAL

The Type VH-103 Tuning Head has been conservatively designed to operate for extended periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventive maintenance operations recommended. The intervals for these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions found in Section II. Reference should also be made to the block diagram, Figure 2-1, and to the schematic diagrams found in Section VI. A complete parts list plus illustrations showing parts locations for the tuning head can be found in Section V.

4.2 CLEANING AND LUBRICATION

The tuning head should be kept free of dust, grease, and foreign matter to insure trouble-free operation. If available, use low-pressure compressed air to remove accumulated dust from the interior and exterior. A clean dry cloth, a soft-bristed brush, or a cloth saturated with a cleaning compound may be used. Refer to paragraph 4.4 for tuning drive lubrication.

4.3 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by a visual inspection of the unit. For this reason, a complete visual inspection should be made for indications of mechanical and electrical defects on a periodic basis, or whenever the unit is inoperative. Electronic components that show signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage to parts due to heat is often the result of other less apparent troubles in the circuit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts. Mechanical parts, and front panel controls should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.4 MAINTENANCE

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

4.4.1 Dial Lamp Replacement. - 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 because if one lamp burns out, it is likely that the other lamps are nearing the end of their lives.

(6) Reassemble the unit by reversing steps (1) through (4).

4.4.2 Alignment of Tape Dial. - 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 fully clockwise until the tape dial stops moving.

(2) The mark to the right of the arrow should line up with the dial pointer. If it does not, proceed with the next step.

(3) Loosen the setscrew on gear no. 14 (Figure 5-10).

(4) Remove the dial escutcheon as described in paragraph 4.4.1, step (3), if necessary.

(5) By hand, move the dial tape and gear no. 14 independent of the tuning drive, to align the reference mark with the pointer.

(6) Tighten the setscrew on gear no. 14 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. 14 and slightly readjust its vertical position.

4.4.3 Removal of Tuning Assembly and Disassembly of Tuning Drive. - The RF tuner and the tuning drive can be removed from the tuning head by following the steps below. Once removed, the tuning drive can be disassembled using Figure 5-10 as a guide.

(1) Remove the tuning knob from the shaft.

(2) Disconnect the following plugs from their respective jacks: plug P2 from jack A1J1, plug P3 from jack A1J2, plug P6 from A1J3.

(3) Remove the two screws that attach the tuning drive to the mounting bracket just to the rear of the drive mechanism.

(4) Support the bottom of the RF tuner chassis with one hand while removing the two mounting screws located at the rear of the assembly.

(5) Carefully remove the entire RF tuning assembly from the tuning head from the bottom.

(6) To reassemble, reverse the steps above.

4.5 TROUBLESHOOTING

Troubleshooting of the VH-103 should be done by the signal substitution method, namely inserting an RF signal into the input and checking for an output at each stage. Signal tracing should be started at the output and terminated at the input. Once the faulty stage is found, voltage measurements will usually pin point the defective part. A list of typical semiconductor element voltages is presented in Table 4-1.

NOTE

The dress of leads and the placement of components in the tuner is extremely critical. When making repairs or adjustments care should be taken to duplicate the exact physical placement of the original part. Do not move leads or wires to remove a component unless absolutely necessary.

4.6 TEST EQUIPMENT REQUIRED

The following test instruments or a suitable equivalent are required to align and test the Type VH-103 Tuning Head:

ITEM	INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED INSTRUMENT(S)
1	Sweeping Signal Generator	10-MHz to 500-MHz frequency range; 0 to 10-MHz sweep width	RF Alignment	Hewlett Packard 675A

ITEM	INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED INSTRUMENT(S)
2	Signal Generators	50 kHz to 65 MHz and 10 MHz to 480 MHz	External Marker Source; troubleshooting	Hewlett Packard 608B and 608C
3	Low impedance detector	50-ohm	RF to DC conversion	Telonic XD-3A
4	Oscilloscope	500-kHz vertical bandwidth	Troubleshooting; alignment	Tektronix 503
5	Frequency Counter	Six digits with four-place accuracy	Signal generator calibration; alignment; troubleshooting	Computer Measurement Corp. 738A
6	FM Signal Generator	10-MHz to 500-MHz frequency range	Performance Checks	Hewlett Packard 202H
7	AC VTVM	-60 to +50 dB and .001 to 300V rms ranges	Performance Checks	Hewlett Packard 400L
8	Termination	50-ohm; BNC or N-Type Connector	Termination; performance checks	Microlab TA5MN 50-ohm or Telonic TRM-2
9	Extender Cable	Mate VH-Series Tuning Heads to 560 or 565 Receiver	Maintenance; alignment and test	WJ-CEI Type EC-560
10	RF VTVM		LO output level measurement	Boonton 91DA-S5
11	Adapter	50-ohm input impedance	LO output level measurement	Boonton 91-8B

4.7 POST-CORRECTIVE ALIGNMENT CHECK

The following alignment check should be made after the replacement of a transistor or a frequency determining component in the preselector, interstage, or oscillator networks, or if the technician feels the alignment of the tuner would have been affected by the repair. If the response curve samples given cannot be duplicated, then the detailed alignment procedure given in paragraph 4.8 should be performed. Proceed as follows:

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

(2) Set the receiver controls as follows:

(a) MODE - AM MAN

(b) RF/IF GAIN - Fully clockwise

(c) IF BANDWIDTH kHz - Widest bandwidth

(d) AUDIO GAIN - Fully clockwise.

(3) Tune the VH-103 to 120 MHz and center the FINE TUNING control.

(4) Tune the sweep generator to 120 MHz.

(5) Tune the signal generator to 1.5 MHz and increase the output level to display 3-MHz markers.

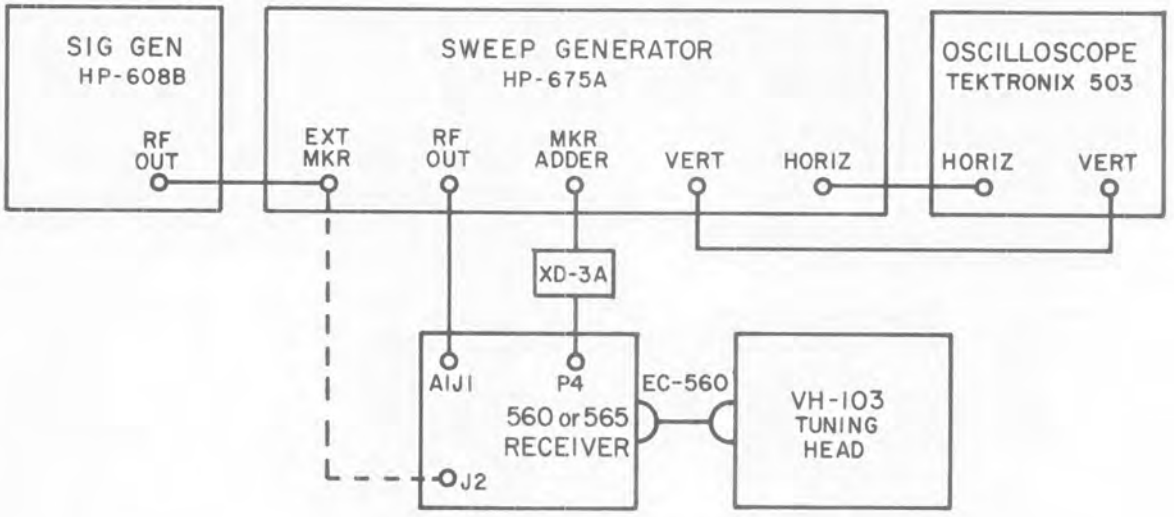


Figure 4-1. Test Setup, Alignment Check

(6) Adjust the sweep generator and oscilloscope controls to display a response curve. (The oscilloscope vertical sensitivity is shown in Figure 4-2.) The response should resemble Figure 4-2. The 3-MHz markers should be on, or between the peaks.

(7) Tune the sweep generator and VH-103 to 250 MHz.

(8) Adjust the sweep generator and oscilloscope controls to display a response curve. It should be a slightly peaked response, similar to Figure 4-3. The 3-MHz markers should appear at the 3-dB points on the response.

(9) If the response curves obtained do not resemble Figures 4-2 and 4-3, proceed to paragraph 4.8.

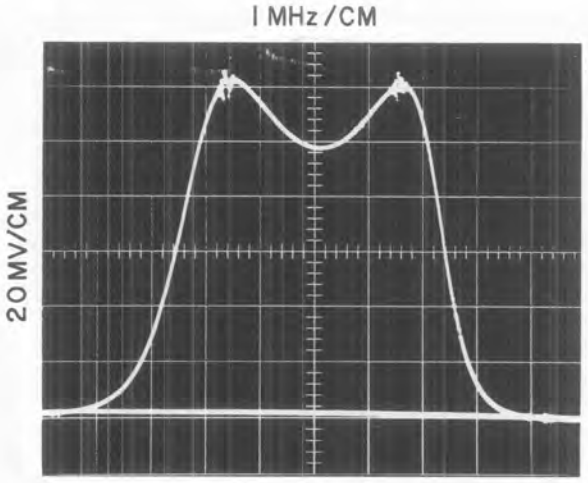


Figure 4-2. Typical Response, RF at 120 MHz

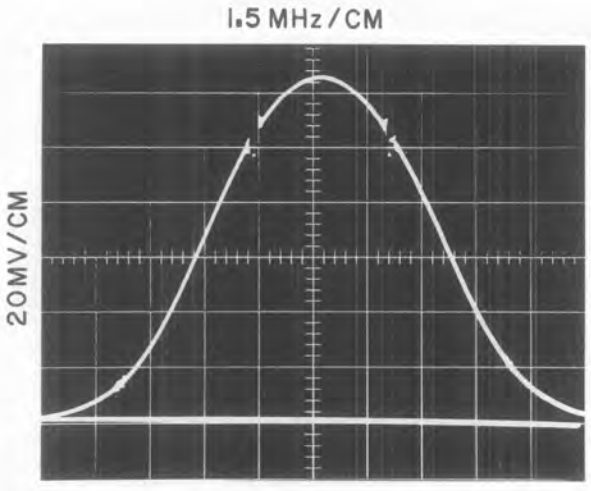


Figure 4-3. Typical Response, RF at 250 MHz

4.8 RF ALIGNMENT

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

(2) Repeat paragraph 4.7, steps (2) through (5).

(3) Adjust the sweep generator and oscilloscope controls to display a response curve.

(4) Adjust capacitors C12, C15, C23, C26, C30 and A1C4 for a response similar to Figure 4-2. The RF bandwidth should be a minimum of 3-MHz. The markers should appear on, or between, the peaks.

(5) Repeat paragraph 4.7, steps (7) and (8). If the response obtained does not resemble Figure 4-3, readjust the capacitors listed in step (4) above and recheck the response at the high end of the band.

NOTE

Additional adjustment of the preselector and interstage responses should not be necessary unless the five-section inductuner (L1A-E) is replaced. In this case, end-inductors L3, L4, L8, L18, and L12 may have to be adjusted by spreading or compressing the turns, to obtain the required bandwidth and gain. This procedure should not be attempted, however, unless considered absolutely necessary.

4.9 DIAL TRACKING

(1) Connect equipment as shown in Figure 4-1; the LO output from plug P5 is connected to the sweep generator EXT MKR input.

(2) Tune the signal generator to 21.4 MHz, and adjust the controls for a CW output.

(3) Tune the sweep generator and VH-103 to 120 MHz.

(4) Calibrate the sweep generator to center the sweep at the 120-MHz marker.

(5) Increase the signal generator output level to produce a second marker on the response curve. This marker is the local oscillator signal.

(6) Tune the VH-103 to beat the two marker signals. Check the dial indication. If it is not within 1% of 120 MHz, adjust capacitor C37.

(7) Tune the sweep generator and VH-103 to 260 MHz.

(8) Check the dial indication versus frequency setting. If it is not within 1% of 260 MHz, adjust C37 slightly.

(9) Check the dial indications versus frequency settings at 10-MHz intervals from one end of the band to the other. The LO marker should beat with the frequency marker in all cases. The dial readings should be within 1% of the actual frequency.

NOTE

If required, transformer T1 can be adjusted by spreading or compressing the turns, at the 260-MHz end to minimize the relative errors across the band.

4.10 PERFORMANCE TESTS

The tests outlined in the following paragraphs provide a means of checking the relative performance of the VH-103 Tuning Head. The equipment required to perform these tests is listed in paragraph 4.6. The EC-560 Extender Cable must be used to connect the VH-103 to the receiver. These tests should be performed after an alignment has been made or after the replacement of a transistor in the RF or oscillator networks.

4.10.1 AM Sensitivity. - Proceed as follows:

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

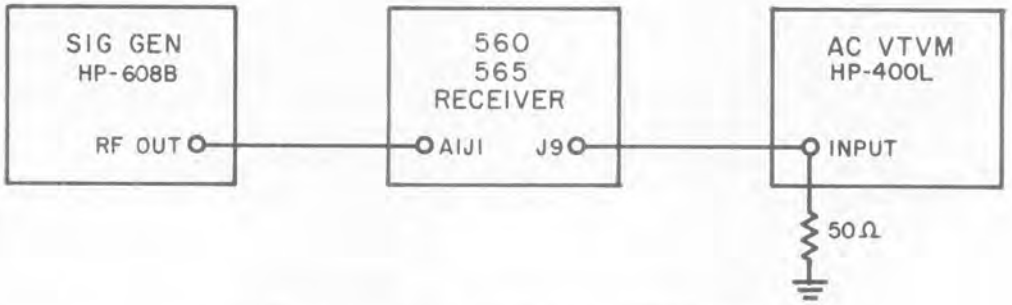


Figure 4-4. Test Setup, Performance Checks

(2) Set the receiver controls as follows:

(a) MODE - AM MAN

(b) IF BANDWIDTH kHz - 10

(c) RF/IF GAIN - Fully clockwise.

(3) Tune the VH-103 to 260 MHz.

(4) Tune the signal generator to 260 MHz and adjust the output level to -110 dBm; adjust the modulation controls for 50% AM, at a 1-kHz rate.

(5) Using the VIDEO GAIN control on the rear of the 560/565 Receiver, set a convenient reference level on the AC VTVM (0-dBm).

(6) Remove the modulation from the input signal and note the reading on the AC VTVM. It should decrease no less than 10 dB.

4.10.2 FM Sensitivity. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-4 except that the HP-202H FM Signal Generator should be substituted for the HP-608B.

(2) Place the receiver MODE switch in the FM position and the IF BANDWIDTH kHz switch in the 10 position.

(3) Tune the signal generator and VH-103 to 260 MHz.

(4) Set the signal generator controls to produce a -110 dBm output, with 3-kHz deviation at a 1-kHz rate.

(5) Using the VIDEO GAIN control on the rear of the receiver, set a convenient reference level on the AC VTVM (0 dBm).

(6) Change the signal generator mode to CW and note the decrease in the reading on the AC VTVM. It should be no less than 16 dB.

4.10.3 IF Rejection. - Proceed as follows:

(1) Install the VH-103 in the receiver.

(2) Connect the output of the HP-608B signal generator to jack A1J1 on the receiver rear apron.

(3) Tune the VH-103 and the signal generator to 90-MHz.

(4) Set the output level of the signal generator to -100 dBm, CW mode.

(5) Using the receiver (SDU) SWEEP WIDTH and GAIN controls, adjust for a convenient full scale reference at the center of the screen.

(6) Tune the HP-608B to 21.4 MHz and increase the output level to again obtain full-scale deflection of the signal pip. Note the output level of the signal generator. It should be at least 60 dB greater than the level set in step (4).

4.10.4 Image Rejection. - Proceed as follows:

(1) Install the VH-103 in the receiver.

(2) Connect the output of the HP-608C signal generator to jack A1J1 on the receiver; set the output frequency to 260 MHz.

(3) Adjust the signal generator controls for a CW output at a level of -100 dBm.

(4) Tune the VH-103 to 260 MHz and adjust the receiver SDU GAIN control to obtain full-scale deflection of the signal pip.

(5) Tune the signal generator to 302.8 MHz and increase the output level to again obtain full-scale deflection of the signal pip. Note the signal generator output level. It should be at least 60 dB greater than the level set in step (4).

4.10.5 Local Oscillator Output Level. - Proceed as follows:

(1) Install the VH-103 in the receiver.

(2) Connect the RF VTVM to jack J2 on the rear apron of the receiver, through the 50-ohm adapter.

(3) Energize the equipment and tune the VH-103 across the entire band while observing the RF VTVM. The LO output level should not be less than 50 mV at any spot in the band.

Table 4-1. Type VH-103 Tuning Head, Typical Semiconductor Element Voltages

		Field Effect Transistor Pins				Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source	Emitter	Base	Collector
A1 Q1	3N140	14.6	3.4	1.2	1.8			
A1 Q2	2N4416	13.0	0.6	GND	GND			
A1 Q3	2N3478					6.00	6.30	14.00
A1 Q4	2N2857					2.50	3.20	14.30
A1 A1Q1	2N5109					-12.00	-11.20	-1.60
A1 A1Q2	2N5109					-0.80	GND	9.40

TEST CONDITIONS: Readings are positive dc with respect to chassis unless otherwise noted. Readings taken with RCA WV-98C VTVM. VH-103 connected to receiver through EC-560 Extender Cable. Receiver controls: AM MAN, RF/IF GAIN fully clockwise; no signal input.

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:

Subassembly Designation

Class and No. of item

Read 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 subassembly 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. Prefixes are provided on drawings and illustrations within the titles in parentheses.

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00328	Sterling Instrument Division of Designatronics, Inc. 76 East Second Street Mineola, New York 11501
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53204
01351	Dynamic Gear Company, Inc. 173-177 Dixon Avenue Amityville, New York 11701
02114	Ferroxcube Corporation of America Mount Marion Road Saugerties, New York 12477
04013	Taurus Corporation 1 Academy Hill Lambertville, New Jersey 08530
04941	Walsco Electronics Corporation 4 South Wyman Rockford, Illinois 61101
14632	Watkins-Johnson Company CEI Division 6006 Executive Boulevard Rockville, Maryland 20852
19505	Applied Engineering Products Co. Division of Samarius, Inc. 26 E. Main Street Ansonia, Connecticut 06401
21604	The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207
23480	Control Knobs, Inc. 180-08 Liberty Avenue Jamaica, New York 11433
25088	Siemens America, Inc. 350 5th Avenue New York, New York 10001
27956	Relcom 2164 East Middlefield Road Mountain View, California 94040

Mfr. Code	Name and Address
70417	Chrysler Corporation Amplex Division 6501 Harper Avenue Detroit, Michigan 48211
71279	Cambridge Thermionic Corporation 445 Concord Avenue Cambridge, Massachusetts 02138
71468	ITT Cannon Electric Incorporated 3208 Humbolt Street Los Angeles, California 90031
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
73899	JFD Electronics Company Division of Stratford Retreat House 15th at 62nd Street Brooklyn, New York 11219
79136	Waldes Kohinoor, Inc. 47-16 Austel Place Long Island City, New York 11101
80131	Electronic Industries Association 2001 Eye Street, N. W. Washington, D. C. 20006
81349	Military Specifications
83086	New Hampshire Ball Bearings, Inc. Peterborough New Hampshire 03458
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
91737	Gremar Manufacturing Company, Inc. 7 North Avenue Wakefield, Massachusetts 01880
95121	Quality Components, Inc. P.O. Box 113 St. Mary's, Pennsylvania 15857
96906	Military Standards Promulgated by Standardization Division Directorate of Logistic Services DSA
99848	Wilco Corporation 4030 West 10th Street P.O. Box 22248 Indianapolis, Indiana 46222

5.4 PARTS LIST

When ordering replacement parts from CEI Division, specify the type and serial number of the equipment, and the reference designation and description of each part ordered. The Manufacturers and Manufacturer's Part Numbers listed are included as a guide to the user of the equipment in the field and do not necessarily agree with the parts installed in the equipment. Except in those cases specifically noted, the replacement part may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original part.

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

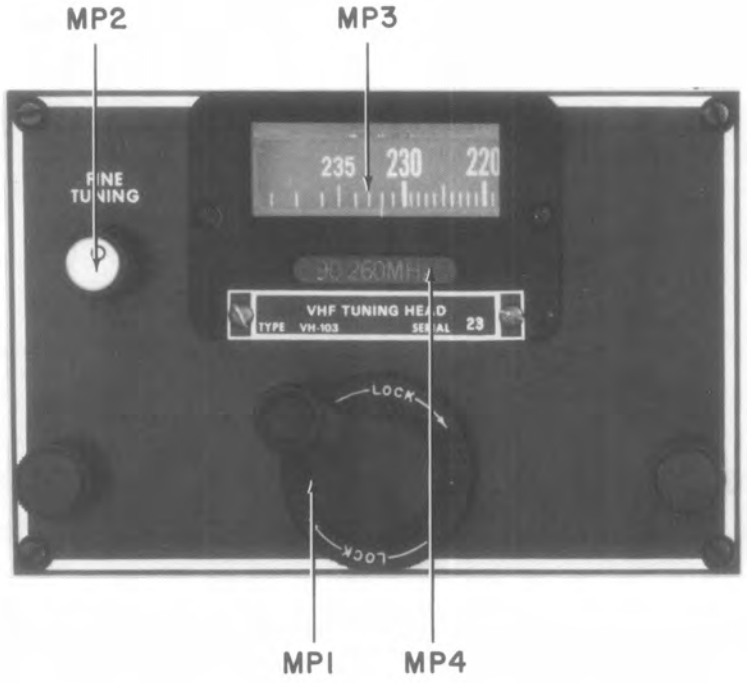


Figure 5-1. Type VH-103 Tuning Head, Front View

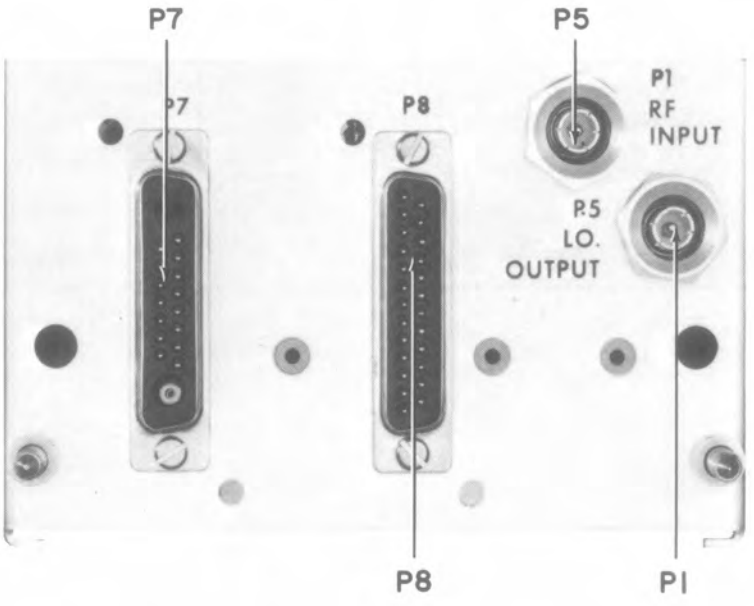


Figure 5-2. Type VH-103 Tuning Head, Rear View

5.4.1 Type VH-103 Tuning Head, Main Chassis

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	TUNING ASSEMBLY	1	71337	14632
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 35V	1	CS13BF475K	81349
MP1	KNOB	1	2S2S	23480
MP2	KNOB	1	PS50D1(Black)	21604
MP3	WINDOW	1	11448-4	14632
MP4	WINDOW	1	11449-1	14632
P1	CONNECTOR, PLUG, PUSH-ON SERIES Part of W1	2	19699-1	91737
P2	CONNECTOR, PLUG, MINIATURE SERIES Part of W1	2	UG-1465/U	81349
P3	Same as P2			
P4	NOT USED			
P5	Same as P1 Part of W2			
P6	CONNECTOR, PLUG, MINIATURE SERIES Part of W3	1	UG-1466/U	81349
P7	CONNECTOR, RECPTACLE, MULTIPIN	1	DBM-17W2P	71468
P7A1	CONNECTOR, RECEPTACLE, COAXIAL INSERT Part of W3	1	DM-53740-5001	71468
P8	CONNECTOR, RECEPTACLE, MULTIPIN	1	DBM-25P	71468
R1	RESISTOR, FIXED, COMPOSITION: 1.2 kΩ, 5%, 1/4W	1	RCR07G122JS	81349
R2	RESISTOR, VARIABLE, COMPOSITION: 2.5 kΩ, 10%, 1/3W	1	RV6NAYSD242A	81349
R3	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349
W1	CABLE AND CONNECTOR ASSEMBLY	1	30020-1450	14632
W2	CABLE AND CONNECTOR ASSEMBLY	1	30020-1451	14632
W3	CABLE AND CONNECTOR ASSEMBLY	1	30020-1452	14632

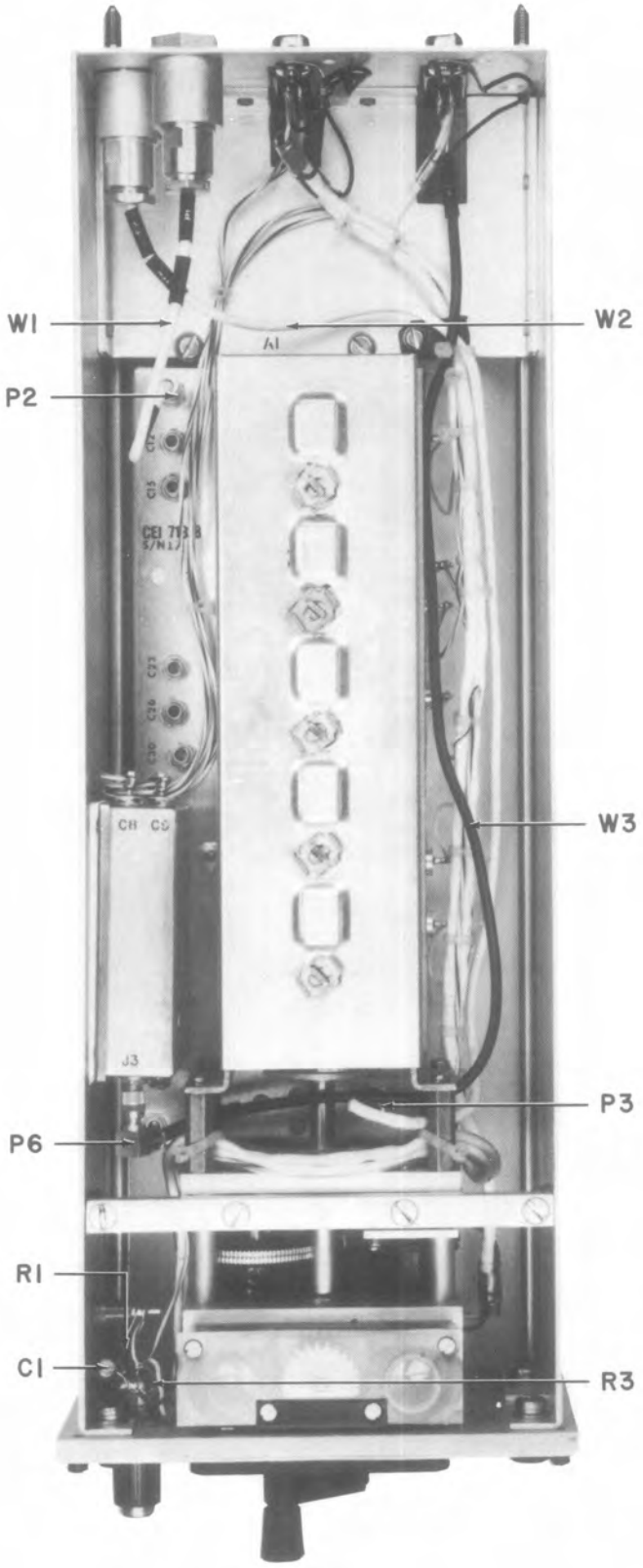


Figure 5-3. Type VH-103 Tuning Head, Top View

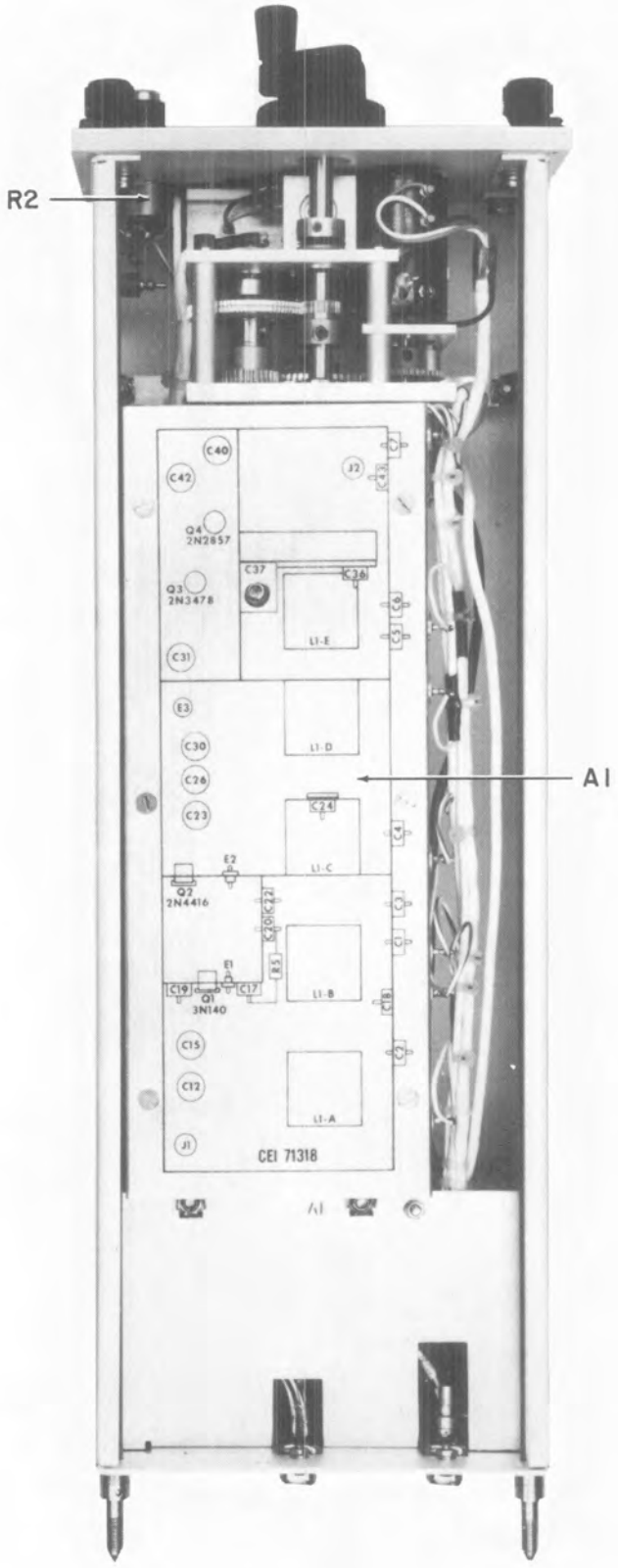


Figure 5-4. Type VH-103 Tuning Head, Bottom View

5.4.2 Type 71337 Tuning Assembly REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	90-260-MHz RF TUNER	1	71318	14632
A2	TUNING DRIVE	1	8595	14632

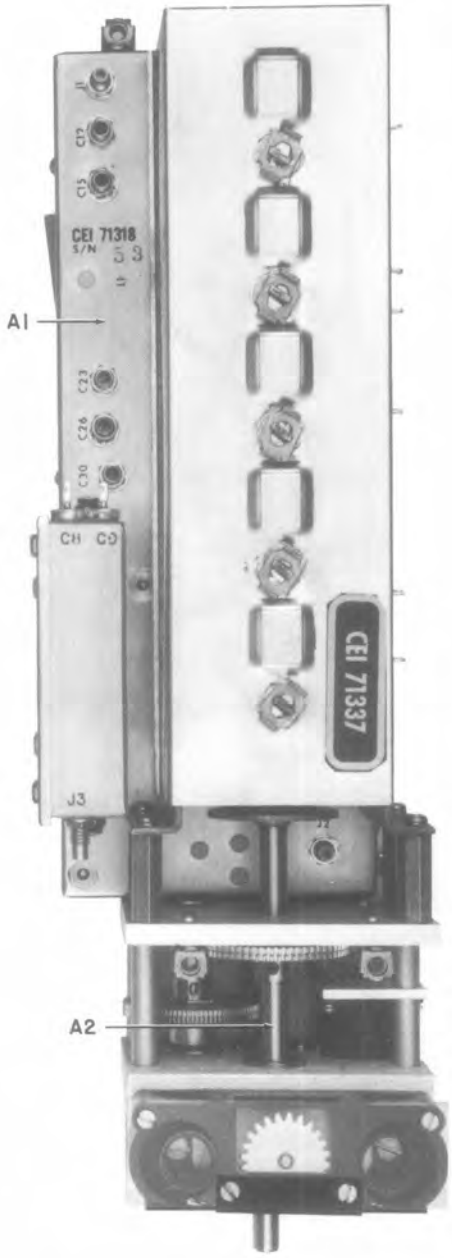


Figure 5-5. Type 71337 Tuning Assembly, Component Locations

5.4.2.1 Type 71318 90-260-MHz RF Tuner REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	MIXER/IF AMPLIFIER	1	16311	14632
C1	CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V	11	FA5C-102W	01121
C2	Same as C1			
C3	Same as C1			
C4	Same as C1			
C5	Same as C1			
C6	Same as C1			
C7	Same as C1			
C8	Same as C1			
C9	Same as C1			
C10	CAPACITOR, CERAMIC, TUBULAR: 3.0 pF, ±.25 pF, 500V	2	301-000-C0J0-309C	72982
C11	CAPACITOR, CERAMIC, TUBULAR: 8.2 pF, ±.5 pF, 500V	2	301-000-C0H0-829D	72982
C12	CAPACITOR, VARIABLE, GLASS: 0.8 - 8.5 pF, 750V	5	VC20GY	73899
C13	CAPACITOR, COMPOSITION, TUBULAR: 0.18 pF, 10%, 500V	1	QC(.18pF,K)	95121
C14	CAPACITOR, COMPOSITION, TUBULAR: 0.12 pF, 10%, 500V	1	QC(.12pF,K)	95121
C15	Same as C12			
C16	Same as C10			
C17	CAPACITOR, CERAMIC, STANDOFF: 1000 pF, GMV, 500V	9	SS5D-102W	01121
C18	Same as C17			
C19	Same as C17			
C20	Same as C1			
C21	CAPACITOR, MICA, DIPPED: 22 pF, 5%, 500V	1	CM05ED220J03	81349
C22	Same as C1			
C23	Same as C12			
C24	Same as C17			
C25	CAPACITOR, COMPOSITION, TUBULAR: 0.68 pF, 10%, 500V	2	QC(.68pF,K)	95121
C26	Same as C12			
C27	Same as C25			
C28	CAPACITOR, COMPOSITION, TUBULAR: 0.3 pF, 10%, 500V	1	QC(.3pF,K)	95121

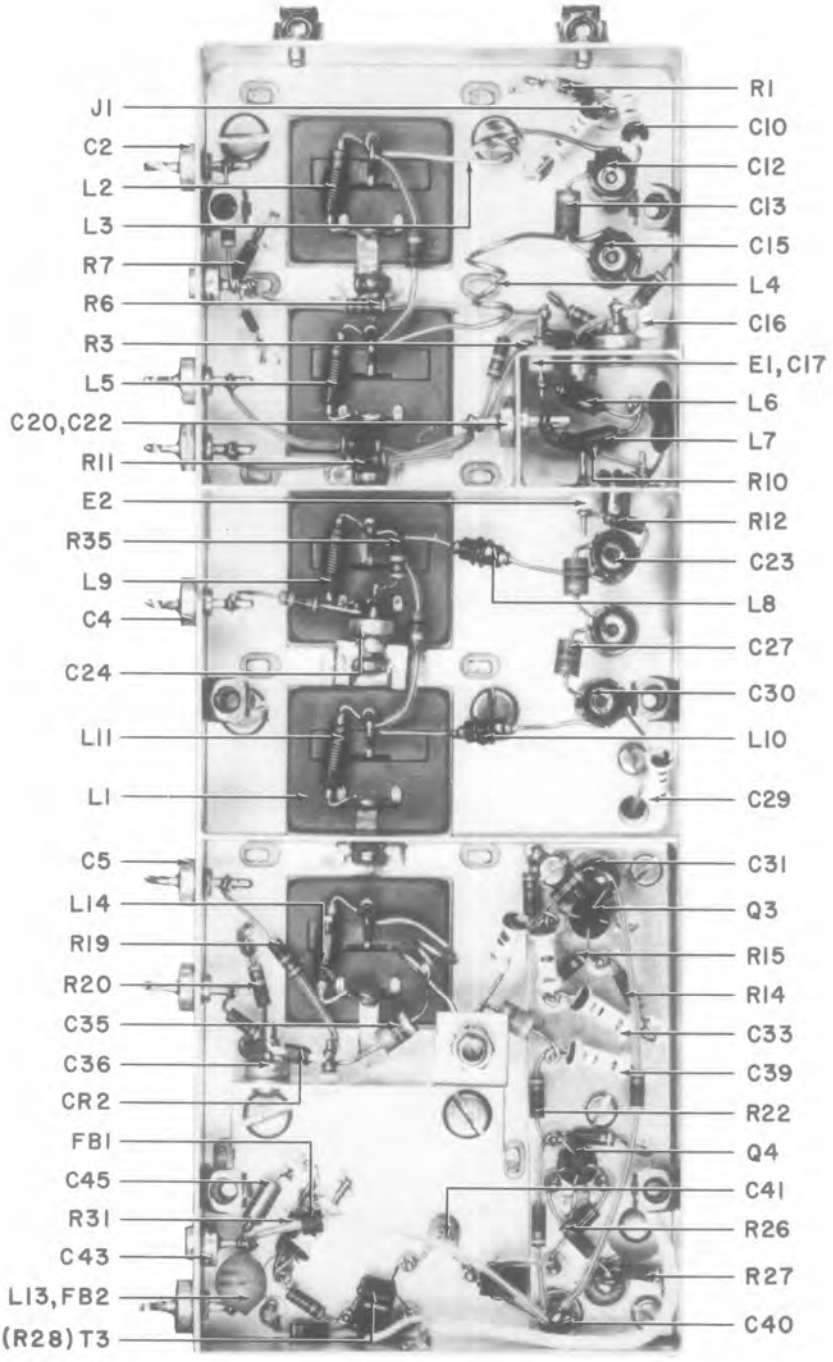


Figure 5-6. Type 71318 90-260-MHz RF Tuner, Component Locations

( ) DENOTES HIDDEN PART

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C29	CAPACITOR, CERAMIC, TUBULAR: 1.5 pF, ±.1 pF, 500V	1	301-000-C0K0159B	72982
C30	Same as C12			
C31	Same as C17			
C32	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±.25 pF, 500V	1	301-000-U2J0-479C	72982
C33	CAPACITOR, CERAMIC, TUBULAR: 2 pF, ±.25 pF, 500V	1	301-000-C0K0-209C	72982
C34	CAPACITOR, CERAMIC, TUBULAR: 2.7 pF, ±.25 pF, 500V	1	301-000-T2J0-279C	72982
C35	CAPACITOR, COMPOSITION, TUBULAR: 0.47 pF, 10%, 500V	1	QC(.47pF,K)	95121
C36	Same as C17			
C37	CAPACITOR, VARIABLE, GLASS: 0.8 - 4.5 pF, 750V	1	VC21GY	73899
C38	CAPACITOR, COMPOSITION, TUBULAR: 0.43 pF, 10%, 500V	1	QC(.43pF,K)	95121
C39	Same as C11			
C40	Same as C17			
C41	CAPACITOR, CERAMIC, DIPPED: 1000 pF, GMV, 500V	1	SM(1000pF,GMV)	91418
C42	Same as C17			
C43	Same as C17			
C44	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±.25 pF, 500V	1	301-000-C0H0-479C	72982
C45	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μF, 10%, 35V	1	CS13BF105K	81349
CR1	DIODE	1	1N462A	80131
CR2	DIODE	1	BB105B	25088
E1	TERMINAL, FEEDTHRU	2	SFU-16	04013
E2	Same as E1			
FB1	FERRITE BEAD	2	56-590-65/4A	02114
FB2	Same as FB1			
J1	CONNECTOR, RECEPTACLE, MINATURE SERIES	3	10-0104-002	19505
J2	Same as J1			
J3	Same as J1			
L1	INDUCTUNER, 5-Section	1	21701-6	14632
L2	COIL, FIXED	4	21210-88	14632
L3	COIL, FIXED	2	1466-19	14632

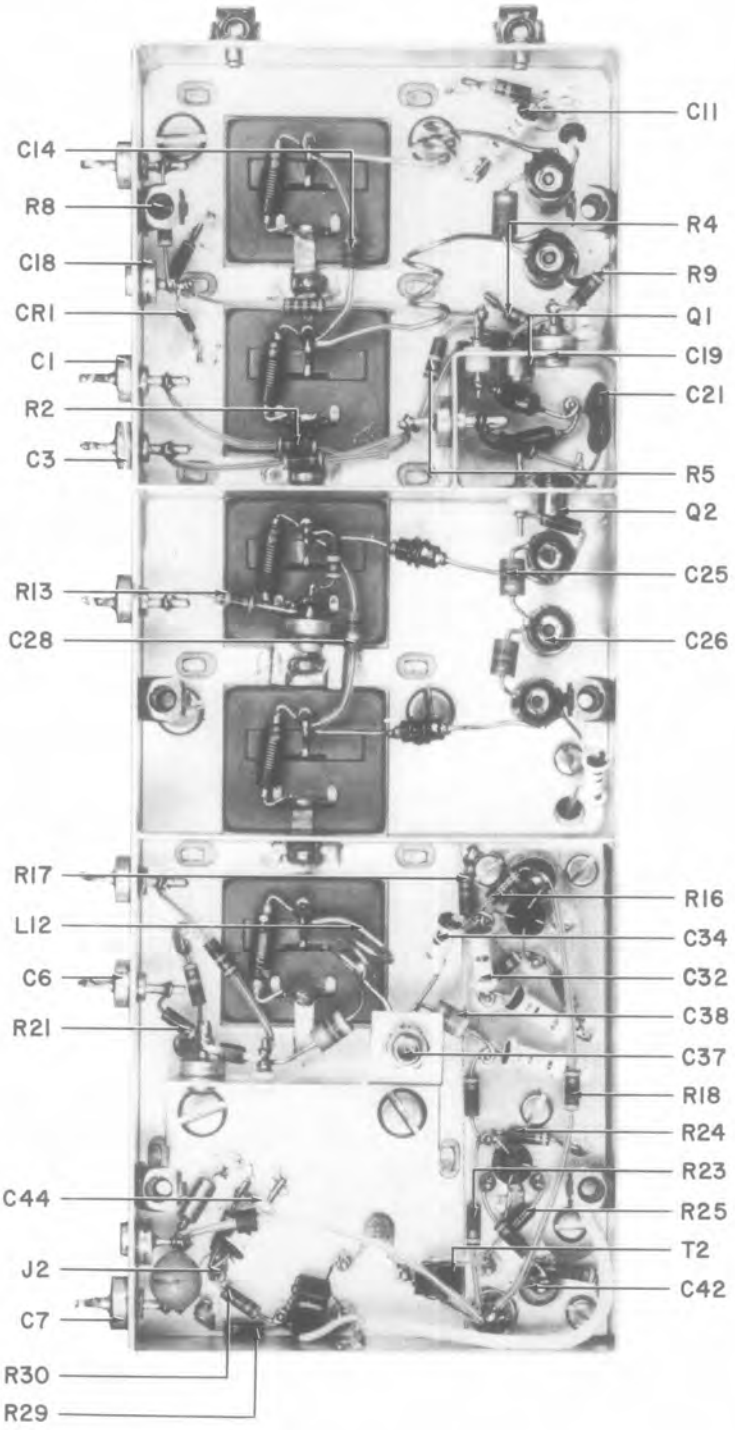


Figure 5-7. Type 71318 90-260-MHz RF Tuner, Component Locations

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
L4	Same as L3			
L5	Same as L2			
L6	COIL, FIXED	1	21210-10	14632
L7	COIL, FIXED: 0.82 μH	1	204-11	99848
L8	COIL, FIXED	1	21210-89	14632
L9	Same as L2			
L10	COIL, FIXED	1	21210-90	14632
L11	Same as L2			
L12	COIL, FIXED	1	21210-91	14632
L13	COIL, FIXED: 4.7 mH	1	3635-45	71279
L14	COIL, FIXED	1	22292-28	14632
MP1	COVER	1	22590-1	14632
MP2	COVER	1	16207-1	14632
Q1	TRANSISTOR	1	3N140	80131
Q2	TRANSISTOR	1	2N4416	80131
Q3	TRANSISTOR	1	2N3478	80131
Q4	TRANSISTOR	1	2N2857	80131
R1	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	3	RCR07G104JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	4	RCR07G470JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 510 kΩ, 5%, 1/4W	1	RCR07G514JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	1	RCR07G682JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 300 Ω, 5%, 1/4W	1	RCR07G301JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	2	RCR07G272JS	81349
R11	Same as R2			
R12	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	4	RCR07G100JS	81349
R13	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 820 Ω, 5%, 1/4W	1	RCR07G821JS	81349
R15	Same as R2			
R16	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349
R17	Same as R16			

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R18	Same as R2			
R19	Same as R1			
R20	Same as R1			
R21	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	RCR07G102JS	81349
R22	Same as R12			
R23	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R24	Same as R10			
R25	Same as R12			
R26	Same as R12			
R27	RESISTOR, FIXED, COMPOSITION: 180 Ω, 5%, 1/4W	1	RCR07G181JS	81349
R28	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349
R29	RESISTOR, FIXED, COMPOSITION: 75 Ω, 5%, 1/4W	2	RCR07G750JS	81349
R30	RESISTOR, FIXED, COMPOSITION: 120 Ω, 5%, 1/4W	1	RCR07G121JS	81349
R31	Same as R29			
R32	RESISTOR, FIXED, COMPOSITION: 270 Ω, 5%, 1/4W	1	RCR07G271JS	81349
R33	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349
R34	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	1	RCR07G332JS	81349
R35	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	RCR07G154JS	81349
T1	NOT USED			
T2	TRANSFORMER	2	21278-7	14632
T3	Same as T2			

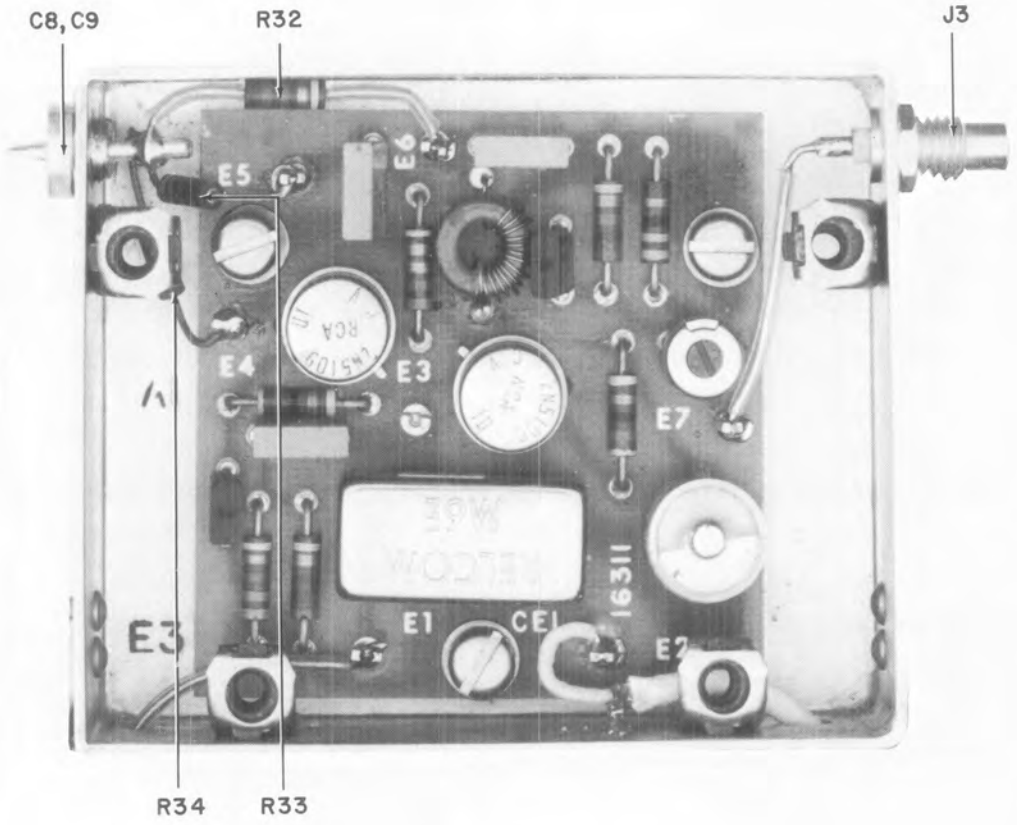


Figure 5-8. Type 71318 90-260-MHz RF Tuner, Side View, Component Locations

5.4.2.1.1 Part 16311 Mixer/IF Amplifier

REF DESIG PREFIX A1A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DIPPED: .01 μF, 10%, 200V	3	CK06BX103K	81349
C2	CAPACITOR, CERAMIC, DIPPED: 1000 pF, 10%, 200V	2	CK05BX102K	81349
C3	Same as C1			
C4	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350V	1	538-011-D9-35	72982
C5	Same as C1			
C6	Same as C2			
Q1	TRANSISTOR	2	2N5109	80131
Q2	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 8.3 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 360 Ω, 5%, 1/4W	1	RCR07G361JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 6.8 Ω, 5%, 1/4W	1	RCR07G6R8JS	81349
R5	Same as R3			
R6	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	1	RCR07G151JS	81349
R7	RESISTOR, VARIABLE, CERAMIC: 100 Ω, 10%, 1/2W	1	62PR100	73138
R8	RESISTOR, FIXED, COMPOSITION: 33 Ω, 5%, 1/4W	1	RCR07G330JS	81349
T1	TRANSFORMER	1	21428-7	14632
U1	MIXER, BALANCED	1	M6E	27956

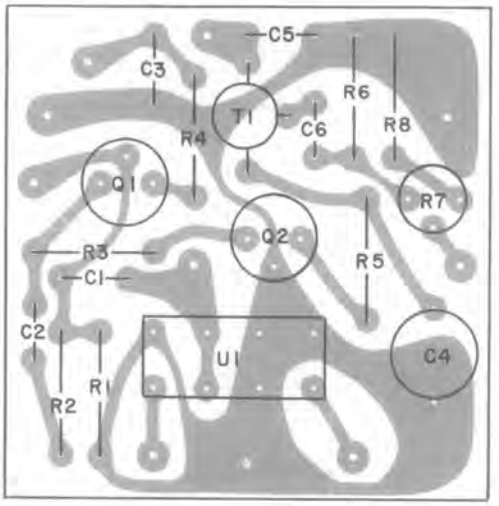


Figure 5-9. Part 16311 Mixer/IF Amplifier, Component Locations

5.4.2.2 Type 8595 Tuning Drive REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
DS1	LAMP, INCANDESCENT: 5V, .06A	3	CM8-683	71744
DS2	Same as DS1			
DS3	Same as DS1			
R1	RESISTOR, VARIABLE, PRECISION: 500 Ω, 1%, 1-1/2W	1	7223-962-1	73138

FOR MECHANICAL PARTS SEE EXPLODED VIEW

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
1	FRONT GEAR PLATE	1	21349-1	14632
2	BALL BEARING	2	SFR2-63MM	83086
3	BALL BEARING	2	SFR33MM	83086
4	BALL BEARING	3	SFR1883MM	83086
5	LIGHT BAR	1	13963	14632
6	LIGHT BOARD ASSEMBLY	1	14004	14632
7	LAMP, INCANDESCENT 5V, 06A (DS1, DS2, DS3)	REF	CM8-683	71744
8	GUIDE PLATE	1	14122-1	14632
9	ANGLE PLATE	1	15357-1	14632
10	COVER	1	14044-2	14632
11	CALIBRATED TAPE	1	32785-1	14632
12	TAPE CHAMBER,MODIFIED	1	15356-1	14632
13	SHAFT	1	13908-4	14632
14	SPUR GEAR, TAPE DRIVE	1	14065-1	14632
15	PINION GEAR,MODIFIED	1	11136-1	14632
16	TENSION SPRING	1	13944-1	14632
17	SUPPORT PLATE	1	11147-5	14632
18	COLLAR	1	11581-2	14632
19	SPRING, TENSION	AR	7754	04941
20	THRUST WASHER (BRONZE)	1	TT-504	70417
21	DRIVE SHAFT	1	1002-96	14632
22	RING, RETAINING	2	5100-25	79136
23	GEAR, SPUR	1	13955-1	14632
24	GEAR, MODIFIED (BEVEL)	1	11135-1	14632
25	RING RETAINING	1	5100-18	79136
26	IDLER SHAFT	1	21352-2	14632
27	COLLAR	1	11581-6	14632
28	SPRING, TENSION	AR	7752	04941
29	CLUTCH BEARING	2	11582-7	14632
30	GEAR, ANTI-BACKLASH	1	20182-1	14632
31	GEAR, SPUR	1	2984-10	14632
32	SHIM SPACER	AR	SSS-23	01351
33	GEAR, ANTI-BACKLASH	1	20180-6	14632

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
34	SPACER	2	20757-26	14632
35	SPACER	2	20757-27	14632
36	PLATE, POTENTIOMETER	1	11131-2	14632
37	CLAMP, SYNCRO MOUNTING	3	C2	00328
38	POTENTIOMETER	REF	7223-962-1	73138
39	GEAR, SPUR	1	2984-29	14632
40	SPACER	2	11151-1	14632
41	REAR GEAR PLATE	1	16202-1	14632
42	SPACER- SHOULDER	4	20755-77	14632
43	INDUCTUNER	REF	21701-6	14632
44	SET SCREW #4-40 x 1/8 LG.	AR	MS51021-9	96906
45	SET SCREW #6-32 x 1/8 LG.	AR	MS51021-21	96906
46	#2 FLAT WASHER	AR	MS15795-802	96906
47	#6 FLAT WASHER	AR	MS15795-805	96906
48	#2 LOCK WASHER (SPLIT)	AR	MS35338-134	96906
49	#4 LOCK WASHER (SPLIT)	AR	MS35338-135	96906
50	#6 LOCK WASHER (SPLIT)	AR	MS35338-136	96906
51	#2-56 x 3/16 LG PAN HEAD MACHINE SCREW	AR	MS35233-2	96906
52	#2-56 x 1/4 LG PAN HEAD MACHINE SCREW	AR	MS35233-3	96906
53	#2-56 x 1/4 LG FILLISTER HEAD MACHINE SCREW	AR	MS35275-203	96906
54	#2-56 x 1/4 LG FLAT HEAD MACHINE SCREW	AR	MS35249-10	96906
55	#4-40 x 3/8 LG PAN HEAD MACHINE SCREW	AR	MS35233-15	96906
56	#6-32 x 1/4 LG PAN HEAD MACHINE SCREW	AR	MS35233-26	96906
57	#6-32 x 3/8 LG CAP SCREW	AR	MS16995-17	96906
58	#6-32 x 1.00 LG FLAT HEAD MACHINE SCREW	AR	MS35249-41	96906

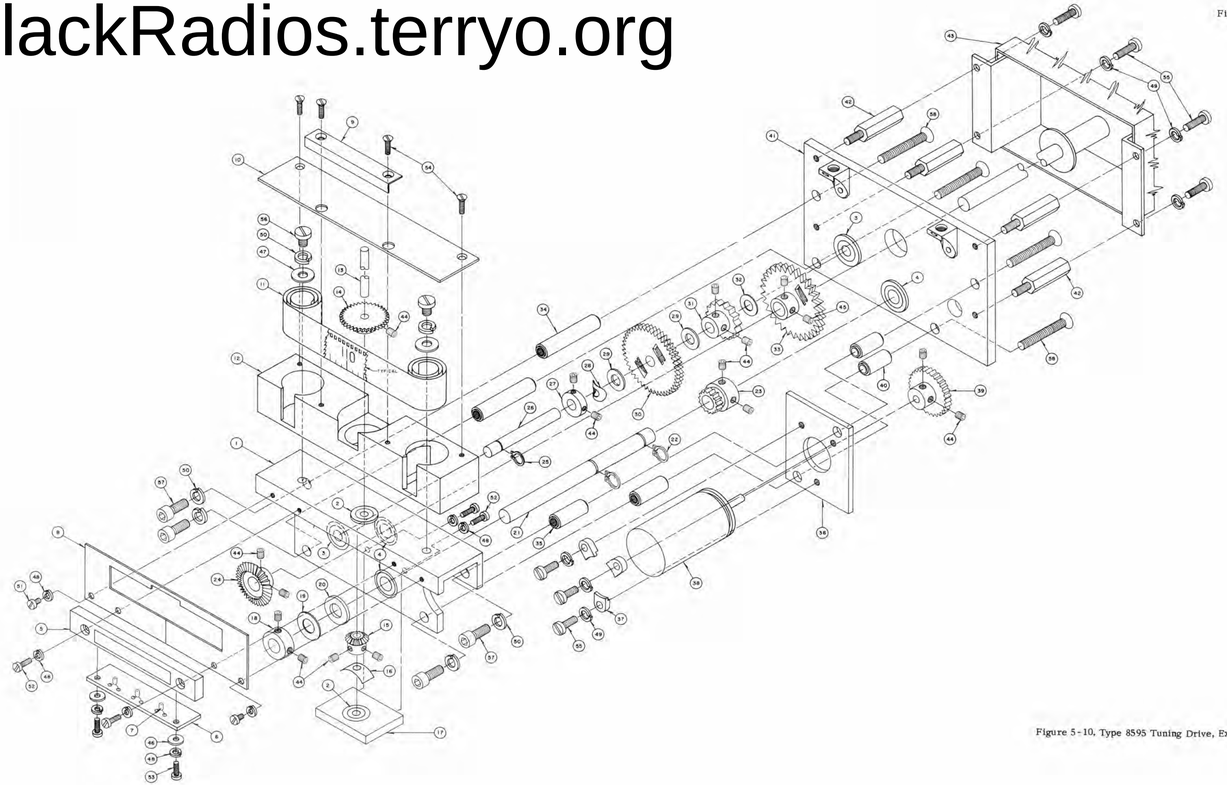


Figure 5-10

Figure 5-10, Type 8595 Tuning Drive, Exploded View

SECTION VI

SCHEMATIC DIAGRAMS

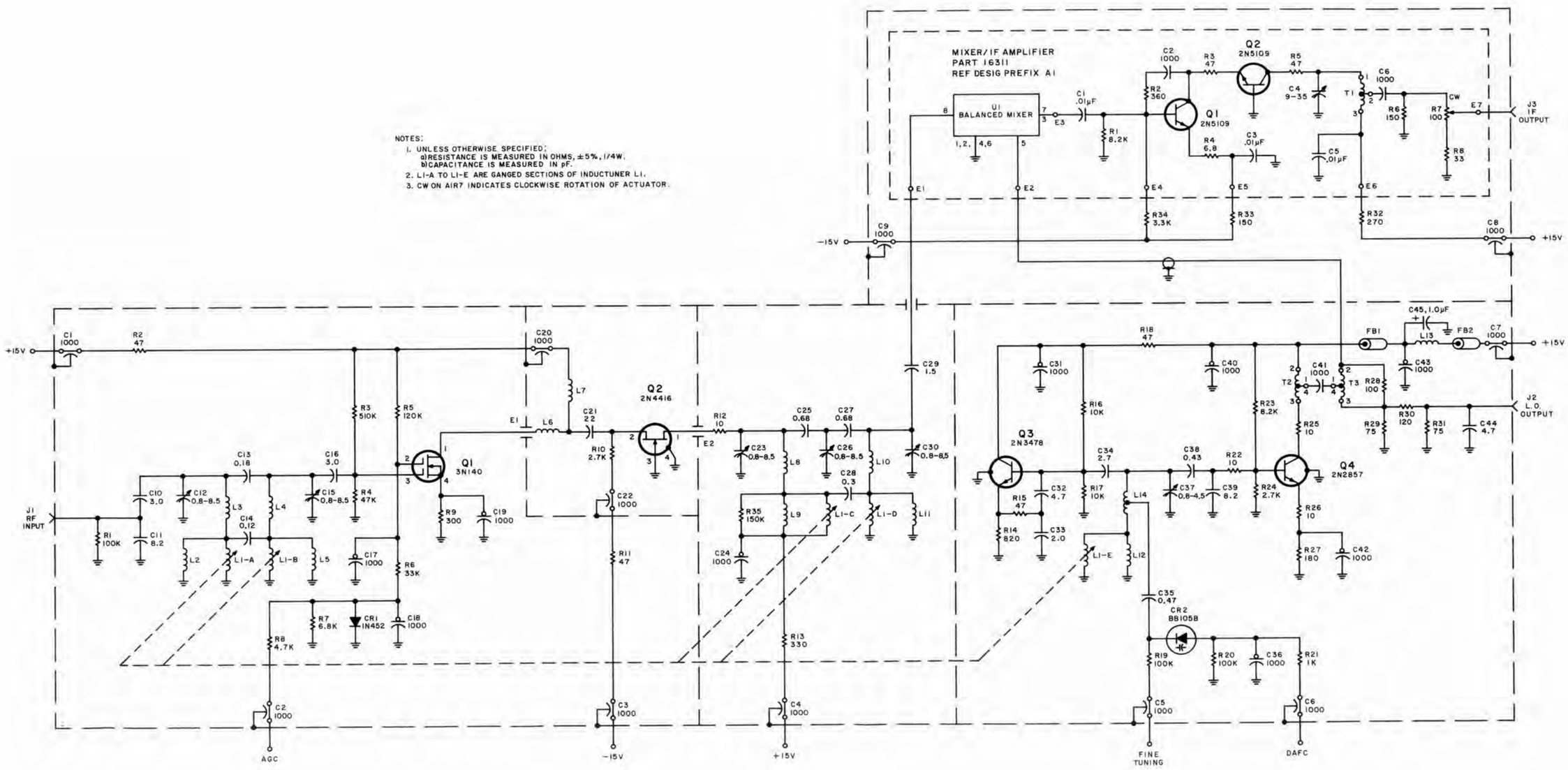
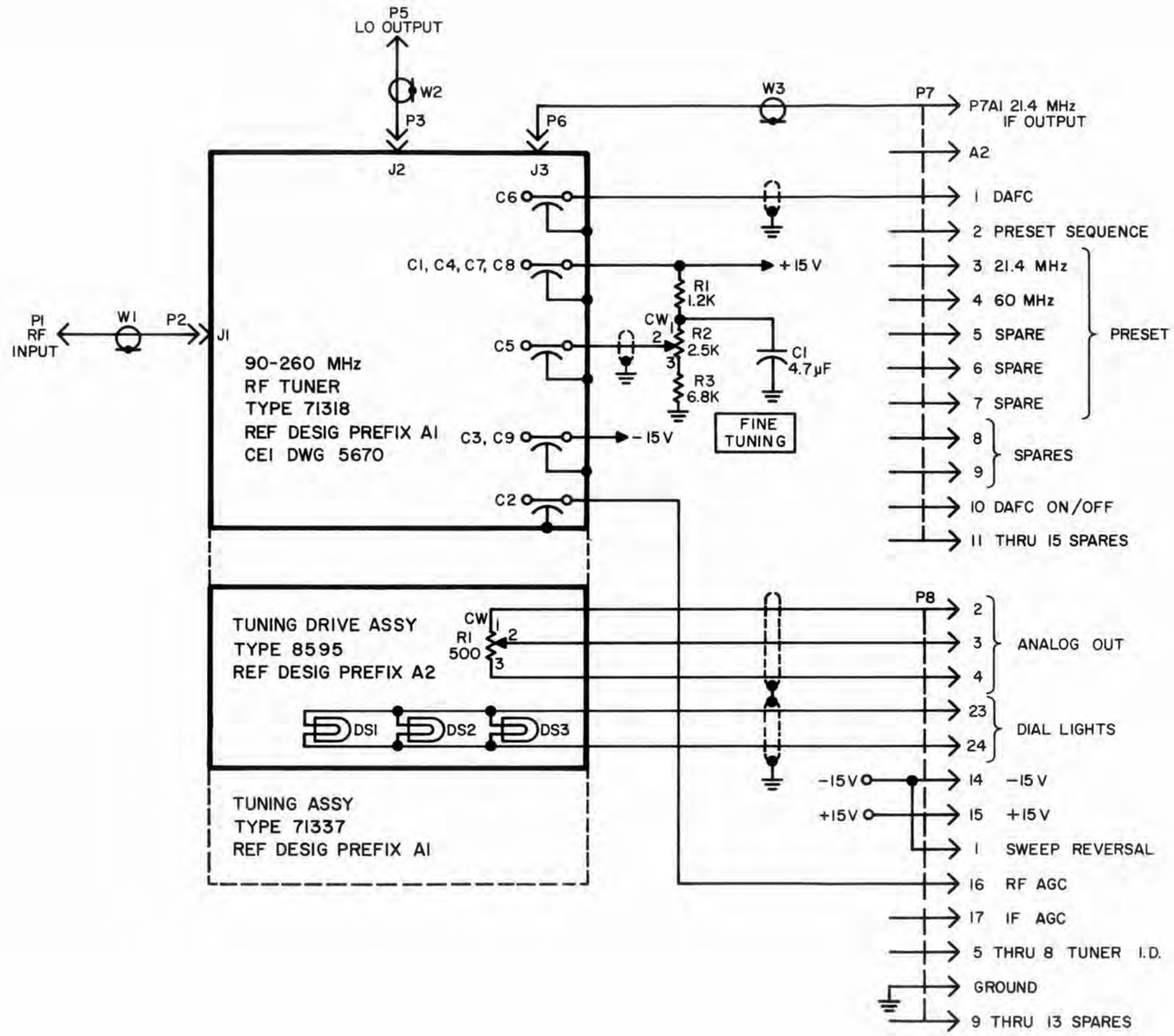


Figure 6-1. Type 71318 90-260-MHz RF Tuner, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ± 5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. CW ON POTENTIOMETERS INDICATES CLOCKWISE ROTATION OF ACTUATOR.
3. ▭ DENOTES FRONT PANEL CONTROL.

Figure 6-2. Type VH-103 Tuning Head, Main Chassis Schematic Diagram