Courtesy of http://BlackRadios.terryo.org

WATKINS-JOHNSON

Courtesy of http://BlackRadios.terryo.org

INSTRUCTION MANUAL
FOR
TYPE TH-120A 1-2 GHz TUNING HEAD

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

Courtesy of http://BlackRadios.terryo.org

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

Courtesy of http://BlackRadios.terryo.org

TABLE OF CONTENTS

Courtesy of http://BlackRadios.terryo.org

LIST OF ILLUSTRATIONS

LIST OF TABLES

Courtesy of http://BlackRadios.terryo.org

Table 1-1. Type TH-120A Tuning Head Specifications

Electrical	
Tuning Range	1-2 GHz
Input Impedance	50 ohms, nominal
Noise Figure	8 dB, typical; 10 dB maximum
Tuner Gain	20 dB, nominal
IF Rejection	80 dB, minimum
Image Rejection	60 dB, minimum
Input VSWR	3:1, maximum
Local Oscillator Output Frequency	$F_{LO} = F_{Tuner} + 160$ MHz
Antenna Conducted LO Radiation	50 microvolts, maximum
LO OUTPUT Level	-25 dBm, minimum into 50 ohms
ANALOG OUTPUT Level	-10V to +10V
Varactor Tuning Range	±500 kHz, minimum
External AFC Tuning Range	±500 kHz, minimum
RF AGC Range, MAN GAIN Control	15 dB, minimum
Dial Calibration	±1%
Dial Resetability	±0.5%
Power Supply Voltages Required for Operation	+150 Vdc, regulated; +28 Vdc, regulated; +15 Vdc, regulated; -15 Vdc, regulated; +6 Vdc, regulated; 5 Vac
Mechanical	
Size	3.15 inches high; 7.75 inches wide; 14.9 inches deep
Weight	7 lbs., approximately

Courtesy of http://BlackRadios.terryo.org

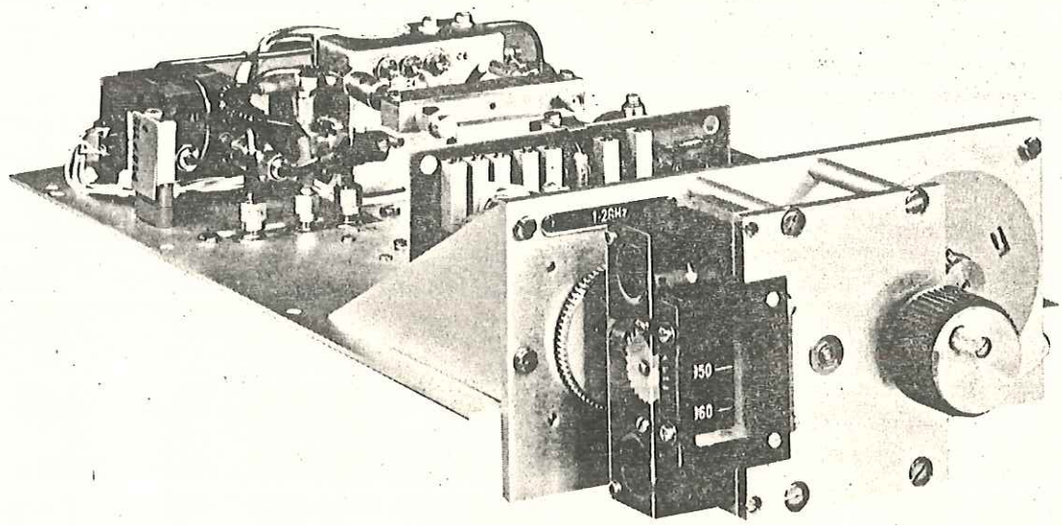


Figure 1-1. Type TH-120A 1-2 GHz Tuning Head, Front View

Courtesy of http://BlackRadios.terryo.org

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The TH-120A Tuning Head, which tunes the 1-2 GHz range, is designed to be used with any of several types of equipment. These parent units supply power and control (AGC; AFC) voltages to the tuning head. As examples, the TH-120A will operate in the Type 112-( ) Microwave Receiver or with the combination of Types MTF-100/ MTF-101 Microwave Tuning Frame(s) and Type DM-112 Demodulator.

1.1.2 The RF stage contains an amplifier electrically connected between two double-tuned YIG filters that are housed in a single mechanical assembly. The RF amplifier yields an improved noise figure; the filters serve as RF pre- and postselectors with a bandwidth of approximately 30 MHz. Both filters are electrically tuned by circuitry associated with a multiturn precision potentiometer that is mechanically linked to the oscillator tuning drive and tape dial. Shaping circuitry modifies the tuning current to the filter so that it tracks with the local oscillator. The YIG filters provide high image frequency rejection and low local oscillator conduction. The filter assembly has an internal, self-regulated heating element that improves frequency-versus-temperature stability and increases the filter's ability to handle high input signal levels.

1.1.3 The local oscillator is a ceramic triode in a mechanically tuned cavity. Fine tuning is provided by a varactor within the cavity. The local oscillator output drives a balanced mixer. A power-tapping coupler supplies a sample of the LO signal to the main chassis of the parent equipment. Attenuators and decouplers are used between the various microwave components to reduce undesirable circuit loading and spurious emissions.

1.1.4 The balanced mixer converts incoming signals to IF. These signals are applied to a 160 MHz preamplifier with a 20 MHz bandwidth. The output of the preamplifier is supplied to the parent equipment.

1.1.5 The parent equipment supplies the tuning head with five regulated dc power supply voltages, routes the antenna input to the YIG preselector, and furnishes two control voltages: AGC with a range of approximately 15 dB, and AFC. The AGC voltage controls the gain of the first stage of the IF preamplifier. The AFC voltage is supplied to a varactor in the local oscillator assembly, and induces small incremental frequency adjustments in response to the fine tuning control or the discriminator output (as applicable) of the parent equipment.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The TH-120A Tuning Head is constructed on an aluminum plate, which serves as a chassis and measures approximately 8 x 12 inches. At the front of the chassis is a vertical plate 3 inches high, which mounts the tuning drive. The tuning control shaft and frequency indicator mechanism are fixed to the vertical plate and extend through the front panel of the receiver or tuning frame when the tuning head is installed. The various subassemblies

Courtesy of http://BlackRadios.terryo.org

which comprise the tuning head are mounted to the chassis and interconnected in a manner which facilitates repair and/or replacement. The tuning drive assembly positions the tape dial, the oscillator tuning shaft, and the YIG driver potentiometer.

1.2.2 The tuning head is mounted in the parent equipment with eight screws. A short cable with a multipin plug and three rigidly mounted coaxial connectors provide the electrical interconnections to the various subassemblies located on the main chassis. The wiring of an adaptor plug modifies the source of the YIG heater voltage to make the tuning head compatible with several types of parent equipment.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the TH-120A Tuning Head only. The dimensions and weight are given in Table 1-1.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The TH-120A Tuning Head is designed to operate when installed in associated equipment. It is not capable of independent operation. As an aid to maintenance of the TH-120A, an extender cable is required to supply operating voltages when the tuning head is removed from the parent equipment.

Courtesy of http://BlackRadios.terryo.org

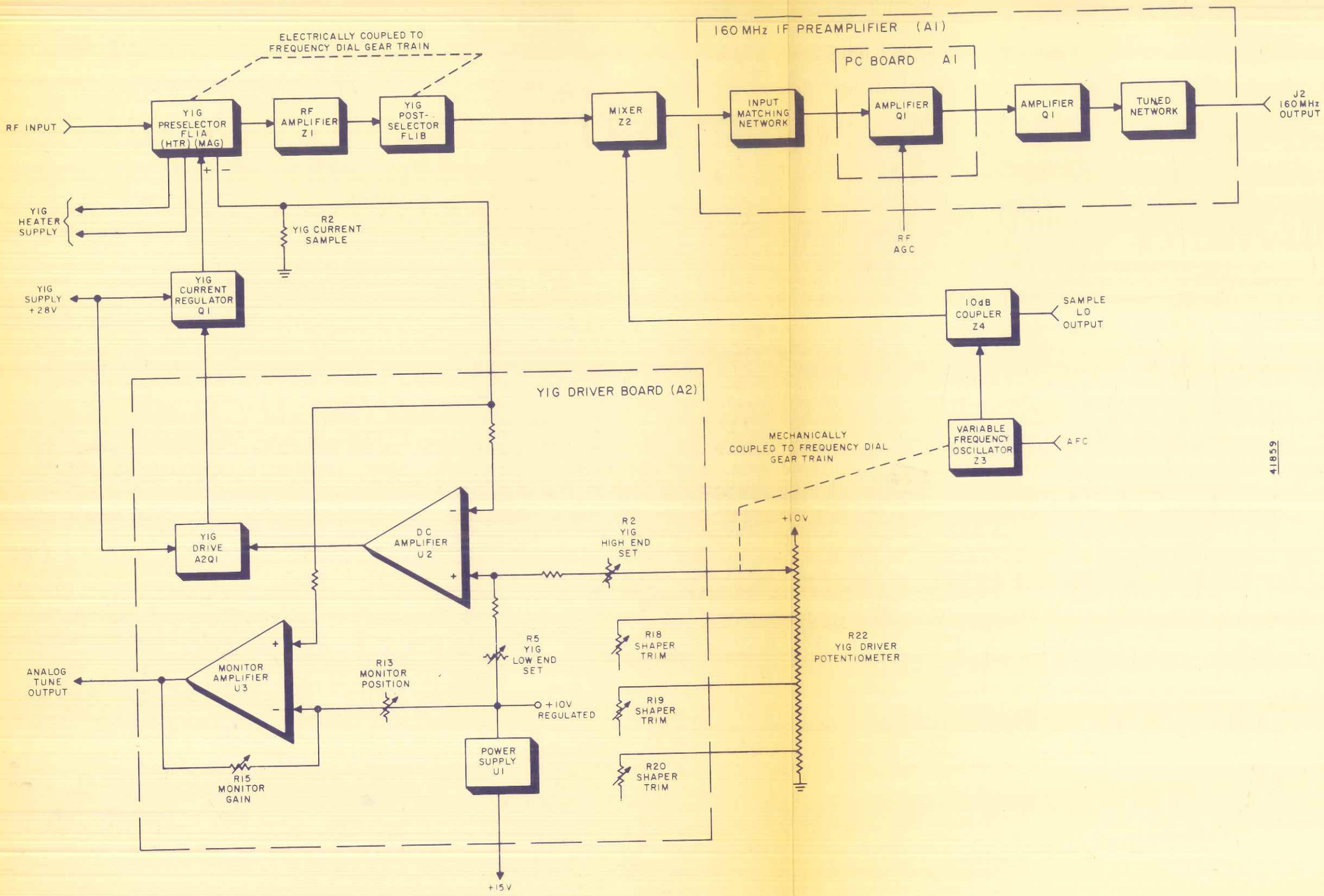


Figure 2-1. Type TH-120A 1-2 GHz Tuning Head, Functional Block Diagram

Courtesy of http://BlackRadios.terryo.org

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

The operation of the various stages in the TH-120A are explained using the functional block diagram, Figure 2-1, and the schematic diagrams included in Section VI of this manual. To identify the subassemblies used in the tuning head, consult the main chassis schematic diagram, Figure 6-3. Note also that the unit numbering system is used for the electrical components. This means that parts on subassemblies carry a prefix before the usual class letter and number of the item (such as A1R1 and A2C10). These subassembly prefixes are omitted on illustrations and in the text except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

2.2.1 The Type TH-120A Tuning Head covers the frequency range of 1 to 2 GHz in one band. Incoming signals are routed to the input of the 1 to 2 GHz filter, FL1A. This preselector, as well as a ganged post-selector, FL1B, are YIG (yttrium-iron-garnet) type, high Q microwave resonators that are magnetically tuned by a variable control current. The resonant frequency of each filter varies linearly with the magnetic field intensity incident on the YIG spheres. Since the field intensity is determined by the magnitude of the tuning current passing through the field-generating electromagnet (MAG), this parameter is accurately controlled by a precision potentiometer. This potentiometer is driven from the main tuning mechanism. Also, since a superheterodyne circuit is employed, the YIG filters must track with the local oscillator tuned cavity. Since the LO frequency rate of change is nonlinear, the YIG tuning current must be shaped, i.e., made to vary in a similar nonlinear fashion. This is accomplished by fixed and variable resistive shunting of the YIG drive potentiometer. Three potentiometers, R18, R19, and R20, permit in-band tracking adjustments. Band set adjustments are accomplished by trimmer potentiometers R2 (high end) and R5 (low end). All five shunt potentiometers are located on YIG driver board A2.

2.2.2 The resonant frequency, bandwidth, and other characteristics of YIG filter FL1 are temperature dependent. For this reason, a constant temperature oven is built into the filter housing. Tuning current requirements for the YIG filter are on the order of 60-120 mA to tune the range of 1 to 2 GHz. The YIG tuning sensitivity is such that a current change of 1 mA will shift the YIG tuned frequency by 17 MHz. In order to supply the required stable current, transistor Q1, transistor A2Q1, and operational amplifier A2U2 form a differential current amplifier. Transistors Q1 and A2Q1 form a Darlington amplifier to supply the necessary current to the YIG filter from the +28V supply. The Darlington pair is controlled by A2U2. Shaped tuning voltage from the YIG drive potentiometer and a low end (band edge) offset voltage are summed and applied to the non-inverting input of A2U1. A voltage developed across R2, which represents a sample of the YIG tuning current, is applied to the inverting input to A2U2. The operational amplifier amplifies the difference between its two inputs until a loop equilibrium is reached. Thus, changes

Courtesy of http://BlackRadios.terryo.org

in current due to temperature dependent components through the entire control loop are sensed and cancelled, thereby maintaining a stable control current.

2.2.3 The YIG current sample voltage can also be used to indicate on external monitoring equipment the approximate frequency to which the TH-120A is tuned. To facilitate this monitoring, a variable gain operational amplifier, A2U3, is employed. The sampled voltage is amplified to an extent dependent on the setting of MONITOR GAIN control A2R15. To set the base line reference for the external monitor, a MONITOR POSITION control, A2R13, is provided. The output of monitor amplifier A2U3 may be coupled to a connector located on the rear apron of the parent equipment into which the TH-120A is installed. This connector is labeled ANALOG OUTPUT.

2.2.4 The output of preselector FL1A is routed to RF amplifier Z1. The amplifier is a low noise, solid state device with a typical gain of 18 dB and a typical noise figure of 5 dB. The output of amplifier Z1 is applied to YIG postselector FL1B. The postselector output is supplied to balanced mixer Z2.

2.2.5 The variable frequency oscillator, Z3, employs a ceramic electron tube in a tuned cavity. The VFO frequency is maintained 160 MHz above the RF signal by gang-tuning with YIG driver potentiometer. In addition, the oscillator frequency may be incrementally tuned from the parent equipment via an AFC voltage applied to a varactor in Z3. This voltage is, for instance, supplied from the Type 112-( ) Receiver in three modes. The mode, selected by the AFC switch located on the receiver front panel, provides AFC voltage furnished: (a) by the receiver discriminator, (b) from a FINE TUNE potentiometer located on the front panel of the receiver or, (c) from an AFC source external to the receiver itself, routed via a receiver rear apron connector labeled EXT AFC.

2.2.6 The output of the variable frequency oscillator is applied to a passive 10 dB directional coupler, Z4. Two attenuated outputs are provided from Z4. One is furnished as the LO OUTPUT; the other is applied to the balanced mixer, Z2, for mixing with the RF signal.

2.2.7 The primary output signals from the balanced mixer (Z2) are the sum and difference of its two inputs. Tuned circuits in the IF preamplifier (A1) select the 160-MHz difference frequency.

2.2.8 The IF preamplifier, A1, employs a modified cascode amplifier consisting of common emitter amplifier A1A1Q1 and grounded base amplifier A1Q1. RF AGC is applied to the base of A1A1Q1. A 160-MHz, double-tuned circuit filters the output of the cascode amplifier. The amplified 160-MHz signal, with a bandwidth of 20 MHz, is matched to 50 ohms and supplied to the parent equipment via connector A1J2.

Courtesy of http://BlackRadios.terryo.org

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 material 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 for 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 electronic components for apparent damage. Check all cables for loose connections.

3.2 INSTALLATION

The TH-120A Tuning Head is designed to be installed in and operate with several different types of parent equipment. Installation of the tuning head is specified in the instruction manual for the parent equipment.

3.2.1 Tuning Head Removal. - As an example, to remove a TH-120A Tuning Head from the Type 112-( ) Receiver, proceed as follows:

(1) Remove the receiver from the equipment rack and place it on its side on the work surface.

(2) Loosen the two screw fasteners at the rear of the top dust cover and slide the cover off.

(3) Loosen the two screw fasteners at the rear of the bottom dust cover and slide the cover off.

(4) Remove the largest of the three Allen wrenches mounted on the underside of the chassis. Remove the tuning knob from the tuning shaft by loosening the two setscrews with the Allen wrench. Return the Allen wrench to its mounting clip.

(5) Disconnect the interconnecting cables between the tuning head and the receiver chassis as follows:

(a) Disconnect the multipin power connector from the multipin jack J9 on the main chassis.

Courtesy of http://BlackRadios.terryo.org

(b) Disconnect the LO coaxial cable connector from LO coupler Z4 of the tuning head.

(c) Disconnect the subminiature plug from jack J2 of 160-MHz IF Preamplifier A1 located on the tuning head.

(d) Disconnect the semi-rigid tubing with its RF connector from YIG filter FL1 which is located on the left corner of the tuning head. Carefully move the semi-rigid tubing and connector away from the jack on the YIG filter.

(6) Remove the eight screws which hold the tuning head to the main chassis. The screws are removed from the top side of the chassis.

(7) Working from the bottom side of the receiver, move the rear of the tuning head down and away from the main chassis.

(8) Remove the tuning head by moving it down and away from the main chassis so that the tuning shaft clears the front panel.

3.2.2 Tuning Head Installation. - To install a tuning head, reverse the above procedure. It is not necessary to remove any of the subassemblies, modules, or cables that are permanently affixed to the tuning head. Make certain that there are no cables pinched between the tuning head and main chassis before tightening the eight screws that secure the tuning head to the main chassis.

3.3 OPERATION

Operation of the TH-120A Tuning Head is controlled entirely by the parent equipment into which it is installed, with the exception of the front-panel manual tuning knob.

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, much of the original packing material can be reused, or will at least 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 condensation).

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

Courtesy of http://BlackRadios.terryo.org

SECTION IV

MAINTENANCE

4.1 GENERAL

The TH-120A 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 and part location illustrations can be found in Section V.

4.2 CLEANING

The unit should be kept free of dust, moisture, grease, and foreign matter to ensure trouble-free operation. If available, use clean, low velocity compressed air to blow accumulated dust from the unit. A clean dry cloth, soft bristled brush, or a cloth saturated with cleaning compound may also be used.

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 to determine and correct the cause of overheating before replacing the damaged parts. Mechanical parts should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.4 MAINTENANCE OF TUNING DRIVE ASSEMBLY

Figure 5-6 is an exploded view of the tuning drive assembly. The tuning drive assembly requires little maintenance except for the occasional removal of any dust or dirt that may accumulate.

4.4.1 The tuning drive assembly bearings should be lubricated annually with a small amount of light machine oil. Care should be taken to avoid accidental lubrication of the clutch plates.

4.4.2 To replace a burned-out dial lamp, proceed as follows:

(1) Remove the two screws that hold the light bar to the tuning drive (refer to Figure 5-6).

(2) Gently pull the light bar and printed circuit light board away from the tuning drive.

Courtesy of http://BlackRadios.terryo.org

(3) Remove the two screws that hold the light board to the light bar.

(4) 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 ends of their lives.

(5) Reassemble the unit by reversing steps (1) through (3).

CAUTION

Maintenance work within this unit should be kept to a minimum. When necessary, maintenance should be performed only by trained and experienced personnel. The placement of components and the dress of leads in the equipment (especially within the IF preamplifier) have been carefully engineered to give optimum performance. In replacing any components, great care should be exercised to duplicate the exact physical layout of the original assembly.

4.5 TROUBLESHOOTING

4.5.1 Most troubles will be caused by semiconductor failure or by a failure of the ceramic electron tube in the variable frequency oscillator. If the oscillator tube fails, the entire tuning head should be returned to Watkins-Johnson, CEI for repair. However, if a spare oscillator unit is available, refer to paragraph 4.7 for removal, installation and alignment instructions. The procedures are quite complex and must be precisely followed to obtain satisfactory results.

4.5.2 In the event of failure, the various power supply voltages should be checked. The test procedure and test equipment recommended in paragraph 4.6 will enable overall signal tracing to the output of the mixer and through the IF preamplifier. Substitution of spare subassemblies, if available, will facilitate the location of failures.

4.5.3 Operation of the YIG filters (see Figure 5-5 and 6-2) can be ascertained by monitoring the voltage at the ANALOG TUNE output connector, the voltage across the YIG driver potentiometer slider arm, and the sample voltage across R2. If a loss in large signal handling capability of the tuning head occurs, it is probable that the YIG heater or its supply has failed.

4.6 ALIGNMENT INSTRUCTIONS

The alignment procedures in this book are suitable for performance in the field after replacing components. The alignment of this unit should be performed only with suitable test equipment and by technicians thoroughly familiar with its use. If the limits and tolerances specified in the following steps cannot be obtained during a field alignment, a factory alignment is necessary. Allow at least 15 minutes for warm-up before beginning the work.

Courtesy of http://BlackRadios.terryo.org

4.6.1 Equipment Required. - The following test equipment, or equivalent, is required to perform the complete tuner alignment.

(1) Oscilloscope, Tektronix Type 503

(2) Sweep Generator, Telonic SM-2000

(3) Sweep Generator Plug-in Head, Telonic SH-1

(4) Signal Generator, Hewlett Packard 608D

(5) Sweep Oscillator, Hewlett Packard Type 8690A

(6) Sweep Head, Hewlett Packard Type 8691B (1-2 GHz)

(7) Microwave Marker Generator, Telonic TMS-1

(8) Signal Sampler, Telonic TSS-1

(9) Power Meter, Hewlett Packard Type 432A

(10) 50-ohm detector, Hewlett Packard Type 423A

(11) 50-ohm isotee, Micro Labs HM-10N

(12) Directional Coupler, Hewlett Packard Type 786D (1-2 GHz)

(13) Slide Attenuator, Weinschel Engineering Type 953-10

(14) Step Attenuator, Hewlett Packard Type 354A

(15) Assorted Pads, Connectors, Cables and Alignment Tools

4.6.2 160-MHz IF Amplifier.

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

(2) Set the sweep generator for 160 ±15 MHz using the output of the HP-608D generator as a marker source.

(3) Adjust A1C9 and A1C11 for maximum amplitude and symmetrical response centered on the 160-MHz marker signal. A typical response curve is shown in Figure 4-2. Use the HP-608D signal generator to check for a minimum bandwidth of 20 MHz at the 3 dB points. The preamplifier overall gain should be approximately 10 to 11 dB.

4.6.3 YIG-Oscillator Tracking Adjustment. - The procedures which follow may be used to check and adjust the tracking of the tracking YIG to the oscillator if it is suspected that the oscillator has drifted due to aging or vibration. Do not attempt to adjust the oscillator unless it is a replacement unit.

Courtesy of http://BlackRadios.terryo.org

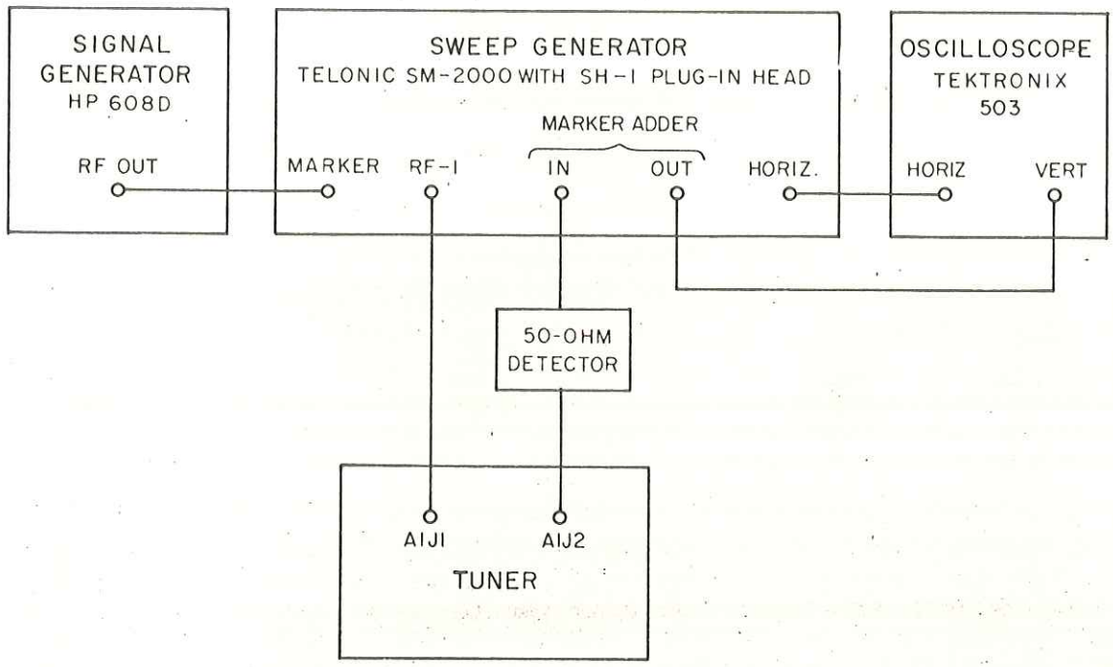


Figure 4-1. Test Setup, 160 MHz IF Preamplifier

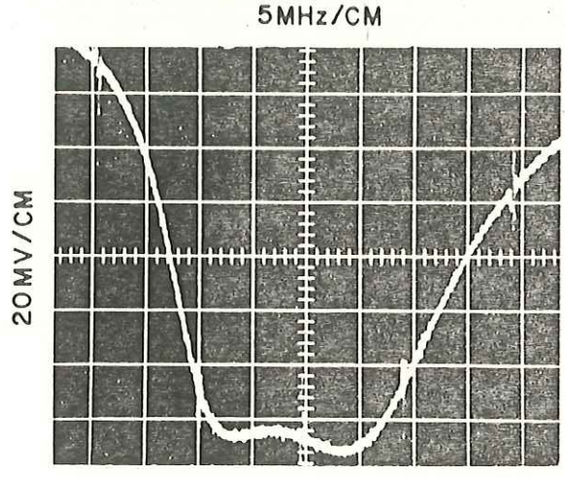


Figure 4-2. Typical Response Curve, 160 MHz IF Preamplifier

Courtesy of http://BlackRadios.terryo.org

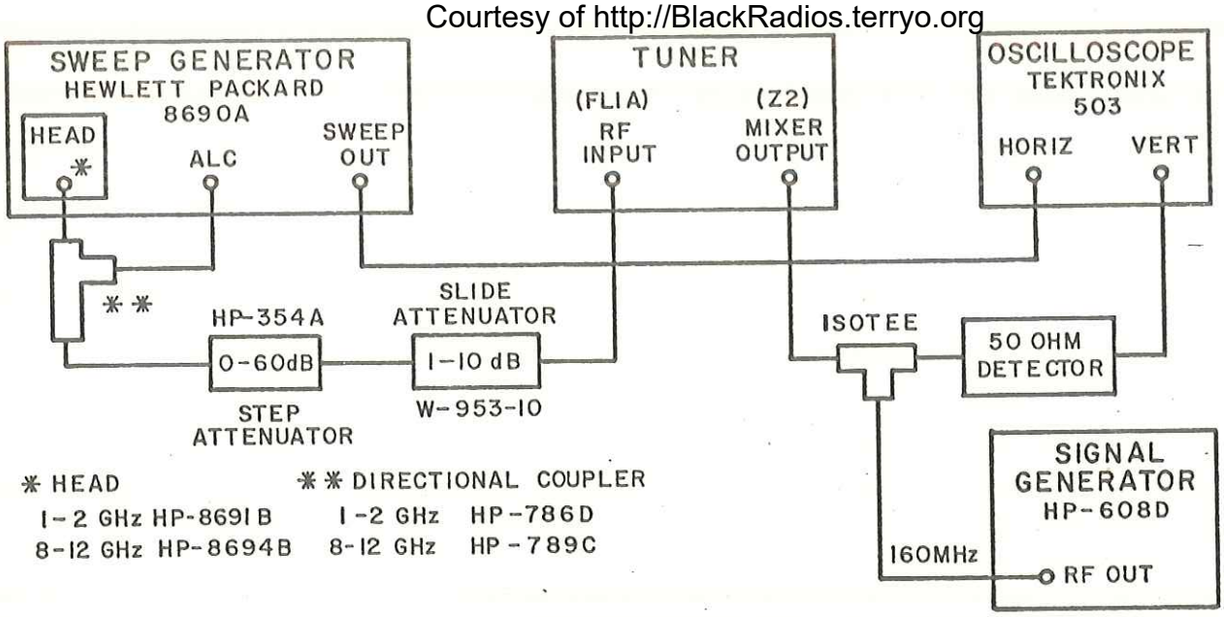


Figure 4-3. Test Setup, YIG-Oscillator Tracking

(1) Connect the equipment as shown in Figure 4-3.

(2) Tune the head across its band, observing the response displayed on the oscilloscope and the 160 MHz marker. The marker must fall within the ±10 MHz passband of the displayed response across the band. If it does not, the following adjustments are to be made on the YIG driver board (A2):

(3) Refer to Table 4-1. This table shows the potentiometers to adjust the TH-120A tuning head. The frequency of adjustment in MHz is given immediately below the potentiometer designation.

(4) Tune the TH-120A to the frequency indicated for the adjustment of A2R1 (2000 MHz) and adjust it to place the marker at the center of the response as displayed on the oscilloscope. A typical response is shown in Figure 4-4.

(5) Repeat step (4) for A2R5, A2R2, A2R3, and A2R4 in that order.

(6) It may be necessary to repeat steps (4) and (5) several times to obtain proper tracking of the YIG filter to the oscillator.

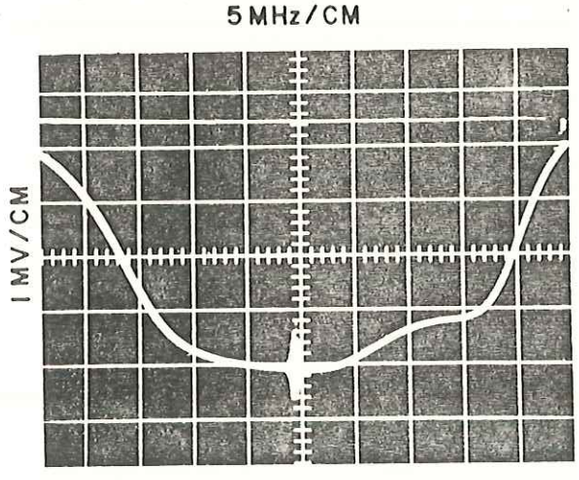


Figure 4-4. Typical Response Curve, YIG-Oscillator Tracking

Courtesy of http://BlackRadios.terryo.org

Table 4-1. YIG Alignment Chart

Tuning Unit	A2R1	A2R2	A2R3	A2R4	A2R5
TH-120A	2000	1700	1180	1000	1000
TH-240A	4000	3450	2450	2400	2000
TH-245A	4500	3800	2650	2200	2000
TH-480A	8000	6900	5000	4325	4000
TH-812A	12000	11400	9500	8500	8000

4.7 VARIABLE FREQUENCY OSCILLATOR (Z3)

The cavity-tuned variable frequency oscillator is a critical assembly and any maintenance attempted should be kept to an absolute minimum. If a failure occurs, it is recommended that the entire tuning head be returned to Watkins-Johnson, CEI for repair. However, a replacement oscillator may be installed in the TH-120A and adjusted to operate properly by performing the procedures in the paragraphs which follow. The procedures should be performed in the sequence given.

4.7.1 Removal. - To remove oscillator Z3 from the TH-120A, proceed as follows:

(1) Refer to paragraph 3.2.2 and remove the TH-120A from the equipment in which it is installed.

(2) Unsolder the filament supply wires from the standoff and ground lug.

(3) Tag and remove the varactor (E. Var.) input wire and the B+ lead.

(4) Remove the oscillator output cable (W3) by unscrewing plug P5 from the oscillator power output probe connector.

(5) Refer to the exploded view of the tuning drive assembly, Figure 5-6, and loosen the setscrews that attach gear 33 to its shaft. Remove the gear from the oscillator tuning shaft.

(6) Remove screw 60 and mounting clamp 44.

(7) Loosen the three setscrews that attach the oscillator to sleeve 41, carefully slide the oscillator to the rear and remove it. Do not dismount the sleeve from the chassis.

4.7.2 Installation. - To install a new oscillator, refer again to Figure 5-6 and proceed as follows:

(1) Carefully slide the new oscillator into sleeve 41, ensuring that the projecting screw on the oscillator assembly is aligned with the recess in the sleeve. Securely tighten the three setscrews in the sleeve.

Courtesy of http://BlackRadios.terryo.org

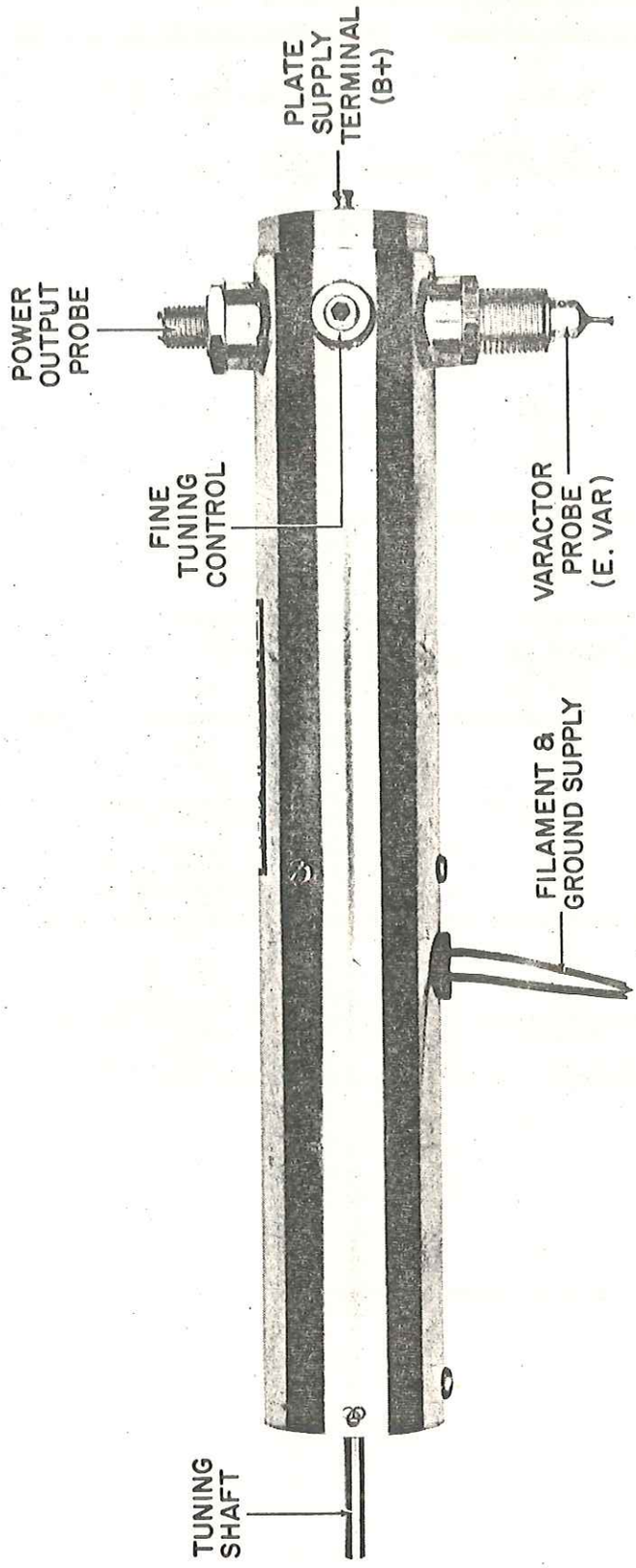


Figure 4-5. Variable Frequency Oscillator (Z3)

Courtesy of http://BlackRadios.terryo.org

(2) Replace the mounting clamp and tighten screw 60.

(3) Install gear 33 on the oscillator tuning shaft, leaving about 1/16-inch clearance.

(4) Turn the tuning drive frequency dial to 2 GHz. Looking from the front of the tuning head, manually turn gear 33 counterclockwise until the end stop is reached. This sets the oscillator to its highest frequency limit. Turn the shaft clockwise one full turn.

(5) Tension (load) split gear 33 approximately two teeth, then move it to mesh with gear 25. Tighten the setscrews that attach gear 33 to the oscillator tuning shaft.

(6) Resolder the brown filament supply wires to the standoff and ground lug.

(7) Solder the varactor (E. Var.) and B+ leads to the appropriate pins on the oscillator.

(8) Connect plug P5 on cable W3 to the oscillator power output probe connector.

4.7.3 Prealignment. - Before applying power to the tuning head the newly installed oscillator must be prealigned as follows:

(1) Refer to Figure 4-5 to locate the oscillator adjustments.

(2) Loosen the varactor probe locknut and move the probe out about 1/16 inch. Loosely retighten the nut.

(3) Loosen the power output probe locknut and move the probe out about 1/16 inch. Loosely retighten the nut.

4.7.4 Power Supply Checks. - Interconnect the TH-120A and its parent equipment using an extender cable to supply power. Check all power supply input voltages to the tuning head.

4.7.5 Oscillator Power Output. - Measure the oscillator power output as follows:

(1) Connect a HP-432A Power Meter to the oscillator output connector with a 20-dB pad in series.

(2) Turn the equipment on and after warmup tune the TH-120A over the 1-2 GHz range and measure the output power. The output from the oscillator should be 125-225 mW. Adjust the lateral position of the output probe as necessary to obtain the correct output and tighten the locknut.

(3) Restore the normal oscillator output connection.

4.7.6 Oscillator Frequency Limits and Fine Tuning Range. - Proceed as follows:

(1) Connect the equipment as shown in Figure 4-6.

(2) Adjust the test equipment controls to obtain a 1-2 GHz sweep response on the oscilloscope with 100-MHz markers.

Courtesy of http://BlackRadios.terryo.org

(3) Tune the TH-120A to 2 GHz and identify the signal and image responses. The desired signal responses is lower in frequency.

(4) Loosen the setscrews in gear 33 and manually turn the oscillator tuning mechanism to center the signal response about the 100-MHz marker representing 2 GHz. The sweep width should be narrowed to obtain the necessary resolution.

(5) Make sure that the TH-120A dial reads 2 GHz and that the signal response is centered about the 2-GHz (100-MHz) marker. Ensure that the fine tuning control on the parent equipment, if activated, is at center range. Tighten the setscrews in gear 33.

(6) Activate the fine tuning control on the parent equipment. Narrow the sweep width to ±10 MHz centered about 2 GHz and check the fine tuning range. It should be possible to move the response approximately 1.5 MHz. If insufficient range is obtained, adjust the fine tuning (E. Var.) probe on the oscillator. Repeat the 2-GHz frequency setting as in steps (4) and (5).

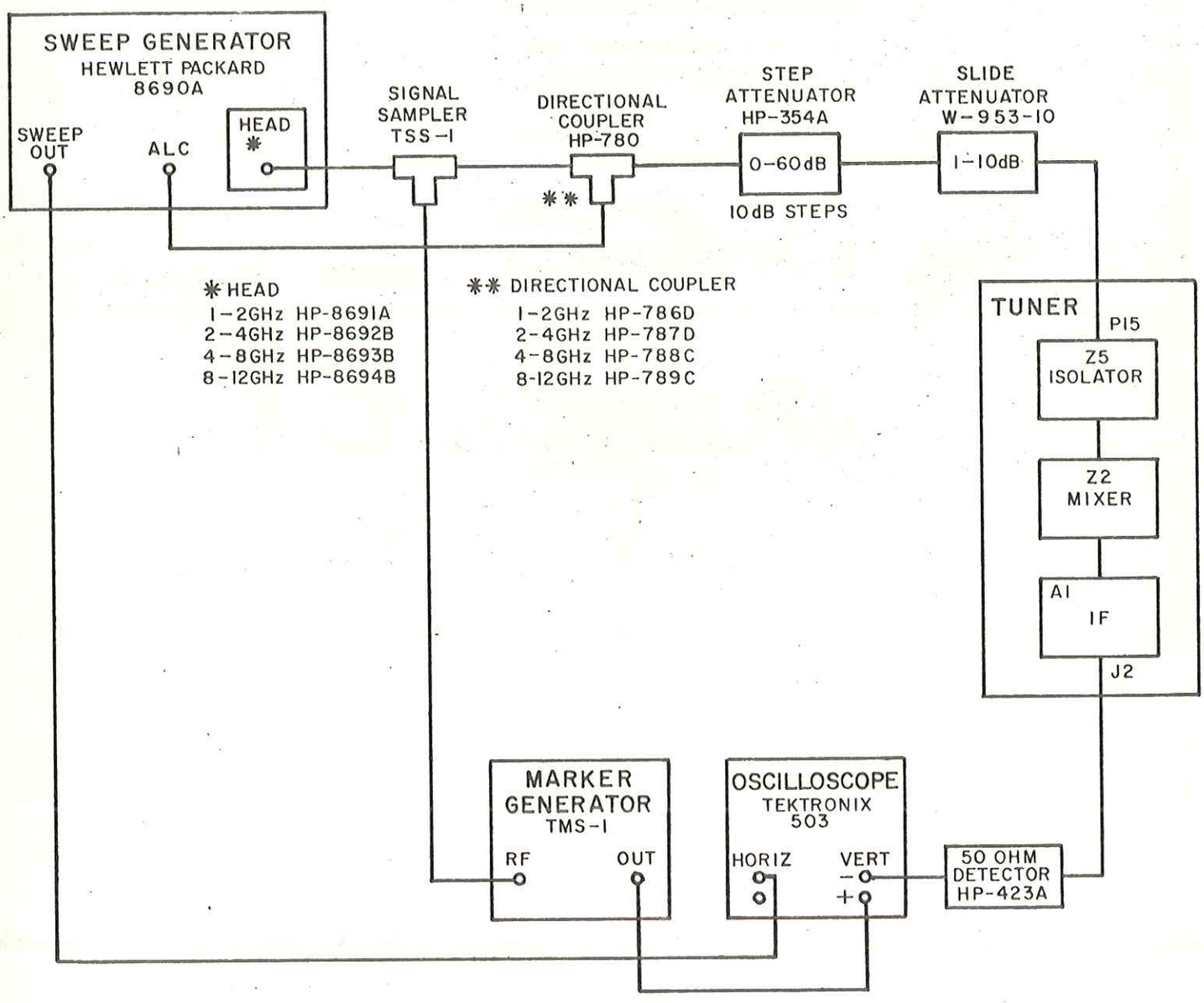


Figure 4-6. Test Setup, Variable Frequency Oscillator Alignment

Courtesy of http://BlackRadios.terryo.org

(7) Tune the TH-120A to 1 GHz and adjust the sweep generator to display the signal response. Check the signal response in relation to the 1-GHz (100-MHz) marker. Adjust the fine tuning screw on the oscillator to center the response about the 1-GHz marker. Ensure that the signal response (lowest frequency response) and not the image is used.

(8) Check the fine tuning range at 1 GHz. A minimum of ±500 kHz should be obtained. If not the fine tuning probe on the oscillator will require further adjustment.

(9) Tune to 2 GHz. Reset the oscillator frequency by repeating steps (4) and (5) if necessary.

(10) Tune to 1 GHz and reset the oscillator using the fine tuning screw if necessary.

(11) Repeat steps (9) and (10) unit the oscillator limits are correct within ±1% of the dial setting.

(12) Check the oscillator output over the entire tuning range as described in paragraph 4.7.6.

(13) Perform the YIG tracking adjustments as described in paragraph 4.6.3.

Courtesy of http://BlackRadios.terryo.org

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

Identify as follows: Second (2) 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. 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
01121	Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53204
01351	Dynamic Gear Company, Incorporated 175 Dixon Avenue Amityville, New York 11701
02114	Ferroxcube Corporation Post Office Box 359 Mt. Marion Road Saugerties, New York 12477
02735	RCA Corporation Solid State Division Route 202 Somerville, New Jersey 08876
04713	Motorola Semiconductor Products Incorporated 5005 East McDowell Road Phoenix, Arizona 85008
04941	Walsco Electronics Corporation 4 South Wyman Rockford, Illinois 61101

Courtesy of http://BlackRadios.terryo.org

Mfr. Code	Name and Address
07263	Fairchild Semiconductor A Division of Fairchild Camera and Instrument Corporation 464 Ellis Street Mountain View, California 94040
13103	Thermalloy Company 8717 Diplomacy Row Dallas, Texas 75247
14482	Watkins-Johnson Company 3333 Hillview Avenue Palo Alto, California 94304
14632	Watkins-Johnson Company CEI Division 6006 Executive Boulevard Rockville, Maryland 20852
15915	Tepro of Florida, Incorporated 375 Patricia Avenue Dunedin, Florida 33528
16179	Omni-Spectra, Incorporated 24600 Hallwood Court Farmington, Michigan 48024
18203	Engelman Microwave Company Skyline Drive Montville, New Jersey 07045
19624	Coastal Components Corporation Hicksville, New York 11801
27956	Relcom 2329 Charleston Road Mountain View, California 94040
56289	Sprague Electric Company Marshall Street North Adams, Massachusetts 01247
71400	Bussman Manufacturing Division of McGraw-Edison Company 2536 West University Street St. Louis, Missouri 63107
71744	Chicago Miniature Lamp Works 4433 Ravenswood Avenue Chicago, Illinois 60640
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624
72136	Electro Motive Manufacturing Company, Incorporated South Park & John Streets Willimantic, Connecticut 06226
72982	Erie Technological Products, Incorporated 644 West 12th Street Erie, Pennsylvania 16512
73138	Beckman Instruments, Incorporated Helipot Division 2500 Harbor Boulevard Fullerton, California 92634
73734	Federal Screw Products, Incorporated 3917 North Kenzie Avenue Chicago, Illinois 60618
74868	Bunker-Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810

Courtesy of http://BlackRadios.terryo.org

Mfr. Code	Name and Address
75042	IRC Division of TRW Incorporated 401 North Broad Street Philadelphia, Pennsylvania 19108
75915	Littelfuse, Incorporated 800 East Northwest Highway Des Plaines, Illinois 60016
79136	Waldes Kohinoor Incorporated 47-16 Austel Place Long Island City, New York 11101
80131	Electronic Industries Association 2001 Eye Street, N. W. Washington, D. C. 20006
81312	Winchester Electronics Division Litton Industries, Incorporated Main Street & Hillside Avenue Oakville, Connecticut 06779
81349	Military Specifications
83086	New Hampshire Ball Bearings, Incorporated Peterborough, New Hampshire 03458
91293	Johanson Manufacturing Company Post Office Box 329 Boonton, New Jersey 07005
91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
91506	Augat, Incorporated 33 Perry Avenue Attleboro, Massachusetts 02703
91637	Dale Electronics, Incorporated Post Office Box 609 Columbus, Nebraska 68601
93332	Sylvania Electric Products, Incorporated Semiconductor Products Division 100 Sylvan Road Woburn, Massachusetts 01801
95121	Quality Components, Incorporated Post Office Box 113 St. Mary's, Pennsylvania 15857
96906	Military Standards

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 Co., 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.

Courtesy of http://BlackRadios.terryo.org

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.

Courtesy of http://BlackRadios.terryo.org

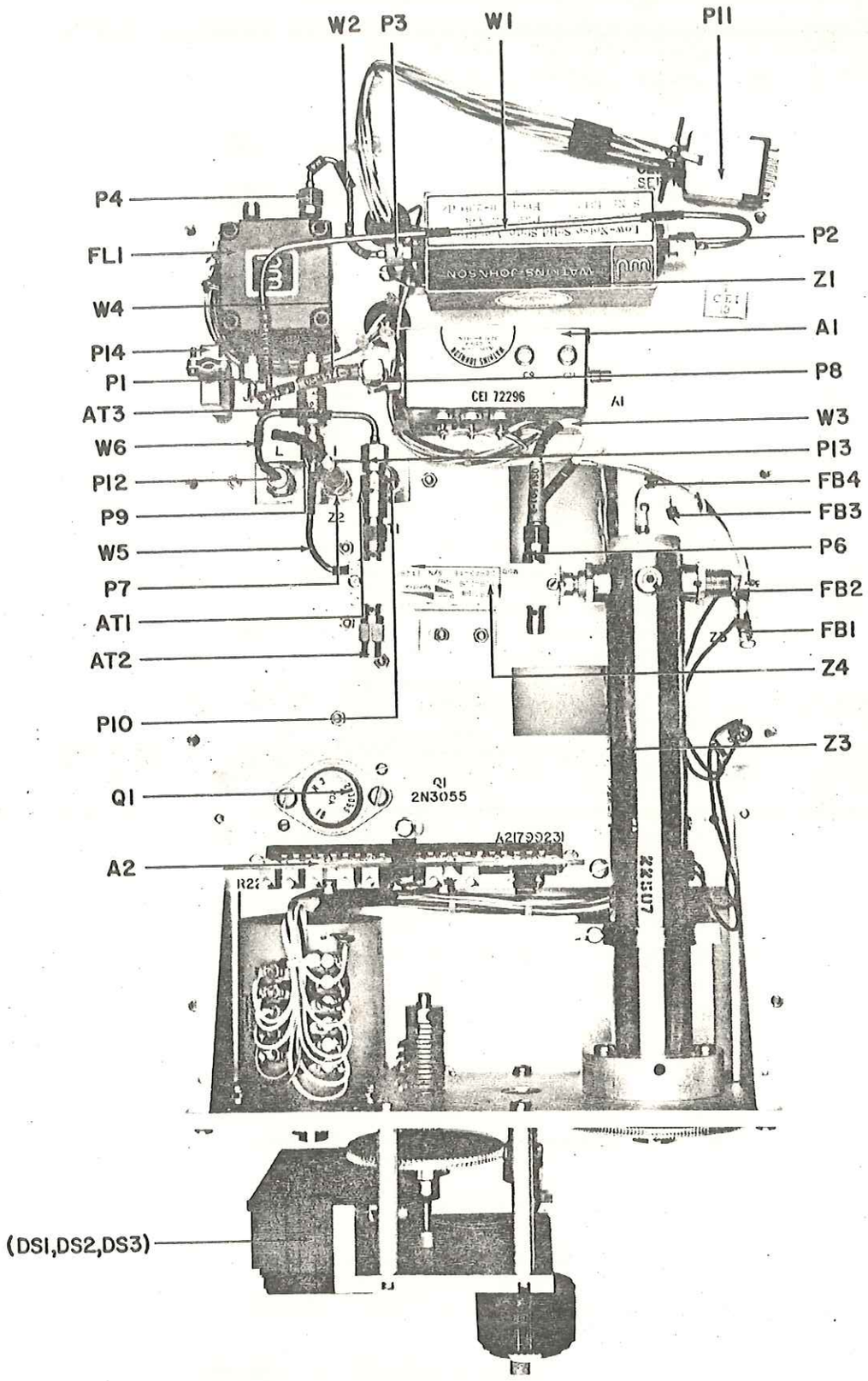


Figure 5-1. Type TH-120A 1-2 GHz Tuning Head, Top View, Component Locations

5.4.1 Type TH-120A 1-2 GHz Tuner, Main Chassis

REF DESIG	DESCRIPTION		QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	160 MHz IF PREAMPLIFIER (20 MHz BW)		1	72296	14632	
A2	YIG DRIVER BOARD		1	79923	14632	
AT1	ATTENUATOR		1	A310M	18203	
AT2	ATTENUATOR	Part of Z4	-	20020P	16179	
AT3	ATTENUATOR		1	20510-3	16179	
DS1	LAMP, INCANDESCENT: 0.06A, 5V		3	CM8-683	71744	
DS2	Same as DS1					
DS3	Same as DS1					
F1	FUSE, 3AG, SLOW-BLOW: 1/4A		1	F02B250V1/4A	81349	71400
FB1	FERRITE BEAD		4	56-590-65/4A	02114	
FB2	Same as FB1					
FB3	Same as FB1					
FB4	Same as FB1					
FL1	YIG PRESELECTOR		1	WJ-619-36	14482	
J1	CONNECTOR, RECEPTACLE, MULTIPIN		1	SRE-7SNSS	81312	
P1	CONNECTOR, PLUG, SMA SERIES	Part of W1	8	201-2A	16179	
P2	Same as P1	Part of W1				
P3	Same as P1	Part of W2				
P4	Same as P1	Part of W2				
P5	CONNECTOR, PLUG, SMA SERIES	Part of W3	2	521-3	16179	
P6	CONNECTOR, PLUG, SMA SERIES	Part of W3	2	501-3	16179	

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

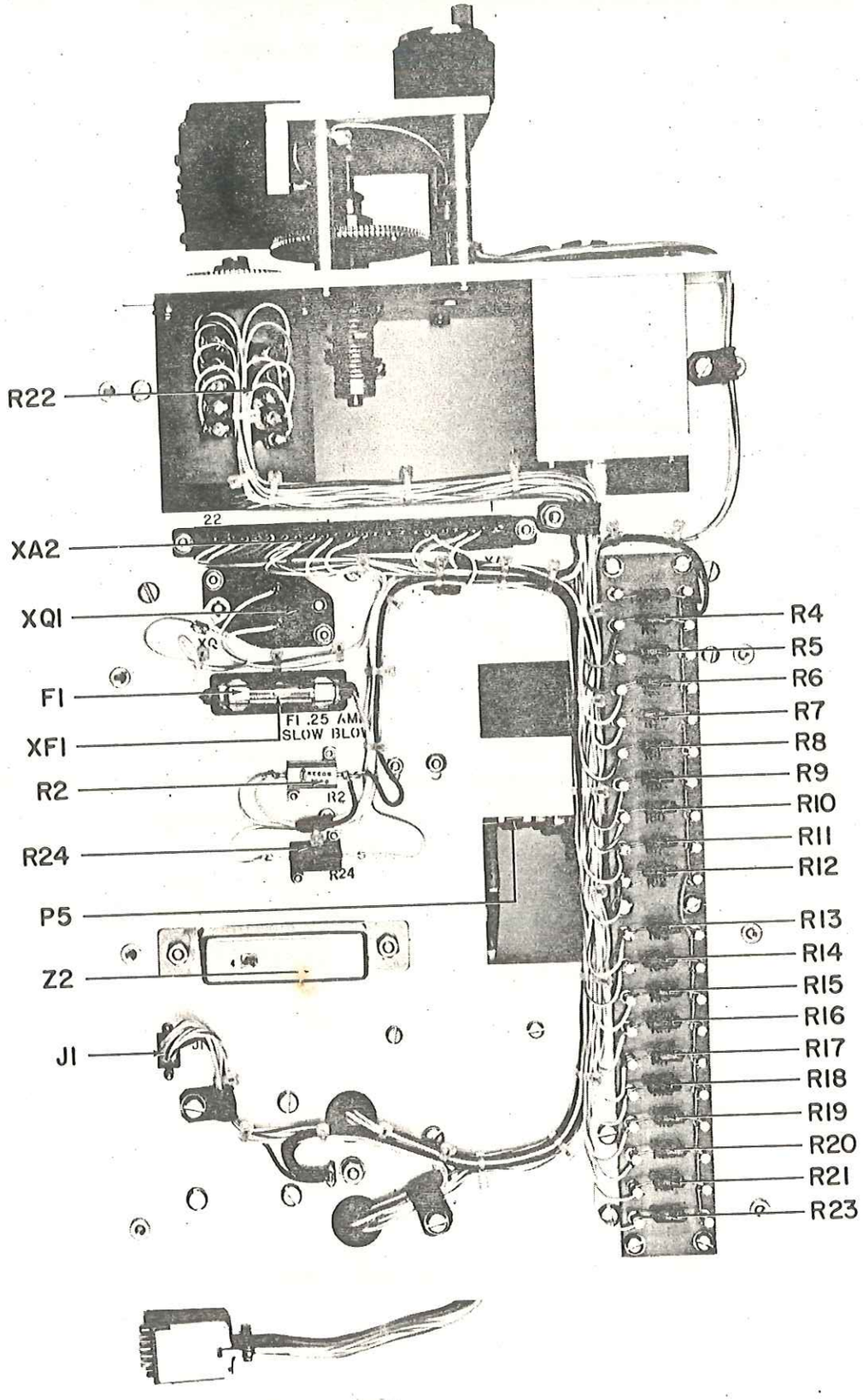


Figure 5-2. Type TH-120A 1-2 GHz Tuning Head, Bottom View, Component Locations

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
P7	Same as P6 Part of W4				
P8	Same as P5 Part of W4				
P9	Same as P1 Part of W5				
P10	Same as P1 Part of W5				
P11	CONNECTOR, PLUG, MULTIPIN	1	SLE-14PNSSH13	81312	
P12	Same as P1 Part of W6				
P13	Same as P1 Part of W6				
P14	CONNECTOR, PLUG, MULTIPIN	1	16634-1	14632	
Q1	TRANSISTOR	1	2N3055	80131	04713
R1	NOT USED				
R2	RESISTOR, FIXED, WIRE-WOUND: 10 Ω, 3%, 5W	1	RH-5(10Ω, 3%)	91637	
R3	NOT USED				
R4*	RESISTOR, FIXED, FILM: 511 Ω, 1%, 1/4W	3	RN60D5110F	81349	75042
R5*	Same as R4				
R6*	Same as R4				
R7*	RESISTOR, FIXED, FILM: 3.92 kΩ, 1%, 1/4W	2	RN60D3921F	81349	75042
R8*	RESISTOR, FIXED, FILM: 2 kΩ, 1%, 1/4W	1	RN60D2001F	81349	75042
R9*	RESISTOR, FIXED, FILM: 1.82 kΩ, 1%, 1/4W	3	RN60D1821F	81349	75042
R10*	Same as R9				
R11*	RESISTOR, FIXED, FILM: 2.74 kΩ, 1%, 1/4W	3	RN60D2741F	81349	75042
R12*	Same as R7				

* Nominal value. Value to be factory selected.

Courtesy of http://BlackRadios.terryo.org

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R13*	Same as R11				
R14*	RESISTOR, FIXED, FILM: 2.05 kΩ, 1%, 1/4W	1	RN60D2051F	81349	75042
R15*	RESISTOR, FIXED, FILM: 1 kΩ, 1%, 1/4W	6	RN60D1001F	81349	75042
R16*	Same as R11				
R17*	Same as R9				
R18*	Same as R15				
R19*	Same as R15				
R20*	Same as R15				
R21*	Same as R15				
R22	RESISTOR, VARIABLE, PRECISION: 500 Ω, 1%, 5W	1	7603-1519-0	73138	
R23*	Same as R15				
R24	RESISTOR, FIXED, WIRE-WOUND: 2 kΩ, 3%, 5W	1	TM5W(2K, 3%)	15915	
XA2	CONNECTOR, PRINTED CIRCUIT CARD	1	250-22-30-170	71785	
XF1	FUSEHOLDER	1	357001	75915	
XQ1	SOCKET, TRANSISTOR	1	8038-1G1	91506	
W1	CABLE AND CONNECTOR ASSEMBLY	1	22995-6	14632	
W2	CABLE AND CONNECTOR ASSEMBLY	1	22995-9	14632	
W3	CABLE AND CONNECTOR ASSEMBLY	1	30020-1354	14632	
W4	CABLE AND CONNECTOR ASSEMBLY	1	30020-1355	14632	
W5	CABLE AND CONNECTOR ASSEMBLY	1	22995-8	14632	
W6	CABLE AND CONNECTOR ASSEMBLY	1	22995-7	14632	

* Nominal value. Value to be factory selected.

Courtesy of http://BlackRadios.terryo.org

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
Z1	RF AMPLIFIER	1	WJ-757	14482	
Z2	MIXER	1	M1G	27956	
Z3	VARIABLE FREQUENCY OSCILLATOR	1	22507-1	14632	
Z4	10 dB COUPLER	1	20063-10	16179	

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

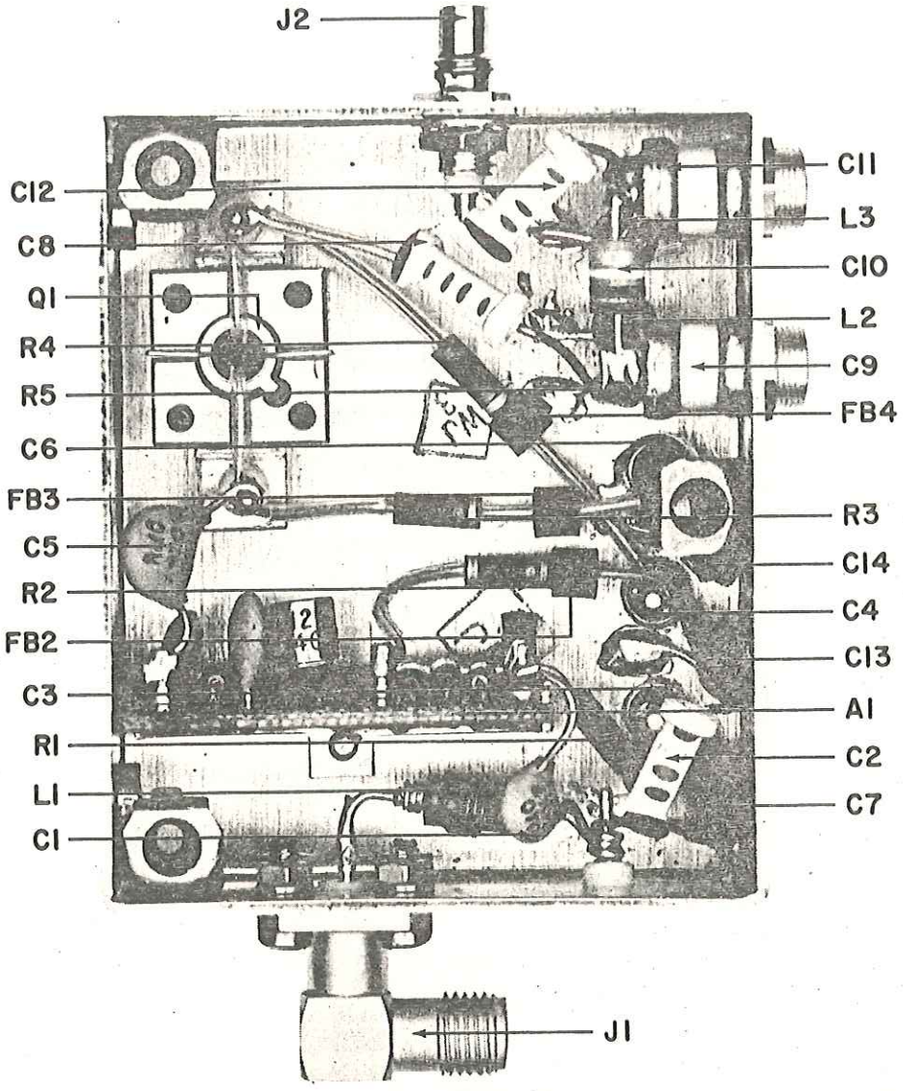


Figure 5-3. Type 72296 160 MHz IF Preamplifier (20 MHz BW) (A1), Component Locations

5.4.2 Type 72296 160 MHz IF Preamplifier (20 MHz BW)

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
A1	INPUT AMPLIFIER	1	15578-1	14632	
C1	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV	1	SM(1000pF, GMV)	91418	
C2	CAPACITOR, CERAMIC, TUBULAR: 6.8 pF, ±.5 PF, 500V	1	301-000-C0H0689D	72982	
C3	CAPACITOR, CERAMIC, FEEDTHRU: 470 pF, 20%, 500V	3	FA5C-4712	01121	
C4	Same as C3				
C5	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 1000V	1	B(470 pF, M)	91418	
C6	Same as C3				
C7	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 100V	3	C023B101F103M	56289	
C8	CAPACITOR, CERAMIC, TUBULAR: 22 pF, 5%, 500V	1	301-000-C0G0-220J	72982	
C9	CAPACITOR, VARIABLE, AIR: 0.8-10 pF, 250V	2	2954	91293	
C10	CAPACITOR, COMPOSITION, TUBULAR: 1 pF, 10%, 500V	1	QC(1pF, K)	95121	
C11	Same as C9				
C12	CAPACITOR, CERAMIC, TUBULAR: 2 pF, ±0.25 pF, 500V	1	301-000-C0K0-209C	72982	
C13	Same as C7				
C14	Same as C7				
FB1	FERRITE BEAD	4	56-590-65/4A	02114	
FB2	Same as FB1				
FB3	Same as FB1				
FB4	Same as FB1				
J1	CONNECTOR, RECEPTACLE, SMA SERIES	1	224	16179	
J2	CONNECTOR, RECEPTACLE, MINIATURE SERIES	1	UG-1464/U	81349	74868

Courtesy of http://BlackRadios.terryo.org

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
L1	COIL, FIXED	1	21210-23	14632	
L2	COIL, FIXED	2	21210-25	14632	
L3	Same as L2				
MP1	COVER	1	15935-1	14632	
Q1	TRANSISTOR	1	2N918	80131	04713
R1	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	2	RCR07G562JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349	01121
R3	Same as R1				
R4	RESISTOR, FIXED, COMPOSITION: 3 kΩ, 5%, 1/4W	1	RCR07G302JS	81349	01121
R5	RESISTOR, FIXED, COMPOSITION: 1.1 kΩ, 5%, 1/4W	1	RCR07G112JS	81349	01121

Courtesy of http://BlackRadios.terryo.org

5.4.2.1 Type 15578-1, -2 Input Amplifier

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 200V	1	CK05BX471M	81349	56289
C2	CAPACITOR, CERAMIC, DISC: 470 pF, 20%, 1000V	1	B(470 pF, 1000V, M)	91418	
C3	CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V	1	SM(1000 pF, GMV)	91418	
Q1	TRANSISTOR	1	2N2857	80131	02735
R1	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349	01121
R2	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	1	RCR07G512JS	81349	01121
R3	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349	01121
R4	Same as R3				

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

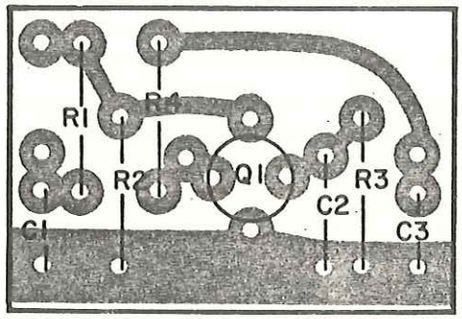


Figure 5-4. Part 15578-2 Input Amplifier (A1A1), Component Locations

5.4.3 Type 79923 YIG Driver Board

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
C1	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 10%, 20V	3	CS13BE106K	81349	56289
C2	Same as C1				
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 0.22 μF, 10%, 35V	1	150D224X9035A2	56289	
C4	CAPACITOR, MICA, DIPPED: 100 pF, 5%, 500V	5	CM05FD101J03	81349	72136
C5	Same as C4				
C6	Same as C1				
C7	Same as C4				
C8	Same as C4				
C9	Same as C4				
C10	CAPACITOR, CERAMIC, DISC: .1 μF, 20%, 100V	1	8131-M100-651-104M	72982	
CR1	DIODE	1	1N4449	80131	93332
Q1	TRANSISTOR	1	2N2270	80131	02735
R1	RESISTOR, FIXED, FILM: 26.1 kΩ, 1%, 1/4W	2	RN60D2612F	81349	75042
R2	RESISTOR, VARIABLE, FILM: 5 kΩ, 10%, 3/4W	6	89PR5K	73138	
R3	RESISTOR, FIXED, FILM: 46.4 kΩ, 1%, 1/4W	2	RN60D4642F	81349	75042
R4	Same as R3				
R5	Same as R2				
R6	Same as R1				
R7	RESISTOR, FIXED, COMPOSITION: 7.5 Ω, 5%, 1/4W	1	RCR07G7R5JS	81349	01121
R8	RESISTOR, FIXED, FILM: 3.24 kΩ, 1%, 1/4W	1	RN60D3241F	81349	75042
R9	RESISTOR, FIXED, FILM: 8.06 kΩ, 1%, 1/4W	1	RN60D8061F	81349	75042

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

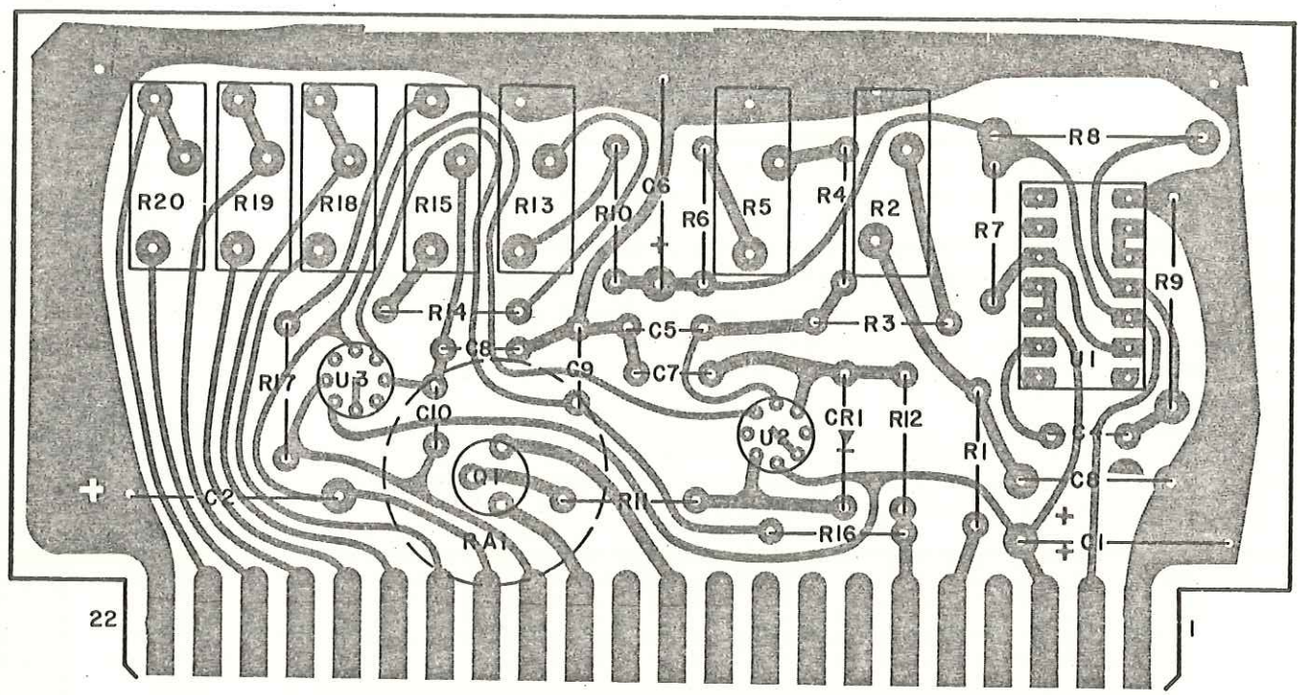


Figure 5-5. Type 79923 YIG Driver Board (A2), Component Locations

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
R10	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	2	RCR07G822JS	81349	01121
R11	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349	01121
R12	RESISTOR, FIXED, COMPOSITION: 22 kΩ, 5%, 1/4W	1	RCR07G223JS	81349	01121
R13	Same as R2				
R14	RESISTOR, FIXED, COMPOSITION: 7.5 kΩ, 5%, 1/4W	1	RCR07G752JS	81349	01121
R15	RESISTOR, VARIABLE, FILM: 20 kΩ, 10%, 3/4W	1	89PR20K	73138	
R16	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349	01121
R17	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	1	RCR07G474JS	81349	01121
R18	Same as R2				
R19	Same as R2				
R20	Same as R2				
RA1	RADIATOR, TRANSISTOR	1	2225B	13103	
U1	INTEGRATED CIRCUIT	1	U6A7723393	07263	
U2	INTEGRATED CIRCUIT	2	U5B7741393	07263	
U3	Same as U2				

Courtesy of http://BlackRadios.terryo.org

5.4.4 Type 8569 Tuning Drive Assembly

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
1	FRONT GEAR PLATE	1	21612-1	14632	
2	LIGHT BAR	1	21363-1	14632	
3	LIGHT BAR WINDOW	1	14144-1	14632	
4	TAPE PRESSURE PLATE	1	14106-1	14632	
5	LIGHT BOARD	1	14004	14632	
6	INCANDESCENT LAMP (DS1, DS2, DS3)	Ref	CM8-683	71744	
7	PINION BEVEL GEAR MODIFIED	2	12124	14632	
8	COLLAR	1	11581-5	14632	
9	TENSION SPRING	1	13944	14632	
10	TAPE CHAMBER PLATE	1	14145-1	14632	
11	BEARING	1	14589-1	14632	
12	TAPE CHAMBER	1	31373-1	14632	
13	GEAR, TAPE DRIVE	1	14065	14632	
14	TAPE, CALIBRATED	1	30946-1	14632	
15	SHAFT	1	13908-6	14632	
16	COVER, TAPE CHAMBER	1	14083-1	14632	
17	BALL BEARING	1	SFR-63MM	83086	
18	BALL BEARING	1	SFR-33MM	83086	
19	BALL BEARING	2	SFR-1888MM	83086	
20	SHAFT	1	1002-79	14632	
21	RETAINING RING	2	5100-25	79136	

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

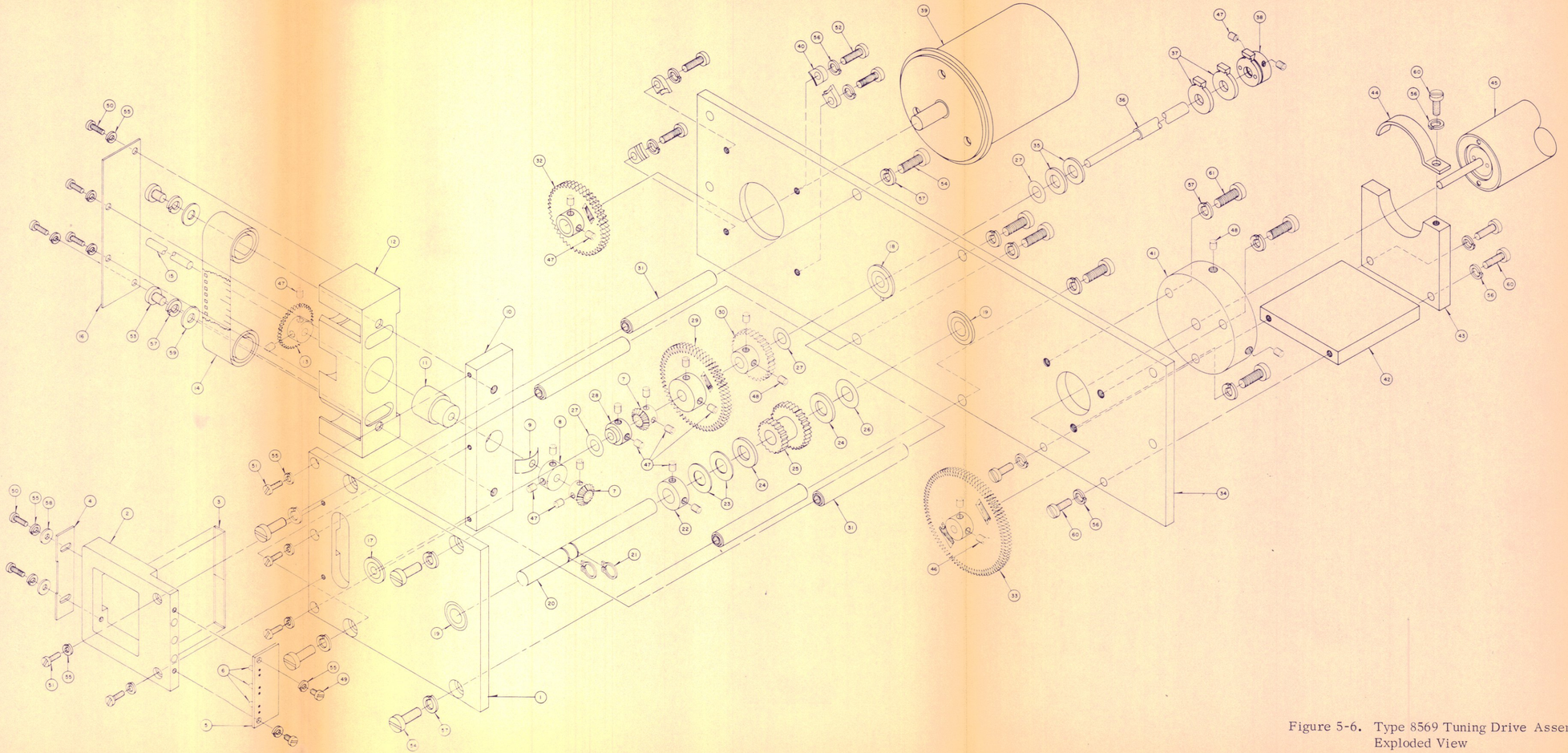


Figure 5-6. Type 8569 Tuning Drive Assembly, Exploded View

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
22	COLLAR	1	11581-2	14632	
23	SPRING FRICTION WASHER	2	7754	04941	
24	THRUST BEARING	2	TT-504	70417	
25	CLUSTER GEAR	1	12556	14632	
26	SHIM SPACER	AR	SSS-33	01351	
27	SHIM SPACER	AR	SSS-23	01351	
28	COLLAR	1	1054-3	14632	
29	ANTI-BACKLASH GEAR	1	20180-35	14632	
30	GEAR, SPUR	1	2984-48	14632	
31	SPACER	4	20757-24	14632	
32	ANTI-BACKLASH GEAR	1	20180-36	14632	
33	ANTI-BACKLASH GEAR	1	20182-6	14632	
34	REAR GEAR PLATE	1	21613-1	14632	
35	#10 FLAT WASHER	2	MS15795-807	96906	73734
36	STOP SHAFT	1	13884-1	14632	
37	STOP WASHER	13	13863-1	14632	
38	STOP RETAINER ASSEMBLY	1	13868	14632	
39	POTENTIOMETER (R22)	Ref	7603-1519-0	73138	
40	SYNCHRO MOUNTING CLAMP	4	SC-9	19624	
41	TUNER MOUNT	1	14612-1	14632	
42	SPACER BLOCK	1	12267	14632	

Courtesy of http://BlackRadios.terryo.org

REF DESIG	DESCRIPTION	QTY. PER ASSY	MANFACTURER'S PART NO.	MFR. CODE	RECM. VENDOR
43	MOUNTING BLOCK	1	12268	14632	
44	CLAMP	1	11970-2	14632	
45	TUNER	Ref	22507-1	14632	
46	#2-56 x 1/8 Lg. SET SCREW	AR	MS51021-1	96906	73734
47	#4-40 x 1/8 Lg. SET SCREW	AR	MS51021-9	96906	73734
48	#6-32 x 1/8 Lg. SET SCREW	AR	MS51021-21	96906	73734
49	#2-56 x 3/16 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-2	96906	73734
50	#2-56 x 1/4 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-3	96906	73734
51	#2-56 x 5/16 Lg. FIL HEAD MACHINE SCREW	AR	MS35275-11	96906	73734
52	#4-40 x 1/4 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-13	96906	73734
53	#6-32 x 1/4 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-26	96906	73734
54	#6-32 x 3/8 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-28	96906	73734
55	#2 LOCK WASHER (SPLIT)	AR	MS35338-134	96906	73734
56	#4 LOCK WASHER (SPLIT)	AR	MS35338-135	96906	73734
57	#6 LOCK WASHER (SPLIT)	AR	MS35338-136	96906	73734
58	+2 FLAT WASHER	AR	MS15795-802	96906	73734
59	#6 FLAT WASHER	AR	MS15795-805	96906	73734
60	#4-40 x 3/8 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-15	96906	73734
61	#6-32 x 7/16 Lg. PAN HEAD MACHINE SCREW	AR	MS51957-29	96906	73734

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org

SECTION VI

SCHEMATIC DIAGRAMS

Courtesy of http://BlackRadios.terryo.org

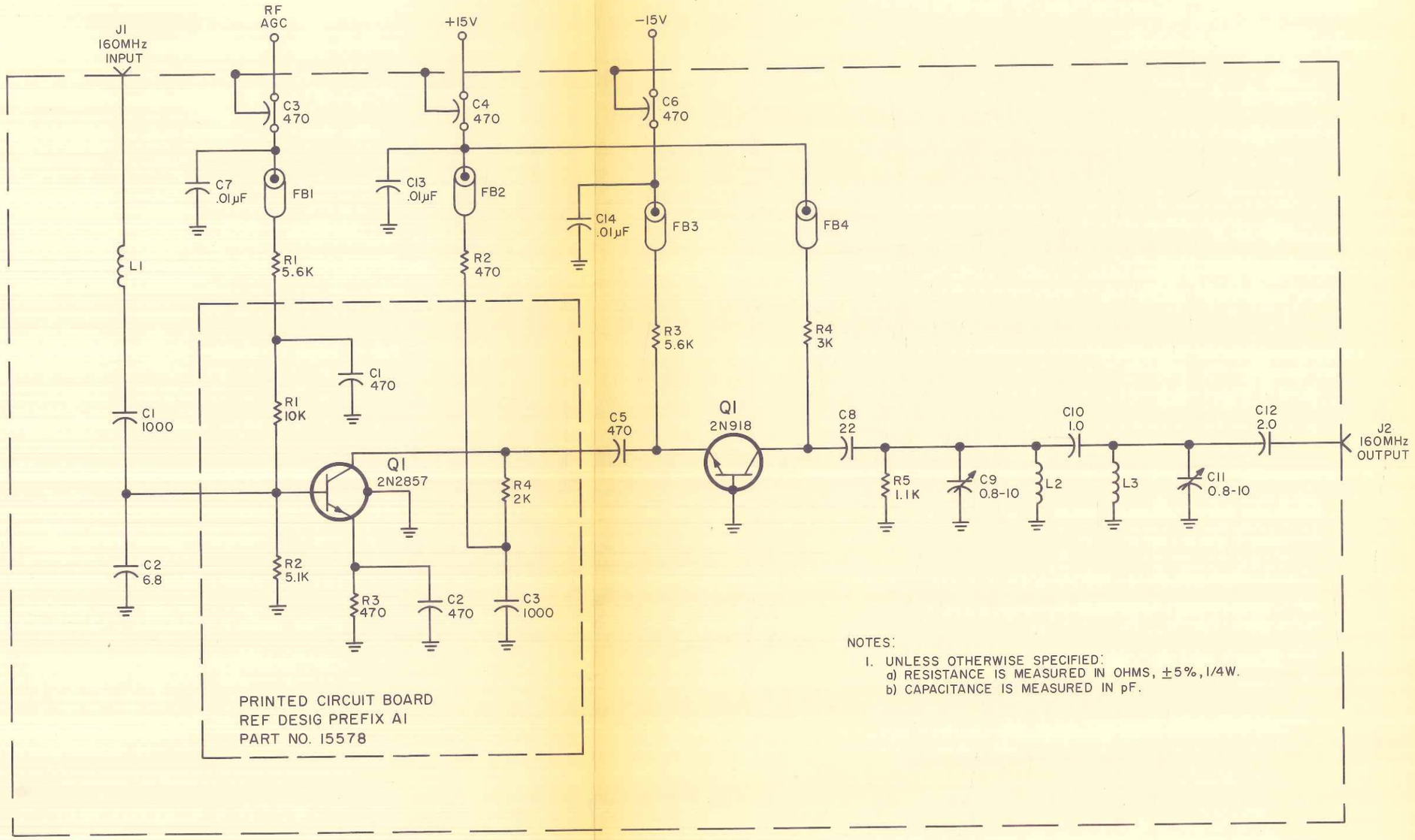
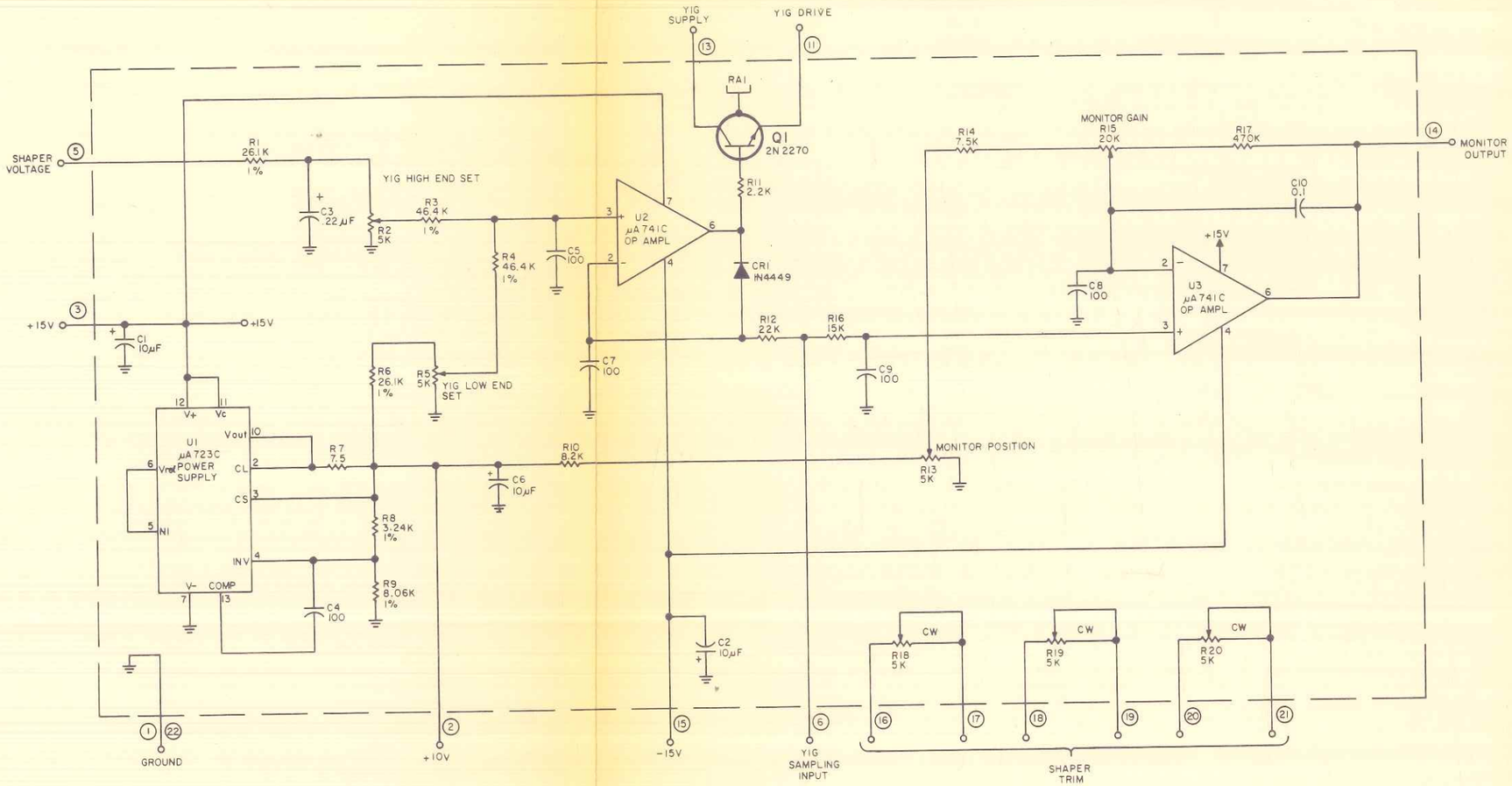


Figure 6-1. Type 72296 160 MHz IF Preamplifier (20 MHz BW) (A1), Schematic Diagram

Courtesy of http://BlackRadios.terryo.org



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN pF
2. FOR LEAD ARRANGEMENT OF U1, SEE DETAIL "A"
3. FOR LEAD ARRANGEMENT OF U2 AND U3, SEE DETAIL "B"

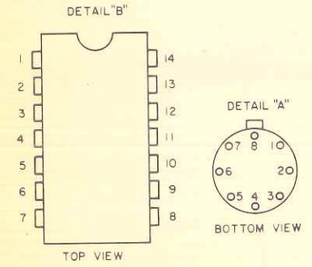
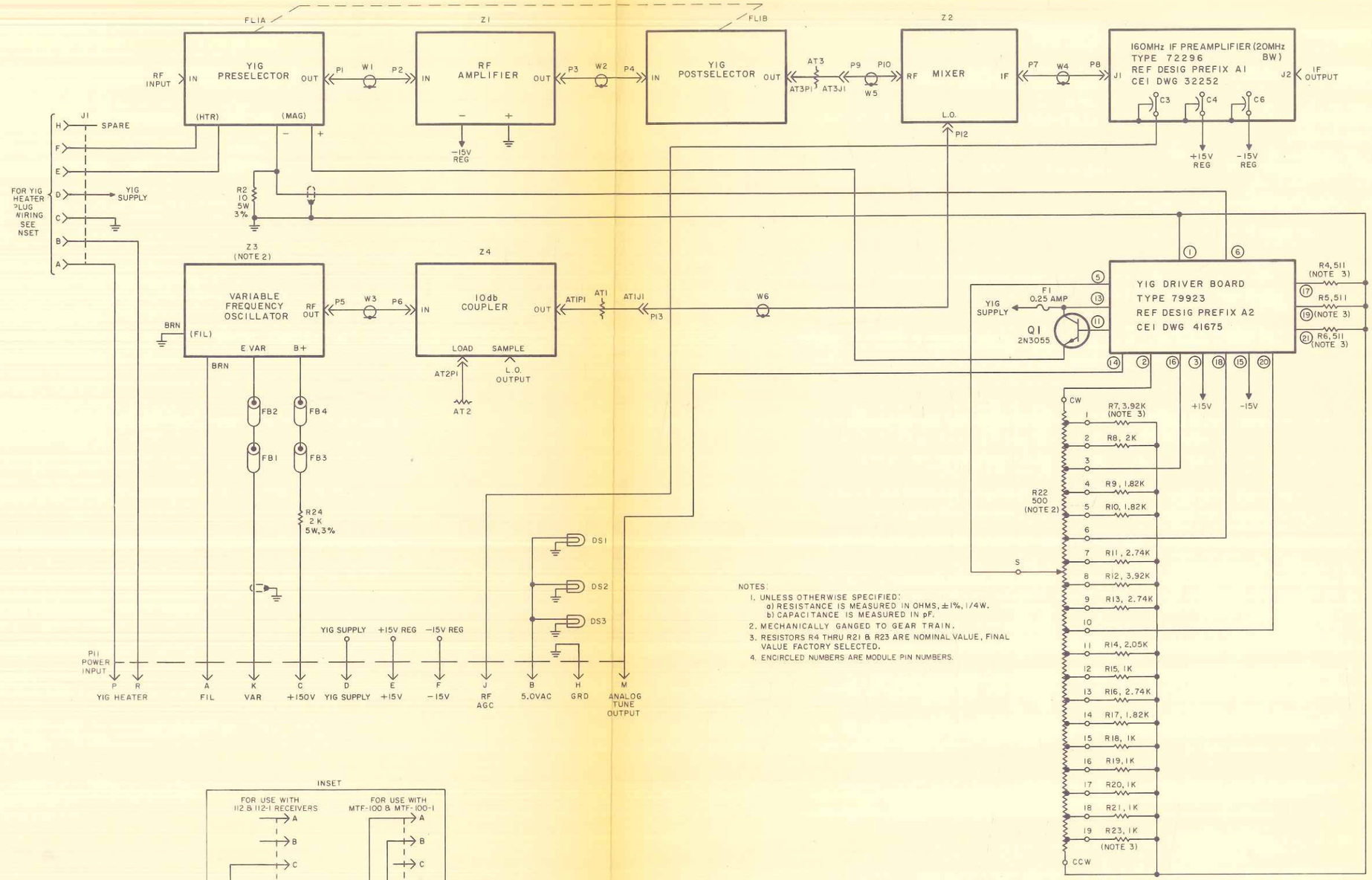


Figure 6-2. Type 79923 YIG Driver Board (A2), Schematic Diagram

Courtesy of http://BlackRadios.terryo.org



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±1%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. MECHANICALLY GANGED TO GEAR TRAIN.
3. RESISTORS R4 THRU R21 & R23 ARE NOMINAL VALUE, FINAL VALUE FACTORY SELECTED.
4. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

Figure 6-3. Type TH-120A 1-2 GHz Tuner, Main Chassis Schematic Diagram

Courtesy of http://BlackRadios.terryo.org

Courtesy of http://BlackRadios.terryo.org