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INSTRUCTION MANUAL
FOR
TYPES MTF-100A, MTF-101, AND
MTF-102A MICROWAVE TUNING FRAMES

WATKINS-JOHNSON COMPANY 
700 QUINCE ORCHARD ROAD
GAITHERSBURG, MARYLAND 20760

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.

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Table 1-1. Types MTF-100A and MTF-101 Microwave Tuning Frame, Specifications

| | |
|---|---|
| Equipment Mounting Accommodations | |
| MTF-100A | Type TH-Series Tuning Head (2) |
| MTF-101 | Type TH-Series Tuning Head (2) |
| In/Out Interfacing | |
| MTF-100A | RF in, AFC/Fine Tuning, AGC, LO out, 160 MHz IF out, *21.4 MHz IF out, Analog Tune out, 160 MHz IF in (from MTF-101), Tuner Indicator out, and all operating voltages for 4 tuning heads (2 mounted in MTF-101) |
| MTF-101 | RF in, 160 MHz IF out, LO out, AFC/Fine Tuning and AGC (from MTF-100A), Analog Tune out (to MTF-100A), and all operating voltages for 2 tuning heads (from MTF-100A) |
| IF Outputs | |
| MTF-100A | 160 MHz IF of 1 of 4 tuners selected by operator. Selected IF also down converted to 21.4 MHz. |
| MTF-101 | 160 MHz (2), 50 Ω nominal impedance. |
| Analog Tuning Output | -10 V to +10 V, from low band edge to high band edge, linear to within $\pm 1\%$. |
| Tuner Indicator Outputs (MTF-100A only) | +15 V on the output corresponding to the selected tuner; 0 V on the other three outputs (unselected tuners). |
| AGC Input | +10 V for zero signal to +1 V to large signal, or 0 V for zero signal to -12 V for large signal. Circuit-board jumper selectable. |
| AFC Input | ± 2 V nominal. Positive-going voltage causes a decrease in tuned frequency. Polarity reversible at circuit board, if required. |

* Bandwidth of 21.4 MHz IF limited to 8 MHz.

Table 1-1. Types MTF-100A and MTF-101 Microwave Tuning Frame, Specifications (Continued)

| | |
|---------------------------------|---|
| Front Panel Controls | |
| MTF-100A | PUSH ON/OFF POWER, FINE TUNING, TUNER SELECT, and AFC |
| MTF-101 | None (controlled by MTF-100A) |
| Input Power | 115/220 V ac, $\pm 10\%$, 48-420 Hz (MTF-100A only) |
| Power Consumption | 50 watts, approximately, with four tuners installed. |
| Power Supply Outputs | +150 V dc, +15 V dc, +12 V dc, +6 V dc, -15 V dc, 32 V ac, 24 V ac, (YIG Heater Voltage), 5 V ac. |
| Operating Temperature | 0° C to +50° C (+32° F to +122° F) |
| Dimensions | |
| MTF-100A | 3.5 inches high, 19 inches wide, 18 inches deep. |
| MTF-101 | 3.5 inches high, 13 inches wide, 16.5 inches deep. |
| Weight | 35 lbs., approximately, with two tuning heads installed. |

Table 1-2. Type MTF-102A Microwave Tuning Frame, Specifications

| | |
|---|---|
| Equipment Mounting Accommodations . . . | Type TH-Series Tuning Head (1) |
| In/Out Interfacing | RF in, AFC/Fine Tuning, AGC, LO out, 160 MHz IF out, *21.4 MHz IF out, Signal Monitor out, Analog Tune out, and all operating voltages for 1 tuning head. |
| IF Outputs | 160 MHz and 21.4 MHz (50 Ω nominal impedance) |
| Analog Tuning Output | -10 V to +10 V from low band edge to high band edge, linear to within $\pm 1\%$. |
| AGC Input | +10 V for zero signal to +1 V for large signal, or 0 V for zero signal to -12 V for large signal. Circuit-board jumper selectable. |
| AFC Input | ± 2 V nominal. Positive-going voltage causes a decrease in tuned frequency. Polarity reversible at circuit board if required. |
| Front Panel Controls | PUSH ON/OFF POWER, AFC, FINE TUNING. |
| Input Power | 115/220 V ac, $\pm 10\%$, 48-420 Hz. |
| Power Consumption | 22 watts, approximately, with tuning head installed. |
| Power Supply Outputs | +150 V dc, +15 V dc, +12 V dc, +6 V dc, -15 V dc, 32 V ac, 24 V ac, 5 V ac. |
| Operating Temperature | 0° C to +50° C (+32° F to +122° F) |
| Dimensions | 3.5 inches high, 19 inches wide, 18 inches deep |
| Weight | 16 lbs., approximately, with tuning head installed. |

* Bandwidth of 21.4 MHz IF limited to 8 MHz.

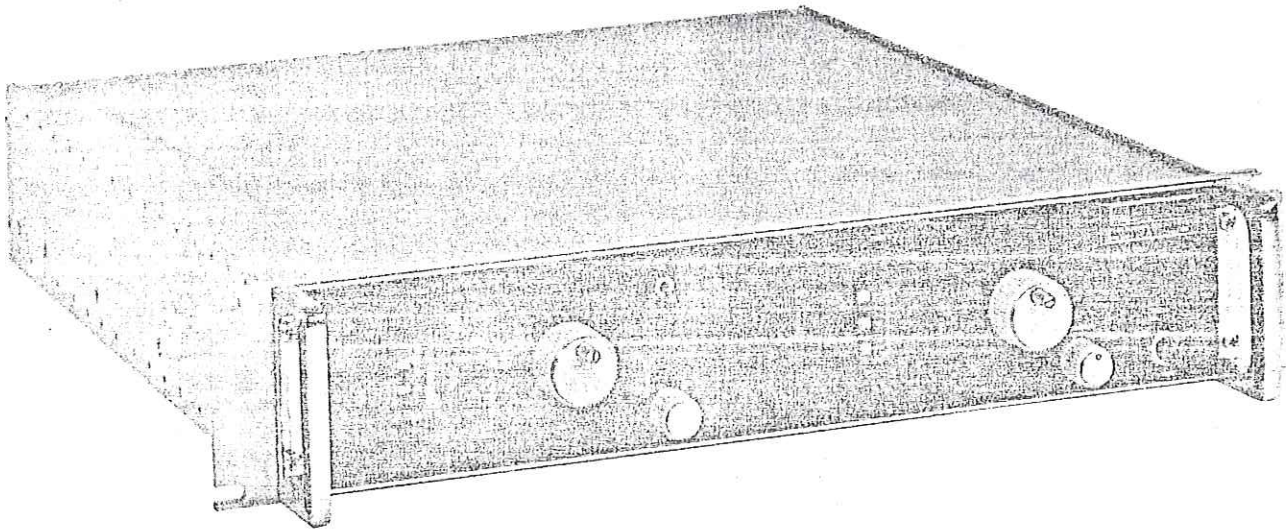


Figure 1-1. Type MTF-100A Microwave Tuning Frame,
Front View.

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The Types MTF-100A, MTF-101, and MTF-102A Microwave Tuning Frames are designed to mount the Watkins-Johnson TH-Series microwave tuning heads and provide the necessary power and interface connections for their operation. The RF, IF, and LO jacks for signal interfacing all have 50 Ω nominal impedances.

1.1.2 MTF-100A Microwave Tuning Frame. - The MTF-100A accommodates two microwave tuning heads. Power supply assemblies in the frame provide the necessary dc and ac voltages for operating these tuning heads and can also power two additional tuning heads installed in the MTF-101. Supply voltages are given in Table 1-1.

1.1.3 A front-panel TUNER SELECT switch allows the operator to place any one of four tuners on-line (in full operation with tuner outputs routed to the frame output jacks). Tuners 1 and 2 are located in the MTF-100A left and right hand sides, respectively, as viewed from the front. Tuners 3 and 4 are located in the MTF-101. The tuners not on-line are in a standby condition and receive YIG heater, filament and oscillator supply voltages, if needed. The TUNER Select switch connects +150 V dc, +15 V dc, +6 V dc, -15 V dc, and 5 V ac to the selected tuner to make it operational and also routes the tuner IF outputs and Analog Tune voltage to the frame output jacks.

1.1.4 The 160 MHz IF output of the selected tuner divides into two signal paths. One path leads to a 160 MHz IF Output jack where the signal may be applied to a demodulator such as the Watkins-Johnson DM-112. The other path is through a 160/21.4 MHz down converter to a 21.4 MHz IF Output jack where the signal may be applied to demodulator such as the Watkins-Johnson DM-4().

1.1.5 AGC voltage from the demodulator may be returned to the MTF-100A for application in parallel to the four tuning heads. The MTF-100A also accepts AFC voltages from the demodulator for processing and parallel application to the four tuning heads. A front panel ON/AFC switch enables or disables the AFC function. When the AFC is disabled, the front panel FINE TUNING potentiometer controls the AFC voltage to the tuning heads.

1.1.6 MTF-101 Microwave Tuning Frame. - The MTF-101 accommodates two microwave tuning heads. Power for the tuning heads is obtained

from a MTF-100A via a rear-panel multipin power interface connector and cable. In addition to power, the interface cable carries AGC and AFC/Fine Tuning to the MTF-101. Analog Tune voltages are returned from the MTF-101 to the MTF-100A via this cable. The two 160 MHz IF outputs from the tuning heads are available at BNC connectors on the rear panel for direct use by demodulators or routing to the MTF-100A for selection and conversion to 21.4 MHz. The two tuner LO outputs are available at the rear panel of the MTF-101.

1.1.7 MTF-102A Microwave Tuning Frame. - The MTF-102A accommodates one microwave tuning head. Tuner operating voltages are provided by a built-in power supply identical to that used in the MTF-100A. Table 1-2 gives the supply voltages. The 160 MHz IF from the tuning head is routed to a rear panel jack and to the built-in 160/21.4 MHz converter in the frame. The 21.4 MHz output of the down converter is available at the 21.4 MHz IF Output jack via a 3 dB attenuator (high level) and at a Signal Monitor Output jack via a 10 dB attenuator (low level). AGC and AFC voltages may be returned to the MTF-102A from a demodulator such as the Watkins-Johnson DM-4() or DM-112. A front panel ON/AFC switch allows the operator to disable the external AFC and utilize the front panel FINE TUNING potentiometer for fine frequency tuning. The LO output of the tuning head is available at the rear panel.

1.2 MECHANICAL CHARACTERISTICS

1.2.1 The Types MTF-100A, -101, -102A Microwave Tuning Frames mount in a standard 19-inch equipment rack. Critical dimensions of the frames are given in Figures 3-4 through 3-6. The chassis are constructed of aluminum. The front panels are finished with gray enamel and overlaid with black anodized bezels etched with control markings. Openings in the front panels permit viewing of the tuning dials. Holes in the front panels of all units accommodate the manual tuning drive-shafts, on which knobs must be installed. In addition, the MTF-100A mounts a POWER push-button/indicator switch, a FINE TUNING control, a TUNER SELECT switch, and an AFC ON/off switch. The MTF-102A front panel mounts PUSH ON/OFF POWER switch, a FINE TUNING control, and an AFC ON/off switch. The MTF-101 has no front panel controls except the tuning head knobs.

1.2.2 The rear panels of all units mount all of the input and output connectors. The rear panels of the MTF-100A and -102A each mount two ac line fuses, an ac power selector slide switch, and a permanently attached power cord, in addition to RF, IF, and control inputs and outputs. The rear panel of the MTF-101 mounts a multipin connector for interfacing with the MTF-100A, plus RF, IF, and LO signal jacks.

1.2.3 Mounted within the MTF-100A and -102A are three printed circuit subassemblies which mate with edge-connectors on the chassis. The IF couplers (A4) and 120/21.4 MHz converter (A5) subassemblies are enclosed in nickel-plated brass chassis.

1.3 EQUIPMENT SUPPLIED

This equipment consists only of the Type MTF-100A, MTF-101, or MTF-102A Microwave Tuning Frame.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The Types MTF-100A and MTF-102A perform no function unless one or more Watkins-Johnson Type TH-Series Tuning Heads are installed. The MTF-101 must be used in conjunction with a MTF-100A unit. In addition, an IF demodulator such as the Type DM-4() or DM-112 is required.

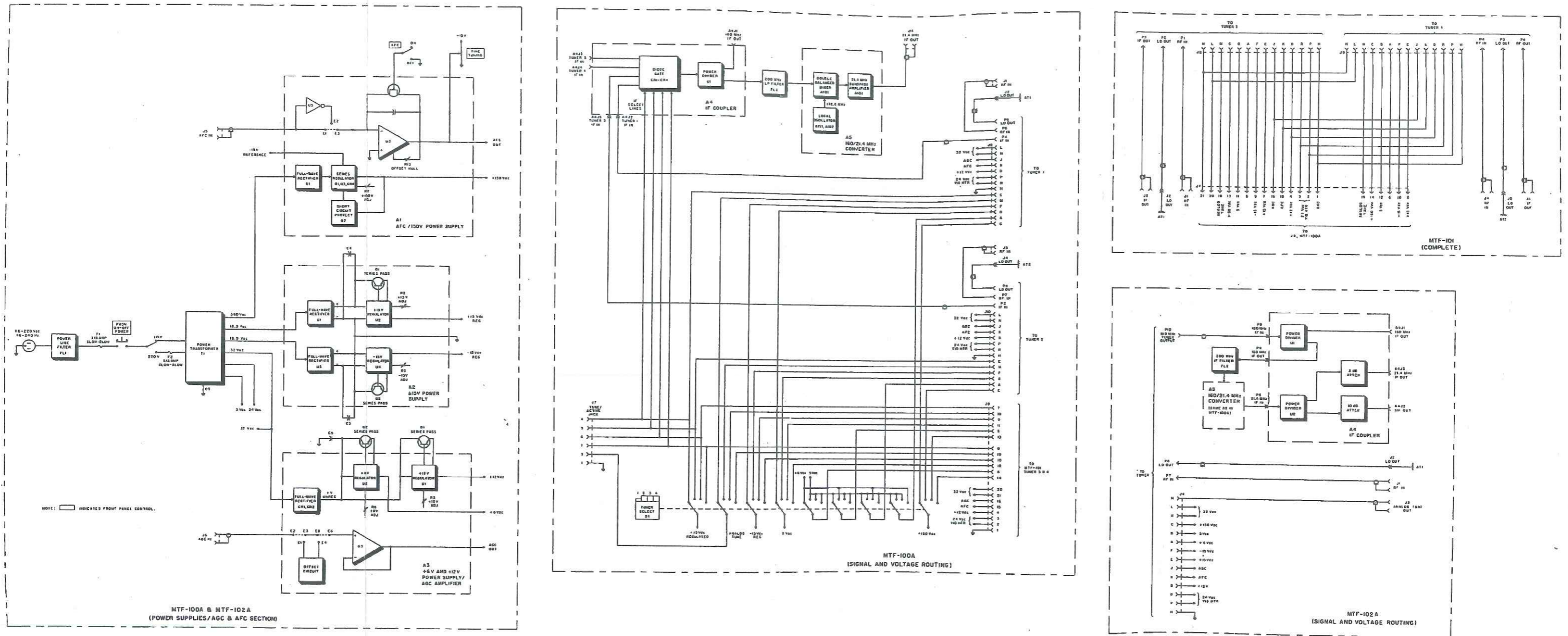


Figure 2-1. Type MTF-100A, MTF-101, and MTF-102A Microwave Tuning Frames, Functional Block Diagram.

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

A complete description of the circuits in the Type MTF-100A, -101, -102A Microwave Tuning Frames is presented in the following paragraphs using the functional block diagram Figure 2-1, and the schematic diagrams, Figures 6-1 through 6-10. The unit numbering method is used for subassemblies and components which means that a prefix is included before the usual class letter and number of the item (such as A1R1 and A4R8). These prefixes are omitted on the illustrations and in the text except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

The power supplies, AFC, and AGC circuits are fabricated in three separate subassemblies which are identical in the MTF-100A and MTF-102A. Paragraphs 2.2.1-2.2.3 describe the basic operation of these subassemblies.

2.2.1 As shown in Figure 2-1, ac power is switched to power transformer T1 after RFI filtering by FL1. The 115/220 V Select Switch, S2, switches the tapped transformer primary to match the applied input power source and also selects the appropriate fuse for transformer protection. Voltages from T1's secondary are applied to three subassemblies where after rectification, filtering, and regulation, produce +150 V dc, +15 V dc, +12 V dc, +6 V dc, and -15 V dc. T1 also provides a 24 V ac YIG heater supply and a 5 V ac supply. The routing of the supply voltages within the frames is described in following paragraphs.

2.2.2 AFC signal processing in the MTF-100A and MTF-102A is performed by part of the circuitry contained on the A1 subassembly (AFC/150 V power supply). External AFC from a demodulator unit is applied to rear panel jack J5 and routed to an integrating amplifier in the A1 subassembly. Circuit board jumpers on the A1 card are provided to make the AFC signal polarity compatible to the TH-Series Tuning Heads. A front panel ON/AFC switch allows the operator to disable the external AFC and perform fine tuning only by the front panel FINE TUNING potentiometer.

2.2.3 A portion of the A3 subassembly (+6 V and +12 V power supply/AGC amplifier) processes the AGC voltage in the MTF-100A and MTF-102A. External AGC signals from a demodulator unit may be ap-

plied to rear panel jack J6 which feeds a voltage follower on the A3 card. The A3 card also contains an offset circuit which may be connected by circuit board jumpers to make the AGC polarity compatible with the TH-Series tuning heads. Tables 1-1 and 1-2 give the AGC input levels acceptable. With no external connection to AGC IN jack J6, the voltage follower in subassembly A3 allows the tuning head to operate with maximum gain.

2.2.4 MTF-100A Voltage Routing. - The MTF-100A Microwave Tuning Frame has the capability of routing operating voltages to one of four tuning heads. As shown in Figure 2-1, interface connectors J8 and J10 connect all supply voltages to TUNER 1 and TUNER 2 respectively. Interface connector J9 routes all of the supply voltages to TUNER 3 and TUNER 4 (mounted in a MTF-101 Microwave Tuning Frame). TUNER SELECT switch S4, a 3-deck rotary wafer switch, is used to switch operating voltages to the tuning head selected by the operator. Some of the supply voltages are hardwired in the frame to the tuning head interface connectors. These voltages (+12 V dc, 32 V ac, and YIG heater 24 V ac) are constantly applied to all tuning heads as long as the MTF-100A power is on and maintains the heads in a standby condition. A section of wafer switch S4 provides standby filament voltage for tube-equipped tuning heads. When not on-line, the standby tuners receive 5 V ac via the +6 V dc filament supply lines.

2.2.5 MTF-100A Signal Routing. - Distribution of RF, LO, AGC, and AFC signals within the MTF-100A is accomplished by wiring shown in Figure 2-1. RF signals from the antenna, applied to RF IN jack J1, go to TUNER 1 via connector plug P5. Likewise, RF signals fed to RF IN jack J3 go to TUNER 2 via connector plug P7. A sample coupled from the LO in TUNER 1 is routed to LO OUT jack J2 which is fitted with a coaxial termination plug, AT1. Similarly, a sample coupled from the LO in TUNER 2 is coupled to LO OUT jack J4 and coaxial termination plug AT2. The termination plugs serve to properly maintain the LO output lines with 50 Ω impedances and prevent stray radiation. Note that RF and LO signals for TUNER 3 and TUNER 4 are not routed through the MTF-100A Microwave Tuning Frame because connection is made directly at the MTF-101. AFC and AGC signals are carried to all installed tuning heads by interface connectors J8, J9, and J10. These interface connectors also return the analog tuning voltage from each tuning head to TUNER SELECT switch S4. The selected analog voltage is available from S4 at the TUNE/ACTIVE JACK J7. This jack also provides for external monitoring of the selected tuner by carrying +15 V dc on one of the select logic pins 4 through 7. In addition, +15 V dc is routed from S4 on one of the IF select lines to the A4 subassembly. One of the IF select lines will be high in accordance with the tuner selected. The 160 MHz IF of each tuning head is brought in to IF coupler subassembly

A4 where the diode gate, controlled by the IF select lines, passes only the selected IF. In power divider U1 the 160 MHz IF is separated into two paths and then routed to A4J1 (160 MHz IF OUT) and to the down converter via a low pass filter. In the 160/21.4 MHz converter, A5, the 160 MHz IF modulates a 138.6 MHz carrier in double balance mixer A1U1 and the resulting 21.4 MHz is fed to J11, 21.4 MHz IF OUT.

2.2.6 MTF-101 Voltage and Signal Routing. - AFC, AGC, Analog Tune, and all operating voltages are distributed to TUNER 3 and TUNER 4 installed in the MTF-101 at interface connector J7 of this unit. An interconnecting cable assembly joins J7 on the MTF-101 with J9 on the MTF-100A for interfacing power and tuner control. RF, LO, and IF signals are directly routed to the rear panel BNC connectors as shown in Figure 2-1.

2.2.7 MTF-102A Voltage and Signal Routing. - All operating voltages for the tuning head installed in the MTF-102A are produced by the built-in power supply assemblies and routed via interface connector J4. This connector also carries AFC, AGC, and Analog Tune voltages. The 160 MHz IF from the tuning head is routed to the IF COUPLER subassembly A4. (The A4 module in the MTF-102A differs from the A4 module in the MTF-100A.) In the power divider U1, the IF signal is coupled out to A4J1 (160 MHz IF OUT) and to the down converter via low pass filter FL2. After down conversion in the A5 subassembly the 21.4 MHz IF is routed back to the IF COUPLER subassembly A4 into power divider U2. One half of the 21.4 MHz IF goes through a 3 dB resistive attenuator to A4J3, 21.4 MHz IF OUT. The other half of the 21.4 MHz passes through a 10 dB attenuator and is available at A4J2 for signal monitoring.

2.3 DETAILED DESCRIPTION

2.3.1 Type 76228 AFC/150 V Power Supply (A1). - The schematic diagram for the AFC/150 V power supply subassembly used in the MTF-100A and -102A is Figure 6-1. The power supply section consists of full wave rectifier, U1, followed by a series regulator. Figure 2-2 is a simplified schematic of the regulator circuitry. The base voltage for emitter follower Q1 is set by voltage-sensing amplifier Q3, constant current diode CR4, and biasing resistor R1. The amount of current flowing through R1 to the junction of Q3 and R2 varies to control the regulator output. For example, an increase in the +150 V output is felt by the base of Q3 which causes a corresponding increase in the collector current of Q3. Since the current through R2 and CR4 is constant, the current through R1 must decrease, causing a decrease in forward bias for series transistor Q1. The increased impedance of Q1 causes the output voltage to drop until the error signal at the base of Q3 is

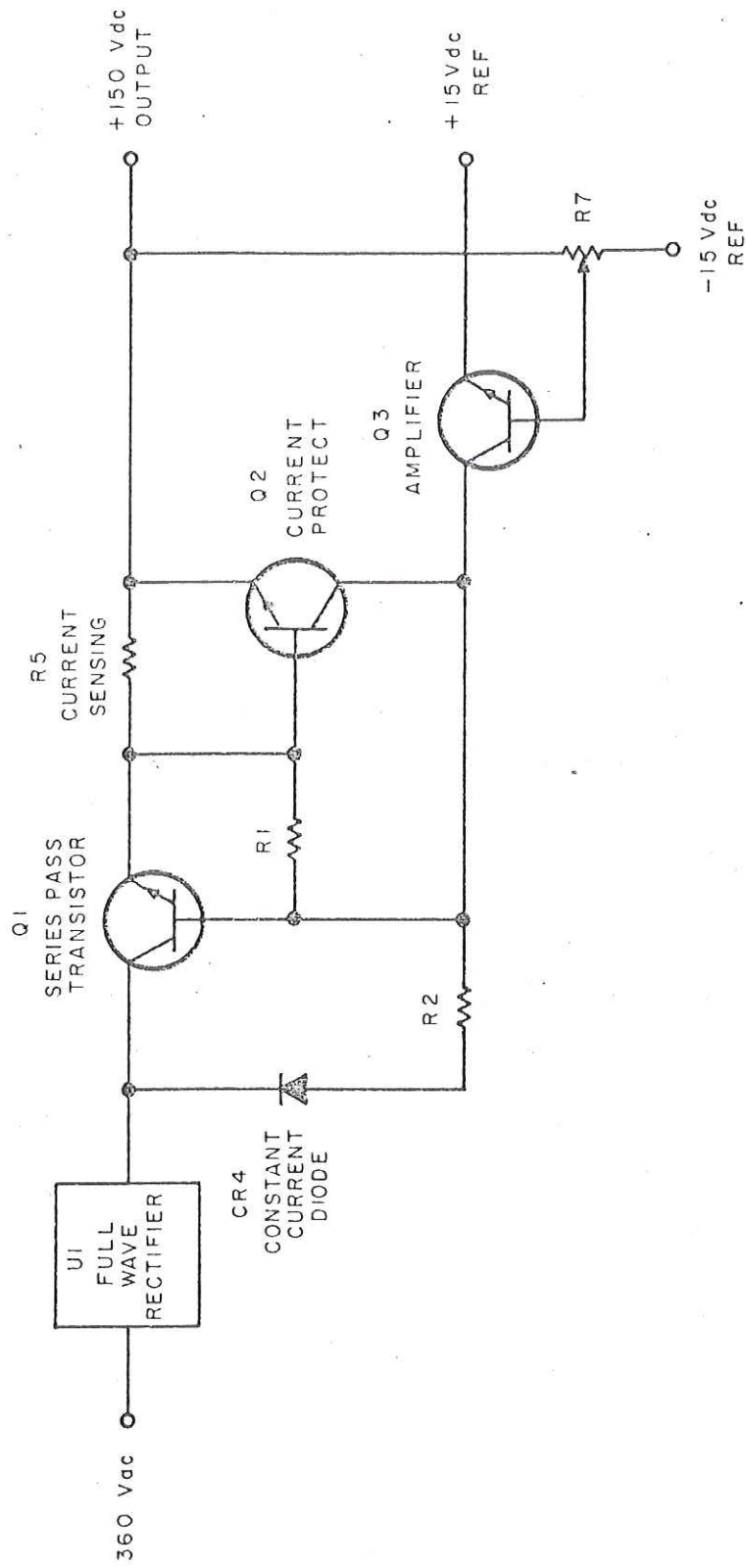


Figure 2-2. +150 V Regulator, Simplified Schematic Diagram

corrected. Short circuit protection is afforded by current control transistor Q2. Normally, Q2 is cut off and does not affect the operation of the circuit. If the drop across current-sensing resistor R5 becomes as large as 0.4 or 0.5 volt, however, Q2 will begin to conduct through R2, which will override the normal control current through R1 for Q1. Thus, the upper current limit of Q1 cannot rise above the point at which Q2 starts to conduct and the total output current of the supply is limited to a preset maximum value. As shown in Figure 6-1, 91 volt zener diode VR1 provides protection for the constant current diode, CR4. Silicon diode CR1 limits the direction of current flow through R1. R7 is the voltage adjustment for the regulator. Note that +15 V and -15 V (from the A2 subassembly) provide a reference source for amplifier Q3.

2.3.2 AFC Circuitry. - The AFC portion of the A1 subassembly is shown at the left hand side of Figure 6-1. The AFC voltage from an external demodulator discriminator is applied through AFC IN jack J6 of the main chassis to module pin 15. This dc voltage, ± 2 V nominal, is routed by circuit board jumpers connecting E1 to E3 to the inverting input of operational amplifier U2 through R11. With the front panel AFC switch in the ON position, field-effect transistor Q4 is cut off by -15 V at the gate. In this mode Q4 is effectively out of the circuit and U2 functions as an integrating amplifier. Resistor R11 and the non-polarized capacitance of C4-C5 provide the integrating function. Due to the integration, a small AFC input voltage will provide a continually increasing AFC output voltage until the LO frequency error is virtually zero. Output voltage from U2 is coupled through R14 to module pin 20 which connects to the local oscillator varactor diode in the tuning head. Diode CR3 prevents the voltage at the junction of R14 and R15 from ever going more negative than -0.6 volts to protect the varactor diode. Potentiometer R13 allows adjustment of U2 for zero volts output with zero volts input. Placing the front panel AFC switch to the OFF position places a ground at pin 16 of the circuit board. With zero volts at the gate of Q4, the FET switches on which reduces the gain of U2 to nearly unity. In this mode, only the front panel FINE TUNING potentiometer has control of the AFC output. Resistor R15 serves to isolate the front panel FINE TUNING potentiometer from the AFC loop when the integrating amplifier is in use. Circuit board jumpers of the A1 subassembly can be changed to make the circuitry compatible with demodulators whose AFC voltage is negative for a positive input frequency change (see note 5 of Figure 6-1). Operational amplifier U3 which provides signal inversion with unity gain can be placed in the circuit input by jumpering E2 to E3.

2.3.3 Type 76210-1 ± 15 V Power Supply (A2). - The schematic diagram of the ± 15 V power supply used in the MTF-100A and -102A is Figure 6-2. A pair of identical circuits is used on A2 to generate the +15 V and -15 V outputs. The versatility of the circuit arrangement on

this module is such that by grounding specific pins either positive or negative voltage can be obtained. The +15 V is taken from pin 13 of the module via series pass transistor Q1 and IC regulator U2. Pin 17 is grounded for this regulator. Resistor R5 of the main chassis is connected between module pins 20 and 13 to set output current limiting. The -15 V is taken from pin 9 and is regulated by series pass transistor Q2 and IC regulator U4. Pin 11 is grounded for this configuration. Resistor R4 of the main chassis is connected between module pins 4 and 11 to set output current limiting. Full wave bridge rectifiers U1 and U3 receive 19 V ac from the power transformer, T1. Potentiometers R2 and R5 are used to set the outputs voltages of the +15 V supply and the -15 V supply, respectively.

2.3.4 Type 76229 +6 V and +12 V Power Supply/AGC Amplifier (A3). - The schematic diagram of the A3 subassembly used in the MTF-100A and -102A is Figure 6-3. The full wave rectifier consisting of CR1 and CR2 receives 32 V ac from transformer T1. Series pass transistor Q1 of the main chassis is heat-sink mounted on the frame and works in conjunction with IC regulator U1 to regulate the +12 V supply. Potentiometer R3 is the voltage set for the regulator, U1. Resistor R1 sets output current limiting. Series pass transistor Q2 is also mounted on the chassis, along with IC regulator U2, regulates the +6 V supply. Current limiting is set by R9 and resistor R6 is the +6 V adjust. The AGC portion of the module consists of a voltage follower and an offset circuit. The circuit board jumpers are shown connected in Figure 6-3 for use with a demodulator whose output AGC is 1 V for a strong signal and +10 V for a weak signal (see Note 6). This AGC is routed to the non-inverting input of voltage follower U3 which provides sufficient output current for up to four tuning heads. For demodulators whose output AGC is -12 V for a strong signal and 0 V for a weak signal the circuit board jumpers are changed (see Note 6). The AGC now receives positive offset by 10 V zener diode VR1 and R13. A zero volt AGC signal applied to the anode of VR1 produces +10 V at the cathode which is jumpered via E4 to E6 to the non-inverting input of U3. A -12 V AGC signal at the anode of VR1 produces -2 V at the cathode. Current flow through CR3 and R12 clamps the maximum negative input at U3 to approximately -0.7 volts. Silicon diode CR4 clamps the maximum positive anode voltage of VR1 at approximately +0.7 volts.

2.3.5 Type 791168 IF Coupler (A4). - Figure 6-4 is the schematic diagram for the IF coupler subassembly used only in the MTF-100A. The 160 MHz IF outputs of TUNER 1, 2, 3, and 4, connect to IF IN jacks J2, J5, J3, and J4 respectively on the A4 subassembly. Diode gating is used to isolate the tuning heads and to select one of the IF inputs for routing on to the power divider, U1. Four IF select lines from the front panel TUNER SELECT switch connect to feed-through ca-

capacitors C1 through C4. One of these lines carries +15 V dc to switch the appropriate diode on and the remaining diodes off. If for example, TUNER 1 is selected, the IF select line connected to feed-through capacitor C1 is high (+15 V) and the other lines are low. With +15 V at the junction of R1 and R5, diode CR1 is forward biased and passes the IF signal applied at J2 on through to C5. The cathode of forward biased CR1 has a potential of approximately +5 V (note current path through R9) which reverse biases CR2, CR3, and CR4 blocking the IF signal. The power divider, U1, is a transformer that divides the signal fed to the primary (pin 1) for two half power outputs. One -3 dB 160 MHz IF signal is fed from pin 2 of U1 to J6 where it is further routed to a down converter. The other -3 dB 160 MHz IF signal is fed from pin 3 of U1 to J1 which is the rear panel 160 MHz IF OUT jack on the frame.

2.3.6 Type 17188 160/21.4 MHz Converter. - The schematic diagram for the 160/21.4 MHz converter board used in the MTF-100A and -102A is Figure 6-7. It is housed in a brass enclosure, A5, whose schematic is Figure 6-6. All components other than connectors are mounted on the printed circuit board, A5A1. In the MTF-100A, the 160 MHz IF input applied to E1 is the selected IF of one of four tuning heads while in the MTF-102A the IF input is from the one tuning head installed. In both types of frames, the A5 assemblies are identical. The crystal controlled oscillator, Q2, injects 138.6 MHz into the double balanced mixer, U1. Transistor Q2 is used in a grounded base configuration. Selectable resistor R16 introduces degeneration to minimize spurious responses. Resistors R13 and R14 form a voltage divider to supply base bias, while R11 and R12 supply emitter current. The tuned tank consisting of L1 and C3 is paralleled by C4 and C5 to provide positive feedback to the emitter. Capacitor C3 is variable to supply frequency tuning. L2 neutralizes stray capacitance of the crystal holder. A pad composed R1, R2, and R3 isolates the oscillator from the nonlinear input impedance of the mixer. The 160 MHz modulates the 138.6 MHz LO signal and the sum and difference frequencies resulting from the heterodyning are coupled out via C2. Transistor Q1 is a high power common emitter voltage amplifier biased by divider R4-R6. The stage receives both the upper (298.6 MHz) and lower (21.4 MHz) sidebands from the balanced mixer U1. The tank circuit in the collector of Q1 (-C9, C14, and T1-) is tuned to 21.4 MHz by C9 and only the lower sideband is coupled via auto transformer T1 to E3, the 21.4 MHz IF output. Capacitor C6 provides neutralization for the stage and resistor R17 is the output level adjust. In the MTF-100A, the output from E3 is directly routed to the rear panel jack J11, 21.4 MHz IF OUT. In the MTF-102A, the output from E3 leads back to the IF coupler subassembly, A4.

2.3.7 Type 791170 IF Coupler (A4). - The schematic diagram for the IF coupler used only in the MTF-102A is Figure 6-5. The installed

tuning head 160 MHz IF signal connects to J4 and power divider U1. One -3 dB 160 MHz IF is routed from the transformer power divider to the rear panel 160 MHz IF OUTPUT jack, J1. The other -3 dB IF from U1 is sent to the 160/21.4 MHz down converter via J5. The 21.4 MHz IF from the down converter returns to the A4 subassembly at J6 where it is coupled by C1 into power divider U2. In U2 the IF is divided into half power outputs and sent to SM OUTPUT jack, J2 through a 10 dB attenuator and to 21.4 MHz IF OUTPUT jack J3 through a 3 dB attenuator.

SECTION III

INSTALLATION AND INSPECTION

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, Gaithersburg, 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. If external damage is visible, remove the dust covers and inspect the internal components for apparent damage. Then check the internal cables for loose connections, and plug-in items such as printed wiring boards (MTF-100A and -102A only), which may have been loosened from their receptacles.

3.2 INSTALLATION

3.2.1 Rack/Mounting Support. - The MTF Series Microwave Tuning Frames are designed for assembly in a standard 19-inch rack in accordance with MIL-STD-189 and E.I.A. Standard RS-310. Due to the equipment weight to front panel height ratio, it is recommended that some means be devised to support the sides and/or rear panel apron of the frame. In addition to the front panel mounting hardware, a shelf, rear panel brace, or chassis slides may be used for the rack installation. The chassis slide mounting technique should be considered for the advantages of ease of tuning head installation and removal, access to cable connections in the frame, and access to the rear apron of the equipment. Additional information, such as mobile equipment installation, can be obtained from your Watkins-Johnson representative.

NOTE

To facilitate system cabling, it is recommended that the MTF-101 be mounted directly above or below its associated MTF-100A. Prior to rack mounting, refer to paragraph 3.2.3 for tuning head installation.

3.2.2 Thermal Considerations. - The equipment is designed for operational temperatures between 0° C and +50° C (32° F and 122° F). The operational temperature range is further qualified for free, unrestricted ambient air at sea level pressure. Equipment installation should provide for free flow of air around and through ventilated units. Forced-air ventilation may be necessary to maintain the proper ambient air temperature in an equipment rack, where close vertical stacking contributes to a high thermal density. Additional information may be obtained from your Watkins-Johnson representative.

3.2.3 Tuning Head Installation. - The procedure for installing a tuning head in the MTF-100A, -101, and -102A is the same. The tools required for the task are: 5/64" Allen wrench, standard blade screwdriver, Phillips head screwdriver, 5/16" open end wrench, 7/32" open end wrench, and a 7/16" nut driver. Proceed as follows:

- (1) Remove the main tuning knob from the tuning head shaft by loosening the two setscrews with the Allen wrench.
- (2) Remove the frequency coverage plate from the front of the tuning head and retain the screws. In the case of tuning heads with LED readouts, the new escutcheon plate supplied with the unit is to be installed on the front panel of the Microwave Tuning Frame in this step.
- (3) Assure that the power to the tuning frame is off, then remove the tuning frame top and bottom dust covers.
- (4) Gain access to the bottom of the tuning frame by extending it out on the chassis slides, or by removing the tuning frame from the equipment rack and placing the frame on its side.
- (5) From the bottom side of the tuning frame, insert the tuning head, tuning shaft first. Slide the tuning shaft into the hole in the front panel then gently bring the rear of the tuning head into the frame. Take care not to pinch the interconnecting cables or wires on the YIG preselector between the head and the tuning frame. The multipin tuning head power plug should be positioned to extend from the top of the frame in this step.
- (6) Fasten the head to the tuning frame by using eight 4-40 X 5/16" pan head screws. The screws, with both flat and lock washers, are installed from the top of the tuning frame. Make certain that there are no cables pinched between the head and frame before tightening the screws.

- (7) Install the tuning knob on the tuning head shaft. Install the frequency coverage plate on the frame using the screws retained in step (2) of this procedure. In the case of tuning heads with a LED readout, mount the band select switch in the hole provided in the new escutcheon plate. Make certain that the switch wiring is routed so that clearance from the gear train and shafts is assured. Tighten the band select switch retaining nut with a 7/16" nut driver.
- (8) Connect the power and signal interface cables for the tuning head. The designations for the plugs, receptacles, and cables vary in accordance with the Microwave Tuning Frame type, tuning head type, and position in which the tuning head is installed. The illustrations in Section V of this manual may be referred to for the location and designations of the interfacing connectors. Tighten the RG-142B/U cable connectors with a 5/16" open end wrench. Tighten the UG 1466/U subminiature connectors with a 7/32" open end wrench.
- (a) Tuner Power Interface Connection. - Connect the 14 pin male plug from the tuning head to the multi-pin receptacle on the tuning frame. The receptacle designations are listed below.

| Frame Type | Tuner Position | Frame Connector Ref. Desig. Prefix |
|------------|----------------|------------------------------------|
| MTF-100A | 1 | J8 |
| MTF-100A | 2 | J10 |
| MTF-101 | 3 | J8 |
| MTF-101 | 4 | J9 |
| MTF-102A | 1 | J4 |

- (b) RF Input Connection. - Connect the RG-142B/U cable from the tuning frame rear panel RF IN jack to the input port of the YIG preselector.

CAUTION

The YIG preselector can be permanently damaged if the RF cable connector is not properly aligned and mated with the RF Input port. The Product Warranty is void where a mating connector has caused center pin movement.

The RF IN (OSM Type) connector designations are listed below.

| Frame Type | Tuner Position | Frame Connector Ref. Desig. Prefix |
|------------|----------------|---------------------------------------|
| MTF-100A | 1 | P5 |
| MTF-100A | 2 | P7 |
| MTF-101 | 3 | P1 |
| MTF-101 | 4 | P4 |
| MTF-102A | 1 | P7 |

- (c) LO Output Connection. - Connect the RG 142 B/U cable from the LO OUT jack on the tuning frame rear panel to the directional coupler output on the tuning head. The directional coupler output port is identified as the vacant threaded jack of the coupler. The LO cable is the longer of the two RG 142 B/U cables. The LO (Type OSM) connector designations are listed below.

| Frame Type | Tuner Position | Frame Connector Ref. Desig. Prefix |
|------------|----------------|---------------------------------------|
| MTF-100A | 1 | P6 |
| MTF-100A | 2 | P8 |
| MTF-101 | 3 | P2 |
| MTF-101 | 4 | P5 |
| MTF-102A | 1 | P8 |

- (d) IF Output Connection. - Identify the IF OUT jack of the 160 MHz IF preamplifier A1 located on the tuning head. To this IF OUT jack connect the coax cable fitted with a UG 1466/U subminiature plug. The plug designations are listed below.

| Frame Type | Tuner Position | Frame Connector Ref. Desig. Prefix |
|------------|----------------|---------------------------------------|
| MTF-100A | 1 | P4 |
| MTF-100A | 2 | P2 |
| MTF-101 | 3 | P3 |
| MTF-101 | 4 | P6 |
| MTF-102A | 1 | P10 |

- (e) YIG Heater Plug Connections. - A Winchester type plug, designated P14, enables the TH-Series tuning head to be installed in and operate with different types of parent equipment. This plug mates with multipin jack J1 on the tuning head and jumpers the YIG heater supply to the appropriate pins. Assure that the installed tuning head has a jumper plug designated P14/MTF inserted into J1 on the tuning head. A plug with a different designation stamped on the cover will cause improper operation of the tuning head installed in a MTF type Microwave Tuning Frame.

- (9) Replace the top and bottom dust covers and return the frame to the equipment rack.

3.2.4 Tuning Head Removal. - To remove a tuning head, reverse the above procedure. Use caution when extracting the tuning head so that the wiring of the YIG preselector clears the tuning frame chassis. It is not necessary to remove any of the subassemblies, modules, or cables that are premanently affixed to the tuning head.

3.2.5 External RF Preamplifier Installation. - Provision has been made on the MTF-100A, -101, and -102A for connecting an external RF preamplifier in the TH-Series Tuning Head circuitry. The external RF preamplifier connects between the YIG preselector FL1A and the isolator Z1 as shown in Figure 3-1. Low noise TWT amplifiers such as the Watkins-Johnson WJ 422, WJ 423, and WJ 424 contain their own integral power supplies and cover the frequency ranges of 2.0-4.0 GHz, 4.0-8.0 GHz, and 8.0-12.0 GHz, respectively. Contact your local Watkins-Johnson representative for details and specifications. Installation of the preamplifier is identical for each type of MTF Tuning Frame and for each tuning head position. Follow the procedure as outlined below.

- (a) Remove the rear apron cover plate marked EXTERNAL RF PREAMPLIFIER from the tuning frame by removing the two retaining screws.
- (b) Install the two accessory preamplifier cables so that the Type N connectors extend from the rear apron.
- (c) Remove plugs P1 and P2 of cable assembly W1 from the preselector OUT port of FL1A and the IN port of isolator Z1.

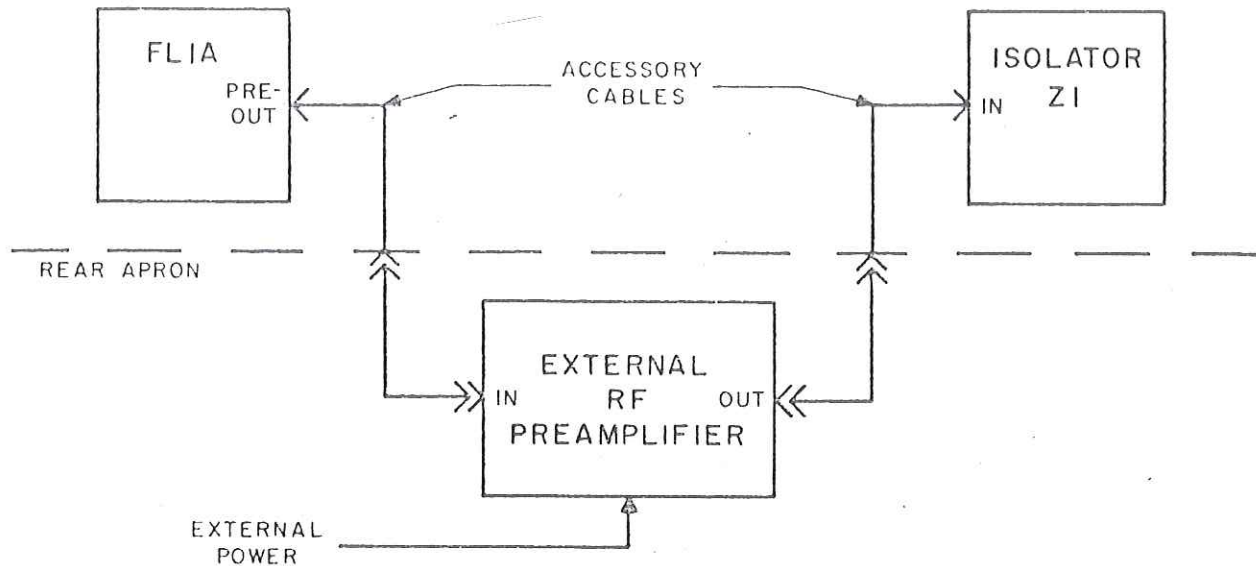


Figure 3-1. External RF Preamplifier Connections

- (d) Complete the installation by connecting the RF preamplifier as shown in Figure 3-1.

3.2.6 MTF-100A Input and Output Connections. - The system wiring for the MTF-100A and MTF-101 is shown in Figure 3-2. Installation of system interconnecting cables is described in the procedure below. If the MTF-100A is used without the MTF-101 disregard the last two steps of this procedure, 3.2.6.8 and 3.2.6.9.

3.2.6.1 Power Connection. - Before proceeding be certain that the PUSH ON/OFF POWER switch on the front panel is in the OFF position (pushbutton extended). Check the 115/220 V ac selector switch, S2, at the rear panel to determine that it is set to match the voltage of the ac power source. The switch can be actuated by a small screwdriver. Connect power plug P1 to a source of 115 or 220 V ac at 48-420 Hz. The third wire of the plug grounds the unit so that external grounding is not required. If the two prong to three prong adapter supplied with the unit must be used, be certain that the ground wire is securely connected to a low impedance ground.

3.2.6.2 RF Input Connections. - Connect the microwave antenna inputs to RF IN jacks J1 and J3 (Type N connectors). Jack J1 connects to the TUNER 1 position and jack J3 connects to the TUNER 2 position.

3.2.6.3 IF Output Connections. - Connect a cable from the appropriate IF OUT jack on the MTF-100A to the IF input of the demodulator used. BNC jack A4J1 provides a 160 MHz IF and BNC jack J11 provides a 21.4 MHz IF. RG 55B/U cable is recommended for this con-

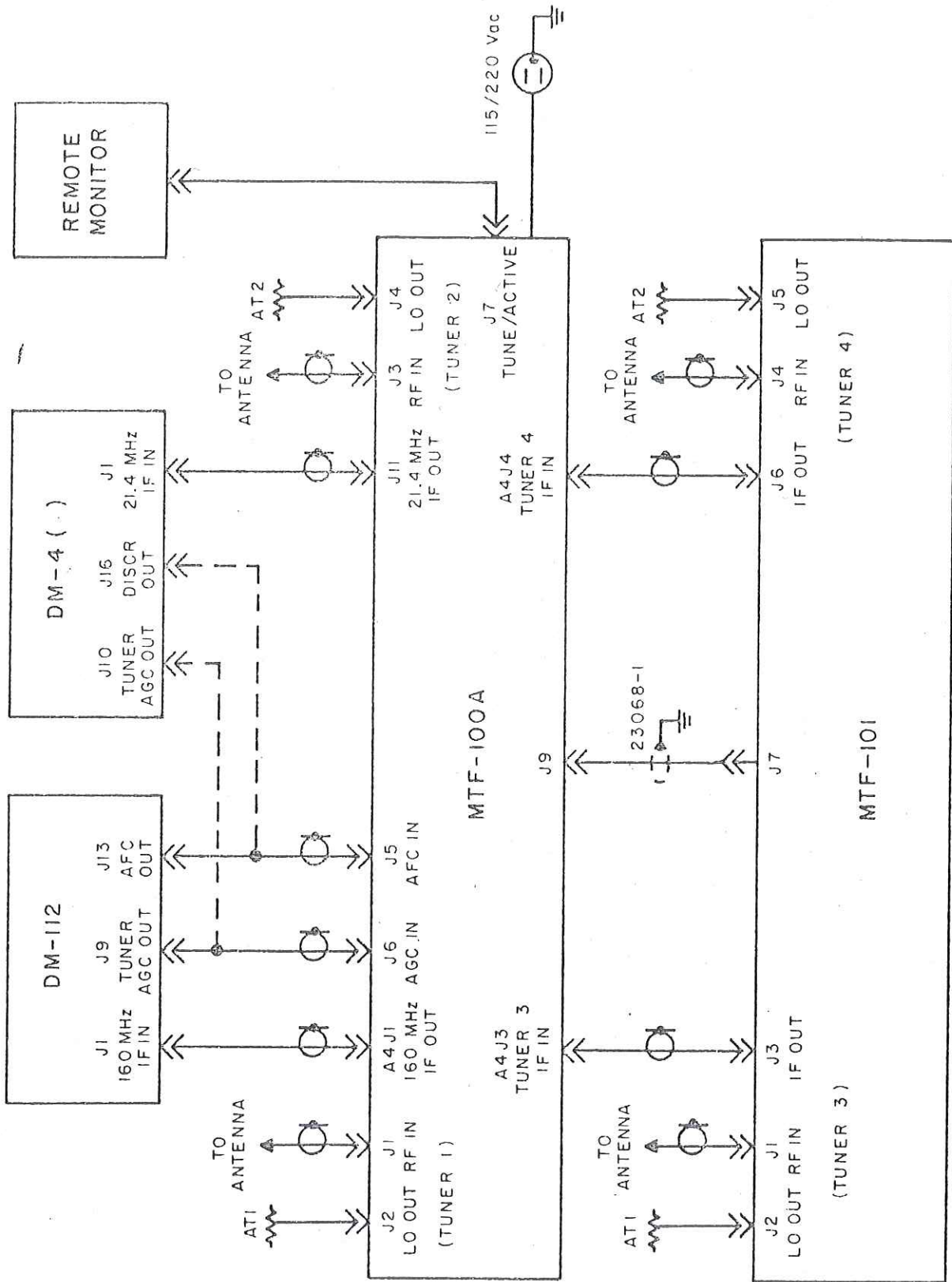


Figure 3-2. MTF-100A/-101 Interconnecting System Wiring

nection. Figure 3-2 shows the connections if a DM-112 or DM-4 () demodulator is used.

NOTE

Although wiring for both 160 MHz and 21.4 MHz demodulators is shown, only one is normally used at a time.

3.2.6.4 AFC Input Connections. Connect the AFC output of the demodulator to the AFC IN jack J5 on the rear panel of the MTF-100A. If the demodulator used does not provide a positive AFC voltage output for a positive IF frequency input change, it will be necessary to change the circuit board jumpers on the A1 subassembly (AFC/150 V power supply). Consult the demodulator instruction manual and refer to note 5 of Figure 6-1 for the proper jumper connections for AFC inputs of the opposite polarity.

3.2.6.5 AGC Input Connections. - Connect the AGC output of the demodulator to the AGC IN jack J6 on the rear panel of the MTF-100A. The frame is factory wired for use with demodulators whose output AGC voltage is +10 V to +1 V. It will be necessary to change the circuit board jumpers on the A3 subassembly for use with demodulators whose output AGC voltage is zero to -12 V. Consult the demodulator instruction manual and refer to note 6 of Figure 6-3 for the proper circuit board jumper connections.

3.2.6.6 Tuner LO Outputs. - Local oscillator jacks J2 (TUNER 1) and J4 (TUNER 2) are provided for general test and monitoring of the corresponding tuner's local oscillator. When not in use, these jacks should be terminated with the coaxial termination plugs provided.

3.2.6.7 Tune/Active Output. - Multipin jack J7 provides a means for monitoring the tuner position selected by the MTF-100A and the frequency of that tuner. The analog voltage output on pin 3 of the jack varies from -10 V to +10 V and represents low band edge to high band edge of the selected tuner. The tuner position selected is indicated by +15 V dc switched to pins 4, 5, 6, or 7 of the jack for Tuner 1, 2, 3 or 4.

3.2.6.8 Power/Control Interface Connections. - Connect multipin jack j9 of the MTF-100A to multipin jack J7 on the rear apron of the MTF-101. Use the interface cable (part number 23062-1) provided with the MTF-101.

3.2.6.9 IF Input Connections. - Connect J3, IF OUT, of the MTF-101, to rear panel jack A4J3 on the MTF-100A. Connect J6, IF OUT, of the MTF-101, to rear panel jack A4J4 on the MTF-100A.

3.2.7 MTF-101 Input and Output Connections. - Refer to Figure 3-2 and proceed as follows:

3.2.7.1 RF Input Connections. - Connect the microwave antenna inputs to RF IN jacks J1 and J4 (Type N connectors). Jack J1 connects to the TUNER 3 position and jack J4 connects to the TUNER 4 position.

3.2.7.2 IF Output Connections. - Rear panel jacks J3 and J6 are the 160 MHz if outputs of TUNER positions 3 and 4 respectively. Using RF 55B/U cable connect J3 on the MTF-101 to A4J3 on the MTF-100A. Similarly connect J6 of the MTF-101 to A4J4 on the MTF-100A.

3.2.7.3 Tuner LO Outputs. - Local oscillator jacks J2 (TUNER 3) and J5 (TUNER 4) are provided for general test and monitoring of the corresponding tuner's local oscillator. When not in use, these jacks should be terminated with the coaxial termination plugs provided.

3.2.7.4 Power/Control Cable Connections. - See paragraph 3.2.6.8.

3.2.8 MTF-102A Input and Output Connections. - Refer to the MTF-102A system wiring diagram, Figure 3-3, and proceed as follows:

3.2.8.1 Power Connection. - Follow the procedure given in paragraph 3.2.6.1.

3.2.8.2 RF Input Connection. - Connect the microwave antenna input to the RF IN jack J1 (Type N connector).

3.2.8.3 IF Output Connection. - Connect a cable from the appropriate IF OUT jack on the MTF-102A to the IF input of the demodulator used. BNC jack A4J1 provides a 160 MHz IF and BNC jack A4J3 provides a 21.4 MHz IF. Figure 3-3 shows shows the connections to a DM-112 and a DM-() demodulator.

3.2.8.4 AFC Input Connection. - Connect the AFC output of the demodulator used to the AFC IN jack J5 of the MTF-102A. The equipment is factory wired for use with a demodulator whose output is a positive AFC voltage for a positive IF input frequency change. If the demodulator output is of the opposite polarity, change the circuit board jumpers on the A1 subassembly (AFC/150 V power supply) as explained in note 5 of Figure 6-1.

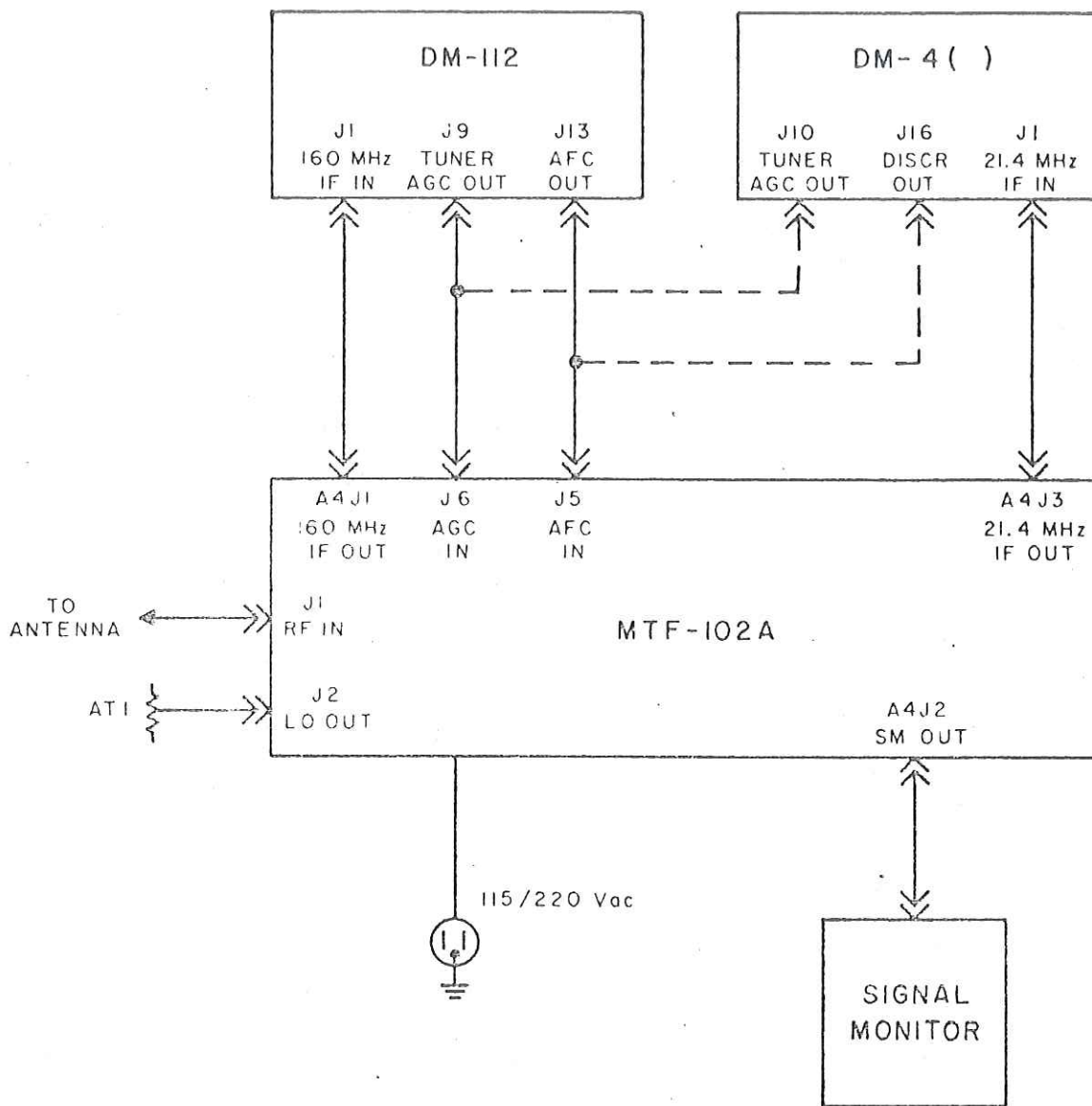


Figure 3-3. MTF-102A System Wiring

3.2.8.5 AGC Input Connection. - Connect the AGC output of the demodulator to the AGC IN jack J6 of the MTF-102A. The equipment is factory wired for use with a demodulator whose AGC voltage is +10 V to +1 V. If the demodulator AGC output voltage is zero to -12 V change the circuit board jumpers on the A3 subassembly (+6 and +12 V power supply/AGC amplifier) as explained in note 6 of Figure 6-3.

3.2.8.6 Tuner LO Output. - Local oscillator jack J2 LO OUT provides a sample of the tuner's local oscillator for general test and monitoring. When not in use the jack should be terminated with the coaxial termination plug AT1 provided.

3.2.8.7 SM Output Connection. - The BNC jack A4J2 SM OUT jack provides a 21.4 MHz IF for signal monitoring purposes. If signal monitoring is used, connect a cable from SM OUT jack, A4J2, to the signal monitor.

3.3 OPERATION

The operation of the controls and switches on the Types MTF-100A, -101, and -102A Microwave Tuning Frames is explained in the following paragraphs.

3.3.1 PUSH ON/OFF POWER Switch. - Push this control to apply line power to the MTF-100A or MTF-102A. Operating potentials for the MTF-101 are supplied by the power supplies of the MTF-100A.

3.3.2 TUNER SELECT Switch. - This switch, mounted only on the MTF-100A provides operating power and the necessary interconnections required for operation of the selected tuner. Positions 1 and 2 correspond to the two tuning heads mounted in the MTF-100A. Positions 3 and 4 correspond to the two tuning heads mounted in the MTF-101. The IF output and analog tune voltage of the selected tuner is available at the rear panel of the MTF-100A.

3.3.3 FINE TUNING Control. - The FINE TUNING control is an electronic vernier of the manual main tuning knob on the tuning head. With this control set initially at midrange, the tuned frequency of the selected tuning head can be slightly increased or decreased.

3.3.4 AFC/ON Switch. - Placing the AFC/ON switch in the ON position allows the AFC voltage from an external demodulator to control the fine frequency of the selected tuning head. In the OFF position of this switch, the demodulator AFC has no control.

3.4 PREPARATION FOR RESHIPMENT

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 excellent 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 surfaces 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 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:

- (a) Maximum humidity: 95% (no condensation)
- (b) Temperature range: -30° C to +85° C.

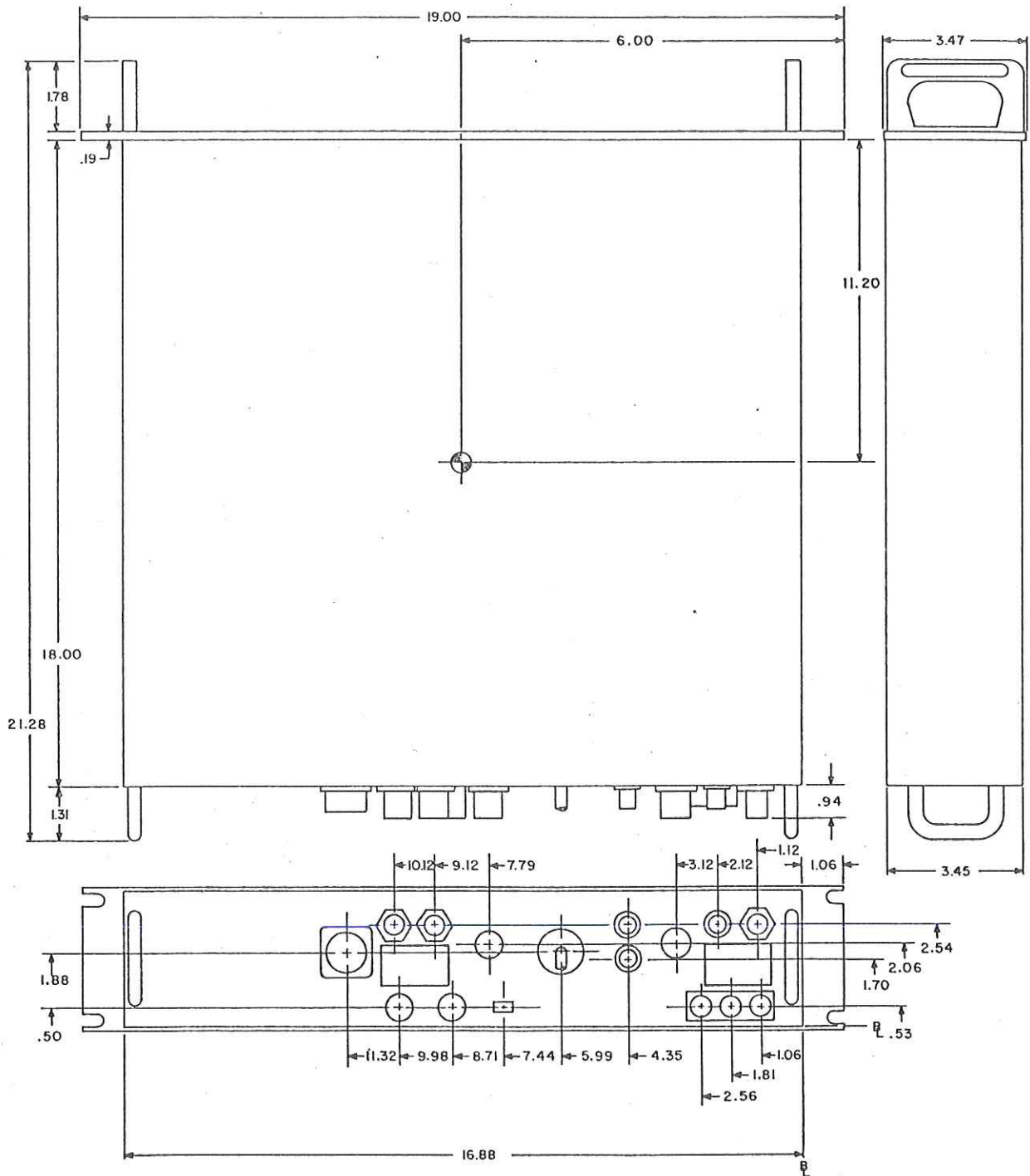


Figure 3-4. Type MTF-100A Microwave Tuning Frame, Critical Dimensions.

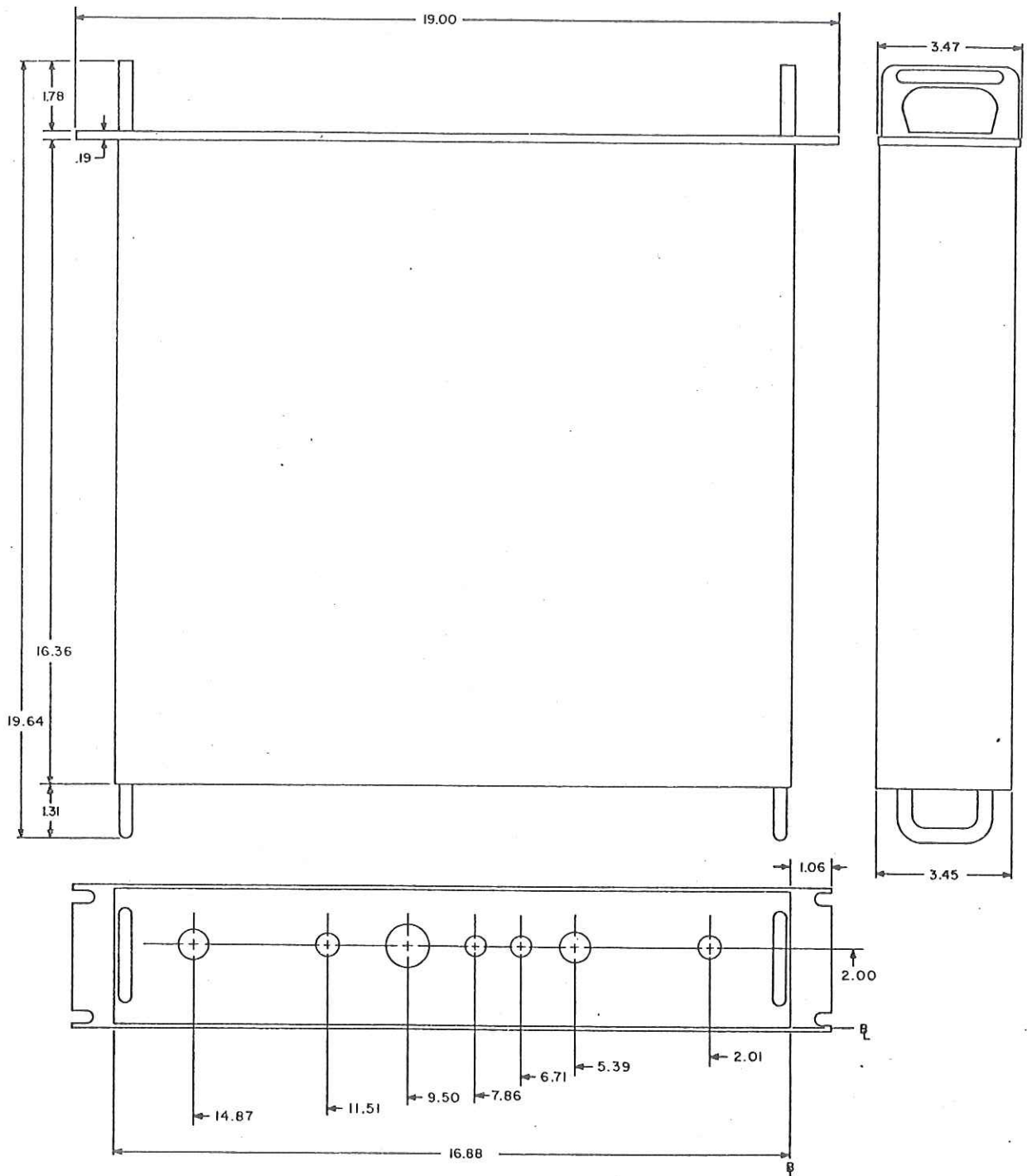


Figure 3-5. Type MTF-101 Microwave Tuning Frame, Critical Dimensions.

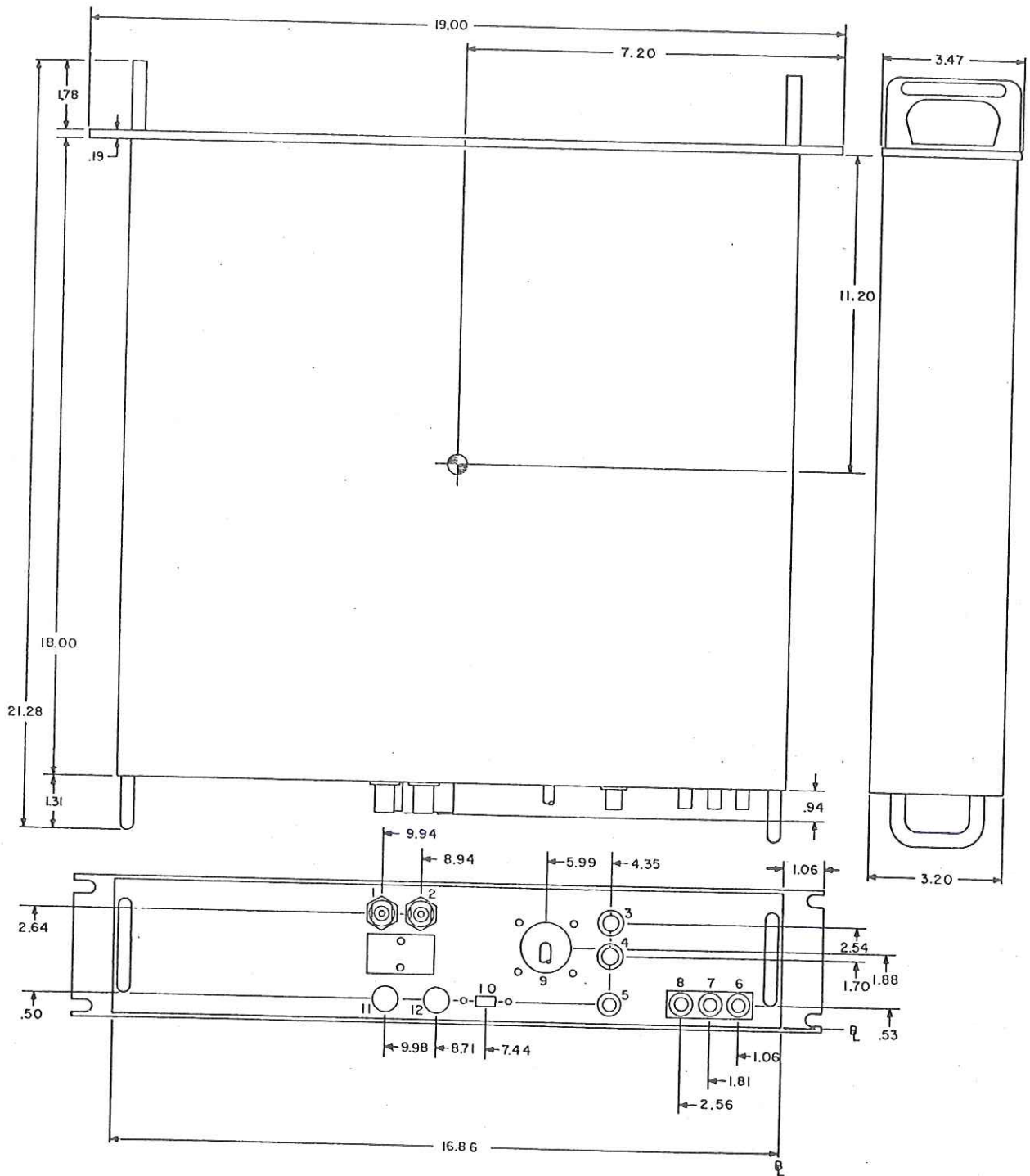


Figure 3-6. Type MTF-102A Microwave Tuning Frame, Critical Dimensions.

SECTION IV

MAINTENANCE

4.1 GENERAL

The Types MTF-100A, MTF-101, and MTF-102A Microwave Tuning Frames have been designed to provide trouble-free operation with little or no routine maintenance. The occasional removal of accumulated dust or dirt and inspection are the only preventative maintenance operations recommended. Intervals for these operations should be based on the operating environment but should not exceed 1000 hours. Repair time will be minimized, should trouble occur, if the maintenance technician is familiar with the circuit descriptions in Section II, with the functional block diagram, Figure 2-1, and with the schematic diagrams, Figures 6-1 through 6-10. A complete parts list and part location illustrations can be found in Section V.

4.2 CLEANING

The frame 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, a soft bristled brush, or a cloth saturated with a cleaning compound can also be used. The Types MTF-100A, -101, and -102A Microwave Tuning Frames do not require lubrication.

4.3 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by a visual inspection of the frames. For this reason, a complete visual inspection should be made for indications of mechanical and/or electrical defects on a periodic basis, or whenever the unit is being examined for a previously reported trouble. 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.

4.4 ALIGNMENT AND TEST PROCEDURES

4.4.1 General. The following alignment procedure is suitable for alignment and test of the tuning frame after component replacement to determine that the function of the unit is adequate to meet factory performance standards. The alignment procedure can also be a valuable aid to trouble-

shooting.

4.4.2 Required Test Equipment. - The following test equipment, or equivalent, is required to perform alignment and test of the MTF-100A, -101, and -102A Microwave Tuning Frames:

| INSTRUMENT TYPE | REQUIRED CHARACTERISTICS | USE | RECOMMENDED INSTRUMENT |
|--|--|--------------------------------|---|
| RF Voltmeter | 50 MHz, 10 mV minimum full scale | Alignment | Boonton 92A |
| Digital Voltmeter | DC and ac voltage ranges | Power Supply checks | Fluke 8120A |
| Signal Generator | 21.4 MHz to 160 MHz | Alignment | Hewlett Packard 608E |
| Adapter, 50Ω | | Alignment | Boonton 91-8B |
| Oscilloscope | 500 kHz vertical bandwidth 1 mV vertical sensitivity | Trouble shooting and alignment | Tektronix Type 503 |
| Variac | Variable from 0 to 250 V ac | Power Supply checks | General Radio W3MT3W |
| Power Supply | -12 V to +12 V dc | AGC and AFC checks | Hewlett Packard 6206B |
| Signal Generator | 4.0 GHz output | Alignment | Hewlett Packard 8616A |
| Power Meter | 4.0 GHz, 10 mV minimum, full scale | Alignment | Hewlett Packard 431C |
| Counter | 160 MHz, 10 mV | Alignment | Hewlett Packard 5245L with 5253B Heterodyne Converter |
| Extender Card | | Trouble shooting | WJ-79645 |
| Assorted pads, connectors, cables, alignment tools | | Trouble-shooting and alignment | |

4.4.3 General Equipment Conditions. - Allow all test equipment to warm-up for a period of thirty minutes. It is recommended that all positions in the frame under test be occupied by a TH-Series Tuning Head and that all interface connections be made to duplicate the operation of the frame under actual conditions.

4.4.4 Power Supply Adjustment. - Adjustment procedures for the power supply voltages in the MTF-100A and MTF-102A Microwave Tuning Frames are presented below. Figure 4-1 shows the location of power supply adjustments and testpoints.

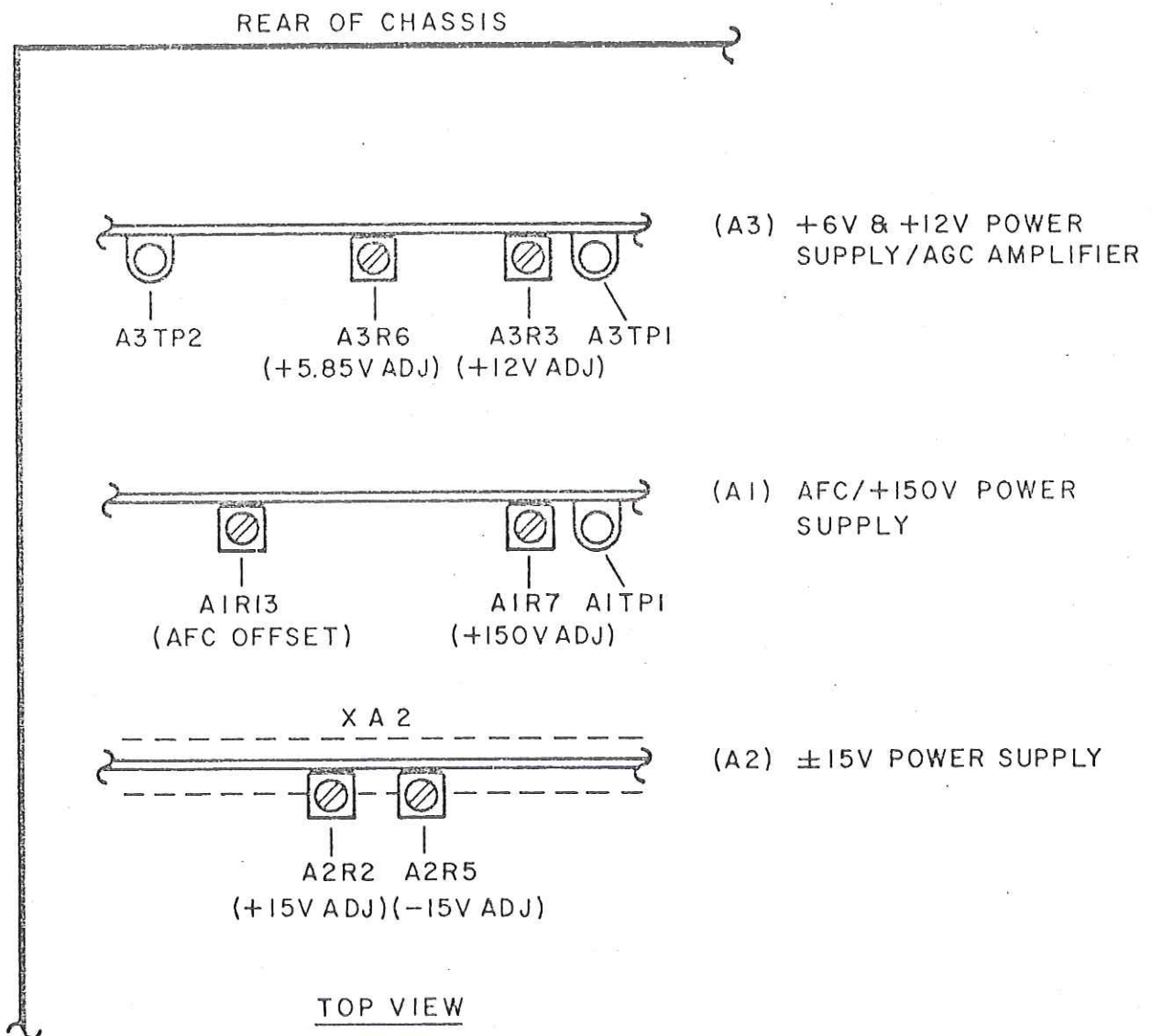


Figure 4-1. A1 - A3 Subassemblies, Test Point and Adjustment Locations

- (1) Assure that the rear panel switch S2 is set to match the voltage of the ac power source to be used.
- (2) Connect the Microwave Tuning Frame power input to the variac and maintain the line voltage at 115 V ac or 220 V ac as appropriate.
- (3) Set the Digital Voltmeter to read negative dc volts and connect it to XA2 pin 9. The reading should be -15 V dc, ± 0.75 V dc. If it is not, adjust A2R5 to obtain this reading.
- (4) Set the DVM to read positive dc volts and connect it to XA2 pin 20. The reading should be +15 V dc, ± 0.75 V dc. If it is not, adjust A2R2 to obtain this reading.
- (5) Connect the DVM to A1TP1. The reading should be +150 V dc, ± 5 V dc. If it is not, adjust A1R7 to obtain this reading.

CAUTION

Dangerous potentials exist at the A1 subassembly. The transistor case of A1Q1 is at +250 V dc. Do not attempt to feel the transistor case to determine the heat dissipation of A1Q1. De-energize the A1 subassembly before handling any of the mounted components.

- (6) Connect the DVM to A3TP1. The reading should be +12 V dc, ± 0.6 V dc. If it is not, adjust A3R3 to obtain this reading.
- (7) Connect the DVM to A3TP2. The reading should be 5.85 V dc, ± 0.6 V dc. If it is not, adjust A3R6 to obtain this reading.
- (8) Set the DVM to read ac volts and connect it to pin 15 of power transformer T1. The reading should typically be 5 V ac. No adjustment can be made.

CAUTION

Dangerous potentials exist on the power transformer terminals. Observe safety procedures when making readings.

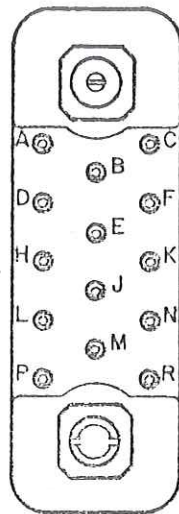
- (9) Connect the DVM to pin 17 of the power transformer T1. The reading should typically be 12 V ac. No adjustment can be made. Repeat for pin 19.
- (10) Connect the DVM to pin 12 of the power transformer T1. The reading should typically be 16 V ac. No adjustment can be made. Repeat for pin 14.
- (11) Adjust the line voltage to 125 V ac (voltage select switch, S2, at 115) or 250 V ac (voltage select switch, S2, at 220) and recheck the previous dc test points (steps 3 through 7) for proper regulation.
- (12) Adjust the line voltage to 105 V ac (voltage select switch, S2, at 115) or 210 V ac (voltage select switch, S2, at 220) and recheck the previous dc test points (steps 3 through 7) for proper regulation.

4.4.5 Voltage Continuity and Switching. - The following procedure can be used to check for suspected voltage continuity and switching problems. For the MTF-102A only the voltages at receptacle J4 are checked.

- (1) Disconnect the multipin interface power connector for the suspected tuning head and position and verify that the voltages given in Figure 4-2 are present at the receptacle pins. Assure that the TUNER SELECT switch is set to the corresponding position for the tuning head in question. The tuning head position/receptacle designations are given below.

| FRAME TYPE | TUNER POSITION | RECEPTACLE DESIGNATION |
|------------|----------------|------------------------|
| MTF-100A | 1 | J8 |
| MTF-100A | 2 | J10 |
| MTF-101 | 3 | J8 |
| MTF-101 | 4 | J9 |
| MTF-102A | -- | J4 |

- (2) Verify that the voltage at pin A of the receptacle is 5 V ac for all positions where TUNER SELECT switch does not correspond with the receptacle position.
- (3) If a faulty TUNER SELECT switch is suspected, repeat the above checks for the other tuning head positions.



| PIN | A | B | C | D | E | F | H | J | K | L | N | P | R |
|---------|----------|------|---------|--------|--------|--------|-----|-----|-----|-------|---|---|-------|
| VOLTAGE | +5.85Vdc | 5Vac | +150Vdc | +12Vdc | +15Vdc | -15Vdc | GND | AGC | AFC | 16Vac | | | 12Vac |

Figure 4-2. Tuner Power Interface Receptacle Pins and Associated Voltages

4.4.6 AFC Test. - Use the following procedure to align and test the AFC circuitry in the MTF-100A and MTF-102A Microwave Tuning Frames. To check for continuity of the AFC voltage, refer to Figure 4-2.

- (1) Set the front panel FINE TUNING potentiometer so that the digital voltmeter indicates +11.2 V dc at XA1 pin 17. Set the ON/AFC switch to the ON position.
- (2) Connect the power supply to AFC IN jack J5 on the MTF-100A or MTF-102A. Monitor the supply output with the digital voltmeter and set the power supply for +1.00 V dc.
- (3) Measure the dc voltage at XA1 pin 20. It should be between zero and +2 V dc (with circuit board jumpers connecting E1 to E3).
- (4) Set the power supply to -1.00 V dc.
- (5) Measure the dc voltage at XA1 pin 20. It should be +14.0 V dc \pm 2.0 V dc (with circuit board jumpers connecting E1 to E3).

- (6) For A1 subassemblies with circuit board jumpers connecting E3 to E2, reverse the readings obtained in steps 3 and 5.
- (7) If the correct readings above were not obtained, proceed as follows: Assure that the FINE TUNING potentiometer is set midrange and the AFC switch is ON. Disconnect the power supply input to AFC IN jack J5 and apply a ground to jumper terminal E3 of the A1 subassembly. Measure the voltage at pin 6 of A1U2 with the DVM. A reading of 0.0 volts should be obtained. If not, adjust A1R13 (shown in Figure 4-1) to obtain this reading. Remove the ground from jumper terminal A1E3 and repeat checks 2, 3, 4 and 5 above.

4.4.7 FINE TUNING Test. - To check the FINE TUNING operation in the MTF-100A and MTF-102A Microwave Tuning Frames follow the procedure outlined below.

- (1) Set the front panel ON/AFC switch to the Off position.
- (2) Set the front panel FINE TUNING control maximum clockwise.
- (3) Set the DVM to read positive dc volts and connect it to XA1 pin 20. The reading should be a minimum of +2.0 V dc and a maximum of +5.0 V dc.
- (4) Set the front panel FINE TUNING control maximum counter-clockwise.
- (5) The DVM reading should be a minimum of +7.0 V dc and a maximum of +10.0 V dc.
- (6) Verify continuity by checking the voltage at pin K of the tuner power interface receptacle for each tuning head position per paragraph 4.4.5 step (1).

4.4.8 AGC Test. - Use the following procedure to test the AGC operation in the MTF-100A and MTF-102A Microwave Tuning Frames. For A3 subassemblies (+6 V and +12 V power supply/AGC amplifier) with circuit board jumpers connecting E2 to E3 and E5 to E6, follow steps 1 and 2 of this procedure. For A3 subassemblies with circuit board jumpers connecting E2 to E1 and E4 to E6, follow steps 3 and 4 of this procedure.

- (1) Set the power supply for +4.0 V dc using the digital volt-meter and connect it to AGC IN jack J6 on the rear panel of the frame.
- (2) Set the DVM to read positive dc volts and connect it to XA3, pin 18. The reading should be +4.00 V dc \pm 0.25 V dc. Now vary the power supply voltage output from +10 V dc to +1 V dc. The DVM reading should follow.
- (3) Set the power supply for -6.00 and connect it to AGC IN jack J6 on the rear panel of the frame.
- (4) Set the DVM to read positive dc volts and connect it to XA3, pin 18. The reading should be +4 V dc \pm 1.0 V dc. Now vary the power supply voltage output from zero volts to -12 V dc. The DVM reading should be approximately 10 V more positive than the power supply voltage.

4.4.9 Cable Insertion Loss. - The following procedure is used to check a suspected fault in a signal cable in the MTF-100A, -101, or -102A Microwave Tuning Frames. The maximum cable insertion loss should not be greater than 1.0 dB.

- (1) RF cables. Set the signal generator frequency to 4.0 GHz and measure the output with a properly terminated power meter. Adjust the signal generator for a CW output of -10 dBm. Connect the suspected cable to the signal generator and note the output of the cable. If a reading below -11 dBm is present, a malfunction exists.
- (2) IF cables. Follow the procedure above with the signal generator frequency set to 160 MHz.
- (3) Check each cable listed below as described in (1) and (2) above.

| FRAME TYPE | FROM | TO | FREQUENCY (RF - 4.0 GHz, IF - 160 MHz) |
|------------|------|----|---|
| MTF-100A | J1 | P5 | RF |
| MTF-100A | J2 | P6 | RF |
| MTF-100A | J3 | P7 | RF |
| MTF-100A | J4 | P8 | RF |
| MTF-101 | J1 | P1 | RF |
| MTF-101 | J2 | P2 | RF |
| MTF-101 | J4 | P4 | RF |

| FRAME TYPE | FROM | TO | FREQUENCY (RF - 4.0 GHz, IF - 160 MHz) |
|------------|------|----|---|
| MTF-101 | J5 | P5 | RF |
| MTF-101 | J3 | P3 | IF |
| MTF-101 | J6 | P6 | IF |
| MTF-102A | J1 | P7 | RF |
| MTF-102A | J2 | P8 | RF |

4.4.10 MTF-100A IF Coupler/Converter Test. - This paragraph describes the procedure for checking the overall performance on the IF coupler/converter section subassemblies A4 and A5, in the MTF-100A. For detailed alignment and/or troubleshooting of this section refer to paragraphs 4.4.12 and 4.5.2.

- (1) Set up the equipment as shown by the dotted line in Figure 4-3.

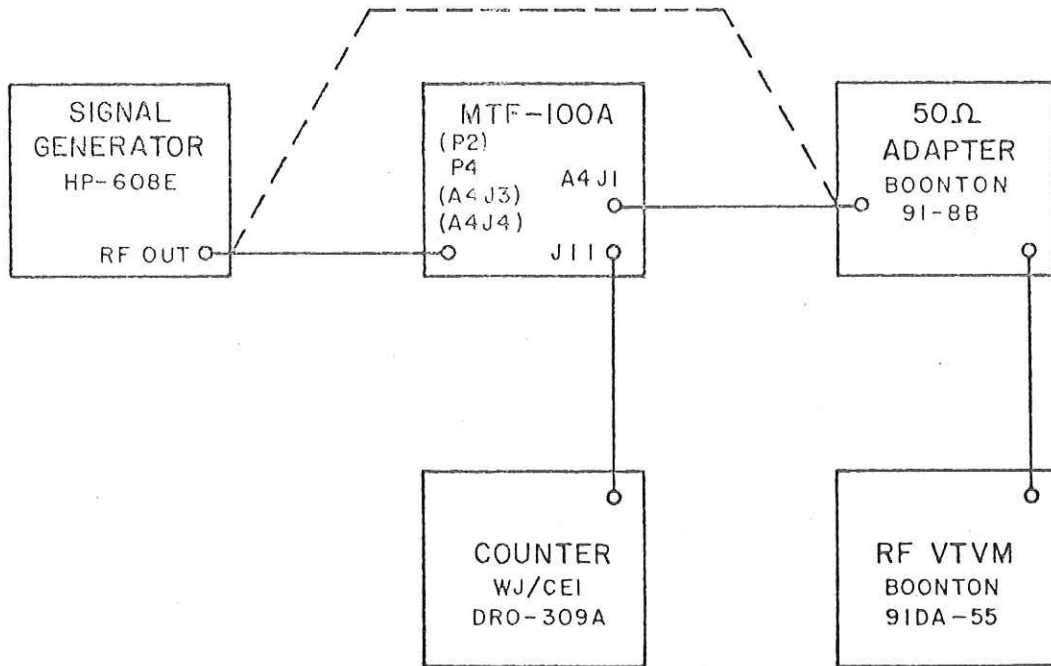


Figure 4-3. Test Setup, MTF-100A IF Coupler/Converter

- (2) Set the signal generator for 160.000 MHz \pm 1 kHz, CW, approximately -30 dBm. Use the counter at the signal generator at the UNCAL jack to set the frequency.
- (3) Adjust the generator output level for a convenient reference on the RF VTVM.
- (4) Connect the RF output of the signal generator to P4 of the MTF-100A. Complete the equipment set up as shown by the solid line in Figure 4-3.
- (5) Set the front panel TUNER SELECT switch to the TUNER 1 position.
- (6) Measure the loss from P4 (IF output, TUNER 1) to A4J1 (160 MHz IF OUT). The loss should be no greater than 6 dB.
- (7) Connect the signal generator to the other tuner IF output jacks (P2, A4J3, A4J4) in turn. The RF VTVM reading should be at least 20 dB below the reading obtained in step 6. This checks the isolation of the IF coupler.
- (8) Connect the signal generator to P2 (TUNER 2 IF OUT), A4J3 (TUNER 3 IF OUT), A4J4 (TUNER 4 IF OUT) and, in turn verify the loss to A4J1 (160 MHz IF OUT) and the isolation of the tuner IF when not selected by the front panel switch.
- (9) Check the frequency at J11, 21.4 MHz IF OUT. It should be 21.400 MHz \pm 3 kHz.
- (10) Remove the counter from J11 and connect the 50 Ω adapter and RF VTVM to J11.
- (11) Measure the insertion loss from P2, P4, A4J3, and A4J4 to J11. It should be typically 4 dB.

4.4.11 MTF-102A IF Coupler/Converter Test. - This paragraph describes the procedure for checking the overall performance of the IF coupler/converter section, subassemblies A4 and A5, in the MTF-102A. For detailed alignment and/or troubleshooting of this section, refer to paragraphs 4.4.12 and 4.5.2.

- (1) Set up the equipment as shown by the dotted line in Figure 4-4.

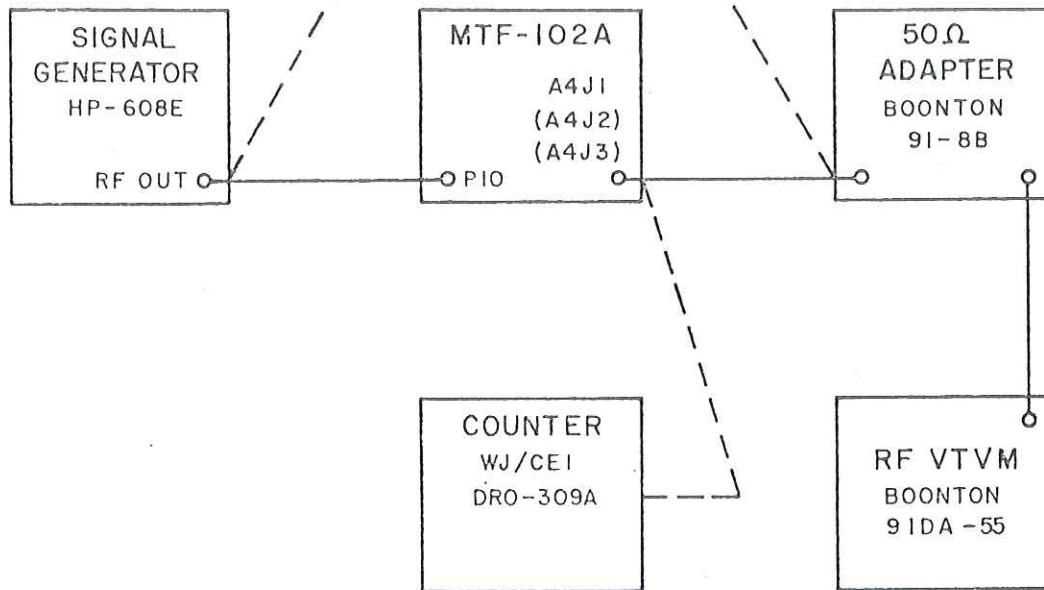


Figure 4-4. Test Setup, MTF-102A IF Coupler/Converter Tests

- (2) Set the signal generator for 160.000 MHz \pm 1 kHz, CW, approximately -30 dBm. Use the counter at the signal generator UNCAL jack to set the frequency.
- (3) Adjust the generator output level for a convenient reference on the RF VTVM.
- (4) Connect the equipment as shown by the solid line in Figure 4-4.
- (5) Measure the insertion loss from P10 (tuner IF out) to A4J1 (160 MHz IF OUT). It should be typically 5 dB or less.
- (6) Measure the insertion loss from P10 to A4J2 (SM OUT). It should be typically 13 dB.
- (7) Measure the insertion loss from P10 to A4J3 (21.4 MHz IF OUT). It should be typically 4 dB.
- (8) Measure the frequency at A4J3. It should be 21.400 MHz \pm 3 kHz. Increase the signal generator output level as necessary to obtain the frequency reading.

4.4.12 MTF-100A and MTF-102A 160/21.4 MHz Converter Alignment. - This paragraph describes the adjustments required for the A5 subassembly in the MTF-100A and -102A after changing the LO transistor A5Q2, the voltage amplifier transistor A5Q1, or associated circuit components.

- (1) Set the signal generator for 160.000 MHz \pm 1 kHz, CW, -20 dBm. Set the frequency with the counter at the signal generator UNCAL jack. Calibrate the level with the RF VTVM. Connect the signal to A5J1 (160 MHz IF IN).
- (2) Connect the frequency counter to A5J2 (21.4 MHz IF OUTPUT).
- (3) Vary A5C3 to obtain 21.400 MHz.
- (4) Connect the RF VTVM to A5J2.
- (5) Vary A5C9 for the peak reading.
- (6) Adjust A5R17 for -17 dBm (3 dBm gain) from A5J1 to A5J2.

4.5 TROUBLESHOOTING

4.5.1 Localizing Troubles. - The troubles that can arise in a MTF-100A and MTF-101 system may be divided into two categories; partial and total. Partial troubles include improper operation of only one tuning head position, improper AGC or AFC, etc. Troubleshooting in this case is usually straightforward. In the case of a total lack of output, however, systematic elimination on a block diagram level will be necessary. The troubleshooting techniques for the MTF-102A are somewhat more difficult because the tuning head positions cannot be switched to aid in isolating the trouble. The first effort should be to eliminate possible troubles in the external equipment and the installed tuning heads before the frame is suspected. The adjustment and test procedures in section 4.4 were specifically written to aid in localizing troubles. Additional aids are provided in the troubleshooting charts, Tables 4-1, 4-2, and 4-3, which list typical malfunctions in the MTF-100A, MTF-101, and MTF-102A Microwave Tuning frames, respectively. Typical transistor and integrated circuit voltages are given in Table 4-4.

4.5.2 Subassembly Removal, Repair, and Replacement. - The power supply/AGC/AFC subassemblies in the MTF-100A and MTF-102A can be easily removed by simply pulling them from the receptacles in which they are mounted. Simple hand tools can be used to remove brass subassem-

blies and the printed circuit boards inside each one. When removing components from a printed circuit board for inspection or replacement, be especially careful not to damage the bonding between the foil conductors and the fiberglass board. The soldering iron should be no larger than 40 watts, and a solder sipper or wicking should be employed in removing solder. Keep the length of time of soldering iron tip contact to the printed foil as short as possible. Use heatsinking on the semiconductor leads to prevent damage. In returning components to the board, make sure the holes are clear and be careful that the leads do not catch the edge of the printed conductor and lift it from the board. A good grade of rosin core 60/40 solder should be used.

Table 4-1. MTF-100A Troubleshooting Chart

| SYMPTOMS OBSERVED | PROBABLE CAUSE | DIAGNOSTIC PROCEDURE |
|--|---|---|
| PUSH ON/OFF POWER switch S4 does not light. Tuning head dials do not light in any position of TUNER SELECT switch. | Power Supply Section | Check AC power input connection. Check F1 and F2. Check S1. |
| All tuning heads totally inoperative. | Power Supply Section. | Perform power supply checks per 4.4.4. |
| | TUNER SELECT switch, S4. | Check switch per 4.4.5. |
| | Subassembly A4, IF Coupler. | Check A4 subassembly per 4.4.10. |
| | Subassembly A5, 160/21.4 MHz Converter. | Check A5 subassembly per 4.4.10. |
| No FINE TUNING control in any head position. | FINE TUNING potentiometer, R3. | Check voltage at wiper arm of R3. |
| | Subassembly A1. | Check A1 subassembly per 4.4.7. |
| Improper AFC operation in all tuning head positions. FINE TUNING control, OK. | Demodulator defective. | Check demodulator by substitution, if possible. |
| | ON/AFC switch. | Check ON/AFC switch, S3. |

Table 4-1. MTF-100A Troubleshooting Chart (Continued)

| SYMPTOMS OBSERVED | PROBABLE CAUSE | DIAGNOSTIC PROCEDURE |
|--|--|---|
| Improper AGC operation in all tuning head positions. | A1 subassembly defective or not properly jumpered. | Perform A1 subassembly checks per 4.4.6. Check for proper jumpering as given in note 5 of Figure 6-1. |
| | Demodulator defective. | Check demodulator by substitution, if possible. |
| Improper operation of only one tuning head position. | A3 subassembly defective or not properly jumpered. | Perform A3 subassembly checks per 4.4.8. Check for proper jumpering as given in note 6 of Figure 6-3. |
| | Defective tuning head. | Replace tuning head or move tuning head to another position. If trouble also moves, it is in the tuning head. |
| | TUNER SELECT switch. | Perform switch checks per 4.4.5. |
| | Subassembly A4, IF coupler. | Check diodes A4CR1 through A4CR4 with ohmmeter. Check +15 V dc on IF select lines to A4 subassembly. |
| | Signal cable routing. | Check RF and IF cables per 4.4.9. |

Table 4-2. MTF-101 Troubleshooting Chart

| SYMPTOMS OBSERVED | PROBABLE CAUSE | DIAGNOSTIC PROCEDURE |
|--|--|---|
| TUNERS 3 and 4 both inoperative. TUNERS 1 and 2 in MTF-100A both OK. | Interconnecting wiring between MTF-100A and MTF-101. | Check for proper voltages at J8 and J9 per 4.4.5. Check RF and IF cables per 4.4.9. |

Table 4-2. MTF-101 Troubleshooting Chart (Continued)

| SYMPTOMS OBSERVED | PROBABLE CAUSE | DIAGNOSTIC PROCEDURE |
|--|---|--|
| Improper operation of only one tuning head position. | Defective tuning head. | Replace tuning head or move tuning head to the other position. If trouble also moves it is in the tuning head. |
| | TUNER SELECT switch. | Perform switch check per 4.4.5. |
| | Subassembly A4, IF coupler in MTF-100A. | Perform IF coupler check per 4.4.10. Check for +15 V dc on proper IF select line. |
| | RF or IF cable. | Check RF and IF cables per 4.4.9. |

Table 4-3. MTF-102A Troubleshooting Chart

| SYMPTOMS OBSERVED | PROBABLE CAUSE | DIAGNOSTIC PROCEDURE |
|--|---|---|
| PUSH ON/OFF POWER switch does not illuminate. Tuning head totally inoperative. | Power Supply Section. | Check ac power input connection. Check F1 and F2. Check S1. |
| No 160 MHz IF output. No 21.4 MHz IF output. | Tuning head defective. | Check LO OUT and ANALOG TUNE OUT. |
| | Power Supply Section. | Check power supply per 4.4.5. |
| | RF or IF cable. | Check RF and IF cables per 4.4.9. |
| 21.4 MHz IF output missing or unstable. 160 MHz IF output OK. | Subassembly A5, 21.4/160 MHz converter. | Perform converter checks per 4.4.11 and 4.4.12. |

Table 4-3. MTF-102A Troubleshooting Chart (Continued)

| SYMPTOMS OBSERVED | PROBABLE CAUSE | DIAGNOSTIC PROCEDURE |
|---|---|---|
| <p>Improper AFC operation, FINE TUNING control OK.</p> <p>Improper AGC operation.</p> | <p>Demodulator defective.</p> | <p>Check demodulator by substitution, if possible. Check ON/AFC switch, S3. Perform A1 subassembly checks per 4.4.6. Check for proper jumpering as given in note 5 of Figure 6-1.</p> |
| | <p>Defective demodulator.</p> <p>A3 subassembly defective or not properly jumpered.</p> | <p>Check demodulator by substitution, if possible.</p> <p>Perform A3 subassembly checks per 4.4.8. Check for proper jumper connections as given in note 6 of Figure 6-3.</p> |
| | <p>Tuning head defective.</p> | <p>Repair tuning head.</p> |

Table 4-4. Typical Transistor and Integrated Circuit Pin Voltages

| | | Integrated Circuit Pin Numbers | | | | | | | | | | | | | |
|---|------------|--------------------------------|--------|----------|--------|--------|---------|---------------------|---------|-----------|---------|--------|--------|--------|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Ref. Desig. | Type | Field Effect Transistor Pins | | | | | | Transistor Elements | | | | | | | |
| | | Drain | Gate 2 | Gate 1 | Source | | | Emitter | Base | Collector | | | | | |
| Q1 | 2N3055 | | | | | | | | + 11.96 | + 12.39 | + 22.16 | | | | |
| Q1 | 2N3055 | | | | | | | + 5.84 | + 6.09 | + 22.16 | | | | | |
| A1Q1 | 2N4064 | | | | | | | +150.2 | +150.7 | +245.6 | | | | | |
| A1Q2 | 2N929 | | | | | | | +150.1 | +150.2 | +151.3 | | | | | |
| A1Q3 | 2N3440 | | | | | | | + 15.03 | + 15.54 | +149.3 | | | | | |
| A1Q4 | U1899E | varies | | ** -14.6 | varies | | | | | | | | | | |
| | | varies | | ***0.0 | varies | | | | | | | | | | |
| A1U2 | USB7741393 | -15.0 | 0.0 | 0.0 | -15.0 | -15.0 | 0(var)* | +15.0 | | | | | | | |
| A1U3 | USB7741393 | -15.0 | 0.0 | 0.0 | -15.0 | -15.0 | 0.0 | +15.0 | + 15.0 | + 15.4 | + 24.9 | +24.75 | +16.78 | | |
| A2Q1 | 2N3055 | | | | | | | | + 0.6 | + 0.0 | + 8.5 | + 8.50 | - 0.28 | | |
| A2Q2 | 2N3055 | | | | | | | | | | + 15.4 | + 15.4 | + 8.50 | | |
| A2U2 | U6A7723393 | --- | +15.0 | +14.98 | + 7.19 | + 7.19 | +7.19 | 0.0 | --- | --- | 0.0 | +22.06 | +22.06 | +13.05 | |
| A2U4 | U6A7723393 | --- | 0.0 | 0.0 | - 7.98 | - 7.98 | -7.98 | -15.0 | --- | --- | + 12.39 | +22.06 | +22.06 | + 6.47 | |
| A3U1 | U6A7723393 | --- | +11.96 | +11.96 | +12.0 | + 7.14 | +7.14 | 0.0 | --- | --- | + 22.06 | +22.06 | +22.06 | | |
| A3U2 | U6A7723393 | --- | + 5.84 | + 5.85 | +12.0 | + 5.85 | +7.17 | 0.0 | --- | --- | + 22.06 | +22.06 | +22.06 | | |
| A3U3 | USB7741393 | | | | | | | | | | | | | | |
| (+4.00 V dc AGC IN, J6, E2 to E3, E5 to E6) | | | + 4.00 | + 3.98 | -15.00 | -15.00 | +4.00 | +15.00 | | | | | | | |
| (-6.00 V dc AGC IN, J6, E2 to E1, E4 to E6) | | | + 3.89 | + 3.71 | -15.00 | -15.00 | | +15.00 | | | | | | | |
| A5AIQ1 | 2N5109 | | | | | | | | - 7.41 | - 6.45 | - 0.75 | | | | |
| A5AIQ2 | 2N3478 | | | | | | | | - 9.90 | - 9.25 | - 0.07 | | | | |

* Depends on AFC voltage at J5. See Text.

** AFC ON

*** AFC OFF

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:

A1 R1

| | |
|----------------------------|--------------------------|
| Subassembly Designation | Class and No. of Item |
|----------------------------|--------------------------|

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

As shown on the main chassis schematic, components which are an integral part of the main chassis have no 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

| <u>Mfr. Code</u> | <u>Name and Address</u> | <u>Mfr. Code</u> | <u>Name and Address</u> |
|----------------------|--|----------------------|--|
| 00779 | AMP, Incorporated P. O. Box 3608 Harrisburg, Pennsylvania 17105 | 04713 | Motorola Semiconductor Products, Inc. 5005 East McDowell Road Phoenix, Arizona 85008 |
| 01121 | Allen-Bradley Company 1201 South 2nd Street Milwaukee, Wisconsin 53212 | 07263 | Fairchild Camera and Instrument Corp. Semiconductor Division 464 Ellis Street Mountain View, California 94040 |
| 02735 | RCA Corporation Solid State Division Route 202 Somerville, New Jersey 08876 | 09353 | C and K Components, Inc. 103 Morse Street Watertown, Massachusetts 02172 |

| <u>Mfr. Code</u> | <u>Name and Address</u> | <u>Mfr. Code</u> | <u>Name and Address</u> |
|------------------|--|------------------|--|
| 11139 | Deutsch Company Electronic Component Division Municipal Airport Banning, California 92220 | 27956 | Relcom 2329 Charleston Road Mountain View, California 94040 |
| 13103 | Thermalloy Company 8717 Diplomacy Row Dallas, Texas 75247 | 49956 | Raytheon Company 141 Spring Street Lexington, Massachusetts 02173 |
| 14632 | Watkins-Johnson Co., CEI Div. 700 Quince Orchard Road Gaithersburg, Maryland 20760 | 50140 | K and L Microwave, Inc. 203 Newton Street Salisbury, Maryland 21801 |
| 15818 | Teledyne Semiconductor 1300 Terra Bella Avenue Mountain View, California 94040 | 56289 | Sprague Electric Company Marshall Street North Adams, Massachusetts 01247 |
| 16179 | Omni-Spectra, Incorporated 24600 Hallwood Court Farmington, Michigan 48024 | 71279 | Cambridge Thermionic Corporation 455 Concord Avenue Cambridge, Massachusetts 02138 |
| 19505 | Applied Engineering Products Co. Division of Samarius Inc. 26 East Main Street Ansonia, Connecticut 06401 | 71400 | Bussman Manufacturing Division of McGraw-Edison Company 2536 West University Street St. Louis, Missouri 63107 |
| 21604 | The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207 | 71785 | Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624 |
| 25088 | Siemens America, Inc. 350 5th Avenue New York, New York 10001 | 72136 | Electro Motive Manufacturing Co., Inc. South Park & John Streets Willimantic, Connecticut 06226 |
| 26805 | American Microwave Industries, Inc. 87 Rumford Avenue Waltham, Massachusetts 02154 | 72259 | Nytronics, Inc. 10 Pelham Parkway Pelham Manor, New York 10803 |

WJ
85

| <u>Mfr. Code</u> | <u>Name and Address</u> | <u>Mfr. Code</u> | <u>Name and Address</u> |
|----------------------|--|----------------------|---|
| 72982 | Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512 | 81349 | Military Specifications |
| 73138 | Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, California 92634 | 82389 | Switchcraft, Inc. 5555 North Elston Avenue Chicago, Illinois 60630 |
| 74868 | Bunker Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810 | 87034 | Marco-Oak Industries, Division of Oak Electro/Netics Corporation 207 South Helena Street Anaheim, California 92803 |
| 75042 | IRC Division of TRW Incorporated 401 North Broad Street Philadelphia, Pennsylvania 19108 | 91418 | Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646 |
| 75915 | Littelfuse, Incorporated 800 East Northwest Highway Des Plaines, Illinois 60016 | 91506 | Augat, Incorporated 33 Perry Avenue Attleboro, Massachusetts 02703 |
| 80058 | Joint Electronics Type Designation System | 93332 | Sylvania Electric Products, Inc. Semiconductor Products Division 100 Sylvan Road Woburn, Massachusetts 01801 |
| 80131 | Electronic Industries Association 2001 Eye Street N. W. Washington, D. C. 20006 | 93459 | Weinschel Engineering Company Clopper Road Gaithersburg, Maryland 20760 |
| 81312 | Winchester Electronics Division Litton Industries, Incorporated Oakville, Connecticut 06779 | 93958 | Republic Electronics Corporation 176 East 7th Street Paterson, New Jersey 07524 |
| | | 99800 | American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, New York 14052 |

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 part. In the case of components defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

NOTE

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

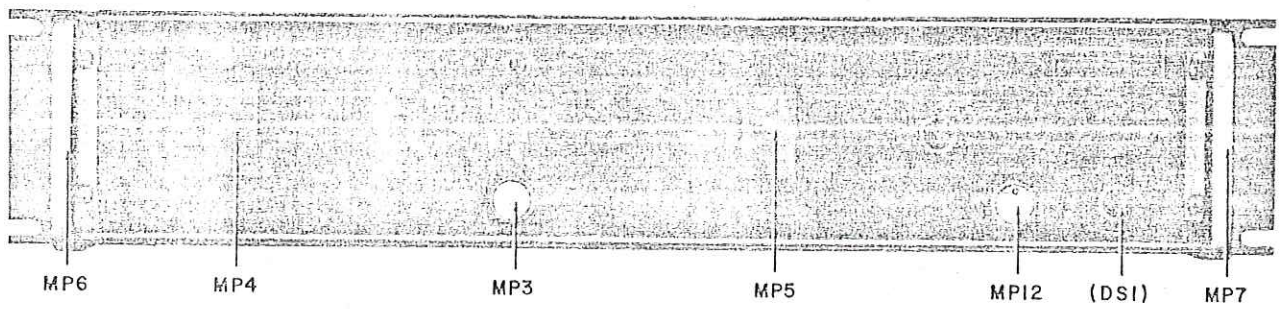


Figure 5-1. Type MTF-100A Microwave Tuning Frame,
Front View, Location of Components.

5.4.1 Type MTF-100A Microwave Tuning Frame, Main Chassis

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---|---------------------|----------------------------|--------------|---|
| AT1 | TERMINATION | 2 | CT-NM | 93459 | Courtesy of http://BlackRadios.terryo.org |
| AT2 | Same as AT1 | | | | |
| A1 | AFC/+150V POWER SUPPLY | 1 | 76228 | 14632 | |
| A2 | +15V POWER SUPPLY | 1 | 76210-1 | 14632 | |
| A3 | +6V & +12V POWER SUPPLY | 1 | 76229 | 14632 | |
| A4 | IF COUPLER | 1 | 791168 | 14632 | |
| A5 | 160-21.4 MHz CONVERTER | 1 | 791169 | 14632 | |
| C1 | CAPACITOR, ELECTROLYTIC, ALUMINIM: 40 μ F, -10+50%, 350V | 2 | 39D406F350GL4 | 56289 | |
| C2 | Same as C1 | | | | |
| C3 | CAPACITOR, ELECTROLYTIC, ALUMINUM: 1100 μ F, -10+75%, 40V | 2 | 39D118G040HL4 | 56289 | |
| C4 | Same as C3 | | | | |
| C5 | CAPACITOR, ELECTROLYTIC, ALUMINUM: 2200 μ F, -10+75%, 25V | 1 | 39D228G025HP4 | 56289 | |
| C6 | CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μ F, 10%, 35V | 1 | CS13BF476K | 81349 | |
| DS1 | LAMP, NEON Part of S1 | 1 | A1H | 87034 | |
| FL1 | FILTER, LOW PASS | 1 | JN33-694B | 56289 | |
| FL2 | FILTER, LOW PASS | 1 | 2L250-210-0 | 50140 | |
| F1 | FUSE, CARTRIDGE: 3/4 AMP, 3 AG | 1 | MDL3/4 | 71400 | |
| F2 | FUSE, CARTRIDGE: 3/8 AMP, 3 AG | 1 | MDL3/8 | 71400 | |
| J1 | CONNECTOR, RECEPTACLE Part of W3 | 3 | 3004-7141-10 | 26805 | |
| J2 | Same as J1 Part of W4 | | | | |
| J3 | Same as J1 Part of W5 | | | | |

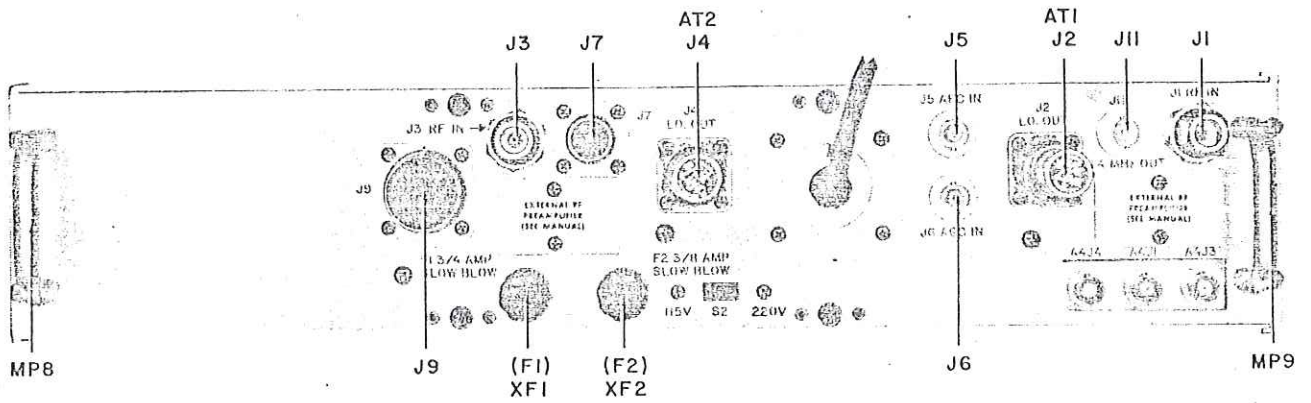


Figure 5-2. Type MTF-100A Microwave Tuning Frame, Rear View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|-----------------------|---------------------|----------------------------|--------------|---|
| J4 | Same as J1 | 3 | I7825-1002 | 74868 | Courtesy of http://BlackRadios.terry.org |
| J5 | CONNECTOR, RECEPTACLE | | | | |
| J6 | Same as J5 | 1 | DS00-7S | 11139 | |
| J7 | CONNECTOR, RECEPTACLE | 2 | SLE14SNSS | 81312 | |
| J8 | CONNECTOR, RECEPTACLE | 1 | DS00-27S | 11139 | |
| J9 | CONNECTOR, RECEPTACLE | | | | |
| J10 | Same as J8 | | | | |
| J11 | Same as J5 | | | | |
| MP1 | CRANK ASSEMBLY | 2 | I1755-5 | 14632 | |
| MP2 | Same as MP1 | | | | |
| MP3 | KNOB | 1 | PS70PL2 (GREY) | 21604 | |
| MP4 | WINDOW | 2 | I1448-3 | 14632 | |
| MP5 | Same as MP4 | | | | |
| MP6 | HANDLE | 2 | 32306-2 | 14632 | |
| MP7 | Same as MP6 | | | | |
| MP8 | HANDLE | 2 | 415-1250-01-02-00 | 71279 | |
| MP9 | Same as MP8 | | | | |
| MP10 | COVER | 2 | 30625-8 | 14632 | |
| MP11 | Same as MP10 | | | | |
| MP12 | KNOB | 1 | PS70D2 (GREY) | 21604 | |
| P1 | CONNECTOR, PLUG | 4 | 521-3 | 16179 | |

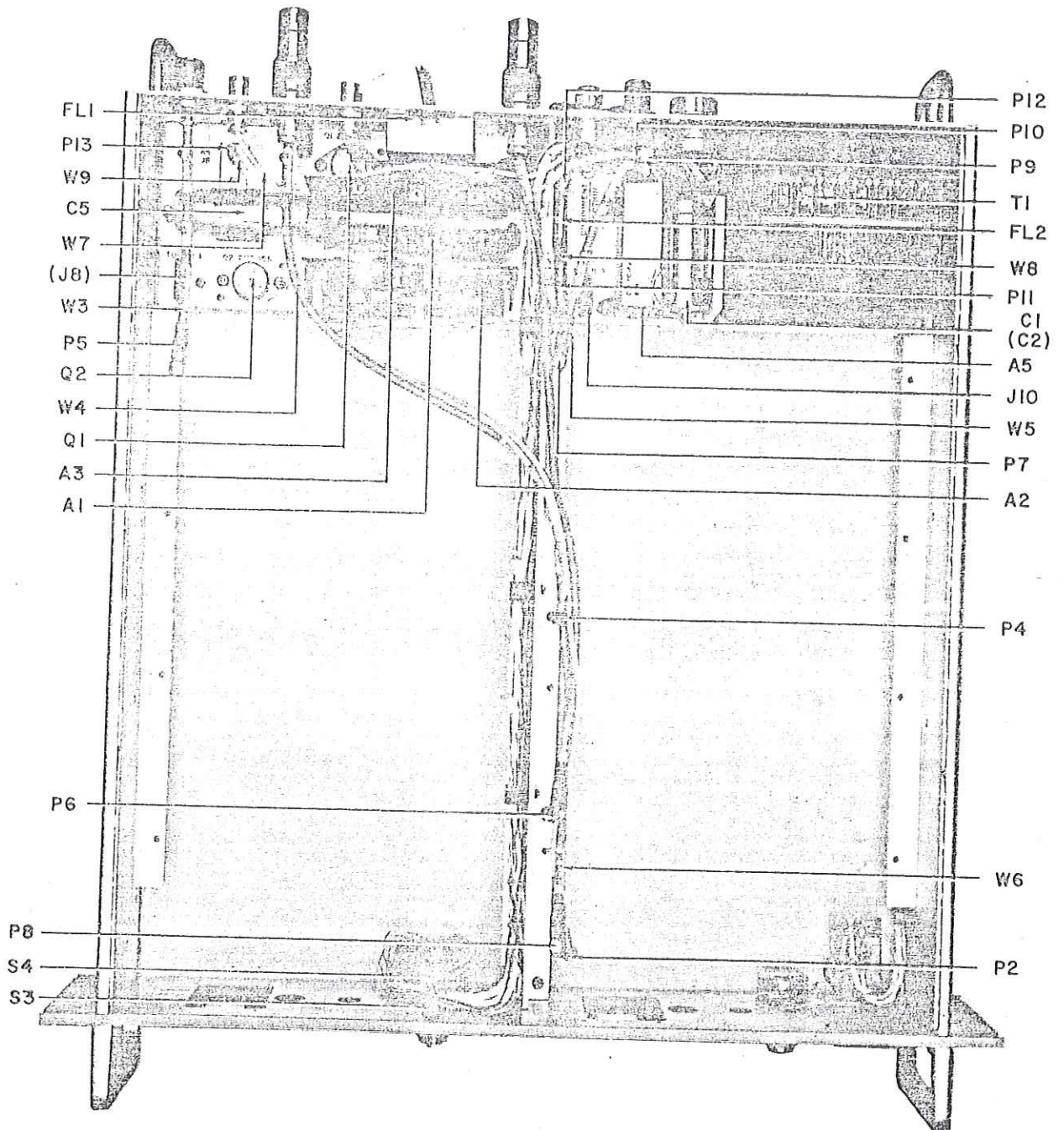


Figure 5-3. Type MTF-100A Microwave Tuning Frame, Top View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|--|---------------------|----------------------------|--------------|-----------------|
| P2 | CONNECTOR, PLUG | 2 | UG-1466/U | 80058 | 74868 |
| P3 | Same as P1 | | | | |
| P4 | Same as P2 | | | | |
| P5 | CONNECTOR, PLUG | 2 | 501-1 | 16179 | |
| P6 | CONNECTOR, PLUG | 2 | 521-1 | 16179 | |
| P7 | Same as P5 | | | | |
| P8 | Same as P6 | | | | |
| P9 | CONNECTOR, PLUG | 3 | UG-1465/U | 80058 | 74868 |
| P10 | Same as P9 | | | | |
| P11 | Same as P1 | | | | |
| P12 | Same as P1 | | | | |
| P13 | Same as P9 | | | | |
| Q1 | TRANSISTOR | 2 | 2N3055 | 80131 | 04713 |
| Q2 | Same as Q1 | | | | |
| R1 | RESISTOR, FIXED, COMPOSITION: 27 k Ω , 5%, 1/2W | 1 | RCR20G273JS | 81349 | 01121 |
| R2 | RESISTOR, FIXED, COMPOSITION: 10 k Ω , 5%, 1/4W | 1 | RCR07G103JS | 81349 | 01121 |
| R3 | RESISTOR, VARIABLE, COMPOSITION: 10 k Ω , 10%, 2W | 1 | RV4NA YSD103A | 81349 | 01121 |
| R4 | RESISTOR, FIXED, COMPOSITION: 1.0 Ω , 5%, 1/2W | 2 | RCR20G1R0JS | 81349 | 01121 |
| R5 | Same as R4 | | | | |
| S1 | SWITCH, PUSH | 1 | 671-6A1H | 87034 | |
| S2 | SWITCH, SLIDE | 1 | 11A1211 | 82389 | |

Courtesy of <http://BlackRadios.terry.org>

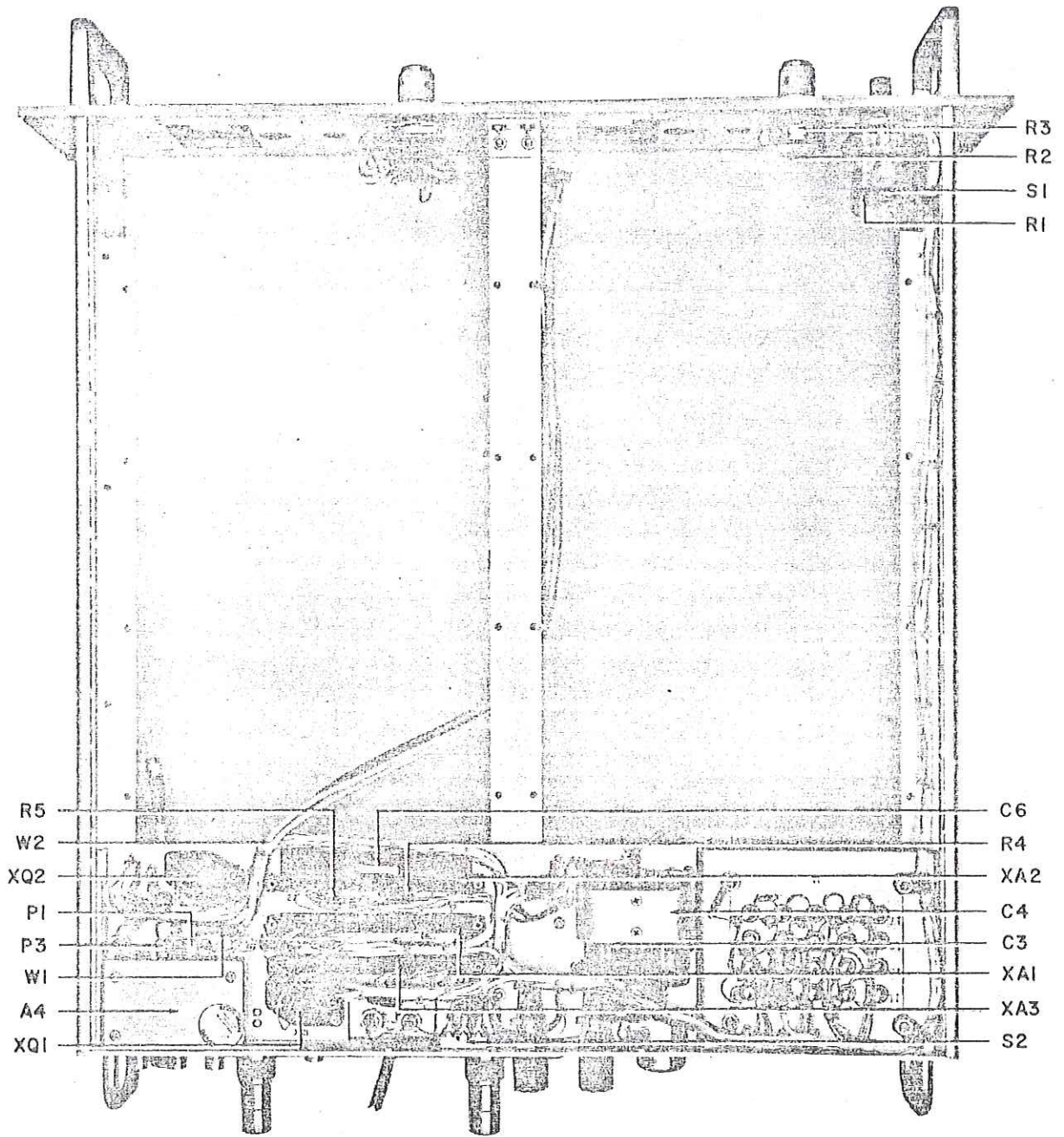


Figure 5-4. Type MTF-100A Microwave Tuning Frame,
Bottom View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---------------------------------|---------------------|----------------------------|--------------|---|
| S3 | SWITCH, TOGGLE | 1 | 7101 | 09353 | Courtesy of http://BlackRadios.terry.org |
| S4 | SWITCH, ROTARY | 1 | 1128-59 | 14632 | |
| T1 | TRANSFORMER, POWER | 1 | 16587 | 14632 | |
| W1 | CABLE ASSEMBLY | 1 | 30020-1832 | 14632 | |
| W2 | CABLE ASSEMBLY | 1 | 30020-1833 | 14632 | |
| W3 | CABLE ASSEMBLY | 1 | 30020-1834 | 14632 | |
| W4 | CABLE ASSEMBLY | 1 | 30020-1835 | 14632 | |
| W5 | CABLE ASSEMBLY | 1 | 30020-1836 | 14632 | |
| W6 | CABLE ASSEMBLY | 1 | 30020-1837 | 14632 | |
| W7 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W8 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W9 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| XA1 | CONNECTOR, PRINTED CIRCUIT CARD | 3 | 250-22-30-170 | 71785 | |
| XA2 | Same as XA1 | | | | |
| XA3 | Same as XA1 | | | | |
| XF1 | FUSEHOLDER | 2 | 357001 | 75915 | |
| XF2 | Same as XF1 | | | | |
| XQ1 | SOCKET, TRANSISTOR | 2 | 8038-1G1 | 91506 | |
| XQ2 | Same as XQ1 | | | | |

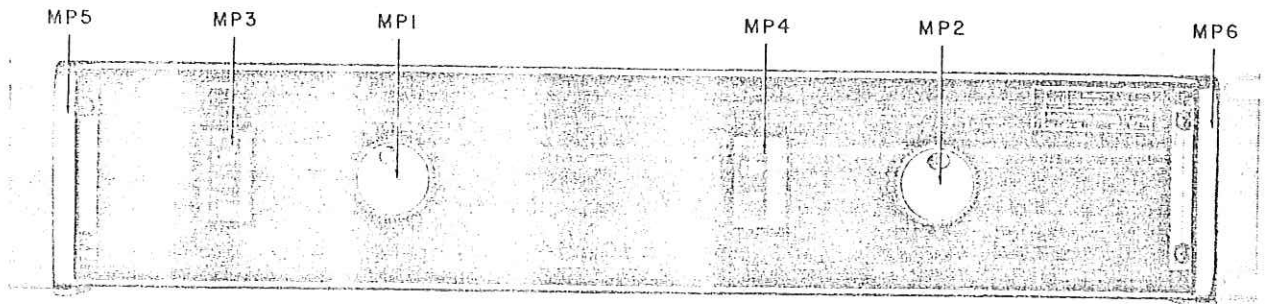


Figure 5-5. Type MTF-101 Microwave Tuning Frame,
Front View, Location of Components.

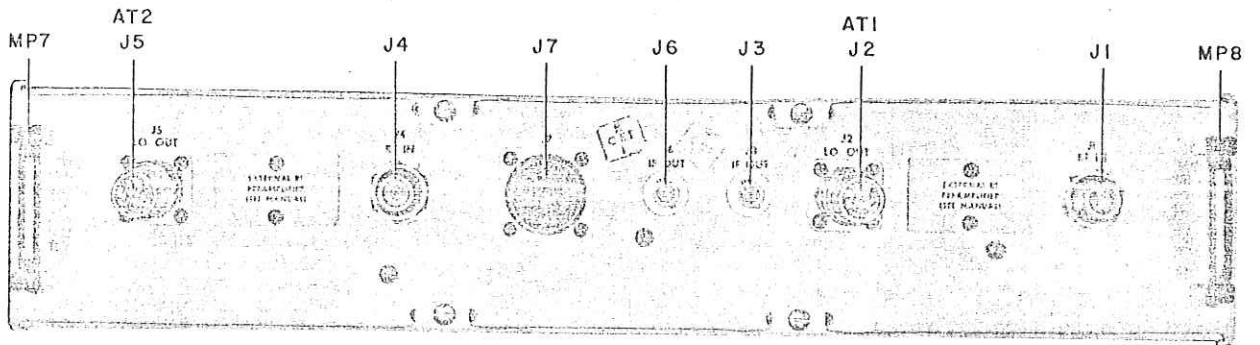


Figure 5-6. Type MTF-101 Microwave Tuning Frame, Rear View, Location of Components.

5.4.2 Type MTF-101 Microwave Tuning Frame, Main Chassis

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|-----------------------|---------------------|----------------------------|--------------|---|
| AT1 | TERMINATION | 2 | CT-NM | 93459 | Courtesy of http://BlackRadios.terry.org |
| AT2 | Same as AT1 | | | | |
| J1 | CONNECTOR, RECEPTACLE | 2 | 3004-7141-10 | 26805 | |
| J2 | CONNECTOR, PLUG | 2 | UG-1095/AU | 80058 | |
| J3 | CONNECTOR, RECEPTACLE | 2 | 17825-1002 | 74868 | |
| J4 | Same as J1 | | | | |
| J5 | Same as J2 | | | | |
| J6 | Same as J3 | | | | |
| J7 | CONNECTOR, RECEPTACLE | 1 | DS00-27P | 11139 | |
| J8 | CONNECTOR, RECEPTACLE | 2 | SLE14SNSS | 81312 | |
| J9 | Same as J8 | | | | |
| MP1 | CRANK ASSEMBLY | 2 | 11755-5 | 14632 | |
| MP2 | Same as MP1 | | | | |
| MP3 | WINDOW | 2 | 11448-3 | 14632 | |
| MP4 | Same as MP3 | | | | |
| MP5 | HANDLE | 2 | 32306-2 | 14632 | |
| MP6 | Same as MP5 | | | | |
| MP7 | HANDLE | 2 | 415-1250-01-02-00 | 71279 | |
| MP8 | Same as MP7 | | | | |
| MP9 | COVER | 2 | 30625-8 | 14632 | |
| MP10 | Same as MP9 | | | | |

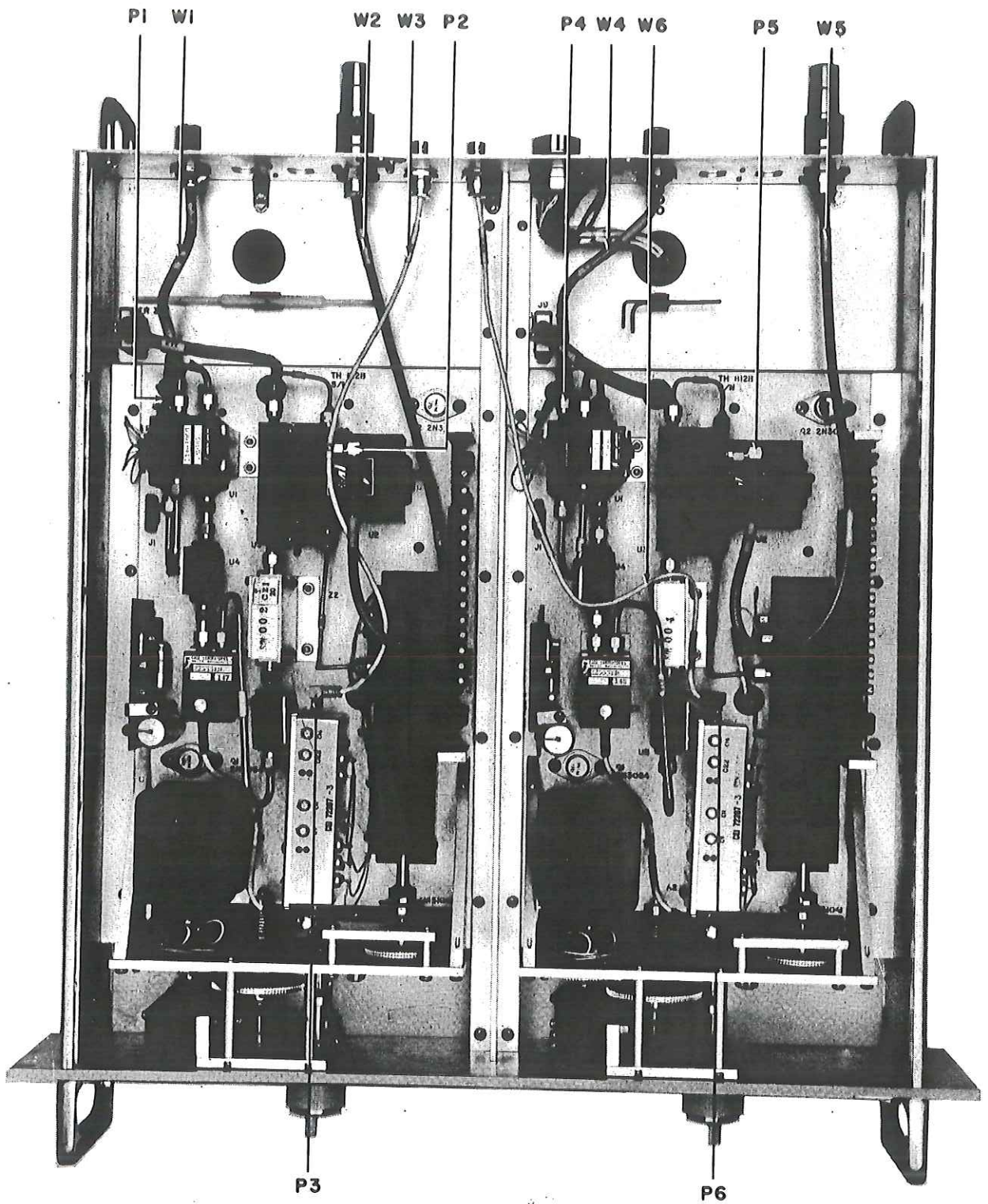


Figure 5-7. Type MTF-101 Microwave Tuning Frame, Top View, Location of Components.

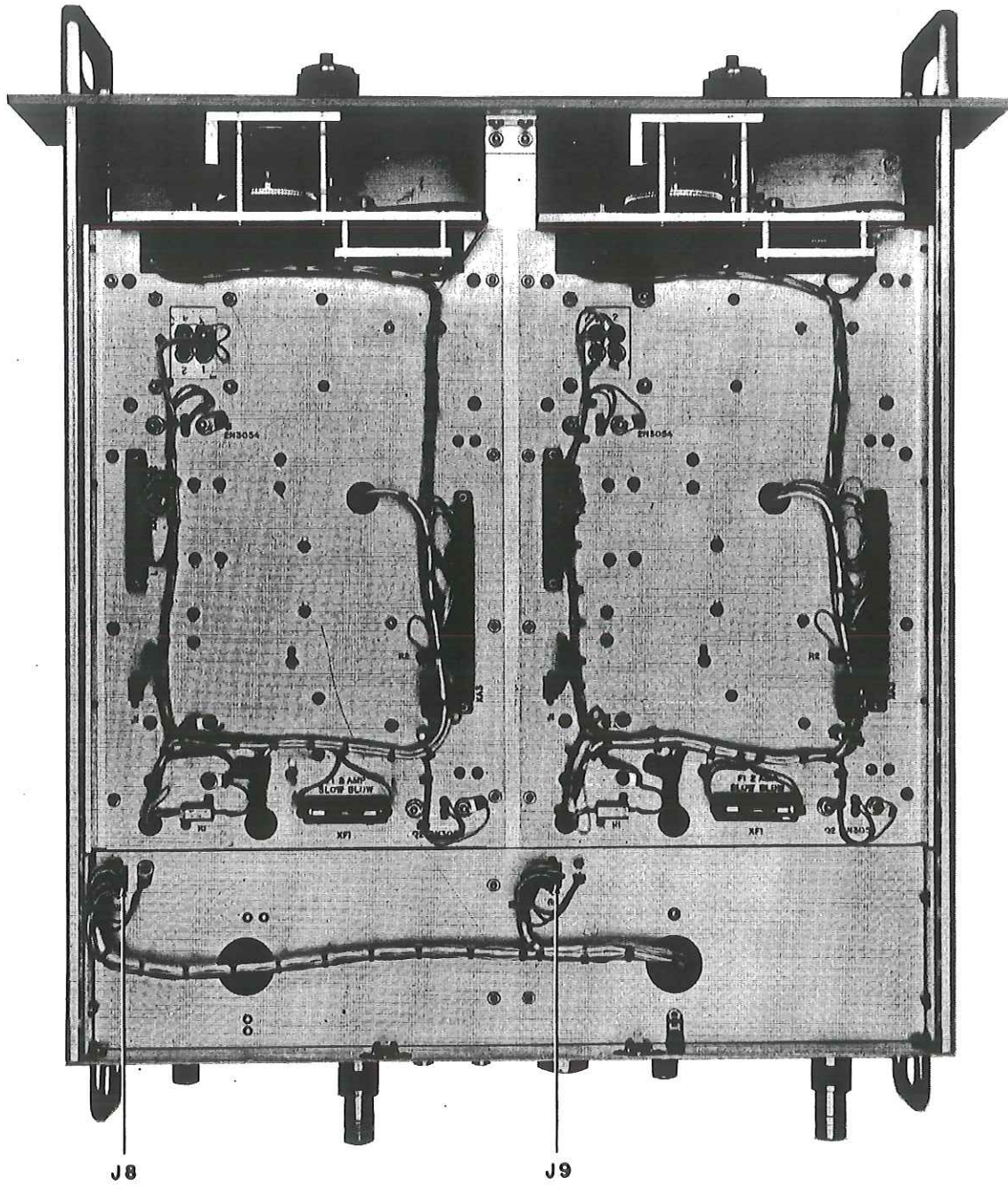


Figure 5-8. Type MTF-101 Microwave Tuning Frame, Bottom View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|-----------------|---------------------|----------------------------|--------------|--|
| P1 | CONNECTOR, PLUG | 2 | 501-1 | 16179 | 74868 Courtesy of http://BlackRadios.terryo.org |
| P2 | CONNECTOR, PLUG | 2 | 521-1 | 16179 | |
| P3 | CONNECTOR, PLUG | 2 | UG-1466/U | 80058 | |
| P4 | Same as P1 | | | | |
| P5 | Same as P2 | | | | |
| P6 | Same as P3 | | | | |
| W1 | CABLE ASSEMBLY | 1 | 30020-1838 | 14632 | |
| W2 | CABLE ASSEMBLY | 1 | 30020-1839 | 14632 | |
| W3 | CABLE ASSEMBLY | 1 | 30020-1840 | 14632 | |
| W4 | CABLE ASSEMBLY | 1 | 30020-1841 | 14632 | |
| W5 | CABLE ASSEMBLY | 1 | 30020-1842 | 14632 | |
| W6 | CABLE ASSEMBLY | 1 | 30020-1843 | 14632 | |

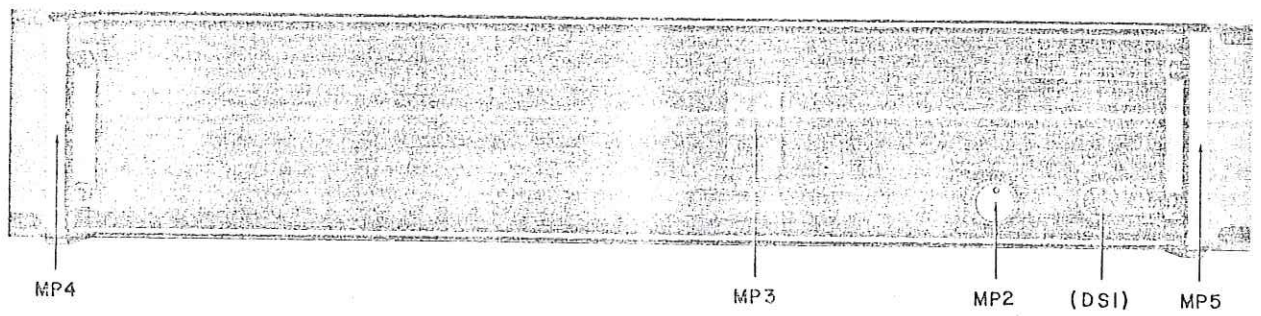


Figure 5-9. Type MTF-102A Microwave Tuning Frame, Front View, Location of Components.

5.4.3 Type MTF-102A Microwave Tuning Frame, Main Chassis

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|--|---------------------|----------------------------|--------------|---|
| AT1 | TERMINATION | 1 | CT-NM | 93459 | Courtesy of http://BlackRadios.terryo.org |
| A1 | AFC/+150V POWER SUPPLY | 1 | 76228 | 14632 | |
| A2 | ±15V POWER SUPPLY | 1 | 76210-1 | 14632 | |
| A3 | +6V & +12V POWER SUPPLY | 1 | 76229 | 14632 | |
| A4 | IF COUPLER | 1 | 791170 | 14632 | |
| A5 | 160-21.4 MHz CONVERTER | 1 | 791169 | 14632 | |
| C1 | CAPACITOR, ELECTROLYTIC, ALUMINUM: 40 µF, -10+50%, 350V | 2 | 39D406F350GL4 | 56289 | |
| C2 | Same as C1 | | | | |
| C3 | CAPACITOR, ELECTROLYTIC, ALUMINUM: 1100 µF, -10+75%, 40V | 2 | 39D118G040HL4 | 56289 | |
| C4 | Same as C3 | | | | |
| C5 | CAPACITOR, ELECTROLYTIC, ALUMINUM: 2200 µF, -10+75%, 25V | 1 | 39D228G025HP4 | 56289 | |
| C6 | CAPACITOR, ELECTROLYTIC, TANTALUM: 47 µF, 10%, 35V | 1 | CS13BF476K | 81349 | |
| DS1 | LAMP, NEON | 1 | A1H | 87034 | |
| FL1 | FILTER, LOW-PASS | 1 | JN33-694B | 56289 | |
| FL2 | FILTER, LOW-PASS | 1 | 2L250-210-0 | 50140 | |
| F1 | FUSE, CARTRIDGE: 3/4 AMP, 3 AG | 1 | MDL3/4 | 71400 | |
| F2 | FUSE, CARTRIDGE: 3/8 AMP, 3 AG | 1 | MDL3/8 | 71400 | |
| J1 | CONNECTOR, RECEPTACLE | 2 | 3004-7141-10 | 26805 | |
| J2 | Same as J1 | | | | |
| J3 | CONNECTOR, RECEPTACLE | 1 | UG-1094/U | 80058 | |
| J4 | CONNECTOR, RECEPTACLE | 1 | SLE14SNSS | 81312 | |

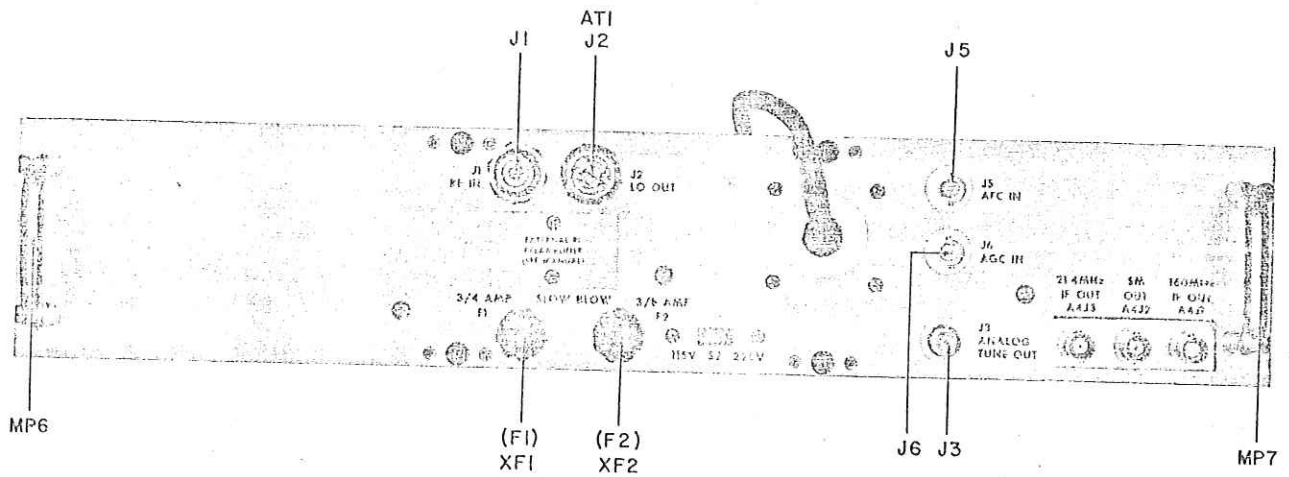


Figure 5-10. Type MTF-102A Microwave Tuning Frame, Rear View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|-----------------------|---------------------|----------------------------|--------------|---|
| J5 | CONNECTOR, RECEPTACLE | 2 | 17825-1002 | 74868 | Courtesy of http://BlackRadios.terry.org |
| J6 | Same as J5 | | | | |
| MP1 | CRANK ASSEMBLY | 1 | 11755-5 | 14632 | |
| MP2 | KNOB | 1 | PS70D2 (GREY) | 21604 | |
| MP3 | WINDOW | 1 | 11448-3 | 14632 | |
| MP4 | HANDLE | 2 | 32306-2 | 14632 | |
| MP5 | Same as MP4 | | | | |
| MP6 | HANDLE | 2 | 415-1250-01-02-00 | 71279 | |
| MP7 | Same as MP6 | | | | |
| MP8 | COVER | 2 | 30625-8 | 14632 | |
| MP9 | Same as MP8 | | | | |
| P1 | CONNECTOR, PLUG | 2 | UG-1465/U | 80058 | 74868 |
| P2 | CONNECTOR, PLUG | 5 | 521-3 | 16179 | |
| P3 | Same as P2 | | | | |
| P4 | Same as P2 | | | | |
| P5 | Same as P1 | | | | |
| P6 | Same as P2 | | | | |
| P7 | CONNECTOR, PLUG | 1 | 501-1 | 16179 | |
| P8 | CONNECTOR, PLUG | 1 | 521-1 | 16179 | |
| P9 | Same as P2 | | | | |
| P10 | CONNECTOR, PLUG | 1 | UG-1466/U | 80058 | |

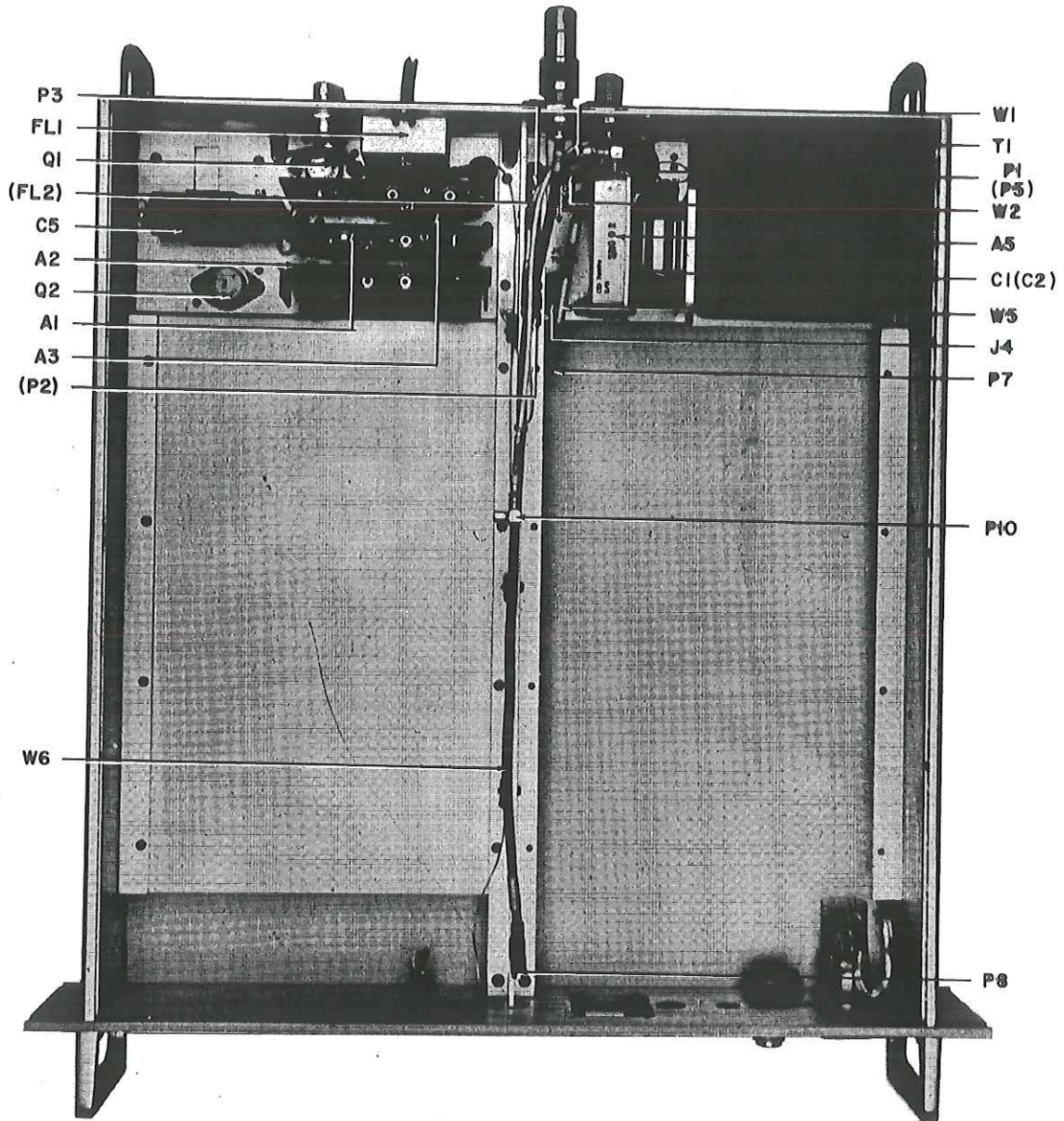


Figure 5-11. Type MTF-102A Microwave Tuning Frame, Top View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|--|---------------------|----------------------------|--------------|-----------------|
| Q1 | TRANSISTOR | 2 | 2N3055 | 80131 | 04713 |
| Q2 | Same as Q1 | | | | |
| R1 | RESISTOR, FIXED, COMPOSITION: 27 k Ω , 5%, 1/2W | 1 | RCR20G273JS | 81349 | 01121 |
| R2 | RESISTOR, FIXED, COMPOSITION: 10 k Ω , 5%, 1/4W | 1 | RCR07G103JS | 81349 | 01121 |
| R3 | RESISTOR, VARIABLE, COMPOSITION: 10 k Ω , 10%, 2W | 1 | RV4NAYS103A | 81349 | 01121 |
| R4 | RESISTOR, FIXED, COMPOSITION: 1.0 Ω , 5%, 1/2W | 2 | RCR20G1R0JS | 81349 | 01121 |
| R5 | Same as R4 | | | | |
| S1 | SWITCH, PUSH | 1 | 671-6A1H | 87034 | |
| S2 | SWITCH, SLIDE | 1 | 11A1211 | 82389 | |
| S3 | SWITCH, TOGGLE | 1 | 7101 | 09353 | |
| T1 | TRANSFORMER, POWER | 1 | 16587 | 14632 | |
| W1 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W2 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W3 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W4 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W5 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| W6 | CABLE ASSEMBLY | 1 | 30020- | 14632 | |
| XA1 | CONNECTOR, PRINTED CIRCUIT CARD | 3 | 250-22-30-170 | 71785 | |
| XA2 | Same as XA1 | | | | |
| XA3 | Same as XA1 | | | | |
| XF1 | FUSEHOLDER | 2 | 342004 | 75915 | |

Courtesy of <http://BlackRadios.terry.org>

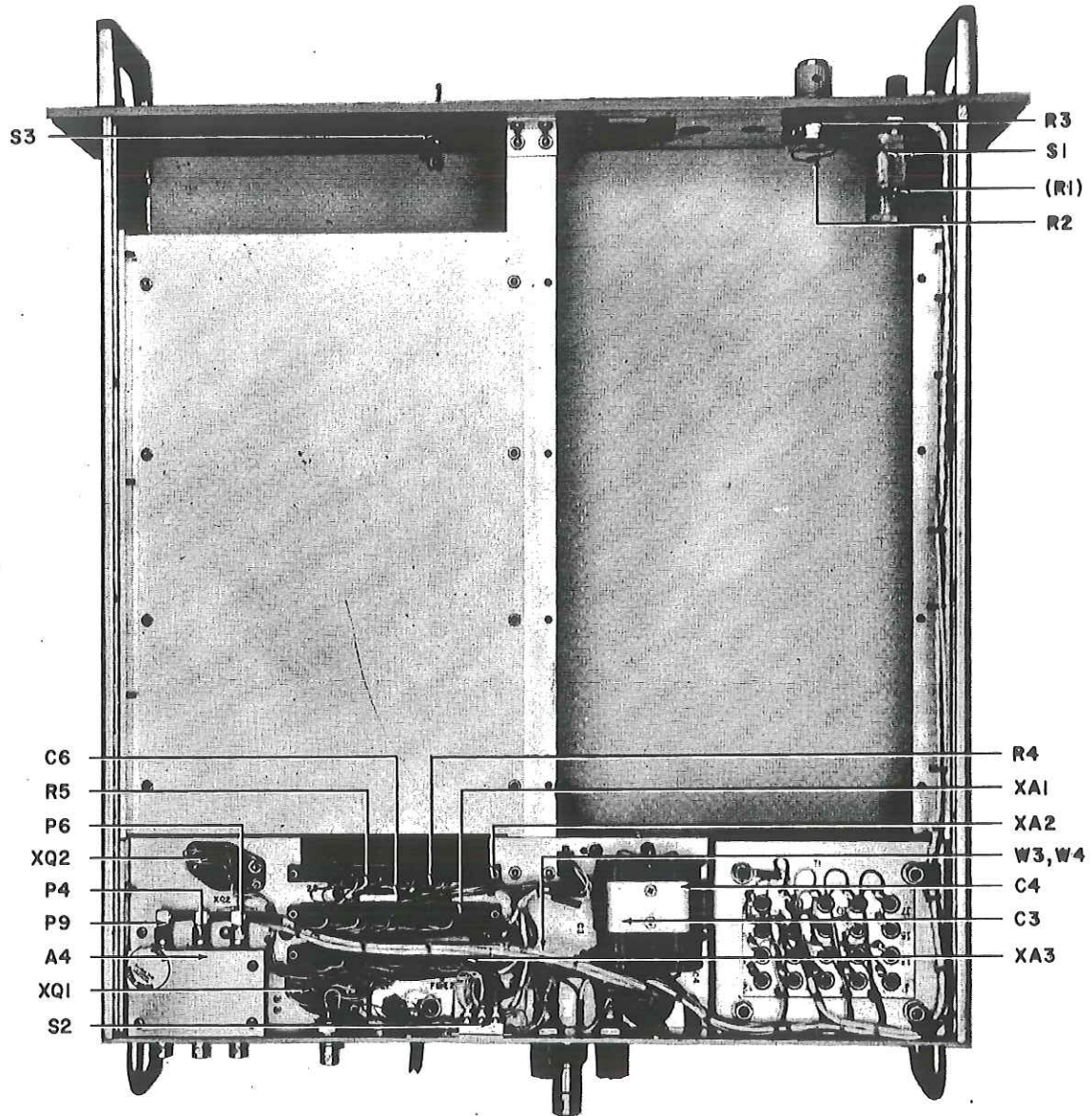


Figure 5-12. Type MTF-102A Microwave Tuning Frame,
Bottom View, Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | REC.M. VENDOR |
|-------------------|--|---------------------|----------------------------|--------------|---|
| XF2 XQ1 XQ2 | Same as XF1 SOCKET, TRANSISTOR Same as XQ1 | 2 | 8038-1G1 | 91506 | Courtesy of http://BlackRadios.terryo.org |

REF DESIG PREFIX A1 (MTF-100A and MTF-102A, only)

5.4.4 Type 76228 AFC/±150V Power Supply

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|-----------|---|---------------|-------------------------|-----------|--------------|
| CR1 | DIODE | 3 | 1N4449 | 80131 | 93332 |
| CR2 | Same as CR1 | | | | |
| CR3 | Same as CR1 | | | | |
| CR4 | DIODE | 1 | 1N5297 | 80131 | 04716 |
| C1 | CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μ F, 10%, 20V | 2 | CS13BE106K | 81349 | 56289 |
| C2 | Same as C1 | | | | |
| C3 | NOT USED | | | | |
| C4 | CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μ F, 10%, 35V | 2 | CS13BF105K | 81349 | 56289 |
| C5 | Same as C4 | | | | |
| C6 | CAPACITOR, ELECTROLYTIC, TANTALUM: 0.01 μ F, 10%, 35V | 2 | 150D104X9035A2 | 56289 | |
| C7 | Same as C6 | | | | |
| Q1 | TRANSISTOR | 1 | 2N4064 | 80131 | 02736 |
| Q2 | TRANSISTOR | 1 | 2N929 | 80131 | 04716 |
| Q3 | TRANSISTOR | 1 | 2N3440 | 80131 | 04716 |
| Q4 | TRANSISTOR | 1 | U1899E | 15818 | |
| RA1 | HEATSINK | 1 | 2225B | 13103 | |
| R1 | RESISTOR, FIXED, COMPOSITION: 47 k Ω , 5%, 1/4W | 1 | RCR07G473JS | 81349 | 01121 |
| R2 | RESISTOR, FIXED, COMPOSITION: 30 k Ω , 5%, 1W | 1 | RCR32G303JS | 81349 | 01121 |
| R3 | RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1W | 1 | RCR32G471JS | 81349 | 01121 |
| R4 | RESISTOR, FIXED, COMPOSITION: 2.2 k Ω , 5%, 1/4W | 1 | RCR07G222JS | 81349 | 01121 |
| R5 | RESISTOR, FIXED, COMPOSITION: 15 Ω , 5%, 1/4W | 1 | RCR07G150JS | 81349 | 01121 |

Courtesy of <http://BlackRadios.terryc.org>

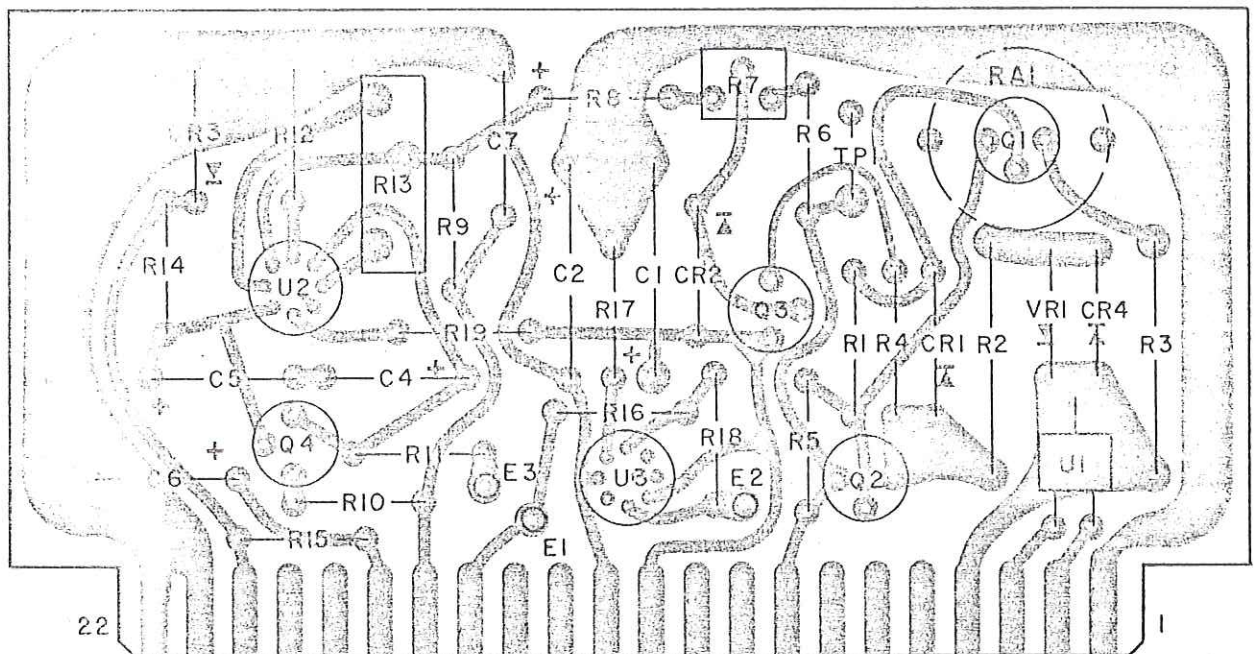


Figure 5-13. Type 76228 AFC/+150 V Power Supply (A1),
Location of Components.

REF DESIG PREFIX A1 (MTF-100A and MTF-102A only)

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|-----------|---|---------------|-------------------------|-----------|--------------|
| R6 | RESISTOR, FIXED, COMPOSITION: 100 k Ω , 5%, 1/4W | 4 | RCR07G104JS | 81349 | 01121 |
| R7 | RESISTOR, VARIABLE, FILM: 10 k Ω , 10%, 1/2W | 1 | 62PAR10K | 73138 | |
| R8 | RESISTOR, FIXED, COMPOSITION: 22 k Ω , 5%, 1/4W | 1 | RCR07G223JS | 81349 | 01121 |
| R9 | Same as R6 | | | | |
| R10 | Same as R6 | | | | |
| R11 | RESISTOR, FIXED, COMPOSITION: 10 k Ω , 5%, 1/4W | 4 | RCR07G103JS | 81349 | 01121 |
| R12 | Same as R11 | | | | |
| R13 | RESISTOR, VARIABLE, FILM: 10 k Ω , 10%, 3/4W | 1 | 89PR10K | 73138 | |
| R14 | Same as R6 | | | | |
| R15 | RESISTOR, FIXED, COMPOSITION: 75 k Ω , 5%, 1/4W | 1 | RCR07G753JS | 81349 | 01121 |
| R16 | Same as R11 | | | | |
| R17 | RESISTOR, FIXED, COMPOSITION: 5.1 k Ω , 5%, 1/4W | 1 | RCR07G512JS | 81349 | 01121 |
| R18 | Same as R11 | | | | |
| R19 | RESISTOR, FIXED, COMPOSITION: 2.7 Ω , 5%, 1/4W | 1 | RCR07G2R7JS | 81349 | 01121 |
| TP1 | Jack, TIP | 1 | TJ203R | 49956 | |
| U1 | RECTIFIER ASSEMBLY | 1 | MDA940A7 | 04713 | |
| U2 | INTEGRATED CIRCUIT | 2 | U5B7741393 | 07263 | |
| U3 | Same as U2 | | | | |
| VR1 | DIODE, ZENER | 1 | 1N4763A | 80131 | |

Courtesy of <http://BlackRadios.terryo.org>

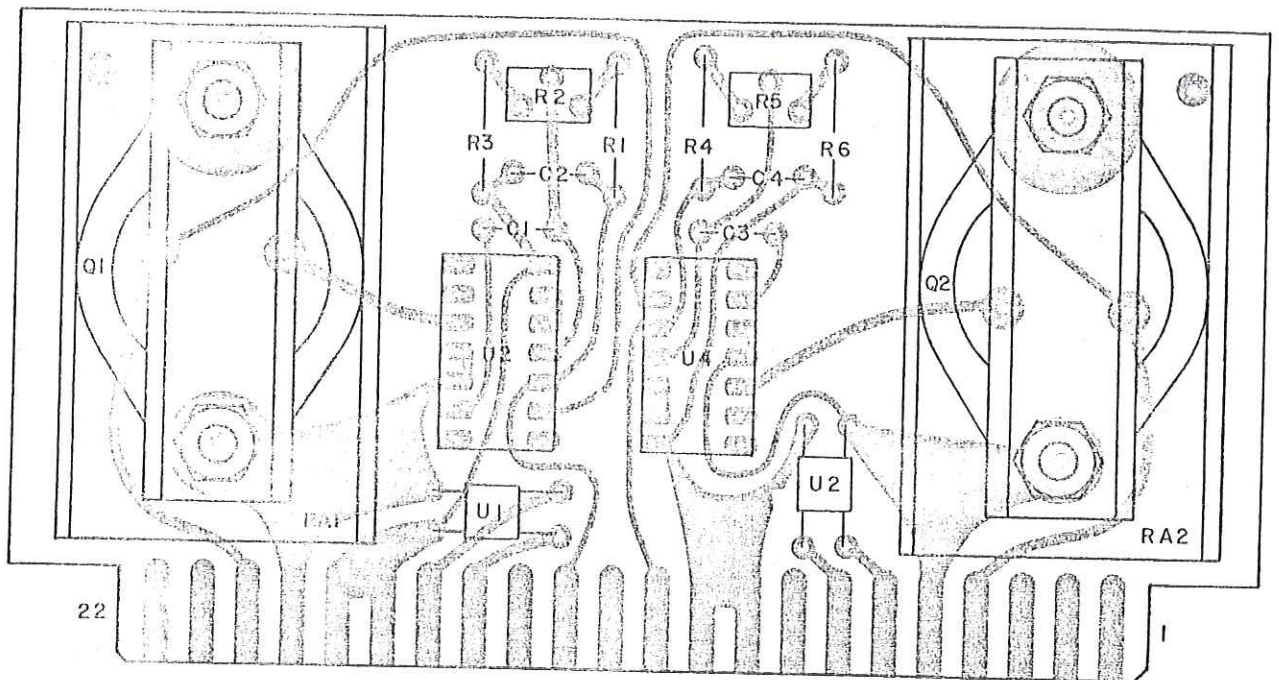


Figure 5-14. Type 76210-1 ± 15 V Power Supply (A2),
Location of Components,

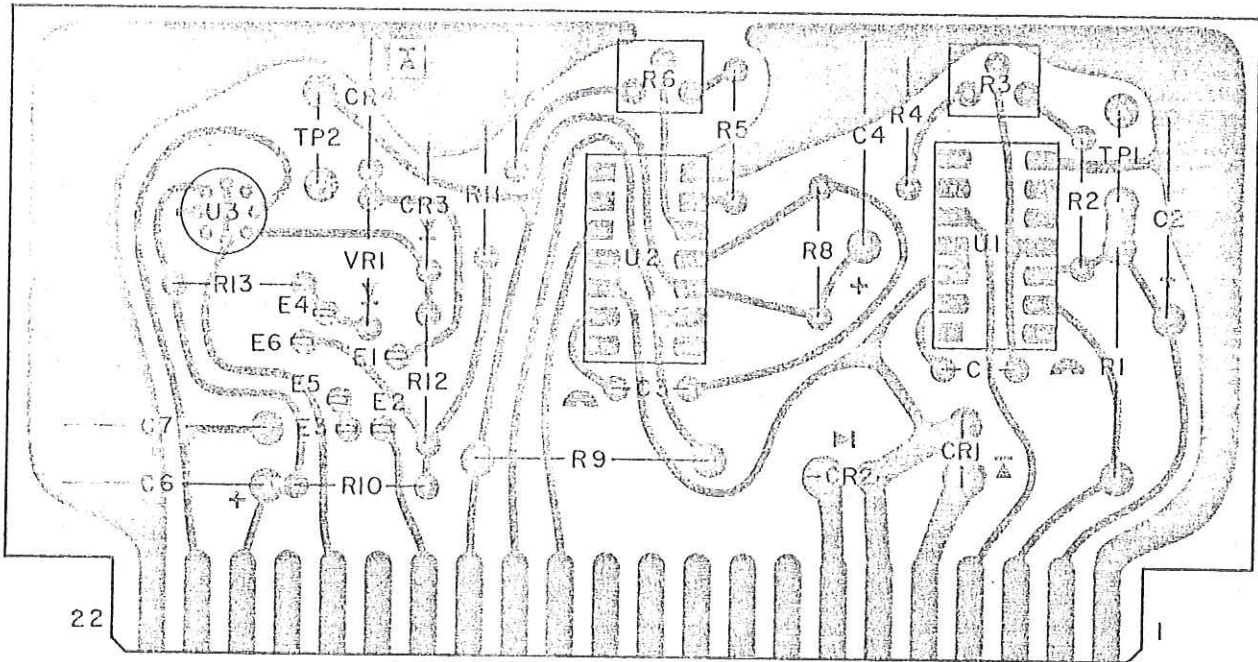
5.4.5 Type 76210-1 ±15V Power Supply

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|-----------|---|---------------|-------------------------|-----------|---|
| C1 | CAPACITOR, MICA, DIPPED: 500 pF, 5%, 500V | 2 | DM15-501J | 72136 | Courtesy of http://BlackRadios.terryo.org |
| C2 | CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 20%, 35V | 2 | 196D225X0035JA1 | 56289 | |
| C3 | Same as C1 | | | | |
| C4 | Same as C2 | | | | |
| Q1 | TRANSISTOR | 2 | 2N3055 | 80131 | |
| Q2 | Same as Q1 | | | | |
| RA1 | HEATSINK | 2 | 6103B | 13103 | |
| RA2 | Same as RA1 | | | | |
| R1 | RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W | 2 | RCR07G332JS | 81349 | |
| R2 | RESISTOR, VARIABLE, FILM: 1 kΩ, 10%, 1/2W | 2 | 62PARIK | 73138 | |
| R3 | RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W | 2 | RCR07G272JS | 81349 | |
| R4 | Same as R1 | | | | |
| R5 | Same as R2 | | | | |
| R6 | Same as R3 | | | | |
| U1 | DIODE ASSEMBLY | 2 | MDA920A3 | 04713 | |
| U2 | INTEGRATED CIRCUIT | 2 | U6A7723393 | 07263 | |
| U3 | Same as U1 | | | | |
| U4 | Same as U2 | | | | |

5.4.6 Type 76229 +6V and +12V Power Supply

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|-----------|--|---------------|-------------------------|-----------|--------------|
| CR1 | DIODE | 2 | 1N4998 | 80131 | 04713 |
| CR2 | Same as CR1 | | | | |
| CR3 | DIODE | 2 | 1N4449 | 80131 | 93332 |
| CR4 | Same as CR3 | | | | |
| C1 | CAPACITOR, MICA, DIPPED: 500 pF, 5%, 500V | 2 | DM15-501J | 72136 | |
| C2 | CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μ F, 10%, 20V | 2 | CS13BE106K | 81349 | 56288 |
| C3 | Same as C1 | | | | |
| C4 | Same as C2 | | | | |
| C5 | NOT USED | | | | |
| C6 | CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 μ F, 10%, 35V | 2 | CS13BF105K | 81349 | 56288 |
| C7 | Same as C6 | | | | |
| R1 | RESISTOR, FIXED, WIRE-WOUND: 0.62 Ω , 5%, 2W | 1 | BWH0.62J | 75042 | |
| R2 | RESISTOR, FIXED, COMPOSITION: 7.5 k Ω , 5%, 1/4W | 1 | RCR07G752JS | 81349 | 01121 |
| R3 | RESISTOR, VARIABLE, FILM: 10 k Ω , 10%, 1/2W | 2 | 62PAR10K | 73138 | |
| R4 | RESISTOR, FIXED, COMPOSITION: 18 k Ω , 5%, 1/4W | 1 | RCR07G183JS | 81349 | 01121 |
| R5 | RESISTOR, FIXED, COMPOSITION: 6.8 k Ω , 5%, 1/4W | 1 | RCR07G682JS | 81349 | 01121 |
| R6 | Same as R3 | | | | |
| R7 | RESISTOR, FIXED, COMPOSITION: 43 k Ω , 5%, 1/4W | 1 | RCR07G433JS | 81349 | 01121 |
| R8 | RESISTOR, FIXED, COMPOSITION: 9.1 k Ω , 5%, 1/4W | 1 | RCR07G912JS | 81349 | 01121 |
| R9 | RESISTOR, FIXED, WIRE-WOUND: 1.5 Ω , 5% 2W | 1 | BWH1.5J | 75042 | |
| R10 | RESISTOR, FIXED, COMPOSITION: 470 k Ω , 5%, 1/4W | 1 | RCR07G474JS | 81349 | 01121 |

Courtesy of <http://BlackRadios.terry.org>



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Figure 5-15. Type 76229 +6 V and +12 V Power Supply/AGC Amplifier (A3), Location of Components.

REF DESIG PREFIX A3 (MTF-100A & MTF-102A, only)

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|--|---------------------|----------------------------|--------------|-----------------|
| R11 | RESISTOR, FIXED, COMPOSITION: 1.0 MΩ, 5%, 1/4W | 1 | RCR07G105JS | 81349 | 01121 |
| R12 | RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W | 1 | RCR07G473JS | 81349 | 01121 |
| R13 | RESISTOR, FIXED, COMPOSITION: 30 kΩ, 5%, 1/4W | 1 | RCR07G303JS | 81349 | 01121 |
| TP1 | JACK, TIP | 2 | TJ203R | 49956 | |
| TP2 | Same as TP1 | | | | |
| U1 | INTEGRATED CIRCUIT | 2 | U6A7723393 | 07263 | |
| U2 | Same as U1 | | | | |
| U3 | INTEGRATED CIRCUIT | 1 | U5B7741393 | 07263 | |
| VR1 | DIODE, ZENER | 1 | 1N758A | 80131 | |

Courtesy of <http://BlackRadios.terry.org>

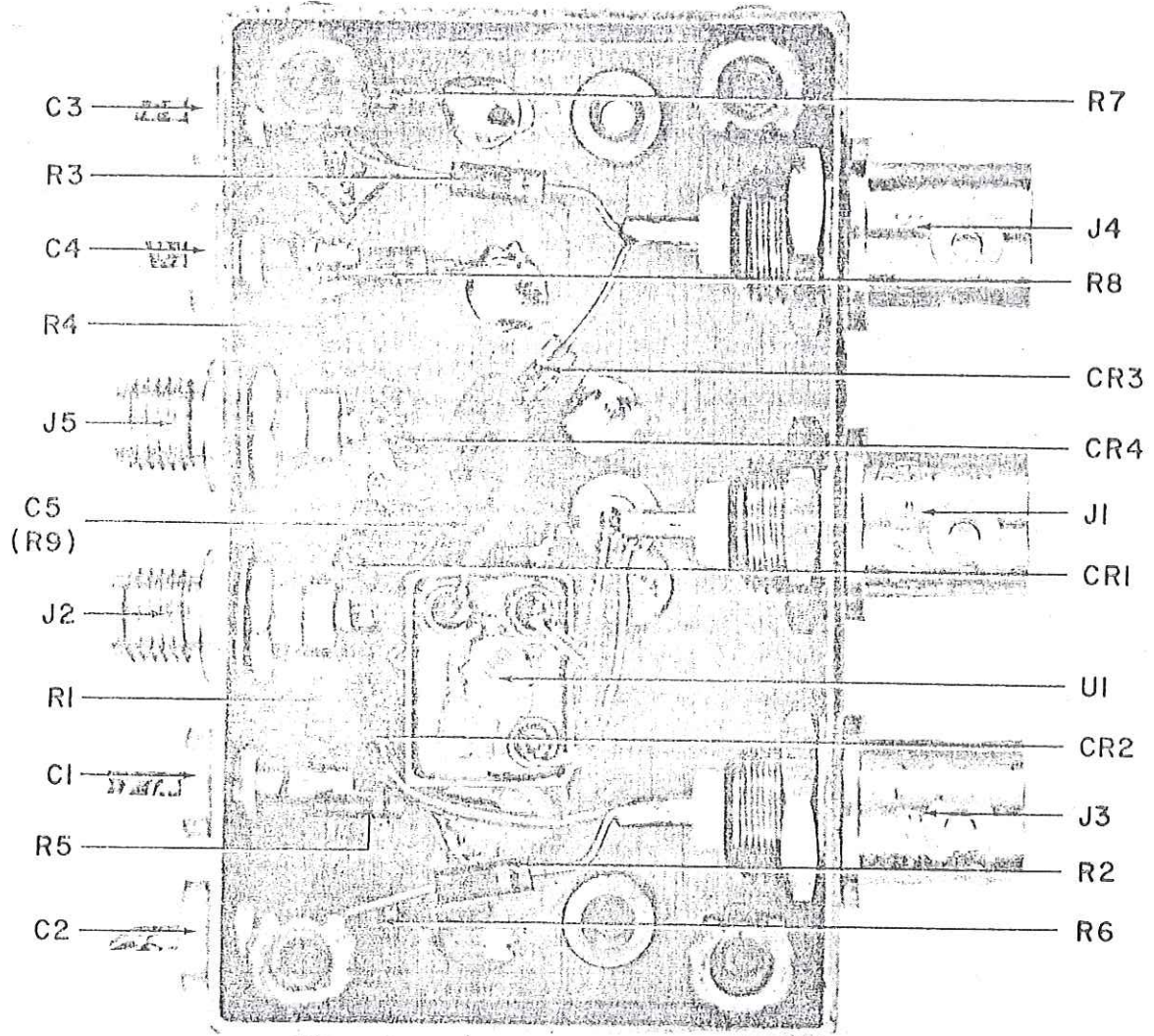


Figure 5-16. Type 791168 IF Coupler (A4),
Location of Components.

5.4.7 Type 791168 IF Coupler

REF DESIG PREFIX A4 (MTF-100A, only)

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---|---------------------|----------------------------|--------------|---|
| CR1 | DIODE | 4 | BA136E | 25088 | Courtesy of http://BlackRadios.terry.org |
| CR2 | Same as CR1 | | | | |
| CR3 | Same as CR1 | | | | |
| CR4 | Same as CR1 | | | | |
| C1 | CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500V | 4 | FA5C102W | 01121 | |
| C2 | Same as C1 | | | | |
| C3 | Same as C1 | | | | |
| C4 | Same as C1 | | | | |
| C5 | CAPACITOR, CERAMIC, DISC: 0.01 μ F, 20%, 500V | 1 | SM01 μ FM | 91418 | |
| J1 | CONNECTOR, RECEPTACLE | 3 | UG-1094/U | 80058 | |
| J2 | CONNECTOR, RECEPTACLE | 2 | 2058-0000 | 26805 | |
| J3 | Same as J1 | | | | |
| J4 | Same as J1 | | | | |
| J5 | Same as J2 | | | | |
| J6 | CONNECTOR, RECEPTACLE | 1 | 10-0104-002 | 19505 | |
| MP1 | COVER | 1 | 23256-1 | 14632 | |
| R1 | RESISTOR, FIXED, COMPOSITION: 1.0 k Ω , 5%, 1/4W | 8 | RCR07G102JS | 81349 | |
| R2 | Same as R1 | | | | |
| R3 | Same as R1 | | | | |
| R4 | Same as R1 | | | | |
| R5 | Same as R1 | | | | |

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---|---------------------|----------------------------|--------------|---|
| R6 | Same as R1 | | | | |
| R7 | Same as R1 | | | | |
| R8 | Same as R1 | | | | |
| R9 | RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W | 1 | RCR07G471JS | 81349 | 01121 |
| U1 | POWER DIVIDER | 1 | 791173 | 14632 | Courtesy of http://BlackRadios.terry.org |

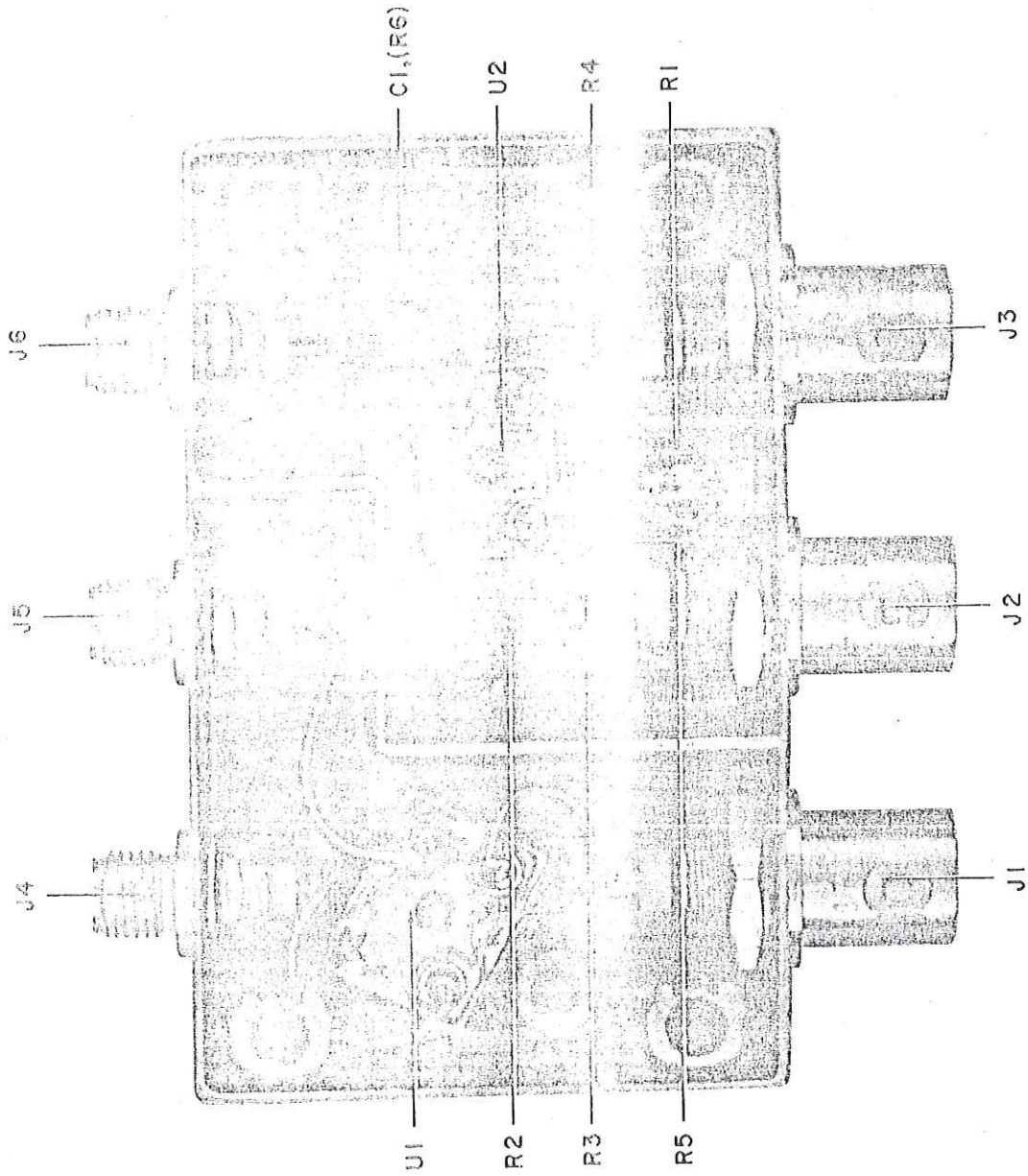


Figure 5-17. Type 791170 IF Coupler (A4);
Location of Components,

5.4.8 Type 791170 IF Coupler

REF DESIG PREFIX A4 (MTF-102A, only)

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---|---------------------|----------------------------|--------------|-----------------|
| C1 | CAPACITOR, CERAMIC, DISC: 0.01 μ F, 20%, 500V | 1 | SM01 μ F, M | 91418 | |
| J1 | CONNECTOR, RECEPTACLE | 3 | UG-1094/U | 80058 | 74868 |
| J2 | Same as J1 | | | | |
| J3 | Same as J1 | | | | |
| J4 | CONNECTOR, RECEPTACLE | 3 | 2058-0000 | 26805 | |
| J5 | Same as J4 | | | | |
| J6 | Same as J4 | | | | |
| MP1 | COVER | 1 | 23272-1 | 14632 | |
| R1 | RESISTOR, FIXED, COMPOSITION: 91 Ω , 5%, 1/4W | 2 | RCR07G910JS | 81349 | 0112 |
| R2 | RESISTOR, FIXED, COMPOSITION: 430 Ω , 5%, 1/4W | 2 | RCR07G431JS | 81349 | 0112 |
| R3 | RESISTOR, FIXED, COMPOSITION: 75 Ω , 5%, 1/4W | 1 | RCR07G750JS | 81349 | 0112 |
| R4 | RESISTOR, FIXED, COMPOSITION: 11 Ω , 5%, 1/4W | 1 | RCR07G110JS | 81349 | 0112 |
| R5 | Same as R1 | | | | |
| R6 | Same as R2 | | | | |
| U1 | POWER DIVIDER | 2 | 791173 | 14632 | |
| U2 | Same as U1 | | | | |

Courtesy of <http://BlackRadios.terry.org>

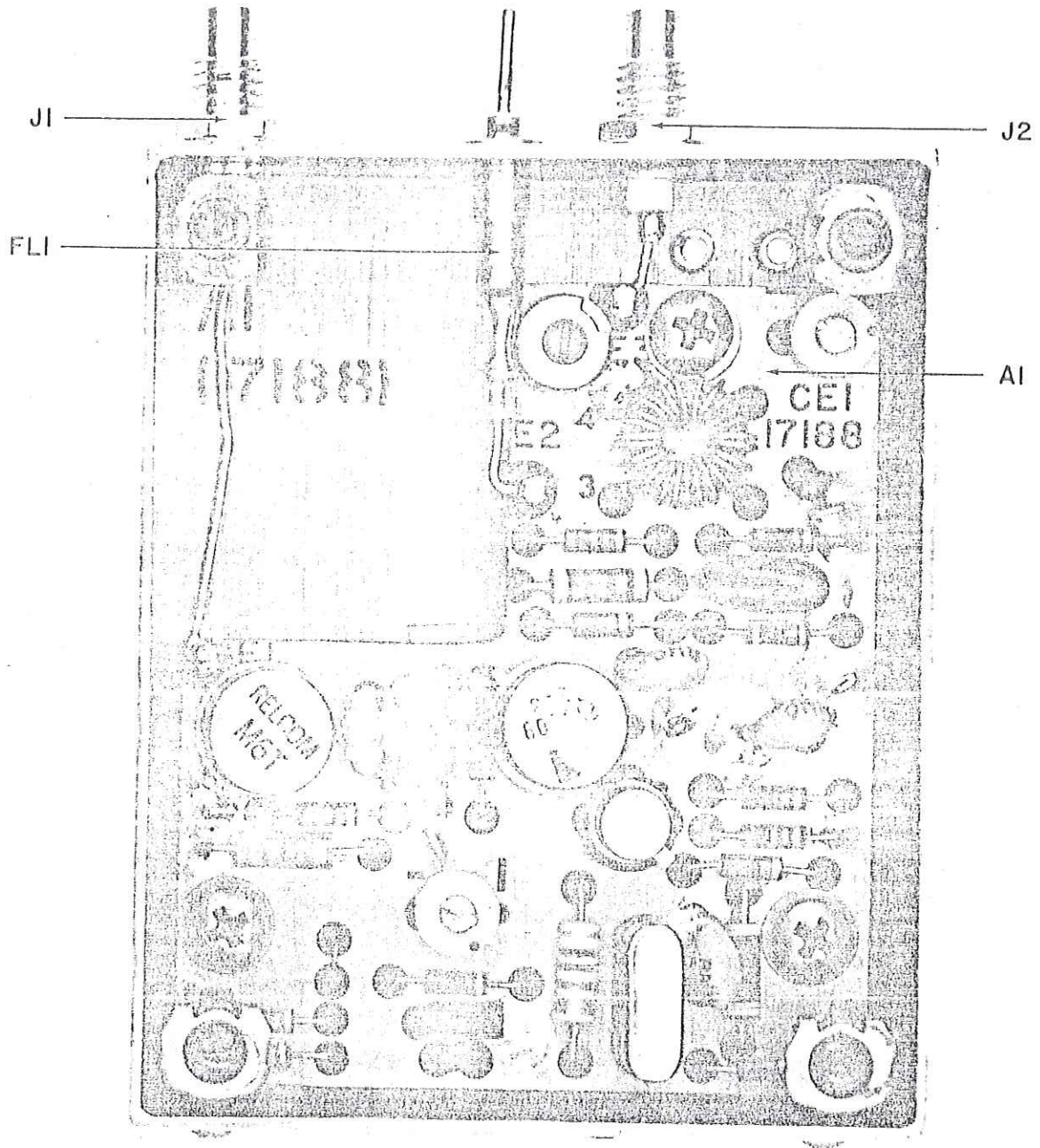


Figure 5-18. Type 791169 160/21.4 MHz Converter Assembly (A5),
Location of Components.

5.4.9 Type 791169 160-21.4 MHz Converter

REF DESIG PREFIX A5 (MTF-100A & MTF-102A, only)

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|-----------------------|---------------------|----------------------------|--------------|---|
| A1 | CONVERTER | 1 | 17188 | 14632 | Courtesy of http://BlackRadios.terryo.org |
| FL1 | FILTER, LOW-PASS | 1 | 859550-1 | 00779 | |
| J1 | CONNECTOR, RECEPTACLE | 2 | 10-0104-002 | 19505 | |
| J2 | Same as J1 | | | | |

5.4.9.1 Part 17188 Converter

REF DESIG PREFIX A5A1 (MTF-100A & MTF-102A, only)

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---|---------------------|----------------------------|--------------|---|
| C1 | CAPACITOR, CERAMIC, DISC: 1 pF, 0.25 pF, 50V | 1 | 1C1RC | 93958 | Courtesy of http://BlackRadios.tenyo.org |
| C2 | CAPACITOR, CERAMIC, DISC: 1000 pF, GMV, 500V | 4 | SM1000PFP | 91418 | |
| C3 | CAPACITOR, VARIABLE, CERAMIC: 2.5-9 pF, 100V | 1 | 518-000A2.5-9 | 72982 | |
| C4 | CAPACITOR, CERAMIC, DISC: 2.5 pF, 10%, 50V | 1 | 1C2.5RK | 93958 | |
| C5 | CAPACITOR, CERAMIC, DISC: 22 pF, 10%, 50V | 1 | CK05EX220K | 81349 | |
| C6 | Same as C2 | | | | |
| C7 | CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 200V | 1 | 8131A200Z5U0-103M | 72982 | |
| C8 | Same as C2 | | | | |
| C9 | CAPACITOR, VARIABLE, CERAMIC: 5-2.5 pF, 100V | 1 | 518-000A5-25 | 72982 | |
| C10 | NOT USED | | | | |
| C11 | Same as C2 | | | | |
| C12 | NOT USED | | | | |
| C13 | CAPACITOR MICA, DIPPED: 47 pF, 5%, 500V | 1 | CM05ED470J03 | 81349 | |
| C14 | CAPACITOR, CERAMIC, DISC: 5 pF, 10%, 50V | 1 | 1C5RK | 93958 | |
| L1 | COIL, FIXED: 0.10 μH, 10% | 1 | DD0.10 | 72259 | |
| L2 | COIL, FIXED: 0.22 μH, 10% | 1 | 1025-04 | 99800 | |
| Q1 | TRANSISTOR | 1 | 2N5109 | 80131 | |
| Q2 | TRANSISTOR | 1 | 2N3478 | 80131 | |
| R1 | RESISTOR, FIXED, COMPOSITION: 8.2 Ω, 5%, 1/8W | 2 | RCR05G8R2JS | 81349 | |
| R2 | Same as R1 | | | | |
| R3 | RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/8W | 1 | RCR05G151JS | 81349 | |

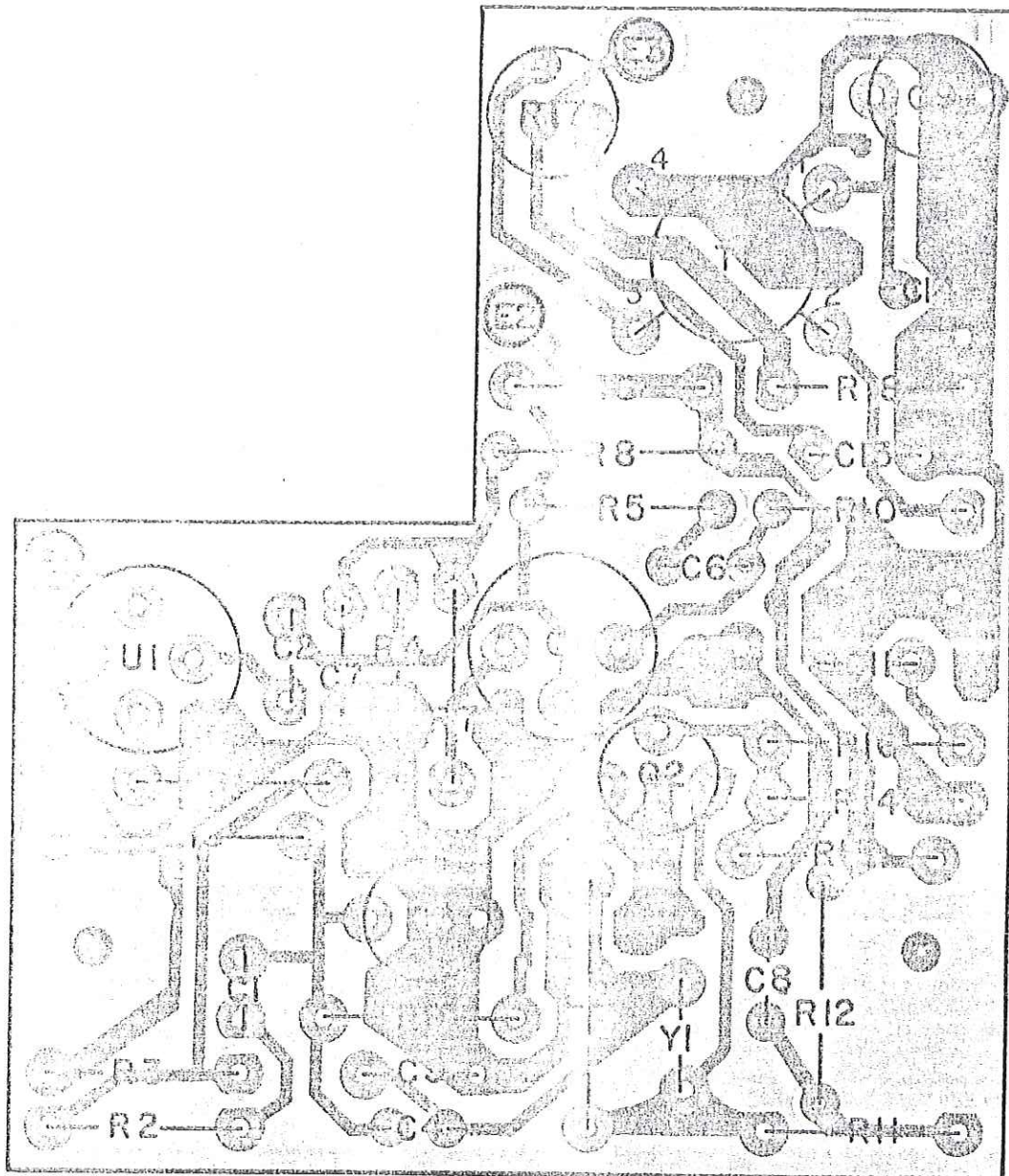


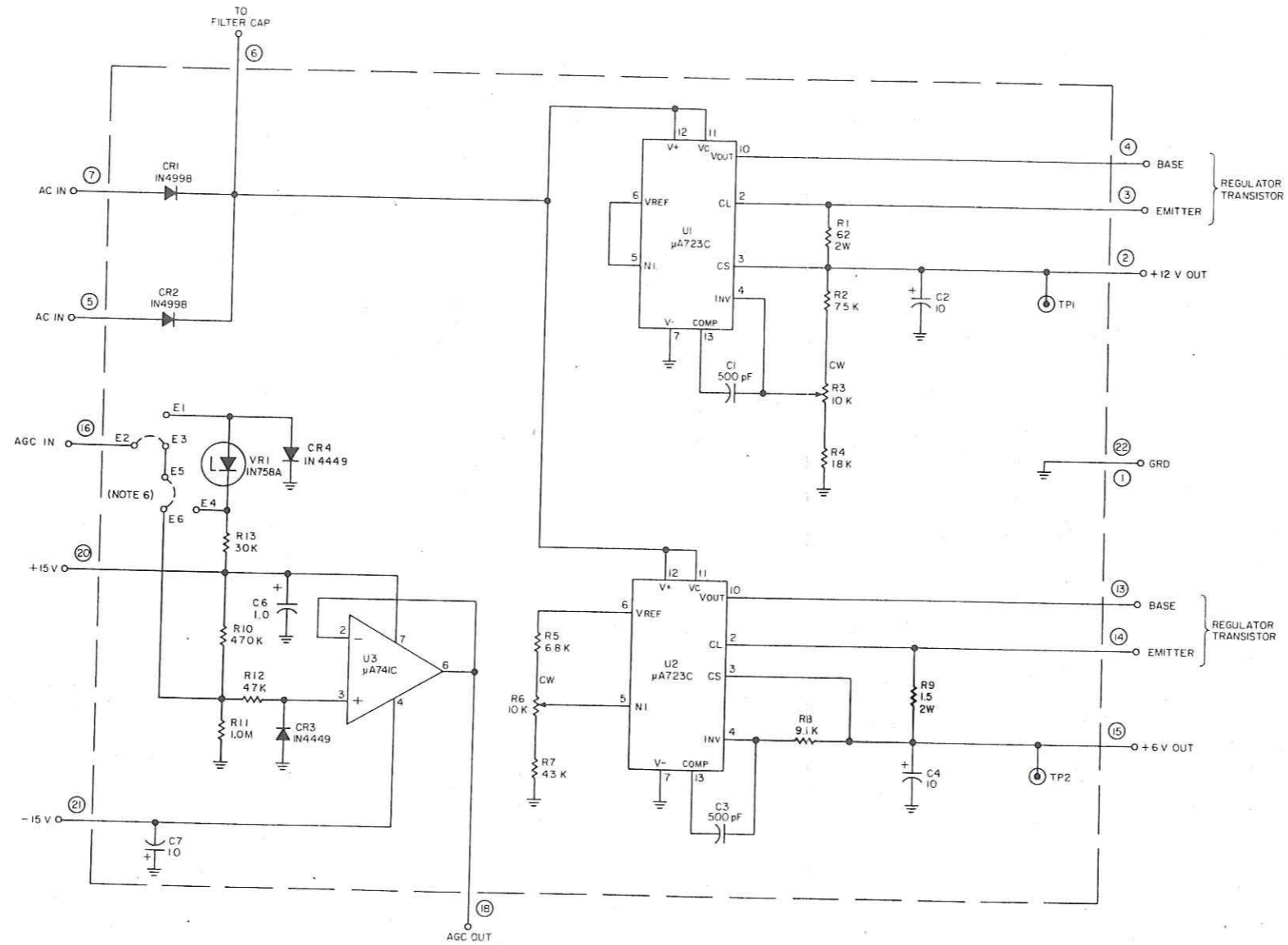
Figure 5-19. Part 17188 160/21.4 MHz Converter (A5A1),
Location of Components.

| REF DESIG | DESCRIPTION | QTY. PER ASSY | MANUFACTURER'S PART NO. | MFR. CODE | RECM. VENDOR |
|--------------|---|---------------------|----------------------------|--------------|-----------------|
| R4 | RESISTOR, FIXED, COMPOSITION: 8.2 k Ω , 5%, 1/8W | 1 | RCR05G822JS | 81349 | 01121 |
| R5 | RESISTOR, FIXED, COMPOSITION: 820 Ω , 5%, 1/8W | 1 | RCR05G821JS | 81349 | 01121 |
| R6 | RESISTOR, FIXED, COMPOSITION: 12 k Ω , 5%, 1/8W | 1 | RCR05G123JS | 81349 | 01121 |
| R7 | RESISTOR, FIXED, COMPOSITION: 5.6 Ω , 5%, 1/8W | 1 | RCR05G5R6JS | 81349 | 01121 |
| R8 | RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4W | 2 | RCR07G471JS | 81349 | 01121 |
| R9 | RESISTOR, FIXED, COMPOSITION: 22 Ω , 5%, 1/8W | 1 | RCR05G220JS | 81349 | 01121 |
| R10 | RESISTOR, FIXED, COMPOSITION: 47 Ω , 5%, 1/8W | 1 | RCR05G470JS | 81349 | 01121 |
| R11 | RESISTOR, FIXED, COMPOSITION: 1.0 k Ω , 5%, 1/8W | 1 | RCR05G102JS | 81349 | 01121 |
| R12 | Same as R8 | | | | |
| R13 | RESISTOR, FIXED, COMPOSITION: 6.8 k Ω , 5%, 1/8W | 1 | RCR05G682JS | 81349 | 01121 |
| R14 | RESISTOR, FIXED, COMPOSITION: 10 k Ω , 5%, 1/8W | 1 | RCR05G103JS | 81349 | 01121 |
| R15 | NOT USED | | | | |
| R16* | RESISTOR, FIXED, COMPOSITION: 10 Ω , 5%, 1/8W | 1 | RCR05G100JS | 81349 | 01121 |
| R17 | RESISTOR, VARIABLE, FILM: 100 Ω , 10%, 1/2W | 1 | 62PR100 | 73138 | |
| R18 | RESISTOR, FIXED, COMPOSITION: 62 Ω , 5%, 1/8W | 1 | RCR05G620JS | 81349 | 01121 |
| T1 | COIL, TOROIDAL | 1 | 22692-1 | 14632 | |
| U1 | MIXER, BALANCED | 1 | M6T | 27956 | |
| Y1 | CRYSTAL, QUARTZ | 1 | 98204-5 | 14632 | |

Courtesy of <http://BlackRadios.terry.org>

* Nominal value. Final value factory selected.

SECTION VI
SCHEMATIC DIAGRAMS



- NOTES:
1. UNLESS OTHERWISE SPECIFIED:
 a) RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4 W.
 b) CAPACITANCE IS IN μF .
 2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
 3. CW ON R3 & R6 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 4. FOR PIN ARRANGEMENT OF U1 SEE DETAIL A.
 5. FOR PIN ARRANGEMENT OF U2 & U3 SEE DETAIL B.
 6. FOR USE WITH DEMODULATORS WHOSE OUTPUT AGC VOLTAGE IS +10V TO +1VOLT CONNECT E2 TO E3 AND E5 TO E6. FOR USE WITH THE DEMODULATORS WHOSE OUTPUT AGC VOLTAGE IS ZERO TO -12V CONNECT E2 TO E1 AND E4 TO E6.

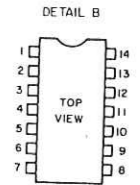


Figure 6-3. Type 76229 +6V and +12V Power Supply/AGC Amplifier (A3), Schematic Diagram

NOTES

1. UNLESS OTHERWISE SPECIFIED:
 - a) RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4W.
 - b) CAPACITANCE IS IN pF.
2. PIN ARRANGEMENT FOR UI IS SHOWN IN DETAIL A.

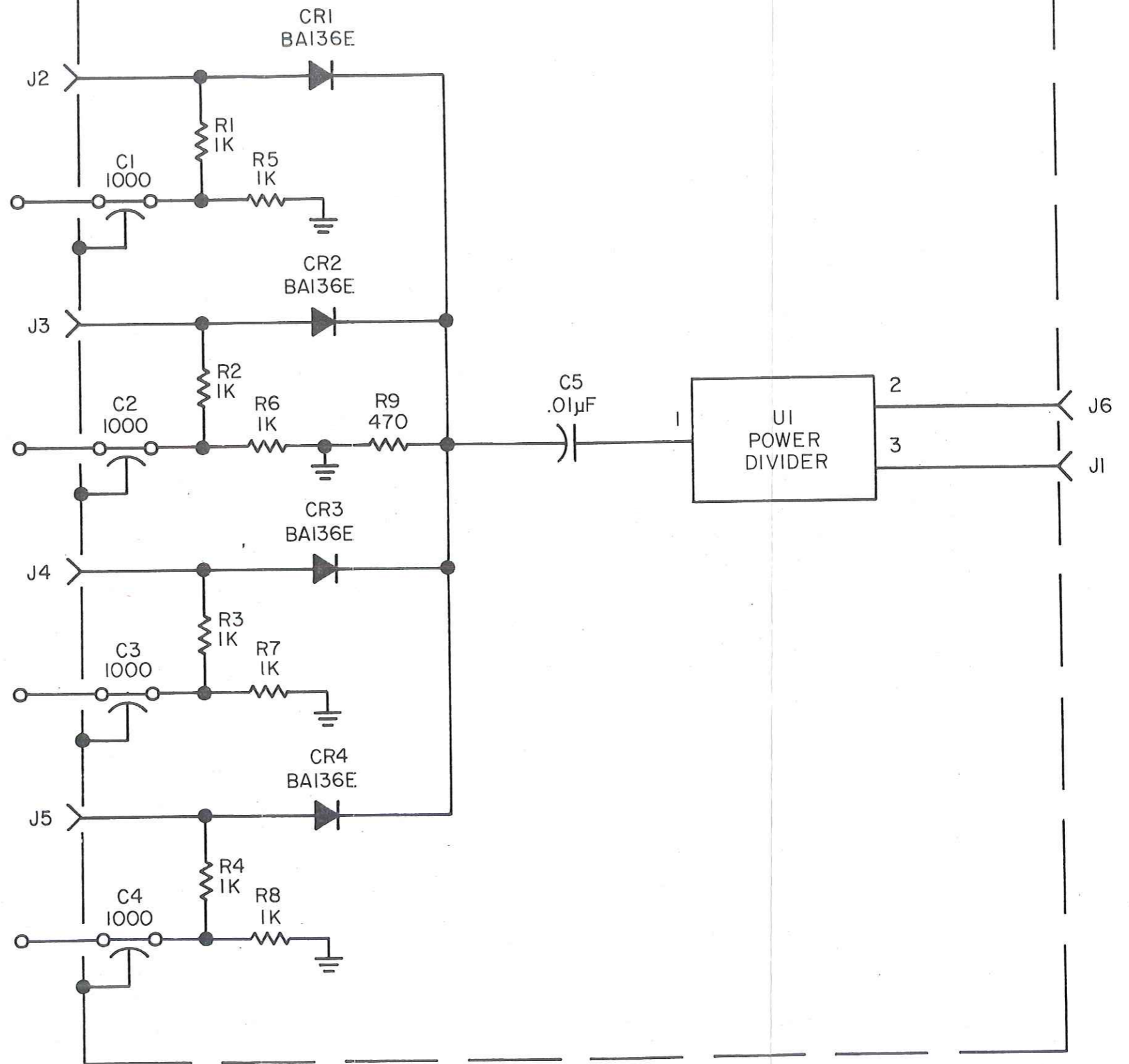
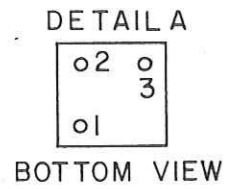
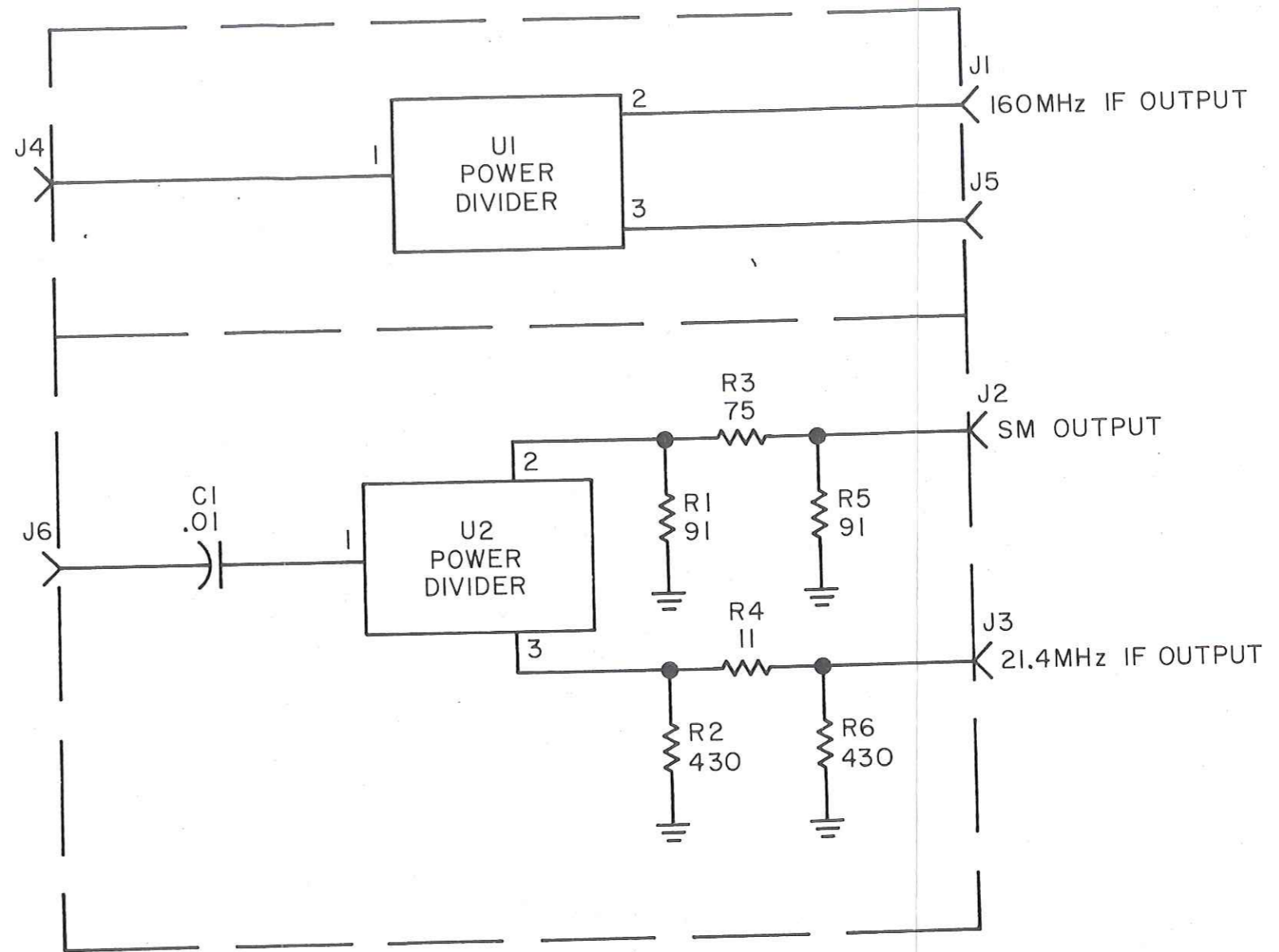


Figure 6-4. Type 791168 IF Coupler (A4), Schematic Diagram (MTF-100A only)



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
 - a) RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4W.
 - b) CAPACITANCE IS IN μF .
2. PIN ARRANGEMENT OF U1, U2 IS SHOWN IN DETAIL A.

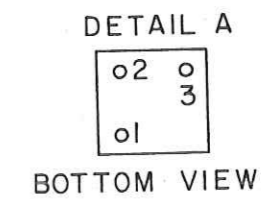


Figure 6-5. Type 791170 IF Coupler (A4), Schematic Diagram (MTF-102A only)

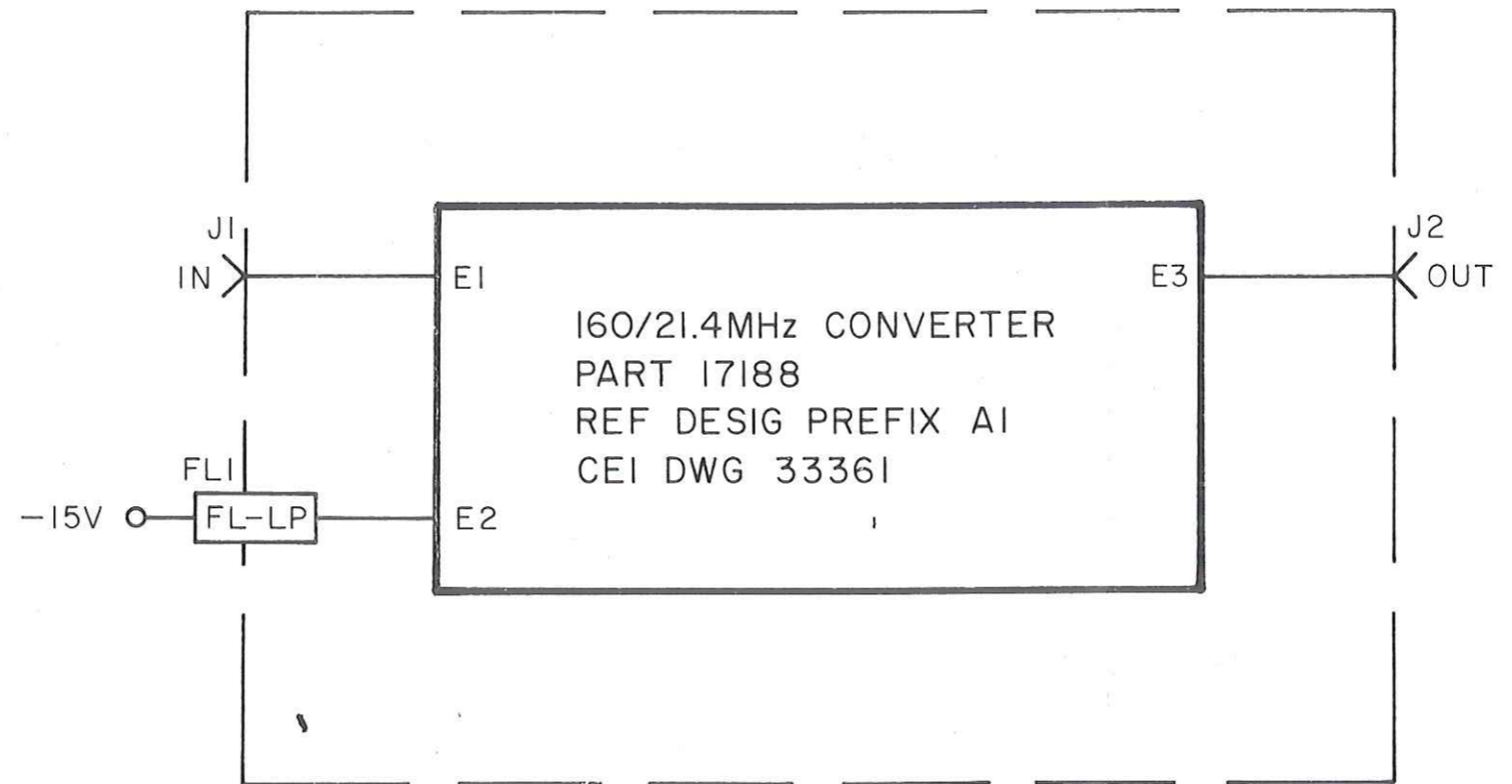
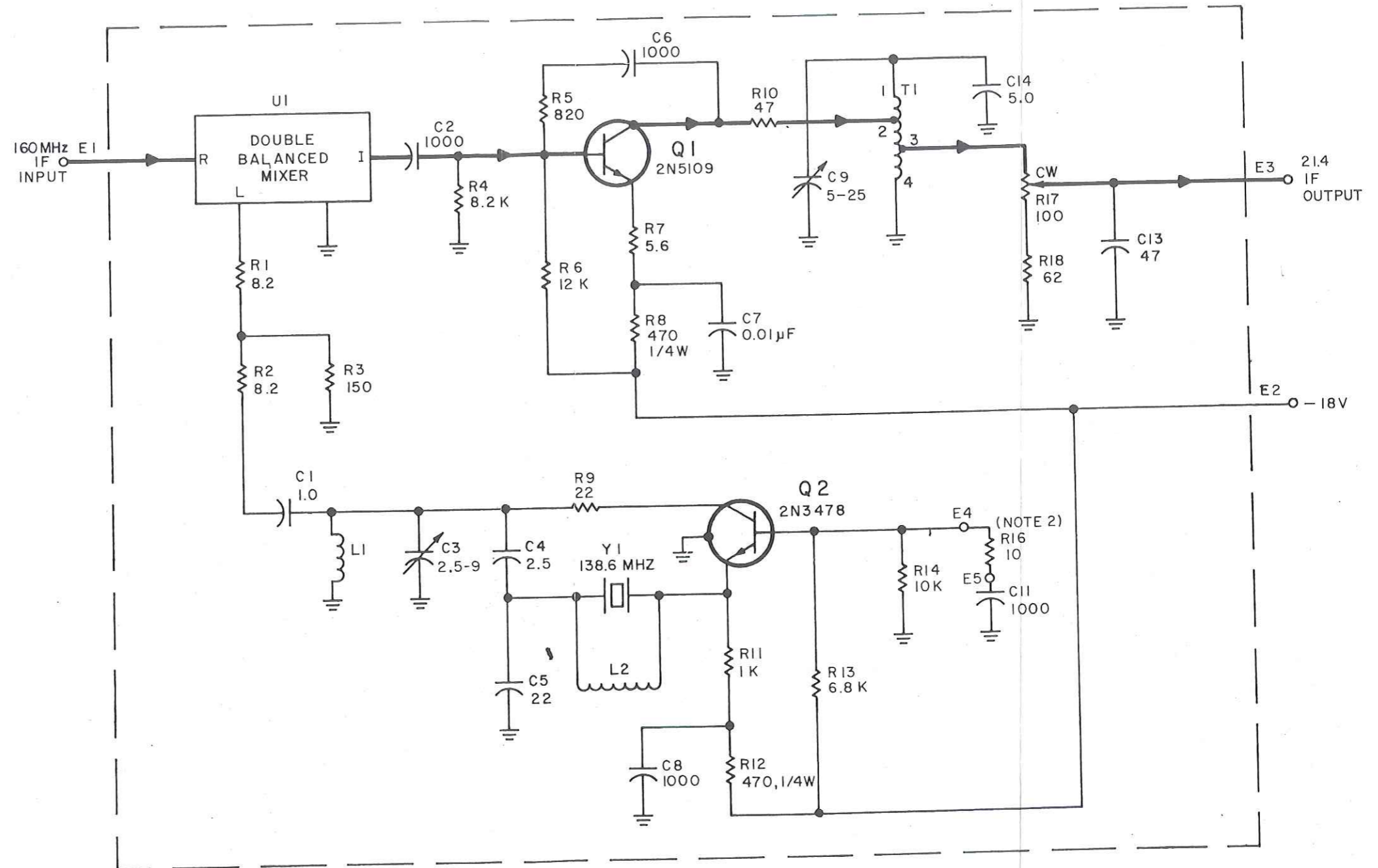


Figure 6-6. Type 791169 160/21.4 MHz Converter Assembly (A5), Schematic Diagram



- NOTES:
1. UNLESS OTHERWISE SPECIFIED:
 - a) CAPACITANCE IS MEASURED IN pF.
 - b) RESISTANCE IS MEASURED IN OHMS, 1/8W, 5%.
 2. NOMINAL VALUE, FINAL VALUE FACTORY SELECTED.
 3. CW ON R17 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 4. HEAVY LINE INDICATES MAIN SIGNAL PATH.

Figure 6-7. Part 17188 160/21.4 MHz Converter (A5A1), Schematic Diagram

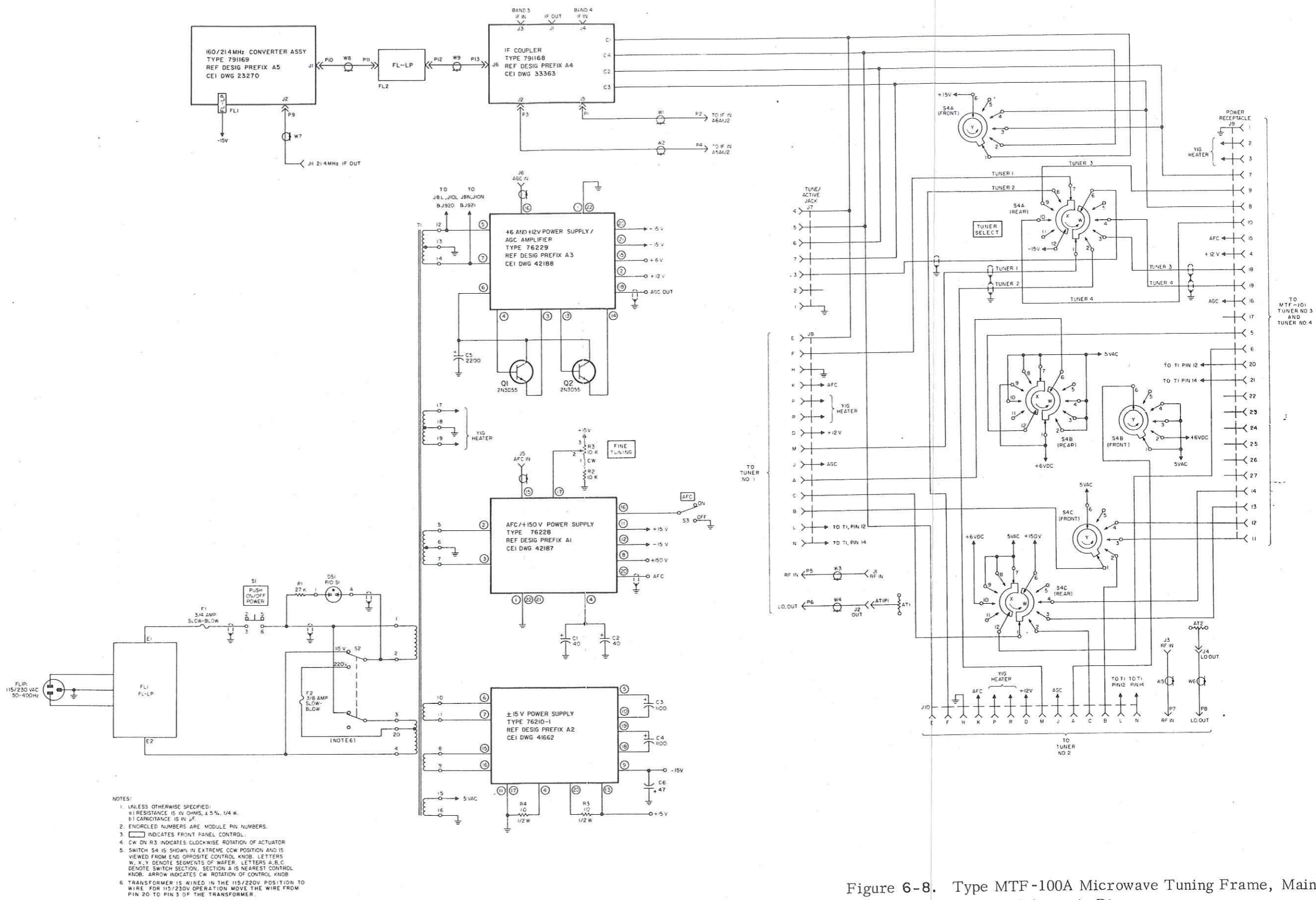


Figure 6-8. Type MTF-100A Microwave Tuning Frame, Main Chassis Schematic Diagram

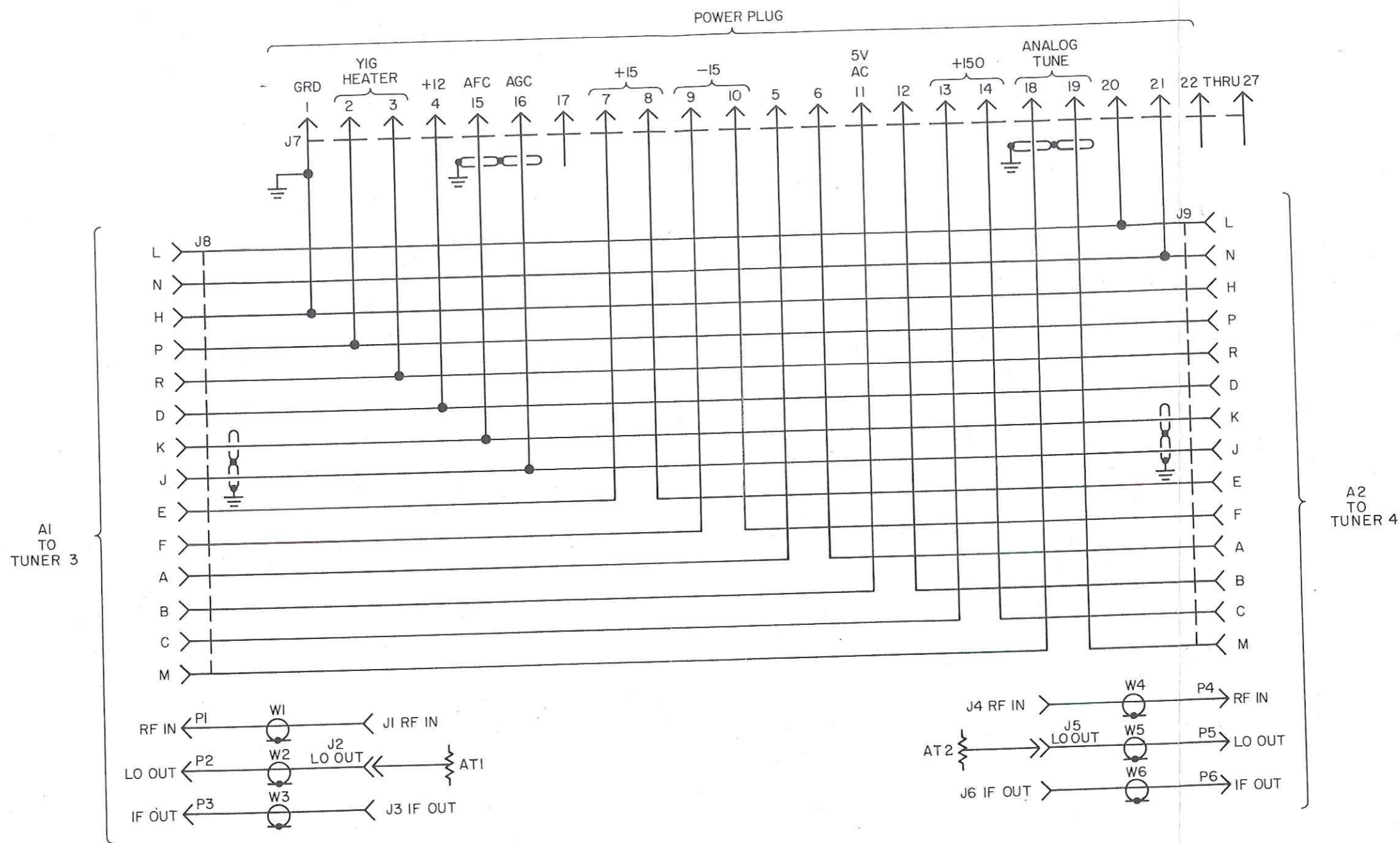


Figure 6-9. Type MTF-101 Microwave Tuning Frame, Main Chassis Schematic Diagram

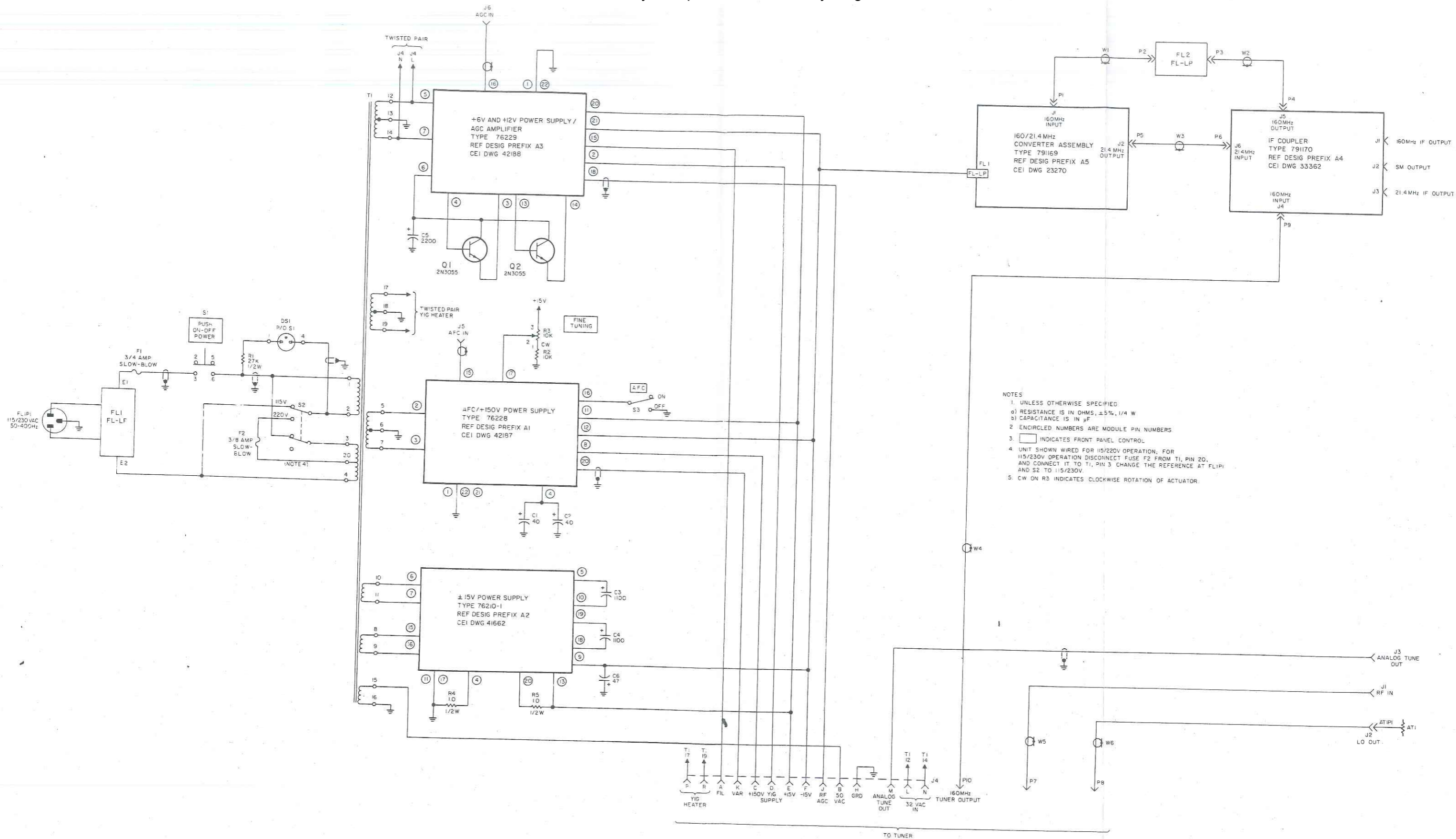


Figure 6-10. Type MTF-102A Microwave Tuning Frame, Main Chassis Schematic Diagram

Courtesy of <http://BlackRadios.terryo.org>

Courtesy of <http://BlackRadios.terryo.org>

INSTRUCTION MANUAL
FOR
TYPES MTF-100A, MTF-101, AND
MTF-102A MICROWAVE TUNING FRAMES

WATKINS—JOHNSON COMPANY
700 Quince Orchard Road
Gaithersburg, Maryland 20878



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.

PROPRIETARY STATEMENT

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This document is provided to the individual or using organization for their use alone in the direct support of the associated equipment unless permission or further disclosure is expressly granted in writing.

EQUIPMENT MALFUNCTIONS

This unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. If an apparent malfunction is encountered after installation, verify that the correct input signals are present at the proper connectors. Prior to taking any corrective maintenance action or breaking any seals, contact your Watkins-Johnson representative, or the Watkins-Johnson Company Service Department to prevent the possibility of voiding the terms of the warranty. Contact the Watkins-Johnson Company via mail, telephone, wire, or cable at:

Watkins-Johnson Company
Company Service Department
700 Quince Orchard Road
Gaithersburg, Maryland 20878-1794

Toll Call: (301) 948-7550 Ext. 7201
TELEX: 89-8402
TWX: 710-828-0546
TELEFAX: (301) 921-9479
EASYLINK: 62928185

If reshipment is necessary, follow the instructions in the following paragraph (Preparation for Reshipment or Storage). Do not return the equipment until a Return for Maintenance Authorization (RMA) number has been obtained from the Watkins-Johnson Company's Customer Service Department. See Item 10 in the General Terms and Conditions of Sale paper (WJ Form # WJ-151-X) for more information on equipment returns.

PREPARATION FOR RESHIPMENT OR STORAGE

If the unit must be prepared for reshipment, the packaging method should follow the pattern established in the original shipment. Use the best packaging materials available to protect the unit during reshipment or storage. When possible, use the original packing container and cushioning materials. If the original packing materials are not available, use the following procedure:

1. Wrap the unit in sturdy paper or plastic.
2. Place the wrapped unit in a strong shipping container and place a layer of shock-absorbing material (3/4-inch minimum thickness) around all sides of the unit to provide a firm cushion and to prevent movement inside the container.

3. If shipping the unit for service, fill out all information on the 5x6 PRODUCT DISCREPANCY REPORT card (WJ Form # WJC-QA55-0) that was provided with the original shipment. Also ensure that the Return for Maintenance Authorization (RMA) number is recorded on the card. If this card is not available, attach a tag to the unit containing the following information:
 - a. Return for Maintenance Authorization (RMA) number.
 - b. The Watkins-Johnson Type/Model number of the equipment.
 - c. Serial number.
 - d. Date received.
 - e. Date placed in service.
 - f. Date of failure.
 - g. Warranty adjustment requested, yes or no.
 - h. A brief description of the discrepant conditions.
 - i. Customer name and return address.
 - j. Original Purchase Order/Contract number.
4. Thoroughly seal the shipping container and mark it **FRAGILE**.
5. Ship to:

Watkins-Johnson Company
700 Quince Orchard Road
Gaithersburg, Maryland 20878-1794
U.S.A

When storing the equipment for extended periods, follow the above packing instructions to prevent damage to the equipment. The safe limits for storage environment are:

Temperature: -40 to +70°C
Humidity: less than 95%

ADDENDA
MTF-100A, MTF-101 and MTF-102A

The following changes should be incorporated into the Instruction Manual for the MTF-100A, MTF-101 and MTF-102A Microwave Tuning Frames.

1. Section V - Replacement Parts List
 - A. Paragraph 5.4.1 MTF-100A, Paragraph 5.4.2 MTF-101 and Paragraph 5.4.3 MTF-102A Microwave Tuning Frames Main Chassis
 - 1) Change FL2 from: Part No. 2L250-210-0 to: Part No. 5B250-160/8-0. (Pages 5-6, 5-15, and 5-20)
 2. Section VI - Schematic Diagrams
 - A. Figure 6-1; Page 6-2; Type 76228 AFC/+150 V Power Supply (A1)
 - 1) Add the following as the last sentence in note 5.
"...E3 in these cases. The standard factory connection shall be E2 to E3."
 - B. Figure 6-3; Page 6-4; Type 76229 +6 V and +12 V Power Supply/AGC Amplifier (A3)
 - 1) Add the following as the last sentence in note 6.
"...connect E2 to E1 and E4 to E6. The standard factory connection shall be E2 to E1 and E4 to E6."
- 9 January 1976
DLM:dwf
3. Section III - Installation and Operation
 - A. Paragraph 3.2.6.8; Power/Control Interface Connections
 - 1) Change P/N from 23062-1 to 23068-1. (Page 3-8)

4. Section V - Replacement Parts List

A. Paragraph 5.4.2; MTF-101 Microwave Tuning Frame, Main Chassis

- 1) Accessory External Cable Assembly to be furnished with the Equipment: CABLE ASSEMBLY; Qty. 1; Part No. 23068-1; Vendor Code 14632. (Page 5-18).

B. Paragraph 5.4.4; Type 76228 AFC +150 V Power Supply (A1 of MTF-100A and MTF-102A only).

- 1) Change CR4 from: Part No. 1N5297 to: P/N 1N5296. (Page 5-27)

C. Paragraph 5.4.5; Type 76210-1 +15 V Power Supply (A2 of MTF-102A)

- 1) Change RA1 from: Part No. 6103B to: RA1A: Part No. 6103C-TOP. (Page 5-31).
- 2) Add RA1B: HEATSINK; Qty. 2; Part No. 6103B-BASE; Vendor Code 13103. (Page 5-31).
- 3) Change RA2 from: Same as RA1 to: RA2A: Same as RA1A. (Page 5-31).
- 4) Add RA2B: Same as RA1B. (Page 5-31).

5. Section VI - Schematic Diagrams

A. Figure 6-1; Page 6-2; Type 76228 AFC/+150 V Power Supply (A1)

- 1) Change CR4 from: Part No. 1N5297 to: P/N 1N5296.

2 March 1976
DLM:dwf

6. Section V - Replacement Parts List

A. Paragraph 5.4.3; Type MTF-102A Microwave Tuning Frame, Main Chassis.

- 1) Change A4 from: IF COUPLER, P/N 791170; Vendor Code 14632 to: 160 MHz IF COUPLER; P/N 791448; Vendor Code 14632. (Page 5-20). Parts List shown on Page 5 of this addenda.
- 2) Add A7: 21.4 MHz IF COUPLER; P/N 791449; Vendor Code 14632. (Page 5-20). Parts List shown on page 8 of this addenda.

- B. Paragraph 5.4.1; Type MTF-100A Microwave Tuning Frame, Main Chassis.
- 1) Change A4 from: IF COUPLER; P/N 791168; Vendor Code 14632 to: IF COUPLER; 160 MHz; P/N 791453; Vendor Code 14632. (Page 5-6). Parts List shown on page 10 of this addenda.
 - 2) Add A6: 21.4 MHz IF COUPLER; P/N 791449; Vendor Code 14632. (Page 5-6). Parts List shown on page 8 of this addenda.
 - 3) Change quantity of J5 from: 3 to: 2. (Page 5-8).
 - 4) Change J11 from: Same as J5 to: NOT USED. (Page 5-8).
 - 5) Change quantity of P1 from: 4 to: 5. (Page 5-8).
 - 6) Add P14: Same as P1. (Page 5-10).

7. Section VI - Schematic Diagrams

- A. Figure 6-10; Page 6-11; Type MTF-102A Microwave Tuning Frame, Main Chassis.

- 1) Change A4 from: 791170 to: 791448.
- 2) Add A7: IF COUPLER; Type 791449.
- 3) Due to the above changes, a 160 MHz signal monitor output capability is added and is available at jack A4J2 on the rear panel. In addition, reference designations for some output connectors have been changed as tabulated below. These changes must be taken in account when interpreting the installation procedures and maintenance information. Parts lists and schematics of the changes as outlined above are shown on pages 5 through 17 of this addenda.

CONNECTOR CHANGES

| CONNECTOR FUNCTION | FORMER OUTPUT JACK | PRESENT OUTPUT JACK |
|-----------------------|-----------------------|------------------------|
| 21.4 MHz IF OUT | A4J3 | A7J1 |
| 21.4 MHz SM OUT | A4J2 | A7J2 |
| 160 MHz IF OUT | A4J1 | A4J1 |
| 160 MHz SM OUT | NONE | A4J2 |

B. Figure 6-8; Page 6-9; Type MTF-100A Microwave Tuning Frame, Main Chassis.

- 1) Change A4 from: 791168 to: 791453.
- 2) Add A6: IF COUPLER; Type 791449.
- 3) Due to the above changes, 160 MHz and 21.4 MHz signal monitor output capabilities are added and are available at jacks A4J7 and A6J2 on the rear panel. In addition, reference designations for some output connectors have been changed as tabulated below. These changes must be taken in account when interpreting the installation procedures and maintenance information. Parts lists and schematics of the changes as outlined above are shown on pages 5 through 17 of this addenda.

CONNECTOR CHANGES

| CONNECTOR FUNCTION | FORMER INPUT/ OUTPUT JACK | PRESENT INPUT/ OUTPUT JACK |
|-----------------------|------------------------------|-------------------------------|
| 21.4 MHz IF OUT | J11 | A6J1 |
| 21.4 MHz SM OUT | NONE | A6J4 |
| 160 MHz IF OUT | A4J1 | A4J1 |
| 160 MHz SM OUT | NONE | A4J7 |
| BAND 3 IF IN | A4J3 | A4J3 |
| BAND 4 IF IN | A4J4 | A4J4 |

8. Section V - Replacement Parts List

A. Paragraph 5.3; Page 5-1; List of Manufacturers.

- 1) Add the following manufacturers:

50021 Technical Research and Manufacturing Company
RFD 3
Grenier Field
Manchester, New Hampshire 03103

15542 Mini-Circuits Laboratory
Division of Scientific Components Corporation
2913 Quentin Road
Brooklyn, New York 11229

PART 17921-1 160 MHz IF COUPLER

REF DESIG PREFIX A4A1 (MTF-102A Only)

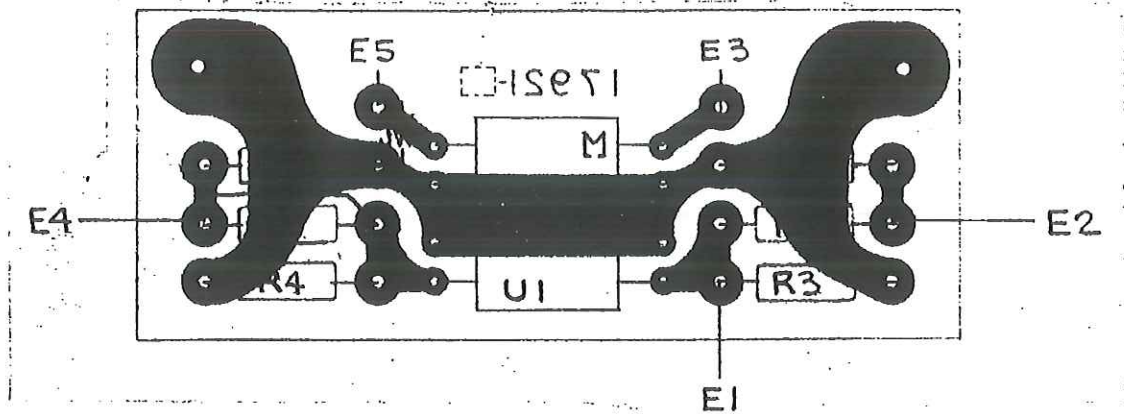
| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR CODE | RECM VENDOR |
|------------|---|--------------|-------------------------|----------|-------------|
| R1 Thru R3 | NOT USED | | | | |
| R4 | RESISTOR, FIXED, COMPOSITION: 91 Ω , 5%, 1/2 W | 2 | RCR07G910JS | 81349 | 01121 |
| R5 | RESISTOR, FIXED, COMPOSITION: 75 Ω , 5%, 1/2 W | 1 | RCR07G750JS | 81349 | 01121 |
| R6 | Same as R4 | | | | |
| U1 | 3-WAY DIVIDER | 1 | DL332 | 50021 | |

TYPE 791448 160 MHz IF COUPLER

REF DESIG PREFIX A4 (MTF-102A Only)

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR CODE | RECM VENDOR |
|--------------|-----------------------------------|--------------------|----------------------------|-------------|----------------|
| A1 | 160 MHz IF COUPLER | 1 | 17921-1 | 14632 | 19505 |
| J1 | CONNECTOR, RECEPTACLE, BNC SERIES | 2 | UG1094/U | 80058 | 19505 |
| J2 | Same as J1 | | | | |
| J3 | CONNECTOR, RECEPTACLE, SMA SERIES | 2 | 2058-0000 | 26805 | |
| J4 | Same as J3 | | | | |

Courtesy of <http://BlackRadios.terry.org>



Part 17921 IF Coupler (A4A1, A6A1, A7A1),
Location of Components

REF DESIG PREFIX A6 (MTF-100A Only)
 REF DESIG PREFIX A7 (MTF-102A Only)

TYPE 791449 21.4 MHz IF COUPLER

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR CODE | RECM VENDOR |
|-----------|-----------------------------------|--------------|-------------------------|----------|---|
| A1 | 21.4 MHz IF COUPLER | 1 | 17921-2 | 14632 | Courtesy of http://BlackRadios.terryo.org |
| J1 | CONNECTOR, RECEPTACLE, BNC SERIES | 2 | UG1094/U | 80058 | |
| J2 | Same as J1 | | | | |
| J3 | CONNECTOR, RECEPTACLE, SMA SERIES | 1 | 2058-0000 | 26805 | |

REF DESIG PREFIX A6A1 (MTF-100A Only)
 REF DESIG PREFIX A7A1 (MTF-102A Only)

PART 17921-2 21.4 MHz IF COUPLER

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR CODE | RECM VENDOR |
|--------------|---|--------------------|----------------------------|-------------|----------------|
| R1 | RESISTOR, FIXED, COMPOSITION: 91 Ω, 5%, 1/8 W | 2 | RCR05B910JS | 81349 | 01121 |
| R2 | RESISTOR, FIXED, COMPOSITION: 75 Ω, 5%, 1/8 W | 1 | RCR05G750JS | 81349 | 01121 |
| R3 | Same as R1 | | | | |
| U1 | 2-WAY DIVIDER | 1 | DL232 | 50021 | |

TYPE 791453 160 MHz IF COUPLER

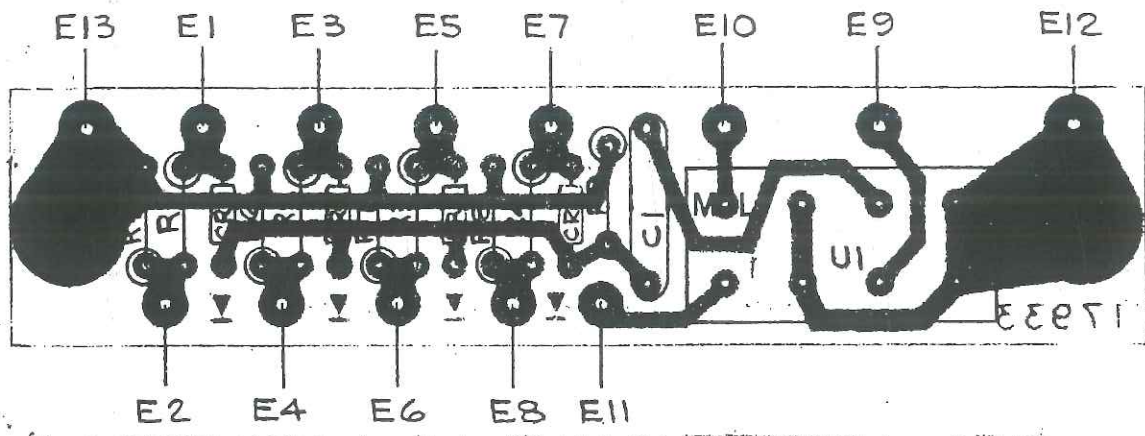
REF DESIG PREFIX A4 (MTF-100A Only)

| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR CODE | RECM VENDOR |
|------------------|---|--------------------|----------------------------|-------------|---|
| A1 | 160 MHz IF COUPLER | 1 | 17933 | 14632 | Courtesy of http://BlackRadios.terryo.org |
| C1 | CAPACITOR, CERAMIC, FEEDTHRU: 1000 pF, GMV, 500 V | 4 | 54-794-009-102W | 33095 | |
| C2 Thru C4 | Same as C1 | | | | |
| J1 | CONNECTOR, RECEPTACLE, BNC SERIES | 4 | UG1094/U | 80058 | |
| J2 | CONNECTOR, RECEPTACLE, SMA SERIES | 2 | 2058-0000 | 26805 | |
| J3 | Same as J1 | | | | |
| J4 | Same as J1 | | | | |
| J5 | Same as J2 | | | | |
| J6 | CONNECTOR, RECEPTACLE, SMC SERIES | 1 | 10-0104-002 | 19505 | |
| J7 | Same as J1 | | | | |

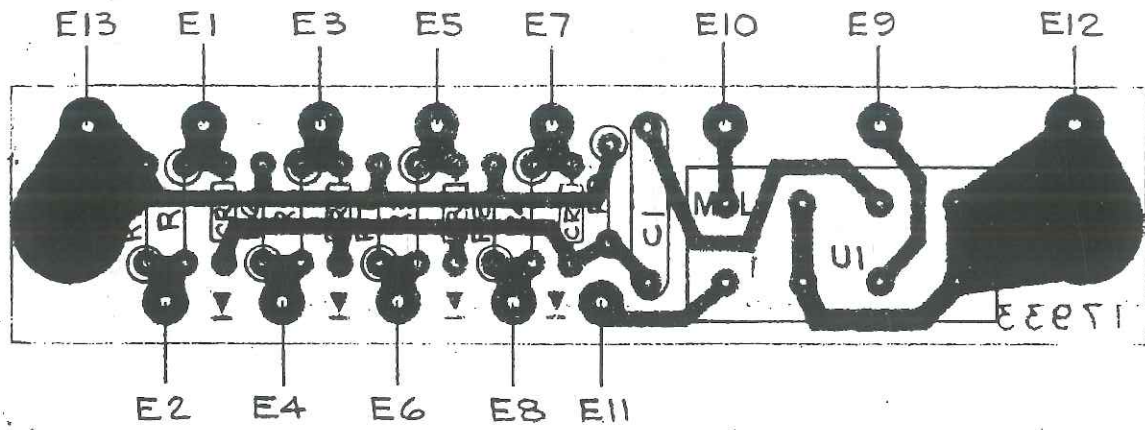
PART 17933 160 MHz IF COUPLER

REF DESIG PREFIX A4A1 (MTF-100A Only)

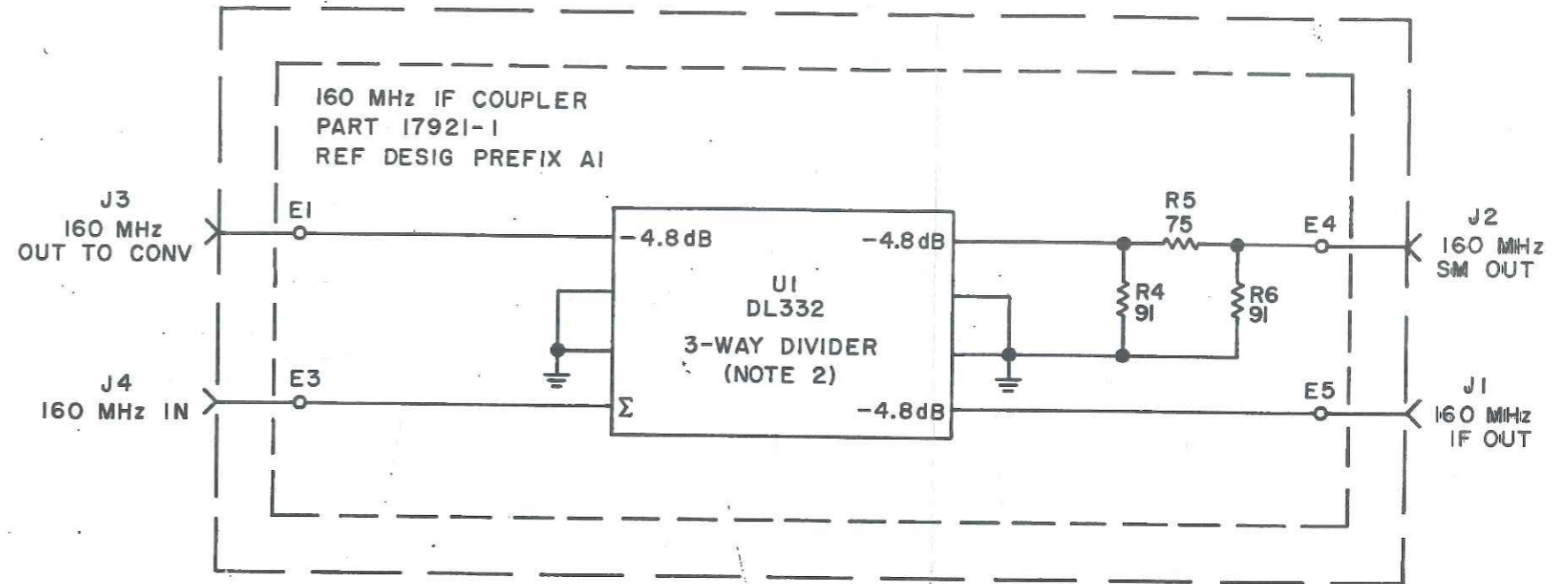
| REF DESIG | DESCRIPTION | QTY PER ASSY | MANUFACTURER'S PART NO. | MFR CODE | RECM VENDOR |
|--------------|--|--------------|-------------------------|----------|-------------|
| C1 | CAPACITOR, CERAMIC, DISC: 0.01 μ F, 20%, 500 V | 1 | SM(0.01 μ F,M) | 91418 | |
| CR1 | DIODE | 4 | MPN3401 | 04713 | |
| CR2 Thru CR4 | Same as CR1 | | | | |
| R1 | RESISTOR, FIXED, COMPOSITION: 1 k Ω , 5%, 1/4 W | 8 | RCR07G102JS | 81349 | 01121 |
| R2 Thru R8 | Same as R1 | | | | |
| R9 | RESISTOR, FIXED, COMPOSITION: 470 Ω , 5%, 1/4 W | 1 | RCR07G471JS | 81349 | 01121 |
| U1 | POWER SPLITTER, COMBINER | 1 | PSC-3-1 | 15542 | |



Part 17933 160 MHz IF Coupler (A4A1),
Location of Components

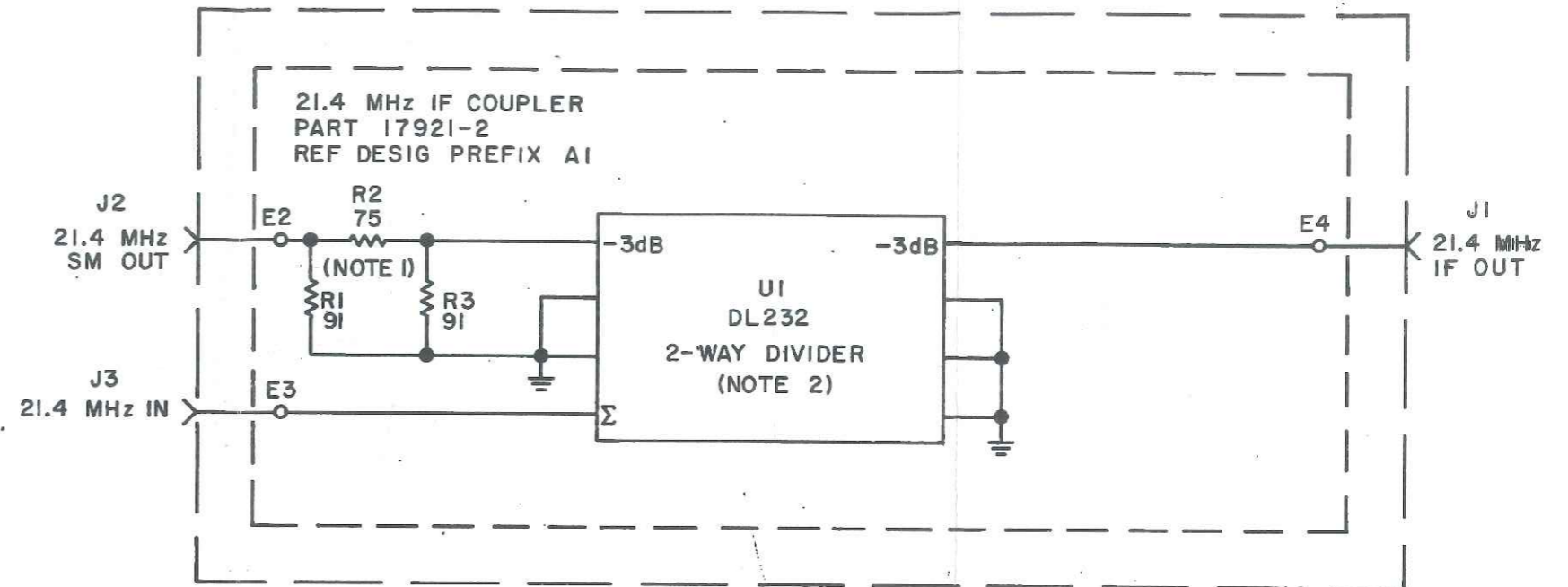


Part 17933 160 MHz IF Coupler (A4A1),
Location of Components



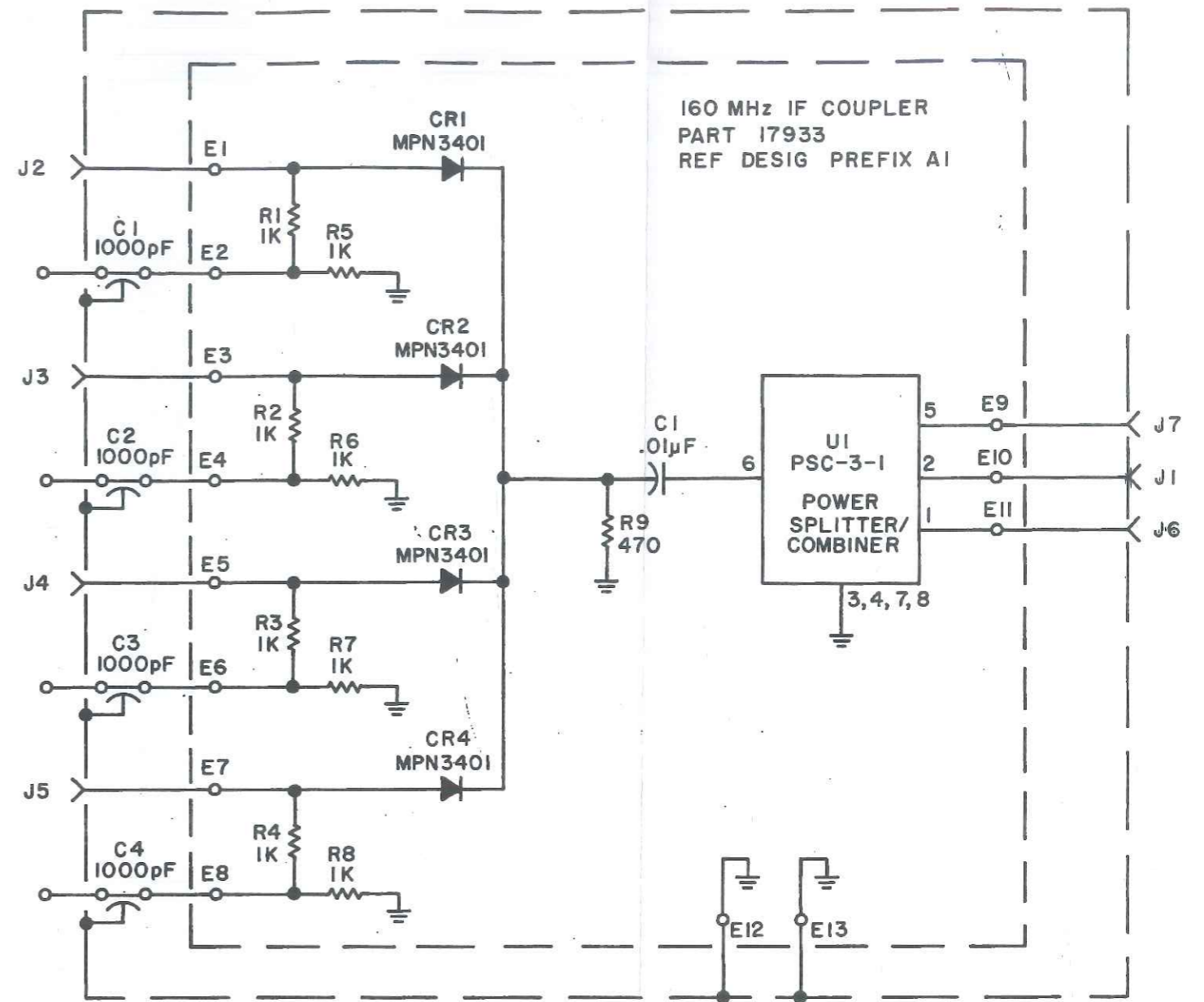
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS, $\pm 5\%$, 1/8 W.
2. PIN ARRANGEMENT OF AIU1 IS AS SHOWN IN THE SCHEMATIC (TOP VIEW).



NOTES

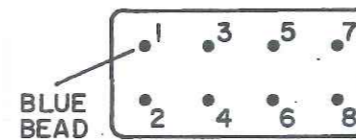
1. UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS, $\pm 5\%$, 1/8 W.
2. PIN ARRANGEMENT OF A1U1 IS AS SHOWN IN THE
SCHEMATIC (TOP VIEW).



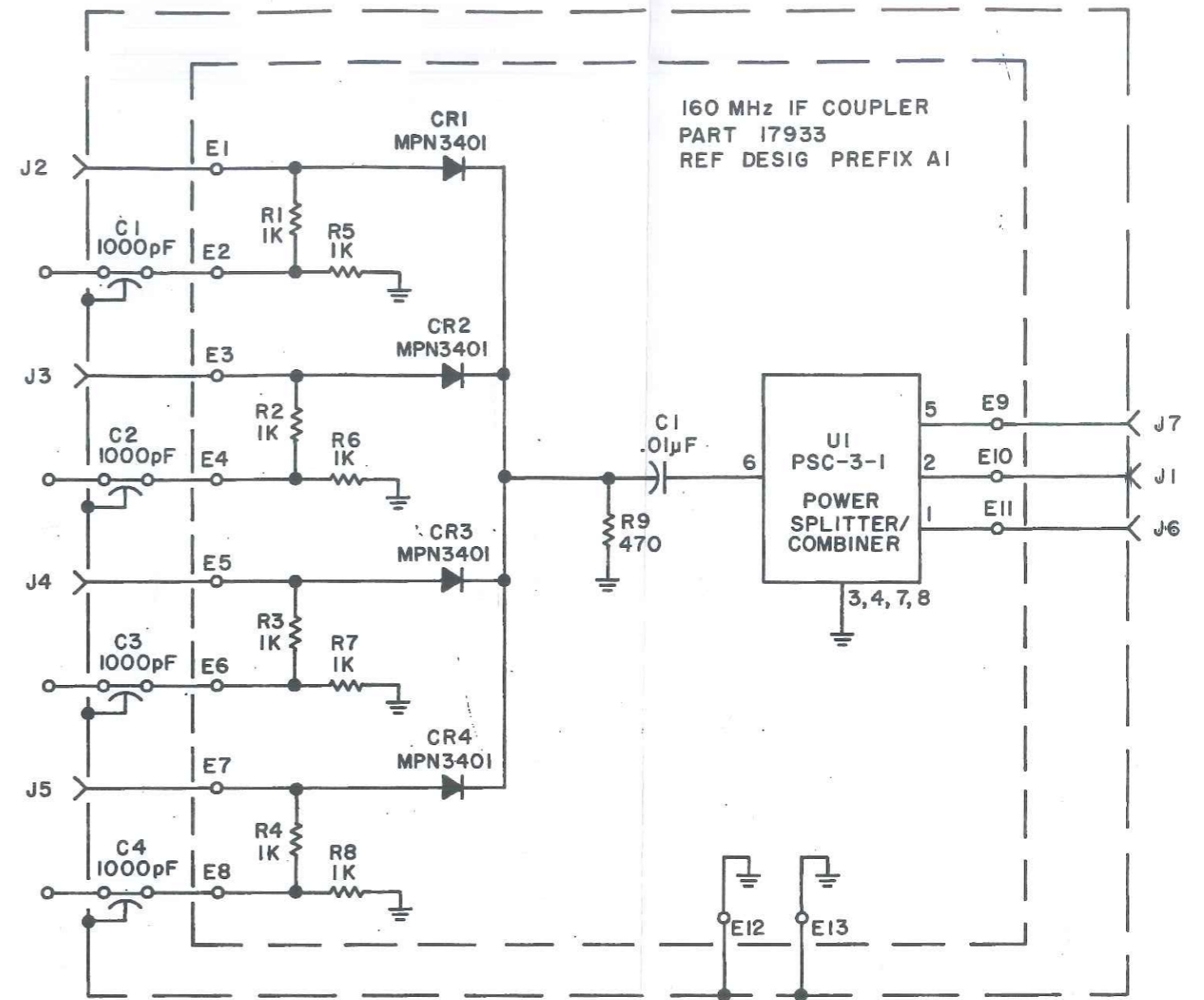
160 MHz IF COUPLER
PART 17933
REF DESIG PREFIX A1

NOTES:

1. RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4W.
2. PIN ARRANGEMENT FOR A1UI IS SHOWN BELOW:



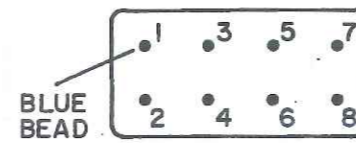
Type 791453 160 MHz IF Coupler, (A4),
Schematic Diagram



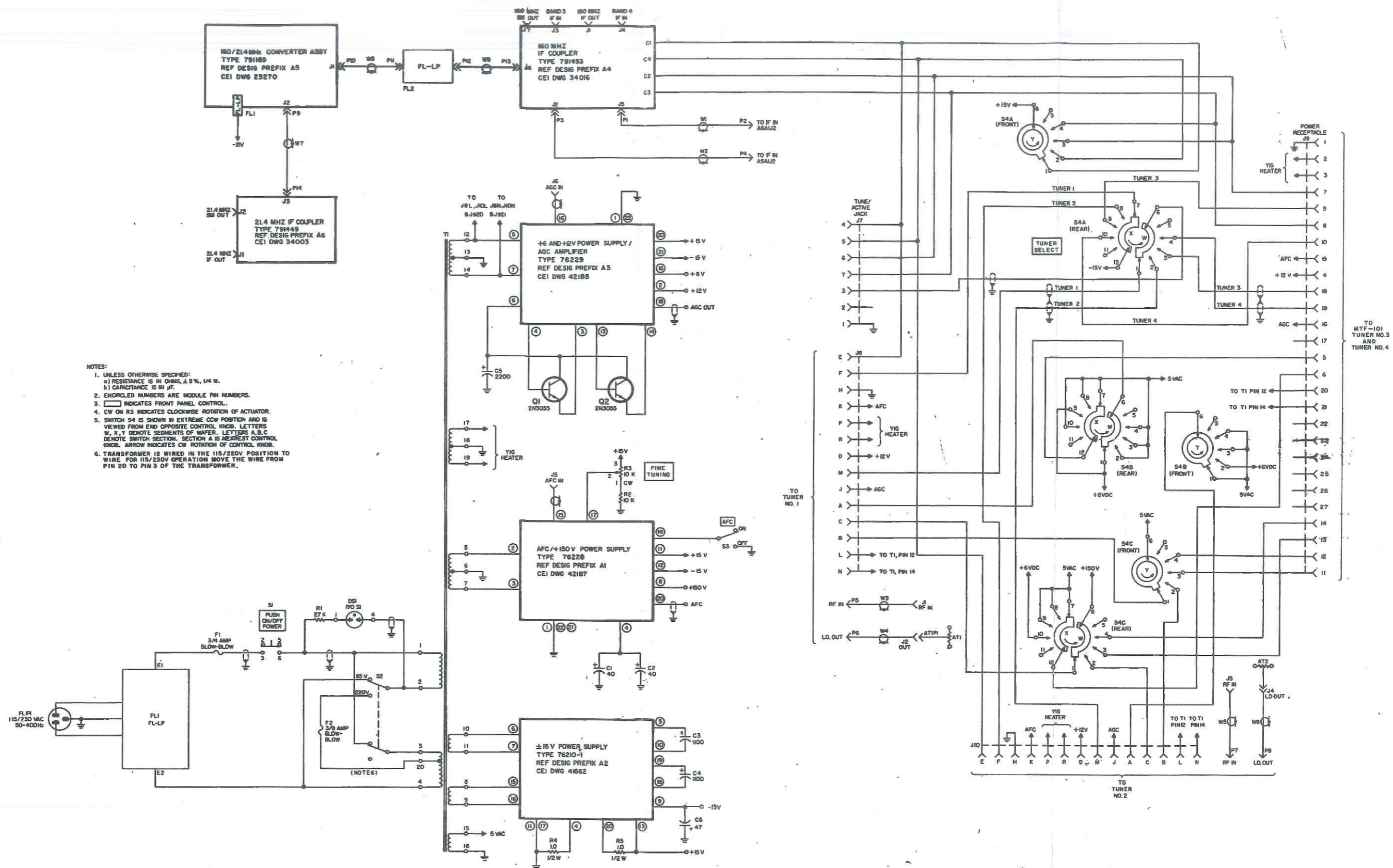
160 MHz IF COUPLER
PART 17933
REF DESIG PREFIX A1

NOTES:

1. RESISTANCE IS IN OHMS, $\pm 5\%$, 1/4W.
2. PIN ARRANGEMENT FOR A1UI IS SHOWN BELOW:

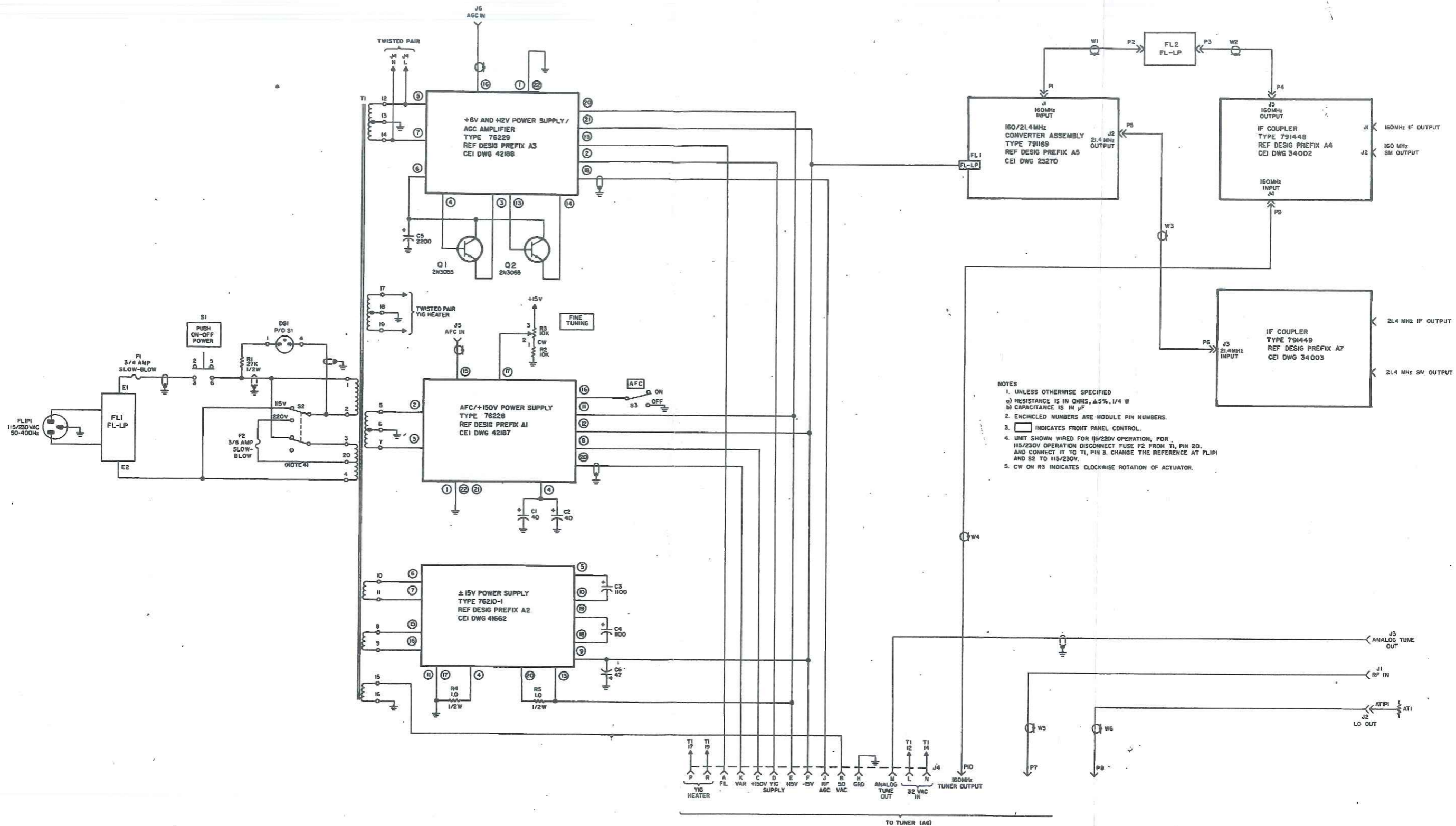


Type 791453 160 MHz IF Coupler, (A4),
Schematic Diagram



- NOTES:
- UNLESS OTHERWISE SPECIFIED:
 - RESISTANCE IS IN OHMS, A 5%, 1/4 W.
 - CAPACITANCE IS IN μ F.
 - ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
 - INDICATES FRONT PANEL CONTROL.
 - CW ON R3 INDICATES CLOCKWISE ROTATION OF ACTUATOR.
 - SWITCH S4 IS SHOWN IN EXTREME CCW POSITION AND IS VIEWED FROM END OPPOSITE CONTROL KNOB. LETTERS W, X, Y DENOTE SEGMENTS OF WAFER. LETTERS A, B, C DENOTE SWITCH SECTION. SECTION A IS NEAREST CONTROL KNOB. ARROW INDICATES CW ROTATION OF CONTROL KNOB.
 - TRANSFORMER IS WIRED IN THE 115/230V POSITION TO WIRE. FOR 115/230V OPERATION MOVE THE WIRE FROM PIN 20 TO PIN 3 OF THE TRANSFORMER.

Type MTF-100A Microwave Tuning Frame Schematic Diagram



Type MTF-102A Microwave Tuning Frame, Schematic Diagram

