INSTRUCTION MANUAL

FOR

TYPE DMS-109 TUNABLE DEMODULATOR

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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.

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Tuning Range	5 kHz to MHz
Types of Demodulation	Upper sideband or lower sideband (selected by front-panel switch)
Input Impedance	10 k-ohm, nominal
Input Level	10 mV to 1V for nominal output
Output Level Control	Manual only
IF Bandwidth	2.8 kHz
Outputs	Phones jack and 600-ohm rear panel output
Output Level	1 mW into 600 ohms
Output Frequency Response	300 Hz to 3.2 kHz, approximately
Undesired Sideband Rejection	40 dB, minimum
Adjacent Channel Rejection	40 dB, minimum (4-kHz channel spacing)
Input Power	115 or 230 Vac, 50-400 Hz
Power Consumption	10 watts, approximately
Dimensions	19 inches wide, 3.5 inches high, and 16 inches deep
Weight	17 lbs., approximately

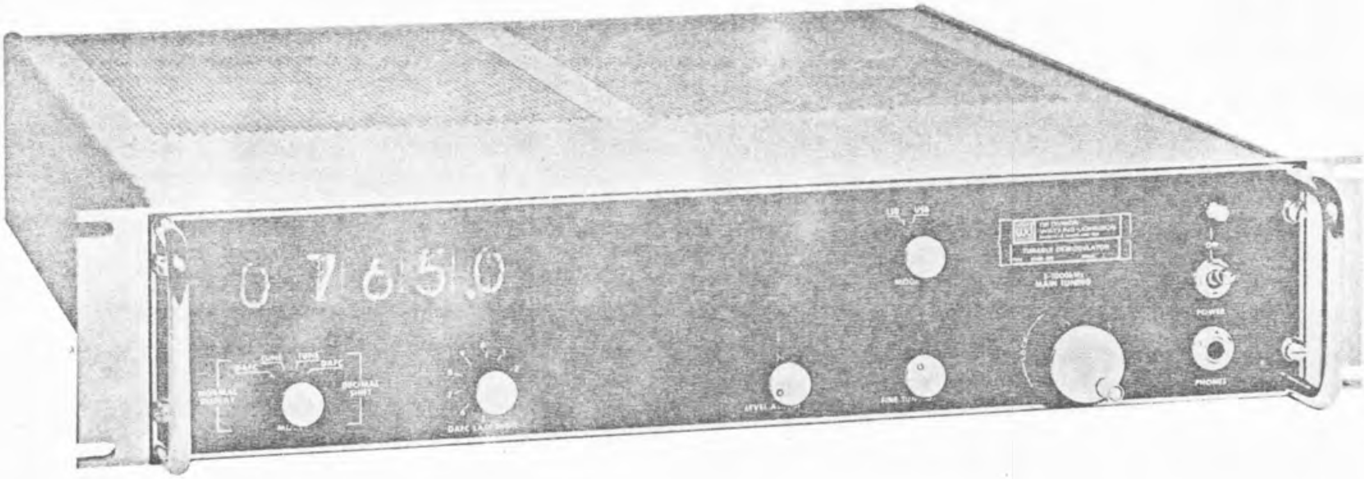


Figure 1-1. Type DMS-109 Tunable Demodulator

SECTION I
GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 The Type DMS-109 Tunable Demodulator is designed to demodulate single-sideband signals in the frequency range of 5 kHz to 1 MHz. This frequency range is covered in a single band. Double conversion is employed in the demodulator with the first conversion up to 2 MHz for high image rejection and the second conversion down to 455 kHz for demodulation of input signals. The IF bandwidth of the DMS-109 is 2.8 kHz and is provided by mechanical filters having extremely steep response skirts. Both upper and lower sideband amplifiers incorporate the narrowband filters for maximum rejection of the adjacent channel and the unwanted sideband.

1.1.2 The DMS-109 is designed to produce a nominal output level of 1 mW into a 600-ohm load with an input level of 10 mV. Manual gain control of the unit permits input levels as high as 1 volt to be used. The nominal input impedance of the demodulator is 10,000 ohms.

1.1.3 The tuned frequency of the DMS-109 is displayed by a five-digit neon readout located on the front panel. By employing the decimal shift feature, the displayed frequency is within 10 Hz of the tuned frequency. A digital automatic frequency control (DAFC) circuit in the DMS-109 counter section permits the demodulator local oscillator to be locked to the extremely accurate electronic counter circuits for a stable and exact LO frequency. In addition to counteracting local oscillator drift, the DAFC circuits provide the equivalent of 99,500 crystal controlled frequencies, each separated by 10 Hz, when in the decimal shift mode. Consequently, the demodulator can be locked to a particular frequency regardless of whether a signal is present or not.

1.1.4 Two audio outputs are provides by the demodulator: a front-panel PHONES jack and a 600-ohm output at terminals 2 and 3 of TB1 on the rear apron. A regulated power supply provides all the necessary operating voltages for the unit. The DMS-109 can be operated from a primary power source of 115 or 230 Vac, 50-400 Hz.

1.2 MECHANICAL CHARACTERISTICS

The DMS-109 is designed for mounting in a standard 19-inch rack. The unit will occupy 3.5-inches of vertical space and extend 16 inches into the rack. The main chassis, front panel, and dust covers are constructed of aluminum. The front panel is finished with grey enamel and is overlaid with a black-anodized etched bezel. All of the etched circuit boards that comprise the counter are housed in a brass enclosure. Eight of the remaining nine subassemblies are etched circuit boards which plug into receptacles on the main chassis. The tuning assembly is constructed in a 1/4-inch thick aluminum box to minimize radiation.

1.3 EQUIPMENT SUPPLIED

This equipment consists of the Type DMS-109 Tunable Demodulator and various tuning and adjustment tools, only. The dimensions and weight of the unit are given in Table 1-1.

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The DMS-109 requires only an input signal of the proper level and within its frequency range for normal operation. For monitoring of the audio output, headphones such as the Telex HM-50 are required, or any 600-ohm audio device which contains a loudspeaker and can be connected to the rear-apron terminal strip.

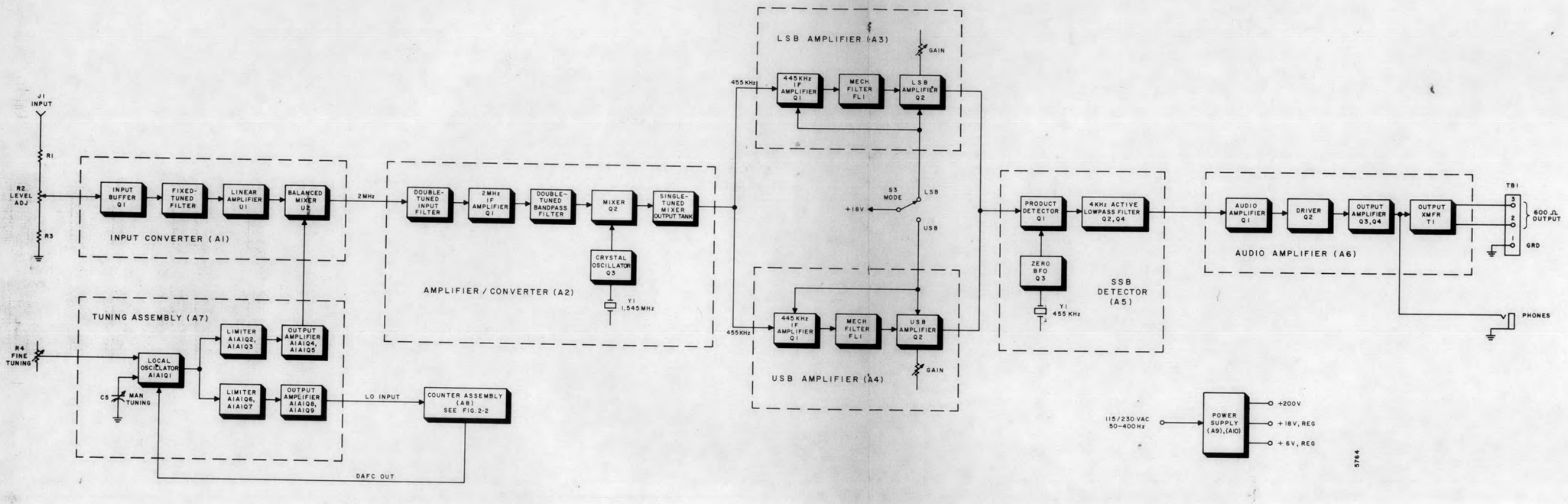


Figure 2-1. Type DMS-109 Tunable Demodulator, Functional Block Diagram

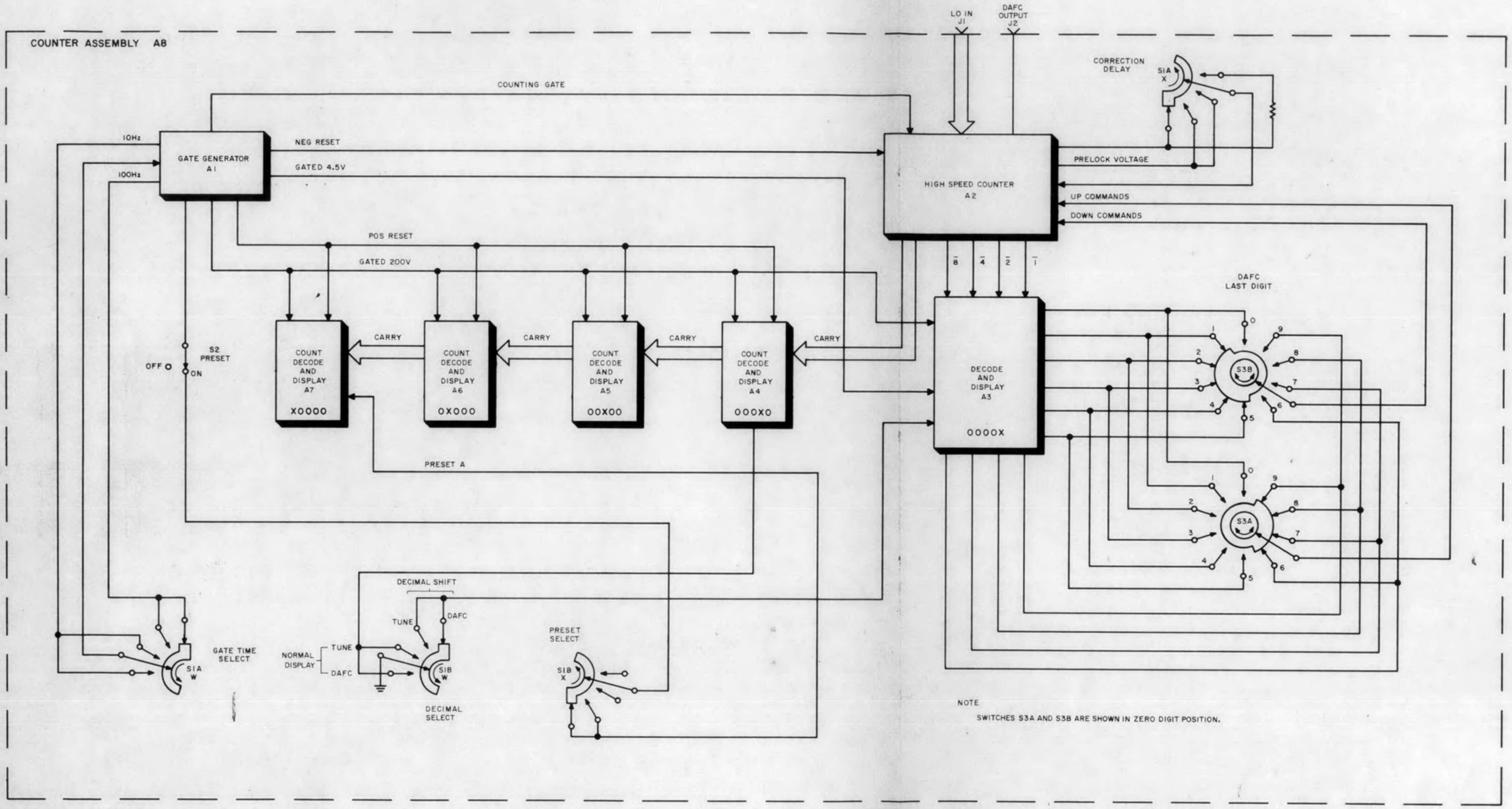


Figure 2-2. Type 79386 Counter, Functional Block Diagram

SECTION II
CIRCUIT DESCRIPTION

2.1 GENERAL

Operation of the various circuits in the DMS-109 Tunable Demodulator is described in the following paragraphs using the functional block diagram, Figure 2-1, and the schematic diagrams in Section VI of this manual. In addition, a functional block diagram for counter assembly A8 is provided in Figure 2-2. The unit numbering method is used for electrical components. This means that parts on subassemblies carry a prefix before the class letter and number of the item (such as A1Q1 and A6R1). These subassembly prefixes are omitted on illustrations and in the text, except in those cases where confusion might result from their omission.

2.2 FUNCTIONAL DESCRIPTION

2.2.1 The Type DMS-109 Tunable Demodulator tunes from 5 kHz to 1 MHz in one band. Input signals are coupled through INPUT jack J1 and a resistive attenuator to the Input Converter (A1). The output of transistor A1Q1 is coupled through a fixed-tuned low-pass filter to the input of A1U1. Linear amplifier A1U1 amplifies the signal and it is then coupled to the input of balanced mixer A1U2. The input signal is mixed with the LO from the tuning assembly (A7) and the sum and difference frequencies from A1U1 are applied to module A2.

2.2.2 Local oscillator A7A1A1Q1 is tuned to 2 MHz above the input frequency. Frequency limits of the oscillator are 2.005 to 3.0 MHz. The LO is tuned by the front-panel tuning knob which is mechanically linked to A7A1C5. Fine adjustments to the LO can be made with the front-panel FINE TUNING potentiometer, R4, and by means of the internal counter DAFC (digital automatic frequency control) circuits. The output from the oscillator tank is split into two identical paths. One path supplies the LO signal to the balance mixer in module A1 and the other path is to the LO input of the internal counter. Each path contains its own limiter transistors, and output amplifiers. The output amplifiers are connected as complementary-symmetry emitter followers.

2.2.3 The output from balanced mixer A1U2 is applied to a double-tuned input filter in the Amplifier/Converter (A2). This network filters the sum frequency from A1U2 and passes the difference frequency of 2 MHz (the first IF) to IF amplifier A2Q1. Amplified first IF signals are coupled through a double-tuned bandpass filter to the second mixer, A2Q2. Transistor A2Q2 mixes the 2-MHz first IF with the 1.545 MHz output of low beat oscillator A2Q3. The difference output of the mixer is 455 kHz, the second IF. The mixer tank circuit is tuned to 455 kHz. It passes the second IF and attenuates the other output frequencies of the mixer.

2.2.4 The second IF is applied to both the LSB Amplifier (A3) and the USB Amplifier (A4). Only one of these modules is enabled at a time. Selection of either the lower sideband or upper sideband is controlled by the front-panel MODE switch, S3. These two modules contain identical circuitry differing only in the mechanical filter employed. With the LSB amplifier enabled, the 455 kHz IF is coupled to IF amplifier A3Q1. Output signals from A3Q1 are applied to mechanical filter A3FL1. This filter has a bandwidth of 2.8 kHz and is used to obtain maximum rejection of the adjacent channel and of the unwanted sideband. The output from the filter is amplified by transistor A3Q2. The gain of this stage is set by a potentiometer connected to gate 2 of the transistor. The output single-sideband signal from the module is coupled to the SSB Detector (A5).

2.2.5 The output from the enabled sideband amplifier is applied to the SSB detector module (A5). Transistor A5Q1 mixes this signal with the output of zero BFO (beat frequency oscillator) A5Q3. Crystal-controlled oscillator A5Q3 operates at a frequency of 455 kHz. The output from the product detector consists of the input frequency, the oscillator frequency, and the sum and difference of these two frequencies. This output is applied to a 4 kHz active, low-pass filter consisting of transistor A5Q2 and A5Q4 plus associated circuitry. This filter passes the difference frequency and filters the others. Thus, the IF is eliminated and only the audio portion of the signal remains.

2.2.6 The audio output from module A5 is coupled to the Audio Amplifier (A6). Audio signals are amplified by transistors A6Q1 through A6Q4 and applied to output transformer T1 and the front panel phones jack. Output amplifiers A6Q3-Q4 provide the necessary current gain and transformer T1 provides a balanced 600-ohm output. The audio output is available at the phones jack and rear apron terminal strip TB1. The output level is 1 mW into a 600-ohm load.

2.2.7 Operating voltages for the DMS-109 are supplied by modules A9 and A10. Module A9 supplies a regulated +18 volts for operation of the demodulating circuits. Supply A10 provides +6V regulated and +200V for operation of counter assembly A8. Both supplies operate from a common power transformer T1. Either 115 or 230 Vac, 50-400 Hz can be used for primary power.

2.3 CIRCUIT DESCRIPTION

2.3.1 Type 79749 Input Converter. - Figure 6-1 is the schematic diagram for this module; its reference designation prefix is A1. The input to this module is taken from rear-apron INPUT jack J1 (see Figure 6-17) and coupled through a resistive attenuator to module pin 2. Resistors R1 and R3, and front-panel potentiometer R2, LEVEL ADJUST, control the level of the signal applied to A1 pin 2.

2.3.1.1 Resistor R1 and capacitor C1 couple the signal from pin 2 to the base of input buffer Q1. Transistor Q1 is an emitter follower. The buffered signal is coupled through a fixed-tuned low-pass filter to the input of U1. Inductors L1, L2, and L3 and capacitors C4, C5, C6, and C7 comprise the filter. Its cutoff frequency is approximately 1.1 MHz. This configuration is employed to prevent signals in the 2 MHz range from interfering with the first IF.

2.3.1.2 Integrated circuit U1 is a linear amplifier. Voltage gain of this stage is 20. The gain is set by the values of C11, C12, and R9 and the by-passing of pin 8. The output from IC U1 is ac coupled to the input of U2 through capacitor C13. Resistor R10 provides the optimum impedance match between U1 and U2. Balanced mixer U2 mixes the output of U1 with the LO output from tuning assembly A7. The LO is applied to U1 through module pin 15 and R11. The two frequencies applied to U2 are effectively balanced out in the mixer. Therefore, only the sum and difference frequencies are present at pin 1 of U2. Resistors R12, R13, and R14 form a pi-network attenuator. The output from U2 is attenuated approximately 6 dB and is fed to module pin 21.

2.3.2 Type 79496 Amplifier/Converter. - Figure 6-2 is the schematic diagram for this module; its reference designation prefix is A2. Output signals from module A1 are coupled to the input of module A2 at pin 21.

2.3.2.1 Sum and difference frequencies from A1U2 are applied to a double-tuned filter consisting of capacitors C1, C2, C3, C4, and C5 and variable inductors L1 and L2. Capacitors C1 and C2 provide a voltage step-up. The entire network is tuned to the difference frequency of 2 MHz. The first intermediate frequency is coupled from the filter through parasitic suppressor R4 to the base of transistor Q1. Resistor R2 and R3 bias Q1 for Class A operation. Gain of the IF amplifier is determined by resistor R7 which sets the amount of emitter degeneration. Collector load for Q1 is a double-tuned bandpass filter consisting of C8, C9, C10, and C20 and variable inductors L3 and L4. This filter, as well as the input filter, has a narrow bandwidth (approximately 30 kHz) to increase the selectivity of the demodulator. The 2-MHz IF signal from the junction of C9 and C10 (effectively center tapping L4) is applied to gate 1 (pin 3) of mixer Q2. Resistors R8 and R9 provide biasing for pin 3 of Q2, and R10 and R11 bias pin 2 of the mixer.

2.3.2.2 Transistor Q3 functions as a crystal controlled oscillator. The configuration is a modified Colpitts circuit. Resistors R12 and R13 provide base bias. Feedback to sustain oscillation is taken from the emitter and coupled to the junction of C14 and C15 through R15. Capacitors C14 and C15 provide the necessary impedance step-up to sustain oscillation. The frequency of the oscillator is set at 1.545 MHz by crystal Y1. Output of the oscillator is taken at the base of Q3 and coupled through dc blocking capacitor C12 to gate 2 (pin 2) of Q2.

2.3.2.3 Mixer Q2 is a dual insulated-gate field-effect (IGFET) transistor. At these low frequencies this mixer provides very good isolation between the two input gates. Resistor R16 is a parasitic suppressor. The drain load for Q2 is a single tuned tank circuit. This tank, consisting of C16 and C17 and L5, is tuned to the second IF of 455 kHz. The tank suppresses the undesired mixer products. The capacitive voltage divider, C16 and C17, provides the necessary impedance step-down to match the high impedance output of Q2 with the low impedance input of the next stage. The 455 kHz second IF signal is fed to the input of both modules A3 and A4 from A2 pin 2.

2.3.3 Type 79748-1 and 79748-2 LSB-USB Amplifiers. - The schematic diagram for these modules is Figure 6-3; their reference designation prefixes are A3 and A4, respectively.

2.3.3.1 With front-panel MODE switch in the LSB position (see Figure 6-17), the LSB Amplifier (A3) is enabled. The 455 kHz IF from module A2 is coupled to the base of transistor Q1 through C1 and R1. Capacitor C1 provides dc isolation between this stage and the previous one, and resistor R1 is a parasite suppressor. Resistors R2 and R3 bias Q1 for Class A operation. Gain of the amplifier is set by R6 and R8 and capacitor C2. Resistor R5 is a parasitic suppressor. Inductor L1 is utilized as an RF choke. Capacitor C3 and R4 provide decoupling of the B+ line. Resistor R7 provides an impedance match between the output of Q1 and the input of FL1.

2.3.3.2 The amplified 455 kHz second IF is ac coupled to the input of mechanical filter FL1 by C4. Variable capacitor C5 provides a reactive match for the filter input and C6 does the same for the filter output. Filter FL1 passes the upper side-band portion of the IF passband centered at 455 kHz. This is actually the input lower sideband. The spectrum was inverted about the center frequency at the first IF conversion to 2 MHz. The inversion was the result of beating the input signal with a high-beat oscillator and taking the difference of these two signals as the first IF. The input signal spectrum was not inverted at the second IF conversion because a low-beat oscillator was employed.

2.3.3.3 The output sideband from FL1 is coupled by C7 to gate no. 1 (pin 3) of dual IGFET Q2. Resistors R9 and R10 bias the gate. Resistor R10 is also the output load for the filter. Gain of the stage is set by R16 and C10 in the transistor source circuit. The overall gain of the amplifier is adjustable by potentiometer R13 connected to gate no. 2 (pin 2) of Q2. The gain control voltage is derived from the combined voltage drops across R12, R13, and R14. Capacitor C8 is used as a by-pass. The drain load for Q2 is a single-tuned tank circuit. Resistor R15 is a parasitic suppressor. The tank consisting of variable inductor L2 and capacitors C11 and C12 is tuned to 455 kHz. Capacitors C11 and C12 provide an impedance step-down to 50-ohms at output pin 2.

2.3.3.4 The upper-sideband amplifier is identical in operation to A3 as described in the preceding paragraphs. The only difference between the circuits is the mechanical filter employed. Module A4 passes the USB portion of the input spectrum.

2.3.4 Type 79751 SSB Detector. - Reference designation prefix for this module is A5. The schematic diagram is depicted in Figure 6-4.

2.3.4.1 The outputs from the LSB and USB amplifiers are connected to module pin 2 (input 1) and pin 4 (input2), respectively. Resistors R1, R2 and R3 comprise a summing network for the two inputs. This is used in lieu of a switch since only one sideband amplifier is energized at any one time. The single-sideband signal is coupled through dc blocking capacitor C1 to gate no. 1 (pin 3) of product detector Q1. Resistors R4 and R5 provide gate biasing. Biasing for gate no. 2 (pin 2) is provided by resistors R6 and R7.

2.3.4.2 Transistor Q3 is connected in a modified Colpitts crystal-controlled oscillator configuration. This circuit functions as a beat frequency oscillator (BFO) to provide proper demodulation of the SSB input signal. This oscillator is electrically identical to A2Q3 described in paragraph 2.3.2.2 except for the crystal frequency. The output of the BFO is coupled through capacitor C2 to pin 2 of Q1.

2.3.4.3 The two inputs to product detector Q1 are mixed and presented at the drain (pin 1). Gain of this stage is a function of both the level of the BFO input to pin 2 and resistor R9 and C5 in the source circuit of the device. Capacitor C5 bypasses R9 at audio frequencies. Resistor R8 is the drain load.

2.3.4.4 Output signals from Q1 are directly coupled to a 4 kHz, active, low-pass filter. This filter consists of capacitors C4, C8, C10 and C12, resistors R14 through R18, and transistors Q2 and Q4. Rolloff frequency of the filter is approximately 4 kHz, therefore, only the difference frequency (audio frequencies) from the mixer is passed. All other products are filtered. Output audio signals from emitter follower Q4 are coupled through impedance matching resistor R19 and ac coupling capacitor C13 to the output at module pin 21.

2.3.5 <u>Type 7440 Audio Amplifier.</u> - Figure 6-5 is the schematic diagram for this circuit; its reference designation prefix is A6. The input is coupled from module pin 21 through R1 and C1 to the base of Q1. The module consists of an NPN transistor, Q1, dc-coupled to Q2, a PNP transistor. These two stages provide the necessary voltage gain to drive complementary symmetry emitter followers Q3 and Q4. The output amplifiers are biased to operate Class B. Negative dc feedback to set the overall gain of the amplifier is taken at the junction of emitter resistors R11 and R12 and fed to the emitter of Q1 through R7. Additional negative feedback is taken from the primary of T1 and fed to the junction of R5 and R6. This action helps stabilize the amplifier through a wide range of input levels. The gain of the stage is determined by the ratio of R5 and R7. These components have 1% tolerances to control gain. Silicon diodes CR1 and CR2 determine the idling currents of Q3 and Q4 and eliminate crossover distortion while improving thermal stability. Since the transistors and diodes are made of the same material they exhibit the same temperature coefficient of voltage characteristics. A rise in temperature lowers the base-emitter voltage drop of the transistors tending to make them conduct harder. However, the diode voltage drop decreases by the same amount so that the voltage applied to the bases also decreases, holding the collector currents nearly constant. Resistors R11 and R12 are included in the emitter circuits of Q3 and Q4 to provide current feedback with low-input signal levels. These resistors eliminate distortion introducted by the difference between the voltage drops of CR1 and CR2 and the base-emitter junctions of Q3 and Q4. With little or no input signal the drop across the resistors is a few tenths of a volt. Large input signals would cause the drop to become excessive except that CR3 and CR4 become forward biased and limit the drop to approximately 0.6 volt. Capacitor C3 provides drive for Q4 through R9 during the negative-going portion of the input signal. The low-impedance output of the amplifiers is matched to the higher impedance drive necessary for the phones jack by resistor R13. This resistor has the additional effect of preventing amplifier overload if the output terminal is accidentally shorted to ground. Resistor R6 provides a discharge path to ground through the primary of T1 for C3 if the amplifier is operated without a dc load. Transformer coupling of the amplified audio signal to the output is employed to obtain the high-and-low-impedance outputs. Audio signals from pin 6 are fed to the front-panel PHONES jack while 600-ohm signals from T1 are fed to pins 3 and 2 of TB1 (see figure 6-17).

2.3.6 Type 71310 Tuning Assembly. - The schematic diagram for this assembly is Figure 6-6; its reference designation prefix is A7. The tuning assembly consists of two basic subassemblies: Type 7760 Local Oscillator (A1) and Type 8580 Tuning Drive (A2).

2.3.6.1 Type 7760 Local Oscillator. - The schematic diagram for this subassembly is Figure 6-7; its reference designation prefix is A7A1. This module contains the main tuning capacitor C5, additional tuning capacitors C4 and C6, and two printed circuit board subassemblies. Type 79511 Local Oscillator Board is A1 and Part 16071 Inductor Board is A2 of A7A1. Figures 6-8 and 6-9 are their schematic diagrams, respectively.

2.3.6.2 The following description of the local oscillator circuitry is given using Figure 2-3, Local Oscillator Equivalent Circuit. The frequency of local oscillator A7A1A1Q1 is maintained 2 MHz above the frequency of the incoming signal. A modified Clapp circuit is used for the oscillator. Regenerative emitter-to-base feedback to sustain oscillation is taken at the junction of A7A1A1C3 and A7A1A1C4. These two capacitors provide the necessary impedance step-up for the oscillator. Variable capacitor A7A1C5 is the main tuning control. Variable inductor A7A1A2L4 and A7A1C5 form the basic oscillator tank. Variable capacitor A7A1C6 is a temperature compensating trimmer. Its capacitance varies with temperature in the direction required to compensate for the shifts in value of the temperature-dependent components to maintain a constant oscillator frequency. The tuning limit of the tank is adjusted by C4 (bandset). Fine adjustments to the frequency of the oscillator tank can be made by means of the front-panel FINE TUNING potentiometer (see Figure 6-17) or the internal counter DAFC circuits. Both adjustments are made by varying the reverse bias of an associated varactor (voltage-variable capacitor) diode. Varactor A7A1A1CR2 is used with the fine tuning control and A7A1A1CR5 is used with the DAFC input voltage. By increasing the reverse bias of a varactor, its capacitance decreases, and the frequency of the oscillator increases. A decrease of reverse bias has the opposite effect. Capacitors A7A1A1C6 and A7A1A1C15 were added to reduce the amount of frequency shift of the varactors. To minimize loading of the oscillator, the output is tapped down through a capacitive voltage divider consisting of A7A1A1C7 and A7A1A1C8, and fed to the limiter circuits.

2.3.6.3 The limiters (refer to Figure 6-8) convert the sinusoidal oscillator output to a square wave for more efficient operation of the balanced mixer. Both limiters are nearly identical. They are essentially differential amplifiers with ac coupling between the emitters. On positive half-cycles of the input to Q2, the positive-going signal developed across R9 is inverted by C9 and applied to the emitter of common-base amplifier Q3. This negative signal on the emitter makes the transistor conduct

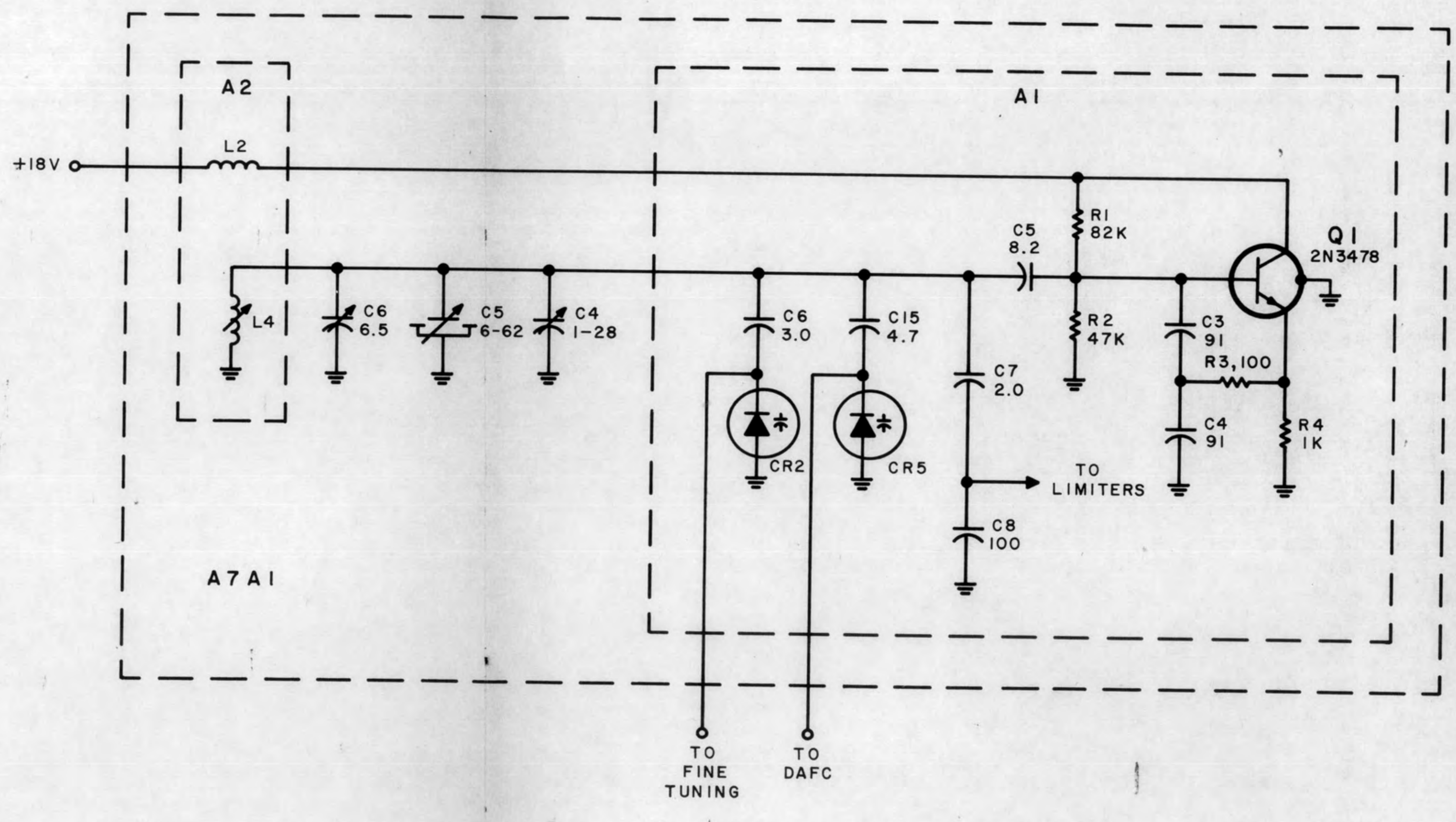


Figure 2-3. Local Oscillator Tank Equivalent Circuit

harder until it is driven into saturation. On the negative half cycle of the input, the positive going signal presented to the emitter of Q3 is a reverse bias and causes the transistor to cut off. Thus, the transistor operates between the cut off and saturated conditions so that the signal is limited on both the positive and negative excursions. The limited output is fed to output amplifiers Q4 and Q5 which are connected in a complementary symmetry emitter follower configuration. The output amplifiers are functionally similar to the ones described in paragraph 2.3.5. The major difference is the absence of the diodes in the emitter circuits and a negative feedback path to the input stage. Both of these circuit parts are unnecessary because of the limited signal applied to the output amplifiers. Because of the very low-impedance output of the emitter followers, the LO output impedance is determined largely by R17. Resistor R21 is included on the output of the output amplifiers, designed to drive the counter circuits, as a discharge path to ground for C14 in case this output has no dc load. The square-wave output is coupled to pin 1 through C11 and then to the balanced mixer A1U2 where it is mixed with the RF input.

2.3.6.4 Type 8580 Tuning Drive Assembly. - Reference designation prefix for this subassembly is A7A2. An exploded view of the tuning drive is shown as Figure 5-14.

2.3.7 Power Supply. - The DMS-109 Demodulator is designed to operate from a 115 or 230 Vac, 50-400 Hz source. The path for the ac input (see Figure 6-17) is from power plug FL1P1, through power line filter FL1, line fuse F1, and POWER switch S1, to the primary windings on power transformer T1. Power selector switch S2 is used to connect the two primary windings in parallel for 115-volt operation and in series for 230-volt operation. Line fuse F2 provides additional overload protection when the latter input power is used. The power transformer has three secondary windings. One of these, 8-10, supplies the ac input to the +18 Vdc power supply board. Winding 11-13 supplies the ac input to the +6 Vdc regulator and winding 5-7 supplies the +200 Vdc rectifier on module A10.

2.3.7.1 Type 76162 +18V Power Supply. - The schematic diagram for this module is Figure 6-15; its reference designation prefix is A9. Transistor Q1 functions as a series regulator whose conduction is controlled by Q2, an emitter follower. Transistor Q2 amplifies the low current output of Q3 thus providing sufficient current drive for the low-input impedance at the base of Q1. Transistors Q3 and Q4 are connected in a differential amplifier configuration. The base of Q4 is held at a fixed potential by Zener diode CR2. The base of Q3 is connected to the regulated output through a sampling network consisting of fixed resistors R6 and R8, and potentiometer R7. The signals at the bases of the two stages are summed in the common emitter circuit to produce an amplified signal at the collector of Q3 that is the difference between the two inputs. Thus, any fluctuation in the output voltage is sensed by Q3, amplified and inverted and fed to the base of Q2. For example, if the output voltage rises Q3 will conduct harder, causing an increased voltage drop across R2 and R3. This lowers the forward bias voltage and the current flow through Q2. As a result, the current flow through Q1 is reduced returning the output voltage to its nominal value. Resistor R4 connects the base of Q3 to the input side of the regulator so that pulsating ac fluctuations at this point can be sensed and compensated for by Q1. A differential amplifier is used in the comparison circuit as variations in base-emitter voltage due to temperature changes in one transistor will tend to cancel similar changes in the other. This configuration also permits the reference diode CR2 to be placed in the base circuit rather than the emitter, as is the case with a one-stage error amplifier. Less current flows through the diode, resulting in a more stable reference voltage.

2.3.7.2 Type 76156 +6V and +200V Power Supply. - Reference designation prefix A10 has been assigned to the module; its schematic diagram is Figure 6-16. The operation of this module for the +6V output is functionally identical to module A9. The major change is a lower ac input voltage. The +200V output is derived by CR2, a full wave rectifier, which rectifies the ac input. Capacitor C1 filters the pulsating dc output of the rectifier. Resistor R1 is a "bleeder" resistor giving C1 a discharge path to ground when no load is present at pin 17.

2.4 COUNTER ASSEMBLY

2.4.1 Type 79386 Counter Assembly. - Figure 6-10 is the schematic diagram for the counter assembly; its reference designation prefix is A8. This assembly is constructed as a self-contained shield unit to prevent the radiation of RFI. The only external inputs to the unit are the +6 Vdc and +200 Vdc supply inputs and the DMS-109 LO signals from tuning assembly A1. The counter provides direct digital readout of the tuned frequency with a five digit gas-filled readout tube display. In addition, digital automatic frequency control (DAFC) circuits in the unit provide an analog voltage output which is used to control the frequency of the DMS-109 local oscillator. DAFC permits the demodulator to be locked to within ±10 Hz of any desired frequency throughout its tuning range in the DECIMAL SHIFT mode. The demodulator local oscillator signal is counted for a precise interval, the IF offset is, in effect, eliminated from this count, and the resulting count is displayed on five gas-filled readout tubes. The least significant digit of the frequency display is compared to a digit selected by the operator and the analog control voltage holds the frequency equal to that selected on the DAFC LAST DIGIT switch. The IF offset is, in effect, eliminated from the displayed count by presetting the counter circuits to a predetermined number before the counting interval begins. When the LO signal count is added to the preset number the final displayed count will be the tuned frequency of the demodulator. To aid in understanding the explanation of the counter circuits, a brief description of the BCD (Binary Coded Decimal) system of counting is included in the following paragraphs.

2.4.2 BCD Counting. - The BDC representation of a digit in the base-ten, or decimal system, requires four binary places. The first place, or bit, represents 1, the second bit 2, the third bit 4, and the fourth bit 8. Thus, 0001 equals 1, 0010 equals 2, 0011 equals 3 and so on. Four flip-flops, each representing one bit, are required to count up to ten. However, a logic 1 output from each flip-flop would represent 15 (1111) unless a means is provided to reset them after a count of ten. Automatic reset of the flip-flops can be accomplished by the use of AND gates, feedback, and feedforward. Combinations of flip-flops and AND gates can be used to count up to any number with automatic reset.

2.4.3 BCD Waveform Development. - Figure 2-4 illustrates the binary coded decimal equivalent of the digits 1 through 9 and 0. Note that rather than the actual count, the value in a decade scaler, or one place counter, is the least significant number. For example, the actual count of twelve results in a two in the counter. One-place decade scalers, upon receipt of the tenth input pulse, reset themselves to zero and pass a "ten" or "carry" pulse to the next higher number counter. The first negative-going transition of the basic frequency initiates the count of that frequency. Note that the BCD 4 and 8 waveforms are not symmetrical due to reset. However, they are useful for timing purposes in addition to counting since the 4 waveform ends as the 8 waveform begins once every ten cycles. The 4 and 8 waveforms from a decade scaler in the gate generator are used to synchronize the counter operations.

ACTUAL COUNT	0	1	2	3	4	5	6	7	8	9	10	11	12
COUNTER VALUE	0	1	2	3	4	5	6	7	8	9	0	1	2
1 BIT	0	1	0	1	0	1	0	1	0	1	0	1	0
2 BIT	0	0	1	1	0	0	1	1	0	0	0	0	1
4 BIT	0	0	0	0	1	1	1	1	0	0	0	0	0
8 BIT	0	0	0	0	0	0	0	0	1	1	0	0	0

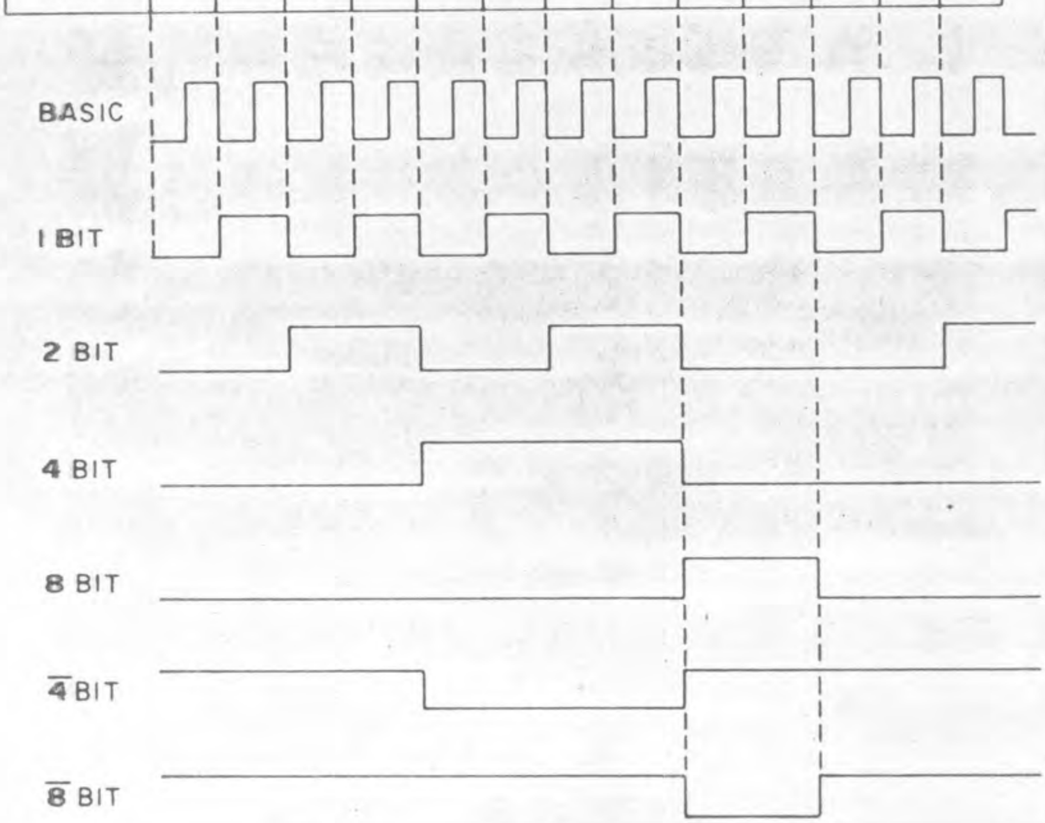


Figure 2-4. BCD Waveform Development

2.4.4 Counter Assembly Functional Description. - This description consists of three parts: operating principle, counting circuits, and DAFC circuits.

2.4.4.1 Operating Principle. - The counter assembly provides readout of the DMS-109 tuned frequency by counting the local oscillator signal for a precise interval of time, and, in effect, subtracting the IF offset from this count. The DMS-109 tunes from 5 kHz to 1 MHz. The first IF frequency is 2 MHz. Thus, the local oscillator frequency range is 2.005 MHz to 3.000 MHz. The counter, in effect, eliminates the 2-MHz offset from the displayed count by presetting the decade counters to a count of 8000.0 when the NORMAL DISPLAY mode is selected. No preset is required when the DECIMAL SHIFT mode is selected. To illustrate the operation, assume that the DMS-109 is tuned to receive 1000 kHz. The 3000 kHz LO signal is gated into the five decade scalers for precisely 10 ms by a pulse from the gate generator. This yields a count of 3,000,000 Hz x .01 sec, or a count of 30,000 in the five decade scalers. However, prior to any counting of the gated LO signal, the most significant digit decade scaler is preset to a count of 8. Thus, when the counting interval begins, the unit begins counting from 80000 instead of 00000. This yields a displayed count of 80000 +30000, or 110000. Since there is no decade scaler to hold or readout tube to display the most significant digit of this count, the final displayed count is 10000. Proper placement of the decimal point in the neon tube readout represents the tuned frequency of the DMS-109, 1000.0 kHz. When the DECIMAL SHIFT mode is selected, the counting interval is changed to 100 ms, or 0.1 sec. This has the effect of shifting the displayed count one digit to the left. As in the previous example, if the LO frequency is 3000 kHz this signal counted for 100 ms would yield a count of 300000. Since the most significant digit (3) has no decade scaler to hold it, the displayed count would be 00000. Shifting the decimal point one place to the left would again yield the tuned frequency in kHz as 000.00, but the resolution is increased to ±10 Hz. Note that presetting is not required as the most significant digit has been "carried" and does not appear in the display. However, the operator must remember that the actual frequency is 1000.00 rather than 000.00 kHz. This is the only place in the tuning range of the DMS-109 that the frequency displayed in the DECIMAL SHIFT mode consists of the readout plus the carry "1". The relationships between the gate time, LO frequency, and display remains the same throughout the tuning range of the DMS-109. As an additional example, assume the DMS-109 is tuned to 700 kHz. The LO frequency is therefore 2700 kHz. In the NORMAL DISPLAY mode this yields a count of 27,000 (2,700,000 x .01 sec) added to the preset of 80000, or a display of 0700.0 kHz. Switching to the DECIMAL SHIFT mode yields a count of 270,000 (2,700,000 x 0.1 sec), or a displayed count of 700.00 kHz. The exact sequence of counter operations and the generation of the timing signals will be explained in a later paragraph.

2.4.4.2 Counting Circuits. - Refer to the functional block diagram, Figure 2-2. The large arrows on the diagram show the counting signal path through the unit. Front-panel MODE switch A8S1 selects the desired mode of operation. A8S1 has four possible positions, two for each mode. Either TUNE or DAFC operation can be selected in both the NORMAL and DECIMAL SHIFT modes. On the block diagram, A8S1 is shown in the DECIMAL SHIFT mode with the DAFC operating. Front-panel switch A8S3 selects the desired last digit of the tuned frequency. Gate generator A8A1 synchronizes the counter operations by providing pulses in the following sequence: positive and negative reset, preset, counting gate, and gated 4.5V and 200V. These pulses are illustrated in Figure 2-5, the gated generator timing chart. The negative reset pulse returns the decade counter on card A8A2 to a count of zero, while the positive reset pulse returns the remaining decade counters located on cards A8A4 through A8A7 to zero. This action initiates the timing cycle. Preset occurs immediately after reset as the negative spike preset pulse is applied to the decade scaler on card A8A7 after passing through switches A8S2 and A8S1B-X. Switch A8S2, located on the counter rear apron, is included to remove the preset for maintenance purposes. The preset pulse sets the high-order decade scaler to the desired preset count. Development of the preset count is explained in detail in the circuit descriptions which follows. The counting gate pulse applied to card A8A2 turns the high speed counter on for a precise interval of time. The duration of the gate pulse is determined by the position of switch A8S1A-W. After the counting interval ends, the gated 200V pulse is applied to the neon display tubes on cards A8A3 through A8A7 to illuminate them. Gating these tubes enables them only after the count has stopped so that the changing numbers during the counting interval are not seen. In addition, coincident with the display interval, a gated 4.5V pulse is applied to card A8A3. The 4.5V gate pulse provides an input to the DAFC circuits representing the final count of the LO signal. The time required for one complete timing cycle is exactly twice the counting interval. In the normal mode one complete cycle requires 20 ms. The reset pulses are 2 msec wide; preset requires only 100 microseconds, 4 msec is unused and the counter circuits are idle, 10 msec are required for counting and 4 msec is the display interval. Although the display interval is only 4 msec long, it occurs fifty times each second eliminating any visible flicker. When using the DECIMAL SHIFT mode of operation, each of the timing events are increased by a factor of ten. Although the display interval in the decimal shift mode is 40 milliseconds long, it occurs only five times each second and flicker is quite evident.

2.4.4.3 High speed counter card A8A2 contains the decade counter for the least significant digit of the display. In addition, circuits which develop the DAFC analog voltage are located on this card. Switch A8S1A-X turns the DAFC on and off and controls the frequency correction rate. Up or down command pulses from DAFC LAST DIGIT switch, A8S3, control the direction of frequency correction. Card A8A2 counts the demodulator LO signal during the interval of the counting gate pulse and passes one "carry" pulse to card A8A4 for every ten input cycles. The output signals from A8A2 are applied to decode and display card, A8A3. The circuits on this card provide a decimal equivalent (a digit from 0 to 9) for the BCD input. The decimal digit output drives the neon display tube on A8A3 and is also applied to switch A8S3. This switch selects the pulse for use as a DAFC up or down command signal which is fed to card A8A2. The carry signals from card A8A2 are counted, decoded and displayed by card A8A4 for the next-to-least-significant digit of the display. Cards A8A5 through A8A7 count, decode, and display the carry pulses from the preceding decade counter. The position of each of these cards in the frequency display is denoted by the position of the X on the card symbol in the block diagram. The preset pulse from the gate generator is applied to switch A8S1B-X through A8S2. Switch A8S2 is included to remove the preset for maintenance purposes. Switch A8S1B-W selects the proper decimal point position for the display by grounding the decimal cathode of the appropriate neon display tube.

2.4.4.4 DAFC Circuits. - The circuits in this unit provide an analog voltage output which is used to control the frequency of the DMS-109 local oscillator. Voltage variable capacitance diode located in the frequency determining tank circuit of the oscillator in LO tuning assembly A7 varies the demodulator local oscillator frequency. A voltage variable capacitance diode is a semiconductor device whose capacitance is inversely related to the reverse-bias applied to it. As the reverse-bias increases, the capacity of the diode decreases causing the local oscillator frequency to increase. The DAFC circuitry is located on cards A8A2 and A8A3 and will be explained in a later paragraph. Switches A8S1A-X, A8S3A, and A8S3B control the operation of these circuits. Switch A8S3 selects the last digit of the frequency to which the receiver will be locked. The decimal output signals representing the digits 0 through 9 are coupled through diodes on card A8A3 and applied to the equivalent switch terminals of A8S3A and A8S3B as shown in the block diagram. When the zero digit lights on card A8A3, for example, a negative pulse appears on terminal zero of both wafers of A8S3. Only during the display interval will these pulses appear on A8S3 because the integrated circuit decimal decoder driver on card A8A3 is gated. This gating is done to prevent the changing count during the counting interval from affecting the receiver frequency. If zero is selected by A8S3 and the last digit of the received frequency is zero, no up or down pulses will be applied to the DAFC circuits on card A8A2. If a pulse representing any of the digits 1 through 5 appears on switch A8S3B the pulse is applied as a down command to A8A2. Up command pulses are developed by the digits 6 through 9 from the wiper of A8S3A. DAFC circuits on card A8A2 develop an analog voltage which is controlled by these pulses. Switch A8S1A turns the DAFC on or off and controls the rate at which a frequency error is corrected by the DAFC.

2.5 COUNTER CIRCUIT DESCRIPTION

This description is module oriented and follows a signal flow sequence.

2.5.1 Type 79409 Gate Generator. - Figure 6-11 is the schematic diagram for this card; its reference designation prefix is A8A1.

2.5.1.1 Oscillator Buffer. - Transistor Q1 is a 1-MHz crystal-controlled Clapp oscillator. Emitter-to-base regeneration to sustain oscillation is developed by voltage divider capacitors C4 and C5. Capacitor C3, in series with the crystal, permits the frequency to be set to precisely 1 MHz. Transistor Q2 is a buffer amplifier stage. This stage is initially biased off. Negative signal excursions at the collector of Q1 cause Q2 to conduct producing positive-going pulses across load resistor R5.

2.5.1.2 Decade Dividers. - Integrated circuits Z1 through Z5 are decade scalers. Each divides its input frequency by a factor of ten. The 3.75V operating voltage for these ICs is provided by the drop across diodes CR1, CR2, and CR3. Positive 4.5V is taken from the junction of CR2 and CR3 for operation of other ICs in the counter assembly. The 1-MHz pulses from buffer amplifier Q2 are divided by a factor of 1000 by Z1 through Z3 providing a 1-kHz pulse train at pin 16 of this card. Decade scaler Z4 divides its input by a factor of ten providing a 100-Hz pulse train output at pin 15 of the card. The 100-Hz and 10-Hz outputs referred to on the schematic are the pulse repetition rates of the 8 and 4 outputs of Z5. Pin 14 of the card is the input to Z5. Either the 1-kHz or 100-Hz output is selected by switch A8S1A-W and applied to Z5. The $\overline{4}$ output from pin 1 and $\overline{8}$ output from pin 8 of Z5 are used to develop the timing signals for the counter.

2.5.1.3 Quad Inverter. - Integrated circuit Z6 is a quad inverter. Quad in the title refers to the four inverters it contains. Only three inverters are used. Each channel is isolated from the others. The $\overline{8}$ output waveform from Z5 is applied to pin 4 of the inverter and appears as an 8 output on pin 6. The $\overline{4}$ input to pin 3 appears as a 4 output from pin 7. The 4 output is passed through the inverter again and appears buffered as a $\overline{4}$ output on pin 8.

2.5.1.4 Quad Two Input NAND Gate Z7. - This IC contains four two-input NAND gates. It is used to develop the positive and negative reset waveforms. In addition, a waveform which is used to develop the gated +4.5V and 200V signals is generated in this IC.

2.5.1.5 Integrated Circuit J-K Flip-Flop Z8. - This flip-flop divides the $\overline{4}$ waveform from Quad inverter Z6 by a factor of two developing the gate pulse for high speed counter card A2, ($\overline{Q}$ output). The other output of this IC (Q output) is NANDed in Z7 with the 4 and 8 waveforms from Z6 to develop the other timing waveforms. The $\overline{4}$ clock input to pin 3 is the only signal input. All other gate inputs are enabled by the fixed +5.25V applied to them. Every negative excursion of the $\overline{4}$ input causes the flip-flop to change state.

2.5.1.6 Transistor Stages. - Transistor Q3 is used to develop the preset pulse. The negative reset pulse, from pins 7 and 8 of Z7, is coupled through resistor R12, differentiated by capacitor C8, and applied to the base of Q3. Diode CR4 shunts the negative-spike, leading edge of the differentiated waveform, to ground. The positive-going trailing edge causes Q3 to conduct producing the preset pulse across load resistor R10. One of the NAND gate outputs, from pin 14 of Z7, is applied to the bases of transistors Q4 and Q5. When the output waveform from Z7 goes positive, Q4 conducts producing the gated +4.5V signal at pin 9 of this card. Transistors Q5 and Q6 develop the gated 200V signal for operation of the neon display tubes. Zener diode CR5 is included to clamp the bases of transistors Q4 and Q5 at +5.6V, should Q5 short, providing protection for Z7. When the input waveform at the base of Q5 swings positive,it conducts producing a drop across R14 and R15. The reduced voltage at the base of Q6 causes it to conduct producing the gated 200V signal at pin 2 of the card.

2.5.1.7 Gate Generator Operation. - Refer to gate generator partial logic diagram, Figure 2-6, and gate generator timing chart, Figure 2-6, for the following explanation. As shown in Figure 2-6, the $\overline{4}$ signal from Z6 is applied to J-K flip-flop Z8. Each negative excursion of the 4 waveform causes Z8 to change stage producing the signal gate. The other gate inputs to Z8 are always enabled by the fixed +5.25V applied to them. The Q output of Z8 is applied to one input of NAND gates 1 and 3. The 4 waveform output of Z6 is applied to the other input of NAND gate 1, and the 8 waveform is applied to the other input of NAND gate 3. The outputs of NAND gates 1 and 3 are applied to one of the inputs to NAND gates 2 and 4, respectively. The other inputs of NAND gates 2 and 4 are always enabled by the fixed +5.25V applied to them. In this application, NAND gates 2 and 4 function as inverters. When both inputs to a NAND gate are high, the output is low. At all other times the output is high. The negative reset level is developed as follows: when the 8 waveform from Z6 is high and the Q output from Z8 is high, the negative reset level is developed. The negative reset level is inverted by NAND gate 4 providing the positive reset level. When the 4 output from Z6 and the Q output from Z8 are both high, a low output level occurs from NAND gate 1. At all other times the output of NAND gate 1 is high. The output of NAND gate 1 is inverted by NAND gate 2 producing the gating waveform for transistors Q4 and Q5. The gate generator timing chart, Figure 2-6, verifies the above explanation. The pulse train, referred to as BASIC, is the 1-kHz or 100-Hz pulse train which is selected by A8S1A-W and applied to Z5.

2.5.2 Type 79410 High-Speed Counter. - Figure 6-12 is the schematic diagram for this card; its reference designation prefix is A8A2. Integrated circuits Z1 through Z4 are high-speed J-K flip-flops. These flip-flops are connected to form a decade counter for the least-significant-digit of the display. Transistors Q5 through

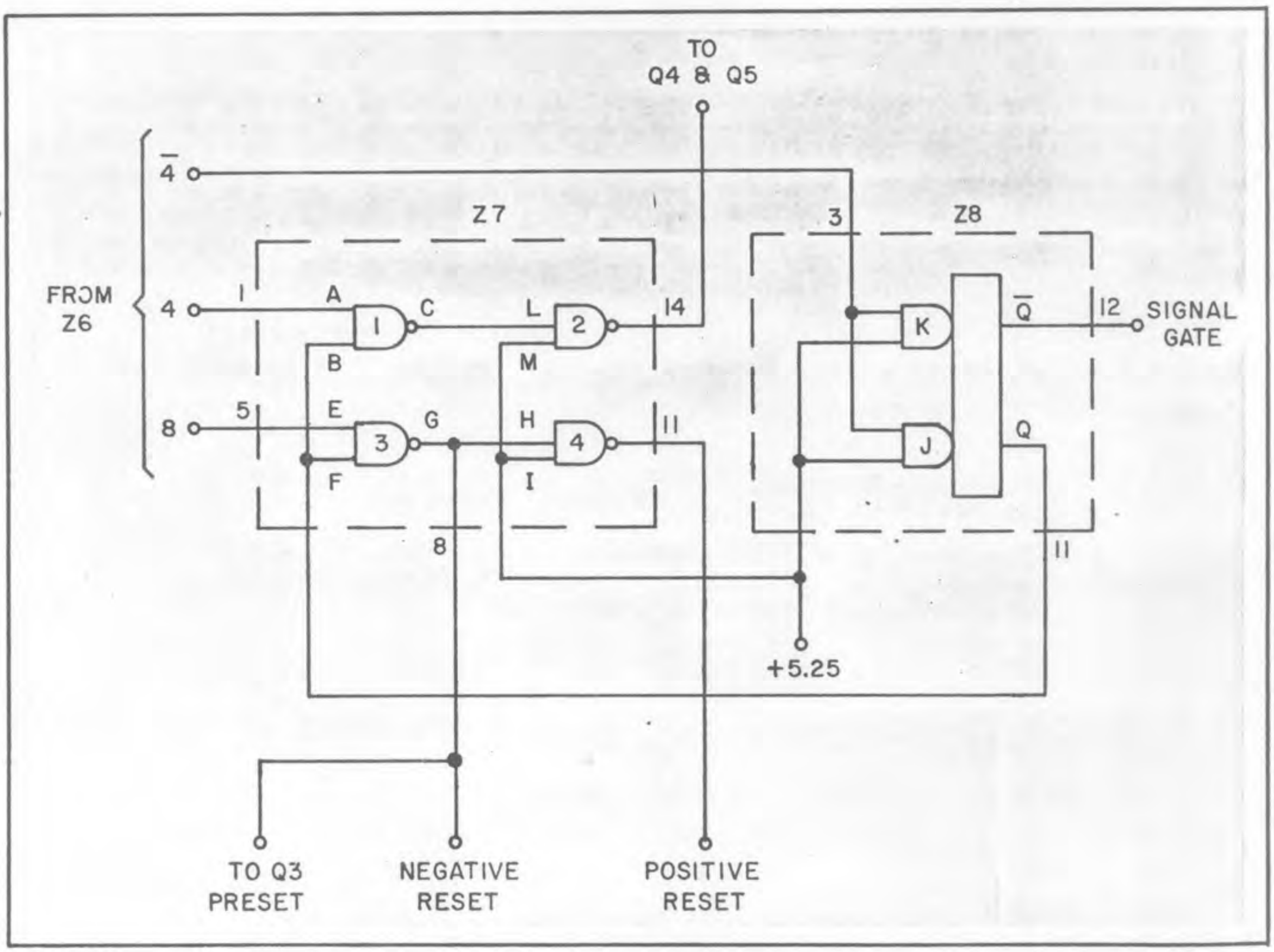


Figure 2-5. Gate Generator Partial Logic Diagram

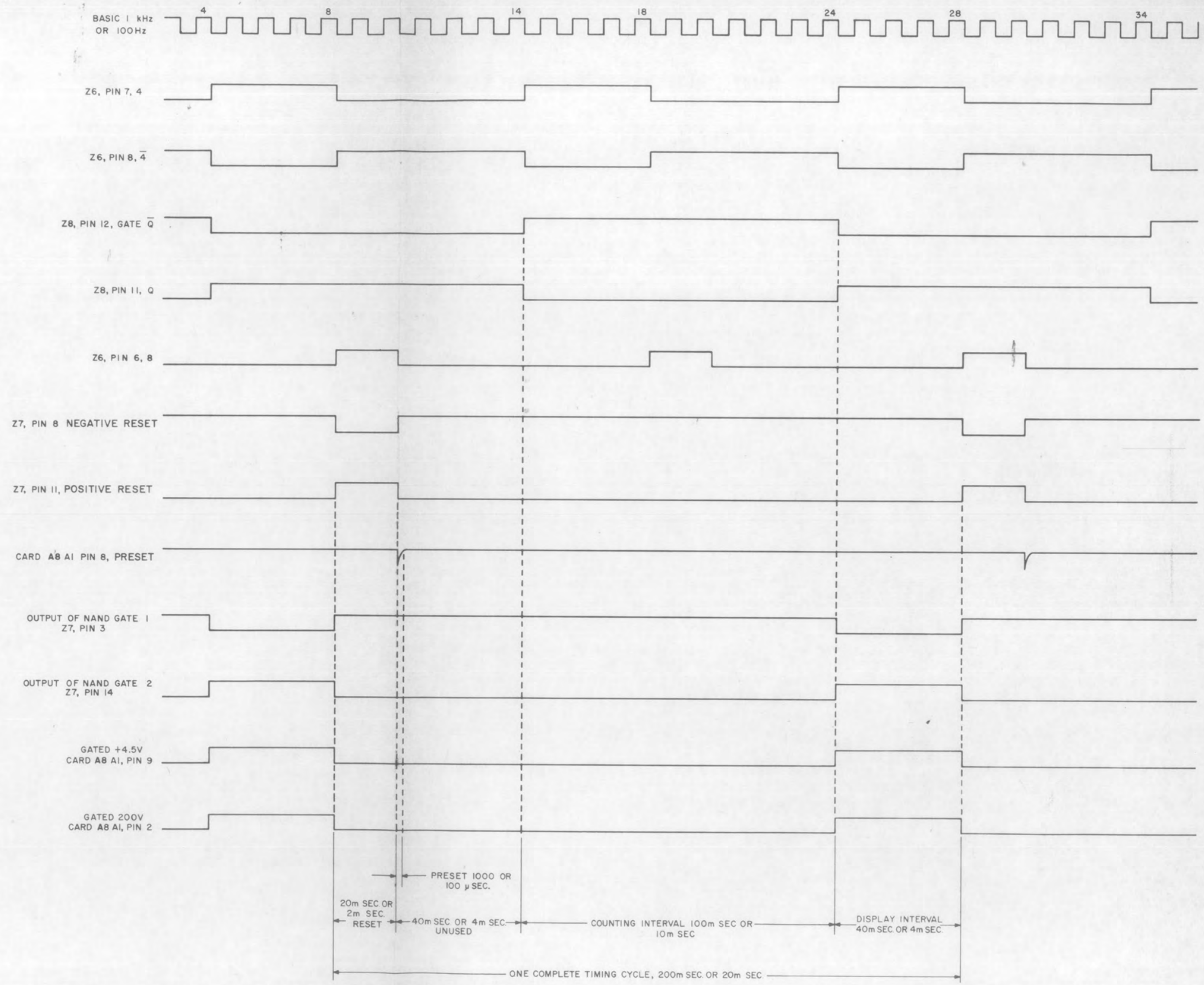


Figure 2-6. Gate Generator Timing Chart

Q7 amplify and shape the DMS-109 LO signals to comply with the input requirements of Z1. Transistor stages Q1 through Q4 develop the DAFC analog voltage for control of the demodulator local oscillator.

2.5.2.1 Transistors Q5, Q6, and Q7 form an amplifier/trigger circuit, for small input signal levels Q5 and Q7 operate as a differential amplifier. With large signal inputs their function is similar to a Schmitt trigger. Base bias for Q5 is fixed at +3.3V by Zener diode CR8. Current flow through both transistors is through common emitter resistor R24. Base bias on Q7 is determined by the voltage divider consisting of R28, CR10, and R30. Initially Q7 is conducting and Q5 is off. Zener diode CR10 is always conducting and functions as a level shifter. When the input LO waveform swings negative, the reduced drop across common emitter resistor R24 causes Q5 to begin conducting since the base voltage is fixed. The voltage drop across L1 and R23, the collector load for Q5, is coupled to the base of Q7 through R26. This negative voltage swing further decreases the conduction through Q7 until it is cut off and Q5 is conducting. The next positive half cycle of the LO input signal causes the opposite effect. Transistor Q5 will cut off and Q7 will conduct. The regenerative action of this stage occurs only with large input signal levels. For small signal levels, the stage functions as a differential amplifier. The output signal developed across load resistor R23 is also coupled through C10 to the base of Q6. Transistor Q6 functions as a high-speed switch to provide fast rise and decay times for the negative pulses developed across its collector load, consisting of L2 and R27. Diode CR7 shunts the negative half cycle of the signals coupled through C10 to ground. The positive half cycles cause Q6 to conduct producing negative pulses at its collector which are direct coupled to Z1. Integrated circuits Z1 through Z4 are J-K flip-flops which are connected as a high-speed decade counter. The J-K flip-flops are capable of operation above 50 MHz. The high-speed counter partial logic diagram, Figure 2-7, shows the interconnection between the four flip-flops. The feed forward and feedback provided by these connections modifies the flip-flops to count in the standard 8-4-2-1 code. The +5.25V supply voltage for the integrated circuits is provided by the drop across diode CR6 from the +6V supply.

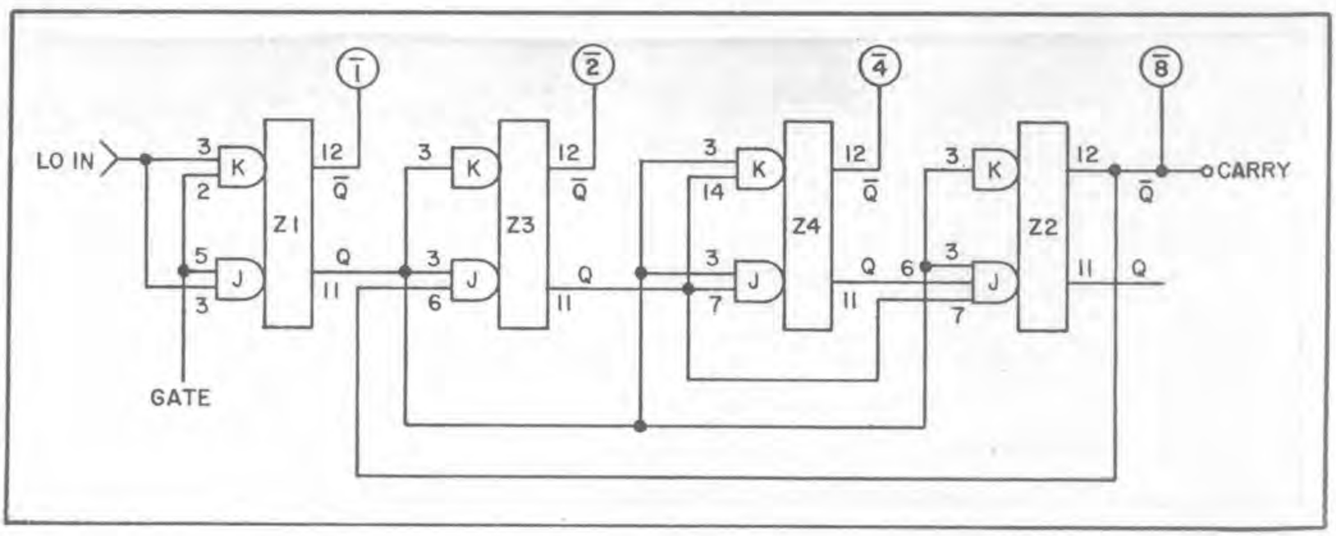
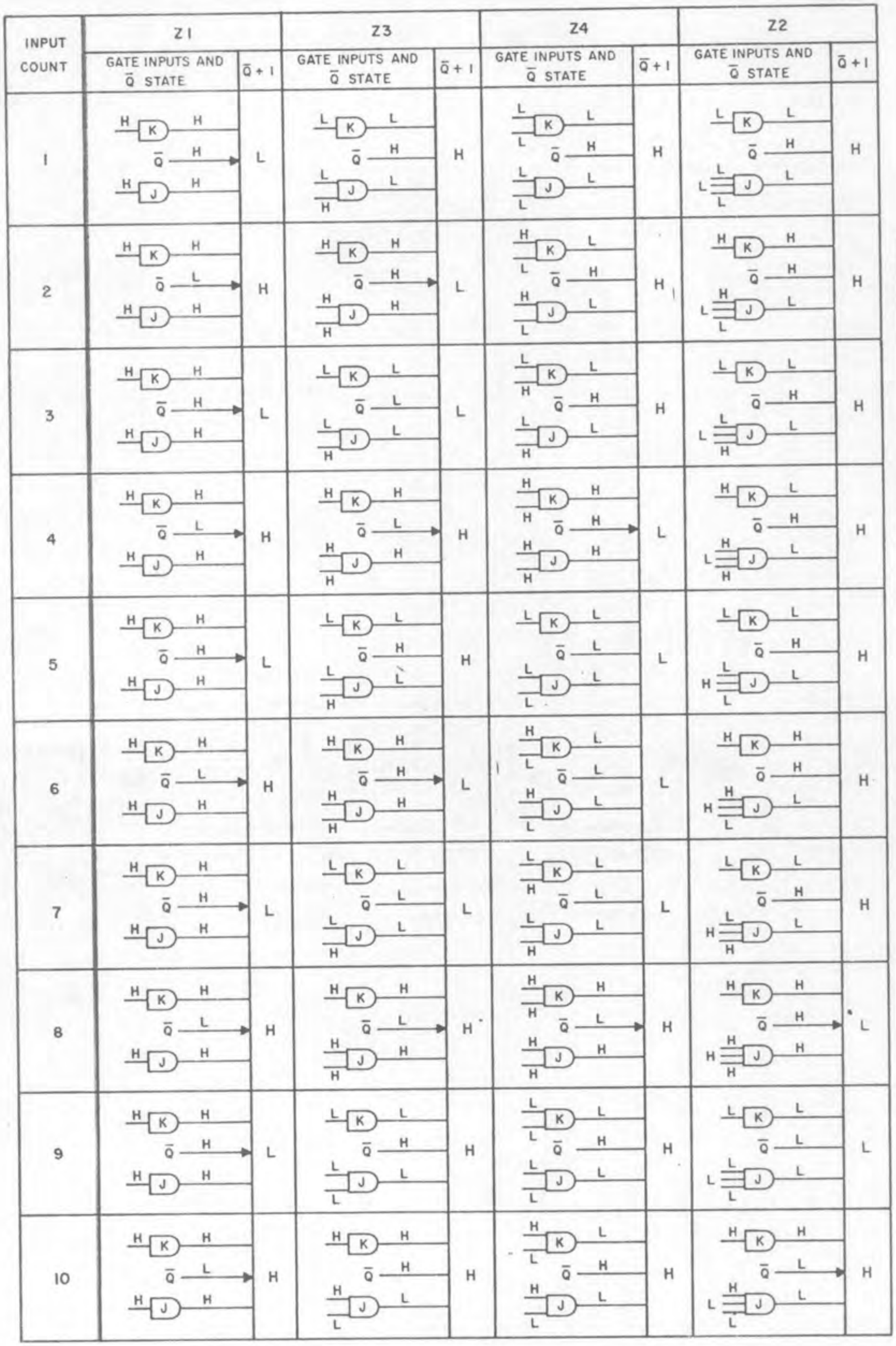


Figure 2-7. High Speed Counter Partial Logic Diagram

2.5.2.2 High-Speed Counter Operation. - The high-speed counter status chart, Figure 2-8, shows the state of the four J-K flip-flops on a pulse-by-pulse basis for a count of ten pulses. The state of the J-K gate inputs and outputs and the condition of the $\overline{Q}$ output during the pulse is shown. An arrowhead at the end of the $\overline{Q}$ line, in the chart, indicates that the flip-flop switches on the trailing edge of the pulse. In addition, the conduction of the $\overline{Q}$ output is shown for the next successive pulse ($\overline{Q}$+1 column). The high output state of the flip-flops is approximately +4.5V and the low state is approximately 0V.

2.5.2.3 The truth table, which is a part of the status chart, shows the state of the $\overline{Q}$ output. The $\overline{Q}$+ 1 column shows whether or not the flip-flop will switch for each possible combination of J-K gate outputs and $\overline{Q}$ levels. The J-K AND gates are enabled when all inputs are high producing a high output from the gate. However, as indicated by the truth table, the fact that a gate is enabled does not necessarily mean that the flip-flop will switch at the end of the pulse. This is determined by the $\overline{Q}$ output during the pulse, due to the fact that these IC's have internal feedback. The internal feedback enables only the flip-flop side that is low. All unused gate inputs are enabled by connecting them to +5.3V. To illustrate, during the tenth pulse the K gate output of Z3 is high, the J gate output is low, and the $\overline{Q}$ output of this flip-flop is high. As shown by line three of the truth table the flip-flop will not switch. However, during the same pulse the K gate of Z 2 is high, the J gate is low, and the $\overline{Q}$ output is low. Line four of the truth table shows that for these conditions Z2 will switch. If both gates of a flip-flop are enabled, then it will always switch on the next negative-going transition of an input pulse. At the end of the first pulse, note that the flip-flop BCD outputs ($\overline{Q}$ +1 column) correspond to a BCD output signal of $\overline{1}$, i.e., Z1 is low, Z3 is high, Z4 is high, and Z2 is high. The counting operation for each of the ten input pulses can be followed by this method. The $\overline{Q}$ output of Z2 is also used as the carry pulse which is applied to the decade scaler for the next-to-least significant digit of the display. The BCD outputs of this card are applied to A8A3 where they are decoded and displayed for the least-significant-digit of the display.

2.5.2.4 DAFC Circuits. - A stable +30V, for operation of this circuit, is provided from the +200V supply by the drop across resistor R19 and Zener diode CR5. Resistor R14, Zener diode CR3, and diode CR4 provide a reference voltage input to source follower transistor Q4 when the DAFC is switched off. This provides a fixed output voltage to the DMS-109 local oscillator voltage variable capacitance diodes when no frequency shift is desired. Diode CR4 is included for temperature compensation. The negative temperature coefficient of CR4 counteracts the positive temperature coefficient of the Zener providing a constant reference voltage with changes in temperature. Current flow through source resistor R17 of Q4 develops the analog voltage output. This voltage is coupled through resistor R18 to pin 19 of the card. Current flow through Q4 is determined by the gate bias. The charge across storage capacitor C4 provides the bias on the stage. Resistor R15 is a parasitic suppressor. An IGFET is used at Q4 due to its extremely high input impedance. The high input impedance is necessary to prevent the transistor from discharging C4 during periods when the DAFC is not correcting. When the DAFC is switched off, the +8.8V reference voltage is applied to pin 18 of the card by switch A8S1A-Z. The reference voltage charges C4 to 8.8V and current flow through the IGFET provides approximately +10V at pin 19 of the card. When the DAFC is switched on, up pulses from Q2 or down



TRUTH TABLE

J	K	$\bar{Q}$	$\bar{Q}$+1
L	L	H	H
L	L	L	L
L	H	H	H
L	H	L	H
H	L	H	L
H	L	L	L
H	H	H	L
H	H	L	H

$\bar{J}\bar{Q}+KQ=\bar{Q}+1$
$J\bar{Q}+\bar{K}Q=Q+1$
IF $\bar{Q}+1=L$, THEN $Q+1=H$

÷10				BCD OUTPUT
Z1	Z3	Z4	Z2	
$\bar{1}$	$\bar{2}$	$\bar{4}$	$\bar{8}$	
H	H	H	H	0
L	H	H	H	1
H	L	H	H	2
L	L	H	H	3
H	H	L	H	4
L	H	L	H	5
H	L	L	H	6
L	L	L	H	7
H	H	H	L	8
L	H	H	L	9

LOGIC 0=L, LOGIC 1=H
1=H $\bar{1}$=L

Figure 2-8. High Speed Counter Status Table pulses from Q3 appear on pin 21 and are applied to C4 through pin 18 of the card and A8S1A-X. Up pulses increase and down pulses decrease the charge across C4.

2.5.2.5 When the DAFC is operated in the NORMAL mode, the correction pulses are applied directly to C4. When operated in the DECIMAL SHIFT mode, the correction pulses are applied to C4 through a resistor, so that the DAFC correction rate will be nearly equal in both operating modes. The pulse width of the correction pulses is the same as the display interval. The correction pulses are ten times wider in the DECIMAL SHIFT mode and would have a much greater effect than the correction pulses in the NORMAL mode if some means of compensation were not used. Up command pulses from the wiper of A8S3A are applied to the base of Q2 through R1. Transistor Q2 is initially biased off. The negative up command pulses cause Q2 to conduct producing positive pulses at its collector. These positive pulses are coupled through diode CR1 and resistor R13 to switch A8S1A-X. Switch A8S1A-X selects either the direct path, or a path through the resistor, to storage capacitor C4 increasing its charge. Transistor Q1 is also initially biased off. When negative down command pulses appear on the wiper of switch A8S3B they are applied to the base of Q1 through R2. These pulses cause Q1 to conduct producing positive pulses across load resistors R5 and R6. The positive pulses, developed across R6, are applied directly to the base of Q3 causing it to conduct. When Q3 conducts, negative pulses appearing at its collector are coupled through diode CR2, R13, and switch A8S1A-X to the storage capacitor. These pulses decrease the charge across C4, reduce current flow through Q4 and thus the DAFC output voltage.

2.5.2.6 An example of DAFC operation follows: Assume that zero is selected for the last digit of the tuned frequency of the DMS-109 and that the last digit of the displayed frequency is 3. Down command pulses will be applied to the down correction channel of the DAFC circuits. The charge across C4 and consequently the DAFC output voltage will begin to decrease. The reverse bias (AFC voltage) applied to the varactor diode in LO tuning assembly A7A1 is decreasec causing an increase in its capacity. The increased capacity of the diode causes the local oscillator frequency to decrease back to the selected frequency. When the last digit of the DMS-109 frequency is equal to that selected by A8S3, no further correction pulses are applied to the DAFC circuits on card A8A2. The charge remaining on the storage capacitor holds the DAFC output voltage at the level necessary to maintain the desired frequency. The opposite effect occurs if the frequency of the LO should decrease from that selected by A8S3. The pull-in range of the DAFC is approximately ±4 digits, i.e., the DMS-109 frequency must be tuned to ±4 digits of the least-significant digit selected by A8S3 in order for the DAFC circuits to lock. However, the holding range of the DAFC is much greater once lock is established. The swing of the DAFC analog voltage is from +4V to +20V approximately. Therefore, if the local oscillator drift is slow compared to the DAFC correction rate, its frequency can be held constant over approximately ±0.1% of the received frequency.

2.5.3 Type 79352A Decode and Display. - Figure 6-13 is the schematic diagram for this card; its reference designation prefix is A8A3. This card receives the BCD output signals from high speed counter card A8A2, decodes these signals, and displays the decimal equivalent with neon display tube DS1. Integrated circuit Z1, a decimal decoder/driver, accepts the BCD signals from card A8A2 and produces the decimal equivalent of its input signal, to drive DS1. The IC is gated on by the 4.5V signal from gate generator A8A1 to provide an input to the DAFC circuits only after the count has stopped. Neon readout tube DS1 is turned on during the display interval by the gated 200V signal from gate generator A8A1.

2.5.4 Type 79353 Count, Decode, and Display. - Figure 6-14 is the schematic diagram for these cards. The reference designation prefixes are A8A4 through A8A7. As inputs, the cards receive "carry" pulses from the preceding counter. These input pulses are counted, decoded, and displayed as a decimal number up to a count of nine. When the tenth input pulse is received, they reset to zero and pass a "carry" pulse to the next card. Integrated circuit Z1 is a decade counter. The IC contains four cascaded binary triggered flip-flops modified by a feedback loop to count in the standard 8-4-2-1 code. It can be preset to any arbitrary count by pulling the appropriate BCD outputs to the logic 1 level (approximately ground) momentarily. The preset pulse from the gate generator is applied to the appropriate BCD outputs through diodes CR1 through CR8. These diodes prevent the preset lines from loading down the BCD outputs of Z1. The counter assembly schematic diagram, Figure 6-6, shows the jumper wires which apply the preset pulse to the appropriate BCD outputs. For preset A, the preset pulse is applied to the $\overline{8}$ output of Z1 on card A8A7 presetting the IC to a count of 8. This is the only preset required by the DMS-109 counter. The remainder of the circuits on these cards are functionally identical to the circuits on card A8A3 except that the decimal decoder/driver is not gated.

SECTION III

INSTALLATION AND OPERATION

3.1 UNPACKING AND INSPECTION

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

3.1.2 See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, CEI Division, or your Watkins-Johnson representative with details 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. Remove the dust covers and inspect the internal components for apparent damage. Check the internal cables for loose connections and plug-in items, such as printed wiring boards, which may have been loosened from their receptacles.

3.2 INSTALLATION

The Type DMS-109 Tunable Demodulator is constructed in a standard 19-inch mounting frame that occupies 3.5 inches of vertical space and extends 16 inches back into the rack. Critical dimensions of the unit are shown in Figure 3-1. If used in a mobile installation, some means should be devised to support the sides and/or rear of the equipment. A brace extending along the sides from the front panel to the rear apron is preferred. Do not rely solely on the front-panel mounting hardware to support the unit. The rack installation should allow a free flow of air through the holes in the top and bottom dust covers. For this reason, at least 1/8-inch of clearance above and below the unit should be provided. The installation should also allow access to the rear panel so that the input and output connections can be made and changed if desired. The rear apron connections to the demodulator are described in the following paragraphs.

3.2.1 Power Connection. - Turn the POWER switdh OFF. Plug the power cord into a 115 or 230 Vac, 50-400 Hz, source. The third pin of the power plug grounds the unit. If a three-pin receptacle is not available use the three-to-two pin adapter provided. Be sure to attach the wire from the adapter to a suitable ground. Before energizing the receiver, check the rear-apron input power selector switch, S2, to make sure it is in the proper position for the line voltage being used.

3.2.2 RF Input Connection. - Connect the source of signals to be demodulated to the INPUT jack, J1, on the rear apron. J1 is a BNC-type connector.

3.2.3 Audio Output Connection. - A balanced 600-ohm audio is available at terminals 2 and 3 of terminal board TB1 on the rear apron. The audio signal is also provided at the front-panel PHONES jack.

3.3 OPERATION

The operation of the controls located on the front panel of the DMS-109 is explained in the following paragraphs. These controls are shown in Figure 1-1, a front view of the unit.

3.3.1 5-1000 kHz Main Tuning Control. - Coarse tuning of the DMS-109 over the 5-kHz to 1-MHz frequency range is by means of the MAIN TUNING control. Approximately thirty-six turns of the control are required to tune the unit throughout its entire range.

3.3.2 Fine Tuning Control. - Small adjustments in the tuning of the DMS-109 are accomplished by the FINE TUNING control.

3.3.3 Mode Switch. - The MODE switch is used to select upper or lower SSB signals as desired.

3.3.4 Level Adjust Control. - The amplitude of the audio signals present at the PHONES jack and rear-apron terminal strip is changed by the LEVEL ADJUST control.

3.3.5 Power Switch. - The POWER switch activates the demodulator when it is placed in the up position. The pilot light is illuminated to verify the application of primary power to transformer T1.

3.3.6 Counter Mode. - The counter MODE switch determines the resolution of the frequency display and switches the DAFC on or off. In the NORMAL DISPLAY mode, the display resolution is ±100 Hz with the switch in the DAFC or TUNE position. The readout resolution is ±10 Hz in the DECIMAL SHIFT, DAFC, or TUNE modes.

3.3.7 DAFC Last Digit Switch. - This switch is effective when the counter MODE switch is in either of the two DAFC positions. It sets the last digit of the frequency display and locks the local oscillator to the selected digit. To set the last digit, first tune the DMS-109 to the desired frequency with the counter MODE switch in either of the TUNE positions. Now, select the desired last digit with the DAFC LAST DIGIT switch. Select either of the two DAFC positions with the counter mode switch. If the demodulator is retuned when operating the DAFC mode, and the new frequency is more than ±4 digits away from the original frequency, switch to a TUNE mode. Reset the DAFC as previously described.

3.4 PREPARATION FOR RESHIPMENT AND STORAGE

3.4.1 If the unit must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be reused to a large extent or will at a minimum provide 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 a 6-inch layer of excelsior. If neither of these filler materials are available, use crumpled paper, rags, or any other available materials to provide as much cushioning as possible.

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

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

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

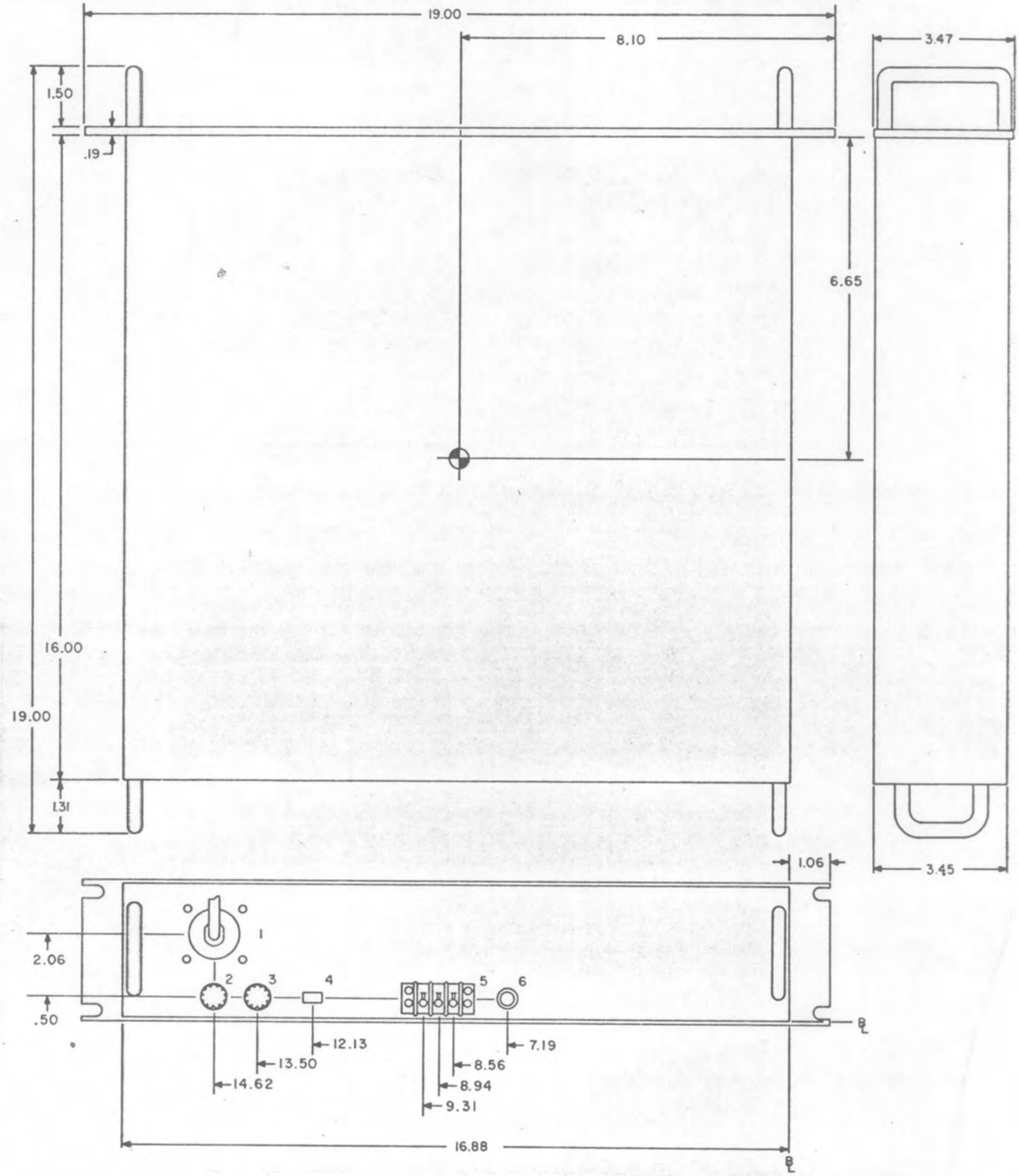


Figure 3-1. Type DMS-109 Tunable Demodulator, Critical Dimensions

SECTION IV
MAINTENANCE

4.1 GENERAL

The Type DMS-109 Tunable Demodulator has been conservatively designed to operate for long periods of time with little or no routine maintenance. An occasional cleaning and inspection are the only preventive maintenance operations recommended. The intervals for these operations should be based on the operating environment. Should trouble occur, repair time will be minimized if the maintenance technician is familiar with the circuit descriptions found in Section II. Reference should also be made to the block diagrams, Figures 2-1 and 2-2, and to the schematic diagrams found in Section VI. A complete parts list plus illustrations showing part locations for the demodulator can be found in Section V. Field maintenance should be confined to cleaning and the replacement of fuses and plug-in modules. All other maintenance should be carried out in a well-equipped shop and performed only by experienced personnel.

4.2 CLEANING AND LUBRICATION

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

4.2.2 Lubrication. - The tuning drive requires an occasional application of a few drops of light oil to the shaft bearings. This is the only lubrication required for proper maintenance of the DMS-109.

4.3 INSPECTION FOR DAMAGE OR WEAR

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

4.4 ALIGNMENT OR ADJUSTMENT PROCEDURES

4.4.1 General. - The alignment procedures listed are suitable for use in the field when misalignment is suspected or when making adjustments after replacing defective components. Only those controls specifically referred to within a series

Table 4-1. Test Instruments Required For Alignment and Test

Item	Instrument Type	Required Characteristics	Use	Recommend Instrument
1	Test Oscillator	10 Hz to 1 MHz frequency range	Alignment, Troubleshooting, and Performance Checks	Hewlett Packard 651B
2	Frequency Counter	6 digits with 4-place accuracy and precision 1 MHz oscillator output	1-MHz reference osc. adjustment, and troubleshooting gating circuits	Computer Measurements Corps., 738A
3	Oscilloscope	10 MHz vertical bandwidth	Alignment, Troubleshooting, and Performance Checks	Tektronix 544
4	Variac	0-150 volt range	Power Supply Checks	General Radio W5M-T3A
5	AC VTVM	-60 to +50 dB and .001 to 300V rms ranges	Alignment and Performance Checks	Hewlett Packard 400L
6	VTVM	3% Accuracy	Power Supply Adjustments and Performance Checks	RCA WV-98C
7	Audio Output Load	600-ohm rated at 1/2 watt	Alignment and Performance Checks	

of steps given for aligning a particular circuit affect the alignment of that circuit. Those controls not mentioned in any one series of steps may be left in any position. The alignment of the DMS-109 should be performed only with suitable equipment by technicians thoroughly familiar with the unit.

4.4.2 Equipment Required. - The test instruments or their equivalents listed in Table 4-1 are required to align and test the DMS-109.

4.4.3 Power Supplies. - Proceed as follows:

(1) Apply power to the DMS-109 and the VTVM.

(2) Connect the VTVM test leads to connector XA9 pin 12 and ground.

(3) Adjust A9R7 for a reading of +18.0 Vdc.

(4) Connect the VTVM test leads to XA10 pin 5 and ground.

(5) Adjust A10R8 for a reading of +6.0 Vdc.

(6) Connect the VTVM to XA10 pin 17. The reading should be approximately +230 Vdc.

NOTE

These following tests can be accurately accomplished only if modules A3 through A6 are functioning properly. Refer to paragraph 4.6 to confirm proper operation of the modules.

4.4.4 Type 79496 Amplifier/Converter. - Proceed as follows:

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

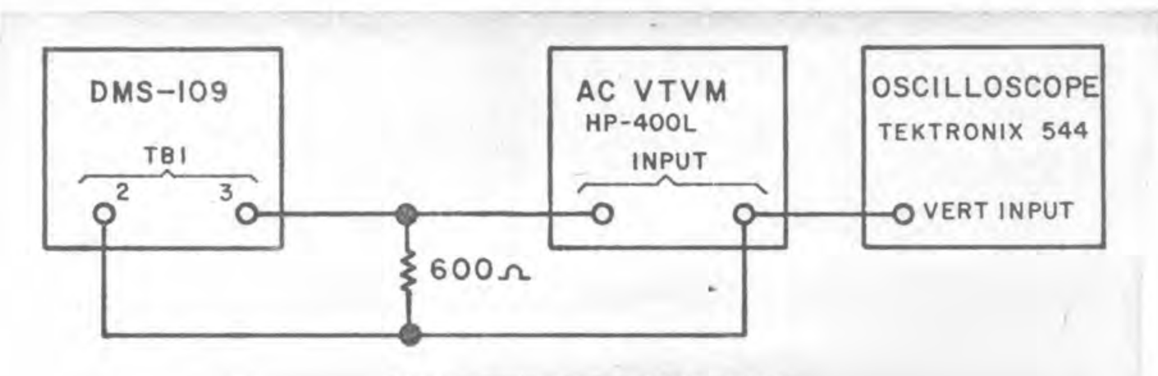


Figure 4-1. Basic Equipment Setup for Alignment and Performance Checks

(2) Connect the output of the test oscillator to XA2 pin 21.

(3) Set the output of the HP 651B for a 2 MHz, 3.4 mV, CW signal.

(4) Adjust variable inductors L5, L4, L3, L2, and L1 in that order for maximum deflection of the oscilloscope trace.

NOTE

It may be necessary to adjust A3R13 or A4R13, depending upon the position of MODE switch S3, to see a deflection on the oscilloscope.

4.4.5 Types 79748-1 and 79748-2 LSB-USB Amplifiers. - Proceed as follows:

(1) Perform alignment described in paragraph 4.4.4

(2) Connect the output of the HP 651B to connector XA4 pin 21.

(3) Rotate the front-panel MODE switch to the USB position.

(4) Set the output of the 651B to 454 kHz, at 2.6 mV, CW mode.

(5) Adjust variable capacitors A4C5 and A4C6 for maximum deflection of the signal on the oscilloscope.

(6) Next, adjust A4L2 for maximum deflection as seen on the oscilloscope.

(7) Adjust A4R13 to produce a 1 mW, nominal, reading on the AC VTVM.

(8) Move the MODE switch to the LSB position and set the 651B to 456 kHz.

(9) Adjust capacitors A3C5 and A3C6 as in step (5) and adjust A3L2 as done in step (6).

(10) Adjust A3R13 for the same reading produced in step (7) above.

4.4.6 Counter 1-MHz Oscillator. - Proceed as follows:

(1) Connect the test equipment as shown in Figure 4-2, and allow a thirty minute warm-up period.

(2) Place the DMS-109 counter MODE switch to the DECIMAL SHIFT - TUNE position.

(3) Set preset switch A8S2 to OFF.

(4) Adjust A8A1C3 for a readout of 000.00 on the counter in the DMS-109.

(5) Place switch A8S2 to ON.

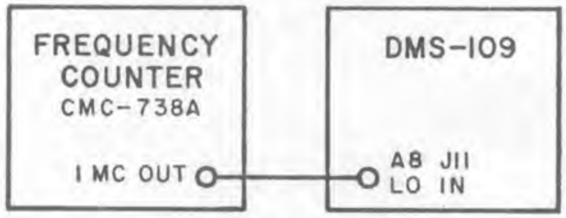


Figure 4-2. Equipment Setup for Counter 1-MHz Oscillator Adjustment

4.4.7 Local Oscillator Alignment. - The local oscillator alignment is presented in the following paragraphs. Note that the counter circuits and the local oscillator circuits are assumed to be operational and only alignment of the local oscillator is necessary. If the local oscillator or counter circuitry is not functioning properly performance of the troubleshooting techniques given in paragraph 4.5 should be accomplished to correct the problem prior to alignment.

(1) Remove the cover from the top of the local oscillator assembly.

(2) Move the main tuning knob to its fully CCW position and lock into place.

(3) Move the fine tuning control to center of rotation.

(4) Check the main tuning capacitor C5 (see Figure 5-11) to ensure that it is fully meshed. If this adjustment is correct, proceed to step (8).

(5) To adjust C5 for full mesh, first loosen the Allen set screws on the flexible coupling between C5 (see Figure 5-11) and shaft #26 (see Figure 5-14) on the tuning drive. It is only necessary to loosen the two screws on the collar closet to C5.

(6) With a thumb, carefully push the movable plates until they are fully meshed with the stationary plates.

(7) Carefully tighten the setscrews on the flexible coupling collar.

(8) Adjust A7A1C4 for a counter reading of 4.5 kHz.

(9) Unlock the main tuning knob and move the control to its CW position.

(10) The reading on the counter should be 000.00 kHz (1000.00) +15.0, -00.0 kHz.

(11) If the reading in step (10)is incorrect adjustment of A7A1A2L1 will change the range of the local oscillator. Note that as the range is increased the output frequency will decrease. Therefore, tune to the lowend and adjust A7A1C4 for a counter reading of 4.5 kHz. Then tune to the high end to check for proper range. Proper adjustments between A7A1A2L1 and A7A1C4 will bring the local oscillator into the proper range.

4.5 TROUBLESHOOTING

4.5.1 Demodulator Circuits. - Troubleshooting efforts should first be directed toward localizing the problem to a particular module or circuit group. As aids in this process, this manual contains troubleshooting information in tabular form (Table 4-2A), a functional block diagram (Figure 2-1) and a complete circuit description (Section II). Once the faulty module has been located, the defective component should be isolated using data obtained from the circuit descriptions, voltage measurements (Table 4-3) and schematic diagrams (Figures 6-1 through 6-9 and 6-15 through 6-17).

4.5.2 Counter Circuits. - If the maintenance technician has a thorough understanding of the counter circuit functions, troubleshooting the unit will be a simple matter. Aids to troubleshooting the counter circuits are the troubleshooting chart (Table 4-2B), the typical waveforms (Figure 4-5), the functional block diagram (Figure 2-2), gate generator timing chart (Figure 2-6), and a complete circuit description (Section II). Once the faulty module has been located, the defective component should be isolated using data obtained from the troubleshooting chart (Table 4-2B), the circuit descriptions, voltage measurements (Table 4-3), and schematic diagrams (Figures 6-10 through 6-14).

4.5.3 Localizing Troubles. - Table 4-2 has been designed to show the methods by which logical troubleshooting can be applied to the Type DMS-109 Tunable Demodulator. Since it is impossible to anticipate all potential troubles only those that could be classified as "probable" are listed. The same basic procedure should be applied to all troubles however, with initial efforts being directed toward the major assembly level:counter, local oscillator, input converter and so on.

4.5.4 Failure Analysis. - Once the trouble has been localized, the demodulator can usually be returned to service by substituting a spare module or subassemly known to be in good operating condition. Prior to performing corrective action on the faulty module, the procedures followed up this point should be reviewed to determine exactly why the failure affected the equipment in the manner that it did. This review is necessary to ensure that the problem discovered is actually the cause and not just the result of the malfunction.

4.5.5 Test Equipment Required. - The following equipment or their equivalent are required to troubleshoot the DMS-109

(1) Test Oscillator, Hewlett Packard, HP-651B

(2) Oscilloscope, Tektronix Type 544

(3) Frequency Counter, CMC-738A

Table 4-2A. Troubleshooting Demodulator Circuits

Trouble Indication	Probable Fault	Diagnostic Procedure
1) Unit total inoperative	Blown fuse(s)	Replace F1 (115 Vac) or F1 and F2 (230 Vac)
	Faulty power switch or 115/230 Vac selector switch	Check continuity of S1 and S2
	Defective Power transformer	Check continuity of T1
2) Pilot Lamp illuminated but no audio output	Failure of +18V Regulator	Check for +18V at XA9 pin 12
3) Power supply voltage normal, counter display and/or audio output abnormal	Counter failure	Refer to Table 4-2B
	Improperly mated connectors and/or cable failure	Check A7A1P1, A7A1J1, and A7A1J2
	Local oscillator defective	Check output waveform at A7A1J1 and A7A1J2 per Figure 4-3 and Figure 4-4, respectively
4) Tuning Assembly outputs normal, audio output abnormal in either LSB or USB position	Defective module A1, A2, A5, and/or A6	Execute performance checks as outlined in paragraph 4.6 to isolate the faulty module
5) Failure of either LSB or USB channel	Defective module A3 or A4	Replace module A3 or A4

Table 4-2B. Troubleshooting Counter Circuits

Trouble Indication	Probable Fault	Diagnostic Procedure
1) Readout tubes dark, pilot lamp OK	Interface malfunction	Check for proper mating of A8J1, A8J2, and A8P1 and check continuity of associated cables
	Power supply regulator malfunction	Check for +6V at XA10 pin 3 and +200 V at XA10 pin 17
2) Power supply OK, tubes still dark or count abnormal	Failure of timing circuits	Check module A8A1 to verify gating and timing circuits beginning with 1-MHz oscillator. Refer to Figures 2-2 and 2-5.
3) Permanent display of one character on readout tube	Defective decoder/driver IC	Substitute component
4) Two characters on one tube light together	Defective decoder/driver IC	Substitute component
	Defective readout tube	Substitute component
5) Incomplete lighting of one character on readout tube	Same as Item 4	Same as Item 4
6) A readout tube has any gross failure indication; tubes to the left readout normally	Same as Item 4	Same as Item 4

Table 4-2B. Troubleshooting Counter Circuits (Cont'd.)

Trouble Indication	Probable Fault	Diagnostic Procedure
7) A readout tube has any gross failure indication; tubes to the left also failed	Failure of decade counter IC	Substitute component
8) Only readout is all zeros, with or without input	Reset pulse failed; stays high (active)	Check waveform per Figure 4-5e
9) Only readout is preset number with or without input	Signal gate pulse failed, stays low (inactive) Failure of tuning assembly	Check waveform per Figure 4-5g Refer to Table 4-2A
10) Most significant digit reads 8; rest of digits respond to count	Preset pulse failed, stays low (active)	Check A8Q1 and A8Z7 pin 4 for short to ground
11) Blurred readout with input; readout of preset number with no input	Signal gate pulse failed, stays high (active)	Check waveform per Figure 4-5g
12) DAFC failed on one correction rate only	Defective DAFC switch A8S3	Make continuity checks
13) DAFC will not lock, all correction rates	Defective FET, A8A2Q4 Defective semiconductors A8A2Q1 - Q3, A8A2CR1-CR2	Substitute component Substitute components

4.6 PERFORMANCE CHECKS

4.6.1 General. - The performance checks listed in the following paragraphs may be executed any time poor performance is suspected, at times of normal preventative maintenance, or after correction of a failure or malfunction. These tests are designed to expose a suspected problem. If degraded performance is discovered refer to paragraphs 4.5 and 4.4 for the proper corrective action.

4.6.2 Equipment Required. - The following test instruments, or their equivalents, are required to complete the entire series of performance checks:

(1) Variac, General Radio, Type W5MT3A.

(2) VTVM, RCA, Type WV-98C.

(3) Test Oscillator, Hewlett Packard, Type HP651B.

(4) AC VTVM, Hewlett Packard, Type HP400L.

(5) Oscilloscope, Tektronix, Type 544.

(6) 600Ω load rated at 1/2W.

(7) Assorted cables and connectors.

4.6.3 Power Supply Tests. - The following tests will ensure that the power supplies are performing within acceptable limits:

(1) Connect the DMS-109 power input to the Variac.

(2) With the line voltage maintained at 115 Vac, 60Hz, use the RCA VTVM to check for the voltages as outlined below:

POWER SUPPLY	MEASURED AT	MINIMUM READING	MAXIMUM READING
+18V	XA9 pin 12	+17.5	+18.5
+ 6V	XA10 pin 3	+ 5.7	+ 6.3
+200V	XA10 pin 17	+180	+225

(3) Maintain the line voltage at 125 Vac, 60Hz and repeat the measurements listed in step (2) above. Note that the +200V supply is not regulated, therefore, measurement of this supply is not meaningful at other than 115 Vac 60Hz.

(4) Maintain the line voltage at 105 Vac, 60Hz and repeat the measurements listed in step (2) above with the same exception as stated in step (3).

4.6.4 Signal Injection Tests. - The following tests are designed to isolate a problem to a particular module by the use of signal injection. The tests are begun at the last module (Type 7440 Audio Amplifier) and continue backwards to the first module (Type 79749 Input Converter).

4.6.4.1 Type 7440 Audio Amplifier. - Proceed as follows:

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

(2) Connect the output of the HP 651B Test Oscillator to connector XA6 pin 21.

(3) Set the output of the test oscillator for a 1 kHz, 23 mV, CW signal.

(4) The nominal output read on the AC VTVM should be 1 mW into the 600-ohm load.

4.6.4.2 Type 79751 SSB Detector. - Proceed as follows:

(1) Move the output of the HP 651B to connector XA5 pin 4.

(2) Set the oscillator output to 455 kHz, 56 mV, CW.

(3) The nominal output should be the 1 mW.

4.6.4.3 Types 79748-1 and 79748-2 LSB-USB Amplifiers. - Proceed as follows:

(1) Move the output of the HP 651B to connector XA4 pin 21.

(2) Move front-panel MODE switch S3 to the USB position.

(3) Set the output of the test oscillator to 454 kHz, 2.6 mV, CW mode.

(4) The nominal output should be 1 mW into the 600Ω load.

(5) Move the front-panel MODE switch to the LSB position and set the 651B to 456 kHz.

(6) Check for a 1 mW reading on the AC VTVM.

(7) If the readings in step (4) or (6) are incorrect, refer to the adjustment procedures detailed in paragraph 4.4 before attempting to troubleshoot either module.

4.6.4.4 Type 79496 Amplifier/Converter. - Proceed as follows:

(1) Transfer the output of the HP 651B to XA2 pin 21.

(2) Set the controls on the test oscillator for a 2 MHz, 3.4 mV, CW signal.

(3) Nominal output measured on the HP 400L AC VTVM should be 1 mW.

(4) If the proper reading is not obtained in step (3) above, refer to the alignment procedures in paragraph 4.4 of this manual before attempting to troubleshoot the module.

4.6.4.5 Type 79749 Input Converter. - Proceed as follows:

(1) Connect the HP 651B output to the DMS-109 INPUT jack, J1, on the rear panel of the unit.

(2) Rotate the front-panel LEVEL ADJ potentiometer, R2, fully clockwise.

(3) Set the output of the test oscillator for a 100 kHz, 1 mV, CW signal.

(4) Check for the nominal output of 1 mW on the HP 400L.

4.6.5 Type 71310 Tuning Assembly. - The following steps are included to determine if the outputs from the local oscillator are approximately of the same amplitude and shape as those given in the illustrations. To perform the tests proceed as follows:

(1) Disconnect plug P1 from jack A7A1J1 and plug P2 from jack A7A1J2 (refer to Figure 6-17).

(2) Set front-panel FINE TUNING control to mid rotation.

(3) Set front-panel counter switch (A8S1B-W on Figure 6-10) to the TUNE position in the NORMAL DISPLAY mode.

(4) Rotate the main tuning knob fully clockwise.

(5) Connect the vertical input of the Tektronix 544 Oscilloscope to the Balanced Mixer output jack, A7A1J1.

(6) Make the following adjustments to the oscilloscope controls:

VERTICAL SENSITIVITY - 0.5V/cm

SWEEP TIME/CM - 0.1μ sec/cm

The trace should approximate the one shown in Figure 4-3.

(7) Connect the vertical input of the oscilloscope to LO output jack A7A1J2.

(8) Place the oscilloscope controls in the following positions:

VERTICAL SENSITIVITY - 0.05V/cm

SWEEP TIME/CM - 0.2μ sec/cm

The trace should approximate the one shown in Figure 4-4.

(9) Remove all test equipment from the DMS-109 and reconnect plugs P1 and P2 to their proper receptacles.

4.6.6 Counter DAFC Operation. - The following test is designed to determine proper operation of the counter DAFC function. Proceed as follows:

(1) Energize the DMS-109 and allow for a ten minute warm-up time.

(2) Set the front-panel counter MODE switch to the tune position of the NORMAL DISPLAY mode and tune the demodulator to 0765.0 kHz.

(3) Move the DAFC LAST DIGIT switch to the 0 position.

(4) Next, move the MODE switch to the DAFC position of the NORMAL DISPLAY mode.

(5) At this point nothing should occur, i.e., the DAFC circuitry should hold the last digit at zero (0).

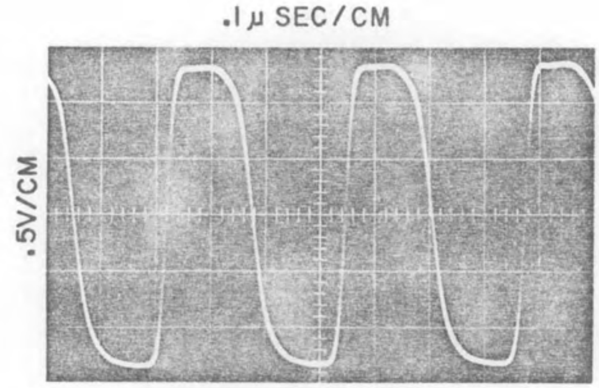


Figure 4-3. Typical Response, Tuning Assembly Balanced Mixer Output

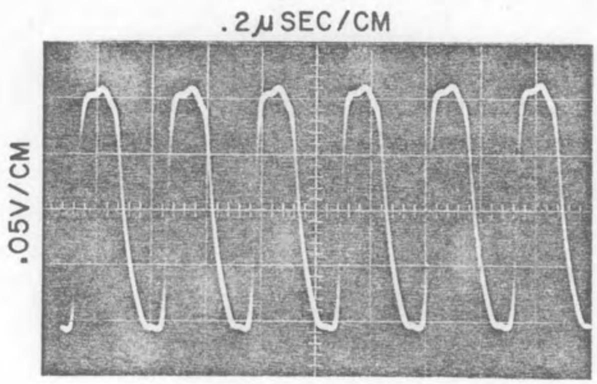


Figure 4-4. Typical Response, Tuning Assembly LO Output

(6) Next, rotate the DAFC LAST DIGIT switch to the 1 position. The DAFC circuitry should now change the last displayed digit to a 1.

(7) Continue advancing the last digit switch one position at a time until position 9 has been reached while checking each position for proper DAFC operation.

(8) Decrease the last digit switch from 9 to 0 stopping at each position to check for proper DAFC action as in step (7). Note that all DAFC positions are assigned the tolerance of ±1 digit. For example, with the DAFC operating and the last digit switch in the 2 position, the display may flicker between 2 and 1 or 2 and 3.

4.6.7 Counter Display Tube Range and Stability. - Proceed as follows:

(1) Initial settings on the DMS-109.

TUNING KNOB - FULLY CW

COUNTER MODE - NORMAL DISPLAY, TUNE

(2) Lower the demodulator frequency in steps to its lowest frequency. Check for proper counter indication at each step. A recommended minimum is approximately 50 kHz steps. Irregular increments are recommended so that every display tube is seen to display all ten digits. Pause randomly during this procedure to ensure that the count is stable.

4.6.8 Decimal Shift Mode. - To check for proper operation of the decimal shift mode of the counter proceed as follows:

(1) Rotate the counter MODE switch to the TUNE position of the DECIMAL SHIFT mode. Note that the decimal point shifts one place to the left when the DECIMAL SHIFT mode is selected.

(2) Alternately switch the counter mode control between the two TUNE positions to ensure that the decimal point shifts properly. Note that in the DECIMAL SHIFT mode the display will be present with a visible flicker.

4.7 SUBASSEMBLY REMOVAL, REPAIR, AND REPLACEMENT

4.7.1 General. - The majority of the subassemblies are constructed on etched circuit boards that plug into receptacles on the main chassis. The Tuning Assembly consists of the Tuning Drive and the Local Oscillator. The Tuning Drive is discussed in a later paragraph. The Local Oscillator module is constructed of cast aluminum. Subassemblies within the module are built on etched circuit boards one of which is attached to the module by means of screws. The other board is a plug-in item. The Counter Assembly is constructed of brass that has been nickle-plated and then gold flashed to prevent tarnishing and to increase conductivity. Subassemblies within the counter are built on individual etched circuit boards that plug into the counter "mother board". All plug-in items are easily removed by pulling them carefully from their receptacles. Printed circuit boards in the local oscillator and counter assembly use gold mechanical pins for interconnections. Extreme care should be used when seating a board of this type to avoid damaging the pins in any way. When properly aligned these boards will seat easily. DO NOT USE FORCE. Repair procedures are straight forward and conventional observing the usual precautions regarding temperature on semiconductors and damage to circuit patterns on boards.

4.7.2 Removal of Tuning Assembly. - The local oscillator and the tuning drive can be removed from the demodulator by following the steps below.

(1) Remove the top and bottom dust covers.

(2) Remove the tuning knob from the shaft using the Allen wrench provided.

(3) Disconnect the following plugs from their respective jacks: plug A7A1P1 from jack J4, plug P1 from jack A7A1J1, and plug P2 from jack A7A1J2.

(4) Turn the unit on its side and remove the two mounting screws that are closest to the front panel.

(5) Support the top of the LO chassis with one hand while removing the two mounting screws located at the rear of the assembly.

(6) Carefully remove the entire tuning assembly from the demodulator from the top.

(7) To reassemble, reverse the steps above.

4.7.2.1 Disassembly of Tuning Drive. - Once the Tuning Assembly has been removed from the demodulator per paragraph 4.7.2, disassembly and subsequent reassembly of the tuning drive can be accomplished using Figure 5-14 as a guide.

4.7.2.2 Subassembly Removal From Type 7760 Local Oscillator. - Proceed as follows:

(1) Remove the top cover from the LO assembly.

(2) To remove the local oscillator board, simply pull it up and out of its receptacle. Use care in replacing this board in order not to samage the mechanical connector pins.

(3) To remove the inductor board, first unsolder the wires from the four terminals marked E1 through E4. Mark these wires to ensure correct replacement. Next, remove the two mounting screws and lift the board out of the assembly.

(4) To reassemble, reverse the steps given above.

4.7.3 Disassembly of the Counter. - Proceed as follows:

(1) Remove the top cover of the counter assembly.

(2) Any PC board is now easily accessible. Simply pull the desired board up and out of the assembly.

(3) To reassembly the counter reverse the steps given above. Care should be exercised when replacing the plug-in boards. Ensure proper pin alignment before seating the board to avoid damage to the mechanical connector pins. DO NOT USE FORCE when seating any board.

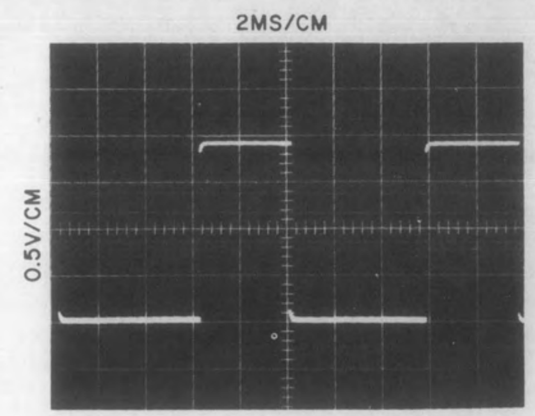


Figure 4-5a. BCD 4 at A8A1Z6 pin 7

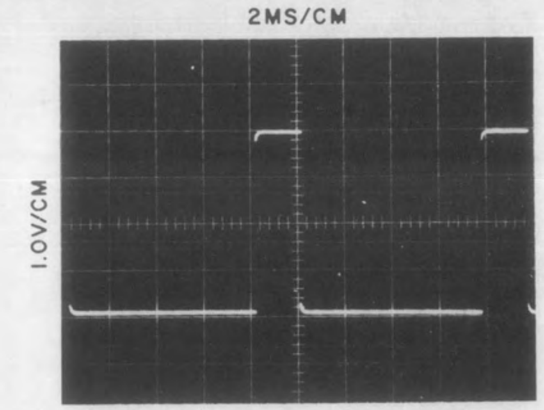


Figure 4-5b. BCD 8 at A8A1Z6 pin 6

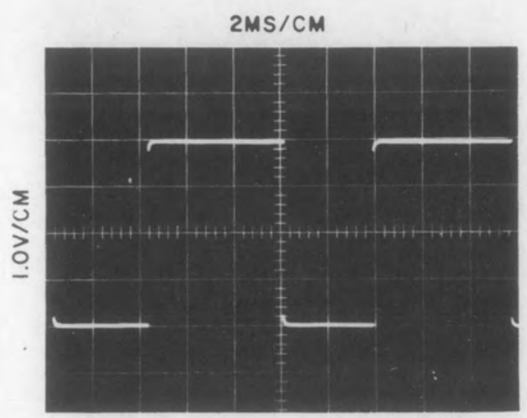


Figure 4-5c. BCD $\overline{4}$ at A8A1Z6 pin 8

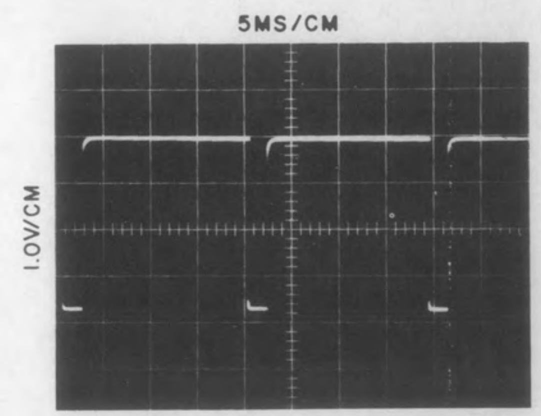


Figure 4-5d. Negative Reset at A8A1 pin 12

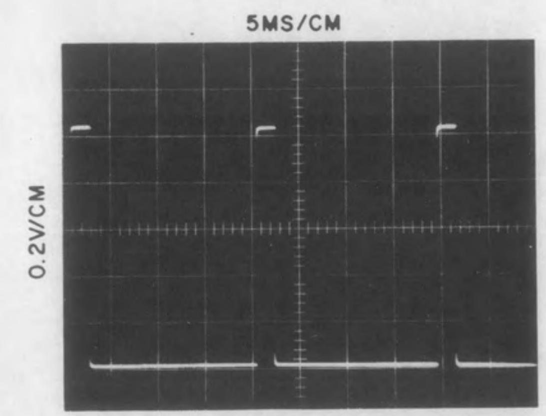


Figure 4-5e. Positive Reset at A8A1 pin 11

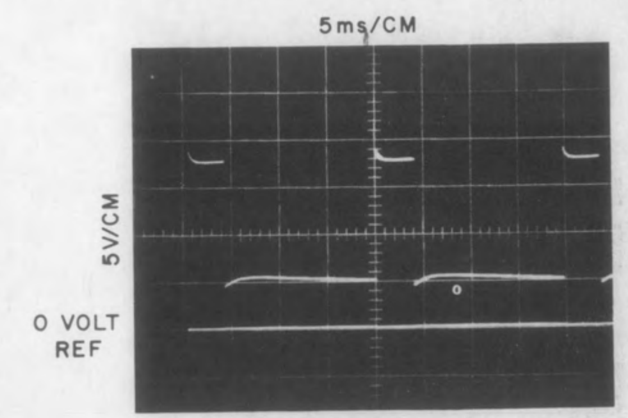


Figure 4-5f. DAFC Up Pulses at A8A2 pin 22

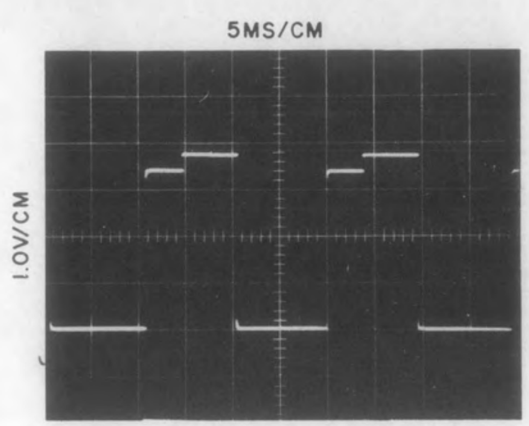


Figure 4-5g. Signal Gate Pulses at A8A1 pin 10

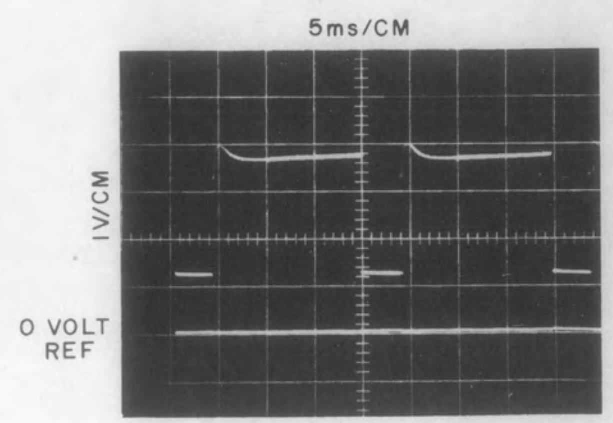


Figure 4-5h. DAFC Down Pulses at A8A2 pin 24

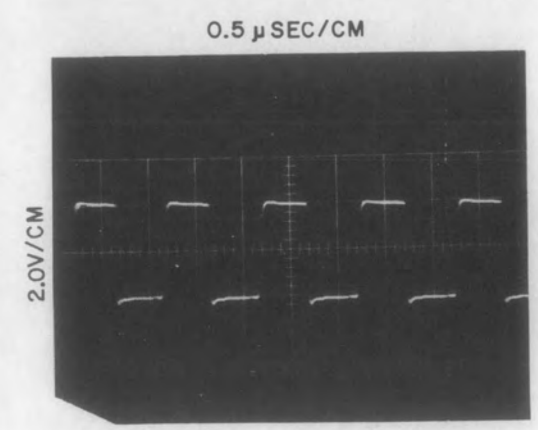


Figure 4-5i. BCD $\overline{1}$ at A8A2 pin 10

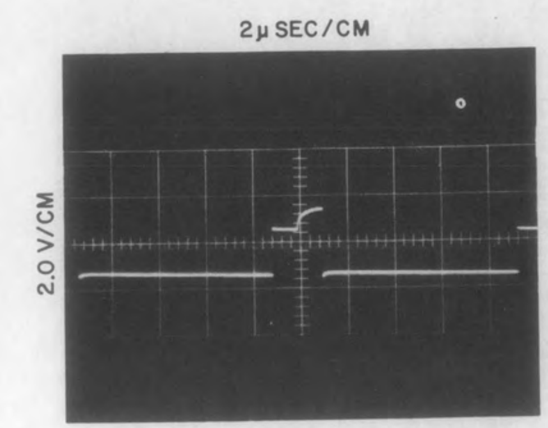


Figure 4-5j. Carry Pulse at A8A2 pin 7

Figure 4-5. Counter Assembly Typical Waveforms

Table 4-3. Typical Semiconductor Element Voltages

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A1Q1	2N2270								5.0	5.6	14.5
A1U1	μA716C		7.9	14.5	GND	8.2	17.5	9.0			
A2Q1	2N3933								2.6	3.2	14.1
A2Q2	3N140	16.5	1.8	0.9	1.3						
A2Q3	2N2222								3.9	4.0	16.0
A3, A4Q1 *	2N3933								2.3	2.9	14.0
A3, A4Q2 #	3N140	16.0	2.7	0.9	1.7						
A5Q1	3N140	12.2	5.0	3.8	4.1						
A5Q2	2N929								11.6	12.2	18.0
A5Q3	2N2222								6.8	6.8	15.0
A5Q4	2N929								11.0	11.6	18.0
A6Q1	2N4074								0.8	1.4	17.0
A6Q2	2N3251								17.6	17.0	10.6
A6Q3	2N2270								10.0	10.6	18.0
A6Q4	2N4037								9.3	8.7	GND
A8A1Q1	2N929								2.9	2.3	5.6
A8A1Q2	2N3251								5.9	5.6	5.0
A8A1Q3	2N706								0.0	0.1	5.0
A8A1Q4	2N706								0.0	1.1	0.8

Table 4-3. Typical Semiconductor Element Voltages

		Integrated Circuit Pin Numbers									
		1	2	3	4	5	6	7	8	9	10
		Field Effect Transistor Pins							Transistor Elements		
Ref. Desig.	Type	Drain	Gate 2	Gate 1	Source				Emitter	Base	Collector
A8A1Q5	2N3440								0.6	0.8	190.0
A8A2Q1	2N3251								28.6	30.8	0.0
A8A2Q2	2N3251								28.6	30.6	0.3
A8A2Q3	2N929								0.0	0.1	0.0
A8A2Q4	3N128	8.6	-	29.7	10.1						
A8A2Q5	2N709A								1.6	2.4	6.0
A8A2Q6	2N709A								0.0	0.3	1.0
A8A2Q7	2N709A								1.6	2.3	2.9
A9Q1	2N3055								18.0	18.6	28.0
A9Q2	2N4074								18.7	19.3	27.5
A9Q3	2N4074								6.7	7.3	19.3
A9Q4	2N4074								6.7	7.3	17.3
A10Q1	2N4074								6.6	7.2	10.0
A10Q2	2N3055								6.0	6.6	10.1
A10Q3	2N4074								2.9	3.5	7.2
A10Q4	2N4074								2.9	3.5	5.8

TEST CONDITIONS: Readings are positive dc with respect to chassis unless otherwise noted. Readings taken with RCA WV98C VTVM. 115 Vac, 60 Hz, applied, no signal input.

NOTE:
* MODE switch S3 in LSB position
# MODE switch S3 in USB position

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:

A1R1

Subassembly Designation	Class and No. of item
A1	R1

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

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

5.2 REFERENCE DESIGNATION PREFIX

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

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
01281	TRW Semiconductors, Inc. 14520 Aviation Boulevard Lawndale, California 90260
01351	Dynamic Gear Company, Inc. 173-177 Dixon Avenue Amityville, New York 11701
04099	Capco Inc. 5262 West 24th Street Lubbock, Texas 79408
04713	Motorola Semiconductor Products, Inc. 5005 East McDowell Road Phoenix, Arizona 85008
04941	Walsco Electronics Corporation 4 South Wyman Rockford, Illinois 61101
06001	General Electric Company Capacitor Department P. O. Box 158 Irmo, South Carolina 29063

Mfr. Code	Name and Address
07263	Fairchild Camera & Instr. Corp. Semiconductor Division 313 Frontage Road Mountain View, Calif. 94040
07663	R. Funk & Company, Inc. 755 North Easton Road Doylestown, Penn. 18901
13103	Thermalloy Company 9717 Diplomacy Row Dallas, Texas 75247
14632	Watkins-Johnson Company 700 Quiace Orchard Road Gaithersburg, Maryland 20760 2
21604	The Buckeye Stamping Company 555 Marion Road Columbus, Ohio 43207
23783	British Radio Electronics, Ltd. 1742 Wisconsin Avenue, N. W. Washington, D. C. 20007
27193	Cutler-Hammer, Inc. Special Products Division 4201 North 27th Street Milwaukee, Wisconsin 53216
27956	Relcom 2164 East Middlefield Road Mountain View, Calif. 94040
49956	Raytheon Company Lexington, Massachusetts 02173
56289	Sprague Electric Company Marshall Street North Adams, Mass. 01247
70417	Chrysler Corporation Amplex Division 6501 Harper Avenue Detroit, Michigan 48211
71279	Cambridge Thermionic Corp. 455 Concord Avenue Cambridge, Mass. 02138
71400	Bussman Manufacturing Division of McGraw-Edison Co. 2536 West University Street St. Louis, Missouri 63107
71590	Globe-Union Incorporated Centralab Division P. O. Box 591 Milwaukee, Wisconsin 53201
71785	Cinch Manufacturing Company Howard B. Jones Division 1026 South Homan Avenue Chicago, Illinois 60624
72136	Electro Motive Mfg. Co., Inc. South Park & John Streets Willimantic, Conn. 06226
72619	Dialight Corporation 60 Stewart Avenue Brooklyn, New York 11237
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania 16512

Mfr. Code	Name and Address	Mfr. Code	Name and Address
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, Calif. 92634	82389	Switchcraft, Incorporated 5527 North Elston Avenue Chicago, Illinois 60630
73899	JFD Electronics Company Div. of Stratford Retreat House 15th at 62nd Street Brooklyn, New York 11219	83086	New Hampshire Ball Bearings, Inc. Peterborough, N. H. 03458
74868	Bunker-Ramo Corporation The Amphenol RF Division 33 East Franklin Street Danbury, Connecticut 06810	83781	National Electronics, Inc. P. O. Box 269 Geneva, Illinois 60134
75915	Littelfuse, Incorporated 800 East Northwest Highway Des Plaines, Illinois 60016	84411	TRW Capacitor Division 112 West First Street Ogallala, Nebraska 69153
76854	Oak Manufacturing Company Div. of Oak Electro/Netics Corp. South Main Street Crystal Lake, Illinois 60014	88044	Aeronautical Standards Group Dept. of Navy and Air Force Silver Spring, Maryland
79136	Waldes Kohinoor Inc. 47-16 Austel Place Long Island City, New York 11101	88245	Litton Industries USECO Division 13536 Saticoy Street Van Nuys, California 91402
80131	Electronic Industries Association 2001 Eye Street, N. W. Washington, D. C. 20006	91293	Johanson Manufacturing Company P. O. Box 329 Boonton, New Jersey 07005
81312	Winchester Electronics Division Litton Industries, Incorporated Main Street & Hillside Avenue Oakville, Connecticut 06779	91418	Radio Materials Company 4242 West Bryn Mawr Avenue Chicago, Illinois 60646
81349	Military Specifications	93332	Sylvania Electric Products, Inc. Semiconductor Products Division 100 Sylvan Road Woburn, Massachusetts 01801

Mfr. Code	Name and Address
95105	Collins Radio Company Newport Beach, California
95146	Alco Electronics Products, Inc. 3 Wolcott Avenue Lawrence, Mass. 01843
96906	Military Standards Promulgated by Standardization, Division Directorate of Logistic Services DSA
99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, New York 14052
99848	Wilco Corporation 4030 West 10th Street P. O. Box 22248 Indianapolis, Indiana 46222

5.4 PARTS LIST

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

NOTE

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

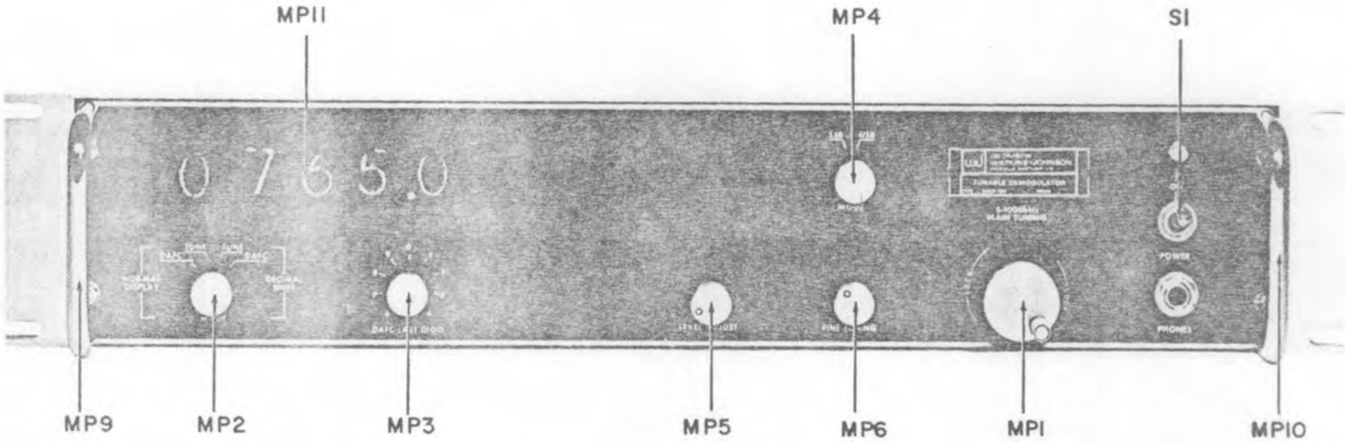


Figure 5-1. Type DMS-109 Tunable Demodulator, Front View, Component Location

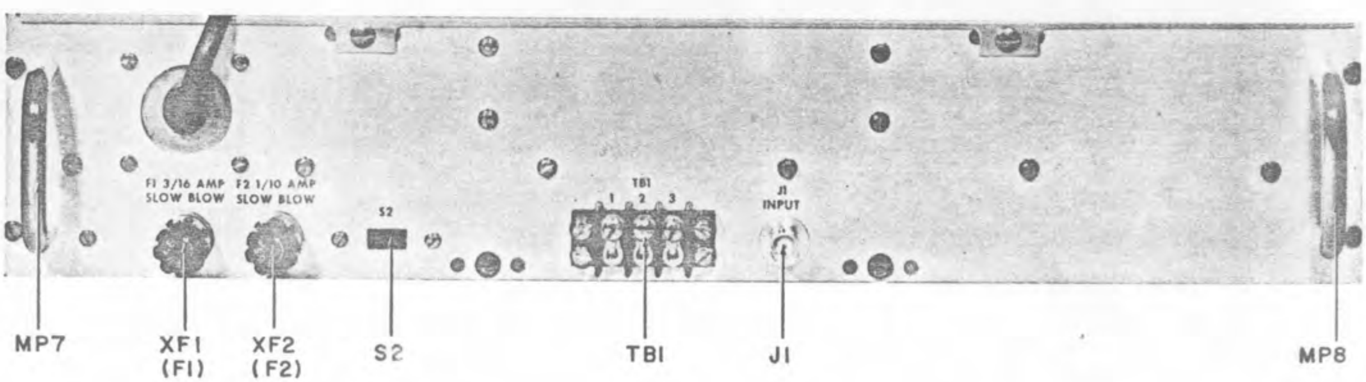


Figure 5-2. Type DMS-109 Tunable Demodulator, Rear View, Component Locations

5.4.1 Type DMS-109 Demodulator, Main Chassis

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	INPUT CONVERTER	1	79749	14632
A2	AMPLIFIER/CONVERTER	1	79496	14632
A3	LSB-USB AMPLIFIER	1	79748-1	14632
A4	LSB-USB AMPLIFIER	1	79748-2	14632
A5	SSB DETECTOR	1	79751	14632
A6	AUDIO AMPLIFIER	1	7440	14632
A7	TUNING ASSEMBLY	1	71310	14632
A8	COUNTER ASSEMBLY	1	79386	14632
A9	+18V POWER SUPPLY	1	76162	14632
A10	+6V/+200V POWER SUPPLY	1	76156	14632
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 2500 μF, -10+150%, 15V	1	43F3003CA4	06001
DS1	LAMP, NEON	1	249-7866-1431-534	72619
F1	FUSE, 3AG, SLOW-BLOW: 3/16A	1	MDL-3/16	71400
F2	FUSE, 3AG, SLOW-BLOW: 1/10A	1	MDL-1/10	71400
J1	CONNECTOR, JACK, BNC SERIES	1	17825	74868
J2	CONNECTOR, PHONE JACK	1	L-11	82389
J3	CONNECTOR, RECEPTACLE, MULTIPIN	2	M4S-LRN	81312
J4	Same as J3			
MP1	CRANK ASSEMBLY	1	11755-4	14632
MP2	KNOB	3	PS70PL2(Black)	21604
MP3	Same as MP2			
MP4	Same as MP2			

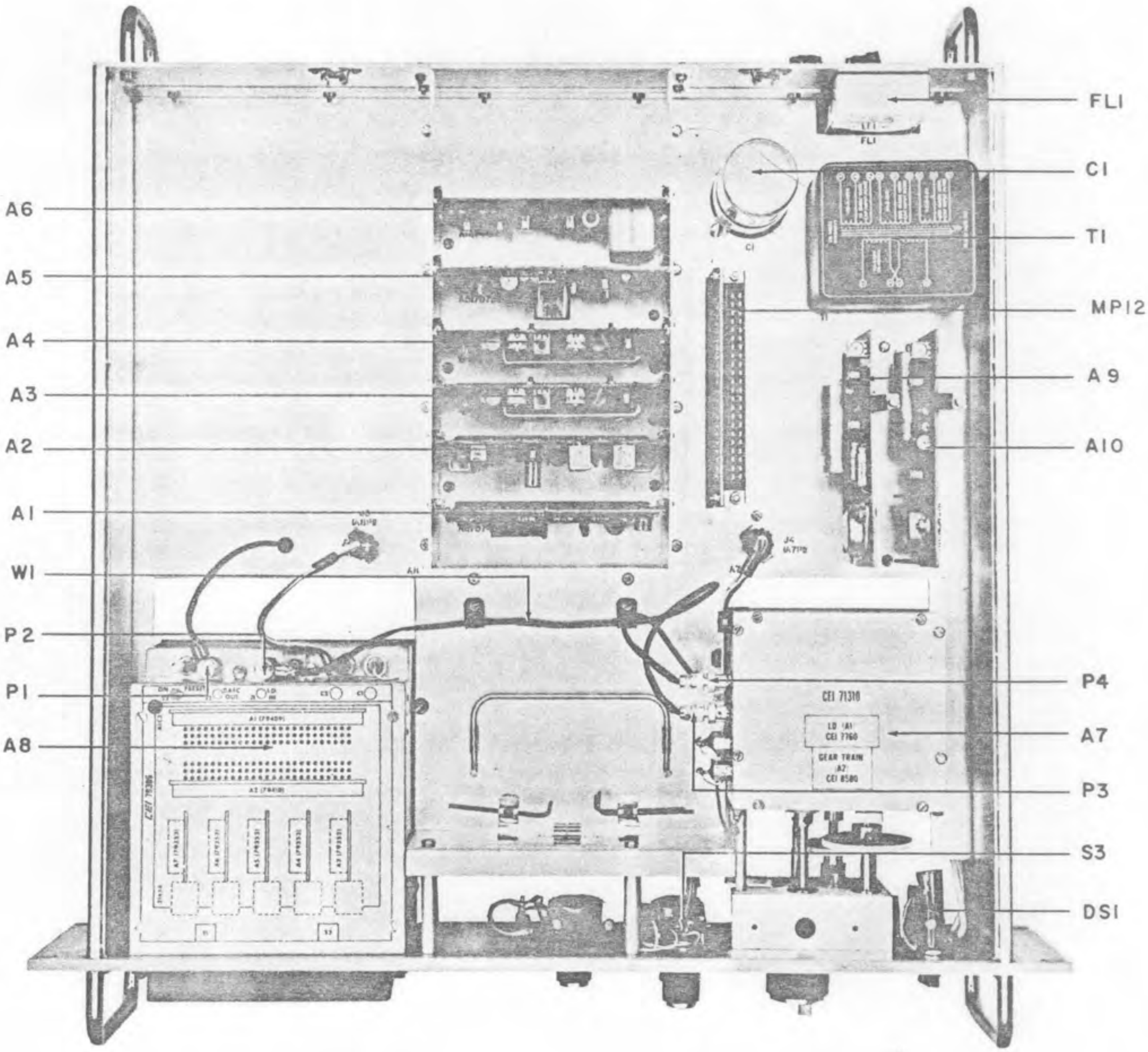


Figure 5-3. Type DMS-109 Tunable Demodulator, Top View, Component Locations

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
MP5	KNOB	2	PS70D2(Black)	21604
MP6	Same as MP5			
MP7	HANDLE	2	1250-1	71279
MP8	Same as MP7			
MP9	HANDLE	2	1015-12	88245
MP10	Same as MP9			
MP11	FILTER, LIGHT	1	12584-5	14632
MP12	EXTENDER CARD	1	79672	14632
MP13	COVER, TOP	1	30625-6	14632
MP14	COVER, BOTTOM	1	30625-13	14632
P1	CONNECTOR, PLUG, MB SERIES	2	44950	74868
P2	Same as P1 Part of W1			
P3	CONNECTOR, PLUG, MB SERIES Part of W1	2	45775	74868
P4	Same as P3			
R1	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349
R2	RESISTOR, VARIABLE, COMPOSITION: 5 kΩ, 10%, 2W	1	RV4NAYSD502A	81349
R3	RESISTOR, FIXED, COMPOSITION: 39 Ω, 5%, 1/4W	1	RCR07G390JS	81349
R4	RESISTOR, VARIABLE, COMPOSITION: 50 kΩ, 10%, 2W	1	RV4NAYSD503A	81349
R5	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 56 Ω, 5%, 1/4W	1	RCR07G560JS	81349
S1	SWITCH, TOGGLE: SPST	1	8280-K16	27193
S2	SWITCH, SLIDE: DPDT	1	46256-LFR	82389

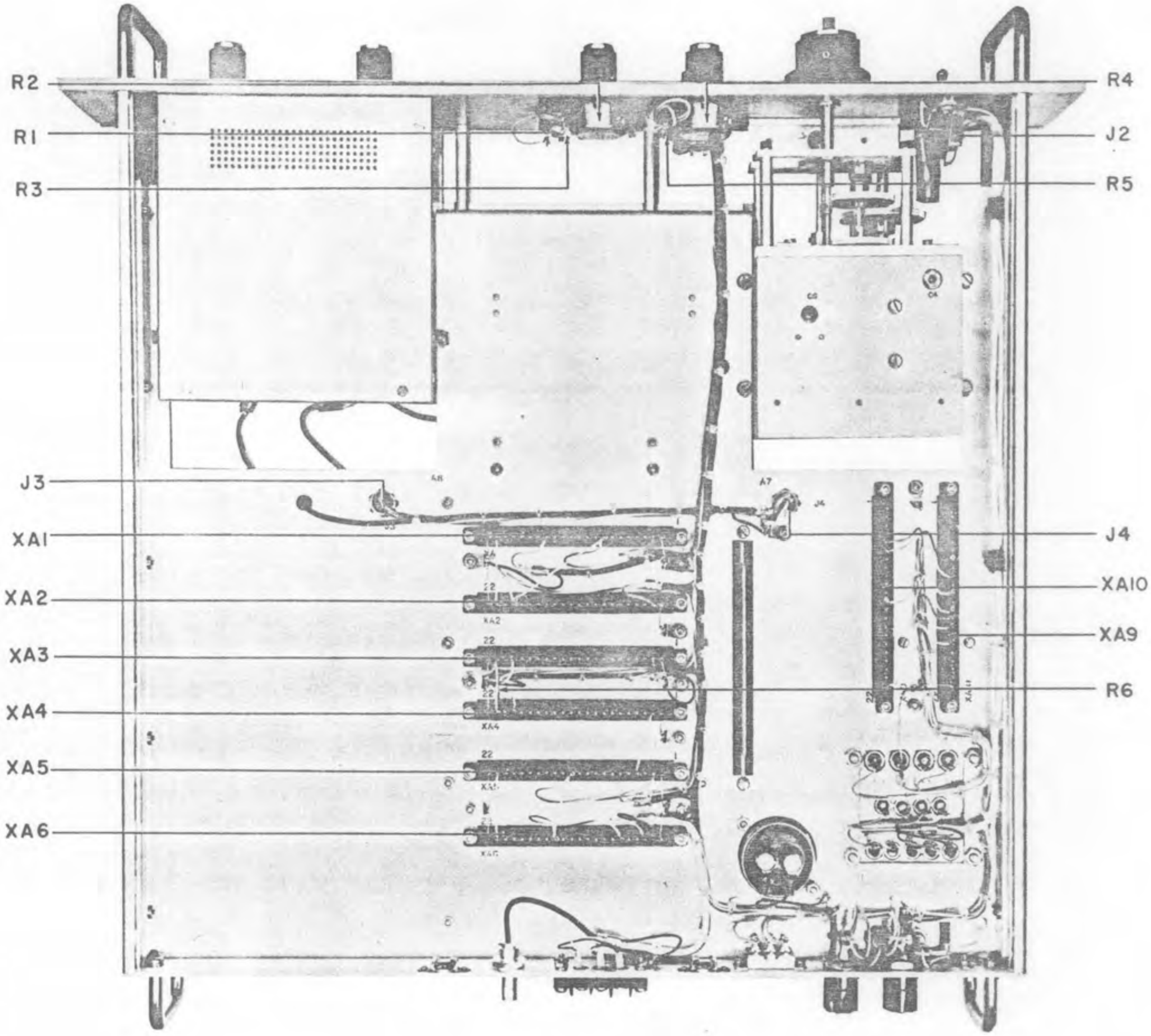


Figure 5-4. Type DMS-109 Tunable Demodulator, Bottom View, Component Locations

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
S3	SWITCH, ROTARY: 1 Section, 2 Pole, 6 Position	1	1128-43	14632
T1	TRANSFORMER	1	14803	14632
TB1	TERMINAL BOARD	1	353-18-03-001	71785
W1	CABLE AND CONNECTOR ASSEMBLY	1	30020-1401	14632
XA1	CONNECTOR, PRINTED CIRCUIT CARD	8	250-22-30-170	71785
XA2	Same as XA1			
XA3	Same as XA1			
XA4	Same as XA1			
XA5	Same as XA1			
XA6	Same as XA1			
XA9	Same as XA1			
XA10	Same as XA1			
XF1	FUSEHOLDER	2	342004	75915
XF2	Same as XF1			

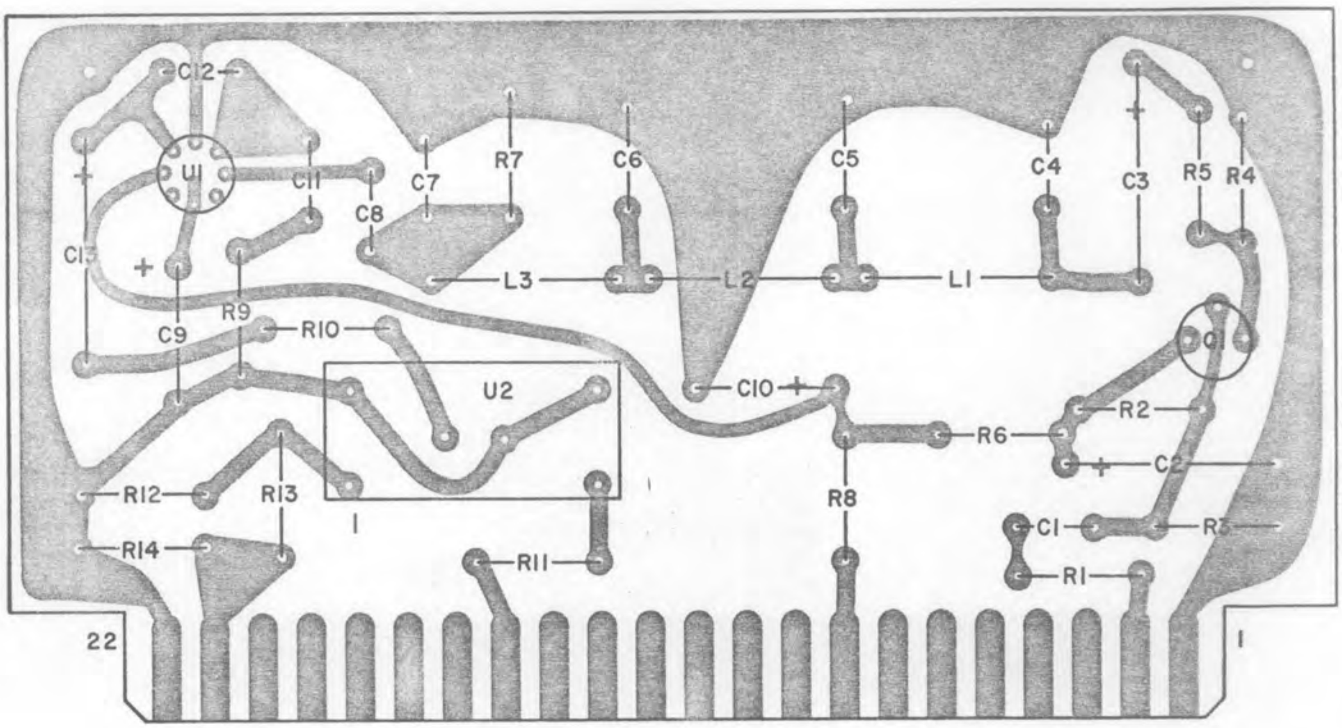


Figure 5-5. Type 79749 Input Converter (A1), Component Locations

5.4.2 Type 79749 Input Converter

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 0.1 μF, +80-20%, 25V	2	DFJ-3	73899
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 35V	3	CS13BF475K	81349
C3	Same as C2			
C4	CAPACITOR, MICA, DIPPED: 360 pF, 5%, 500V	2	CM05FD361J03	81349
C5	CAPACITOR, MICA, DIPPED: 620 pF, 5%, 500V	2	CM06ED621J03	81349
C6	Same as C5			
C7	Same as C4			
C8	Same as C1			
C9	CAPACITOR, ELECTROLYTIC, TANTALUM: 2.2 μF, 10%, 20V	1	CS13BE225K	81349
C10	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μF, 10%, 35V	1	CS13BF105K	81349
C11	CAPACITOR, MICA, DIPPED: 51 pF, 5%, 500V	1	CM05ED510J03	81349
C12	CAPACITOR, MICA, DIPPED: 27 pF, 5%, 500V	1	CM05ED270J03	81349
C13	Same as C2			
L1	COIL, FIXED: 120 μH	2	1537-80	99800
L2	COIL, FIXED: 130 μH	1	1537-82	99800
L3	Same as L1			
Q1	TRANSISTOR	1	2N2270	80131
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 510 Ω, 5%, 1/4W	2	RCR07G511JS	81349

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R6	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	3	RCR07G101JS	81349
R7	Same as R5			
R8	Same as R6			
R9	RESISTOR, FIXED, COMPOSITION: 75 Ω, 5%, 1/4W	1	RCR07G750JS	81349
R10	Same as R6			
R11	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349
R12	RESISTOR, FIXED, COMPOSITION: 150 Ω, 5%, 1/4W	2	RCR07G151JS	81349
R13	RESISTOR, FIXED, COMPOSITION: 39 Ω, 5%, 1/4W	1	RCR07G390JS	81349
R14	Same as R12			
U1	INTEGRATED CIRCUIT	1	U5B771639X	07263
U2	MIXER	1	M6	27956

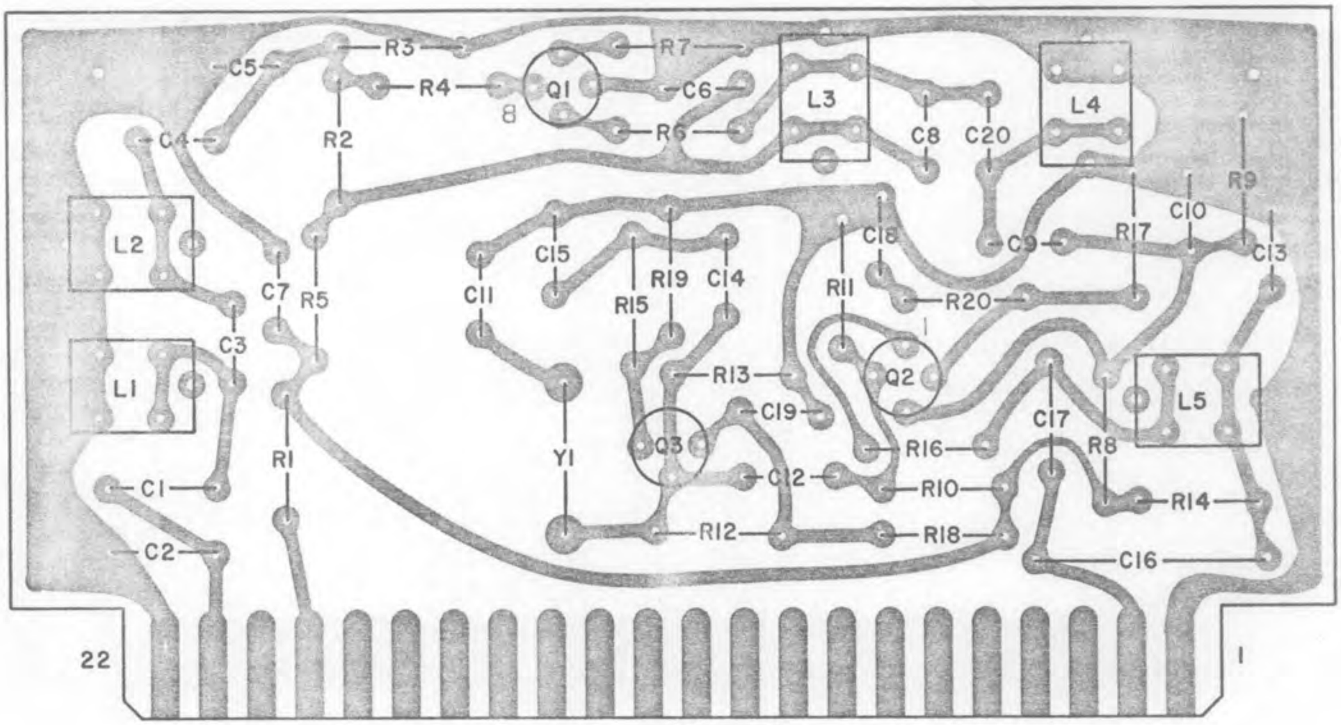


Figure 5-6. Type 79496 Amplifier/Converter (A2), Component Locations

5.4.3 Type 79496 Amplifier/Converter

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, MICA, DIPPED: 560 pF, 5%, 300V	3	DM15-561J	72136
C2	CAPACITOR, MICA, DIPPED: 6800 pF, 5%, 100V	1	DM19-682J	72136
C3	CAPACITOR, MICA, DIPPED: 12 pF, 5%, 500V	2	CM05CD120J03	81349
C4	CAPACITOR, MICA, DIPPED: 680 pF, 5%, 300V	1	DM15-681J	72136
C5	CAPACITOR, CERAMIC, DISC: 2200 pF, 10%, 200V	1	CK06BX222K	81349
C6	CAPACITOR, CERAMIC, DISC: 0.1 μF, +80-20%, 25V	4	DFJ-3	73899
C7	Same as C6			
C8	CAPACITOR, MICA, DIPPED: 510 pF, 5%, 500V	1	DM15-511J	72136
C9	CAPACITOR, MICA, DIPPED: 1000 pF, 5%, 500V	2	DM15-102J	72136
C10	Same as C9			
C11	CAPACITOR, MICA, DIPPED: 39 pF, 5%, 500V	1	CM05ED390J03	81349
C12	CAPACITOR, CERAMIC, TUBULAR: 15 pF, 5%, 500V	1	301-000-C0G0-150J	72982
C13	Same as C6			
C14	Same as C1			
C15	Same as C1			
C16	CAPACITOR, MYLAR, TUBULAR: 0.022 μF, 5%, 100V	1	663UW-223-5-1-W	84411
C17	CAPACITOR, MICA, DIPPED: 2200 pF, 5%, 500V	1	CM06FD222J03	81349
C18	Same as C6			
C19	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 100V	1	C023B101F103M	56289
C20	Same as C3			
L1	COIL, VARIABLE	4	7107-26	71279
L2	Same as L1			

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
L3	Same as L1			
L4	Same as L1			
L5	COIL, VARIABLE	1	7107-35	71279
Q1	TRANSISTOR	1	2N3933	80131
Q2	TRANSISTOR	1	3N187	80131
Q3	TRANSISTOR	1	2N2222	80131
R1	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	2	RCR07G103JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	4	RCR07G470JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	3	RCR07G102JS	81349
R6	Same as R4			
R7	Same as R5			
R8	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	2	RCR07G184JS	81349
R9	Same as R3			
R10	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 15 kΩ, 5%, 1/4W	1	RCR07G153JS	81349
R12	Same as R8			
R13	RESISTOR, FIXED, COMPOSITION: 82 kΩ, 5%, 1/4W	1	RCR07G823JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349
R15	Same as R4			
R16	Same as R4			

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R17	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	1	RCR07G471JS	81349
R18	Same as R5			
R19	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349
R20	RESISTOR, FIXED, COMPOSITION: 68 Ω, 5%, 1/4W	1	RCR07G680JS	81349
Y1	CRYSTAL, QUARTZ: 1.545 MHz		CR-18/U	81349

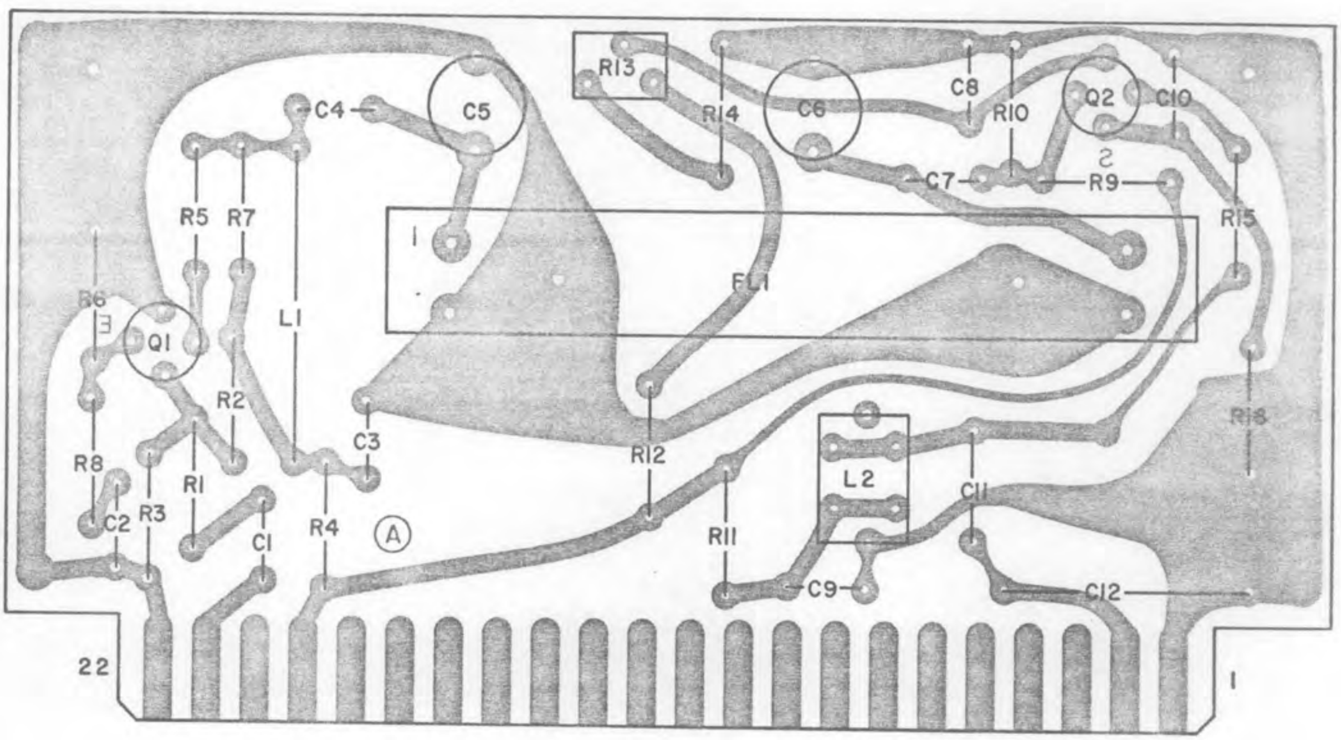


Figure 5-7. Types 79748-1 and 79748-2 LSB-USB Amplifiers (A3, A4), Component Locations

5.4.4 Types 79748-1 & 79748-2 LSB-USB Amplifiers

REF DESIG PREFIX A3 & A4

REF DESIG	DESCRIPTION		QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 100V		4	C023B101F103M	56289
C2	CAPACITOR, CERAMIC, DISC: 0.1 μF, +80-20%, 25V		4	DFJ-3	73899
C3	Same as C2				
C4	Same as C1				
C5	CAPACITOR, VARIABLE, CERAMIC: 9-35 pF, 350V		2	538-011-D9-35	72982
C6	Same as C5				
C7	Same as C1				
C8	Same as C1				
C9	Same as C2				
C10	Same as C2				
C11	CAPACITOR, MICA, DIPPED: 2400 pF, 5%, 500V		1	CM06FD242J03	81349
C12	CAPACITOR, MYLAR, TUBULAR: 0.022 μF, 5%, 100V		1	663UW-223-5-1-W	84411
FL1	FILTER, BANDPASS	(Type 79748-1 only)	1	F455Z23C	95105
FL1	FILTER, BANDPASS	(Type 79748-2 only)	1	F455Z24C	95105
L1	COIL, FIXED: 9.1 mH		1	2500-74	99800
L2	COIL, VARIABLE		1	7107-35	71279
Q1	TRANSISTOR		1	2N3933	80131
Q2	TRANSISTOR		1	3N187	80131
R1	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W		2	RCR07G101JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W		1	RCR07G183JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W		1	RCR07G472JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W		2	RCR07G102JS	81349

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R5	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R6	Same as R4			
R7	RESISTOR, FIXED, COMPOSITION: 2 kΩ, 5%, 1/4W	1	RCR07G202JS	81349
R8	Same as R1			
R9	RESISTOR, FIXED, COMPOSITION: 39 kΩ, 5%, 1/4W	1	RCR07G393JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 330 Ω, 5%, 1/4W	1	RCR07G331JS	81349
R12	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349
R13	RESISTOR, VARIABLE, FILM: 10 kΩ, 30%, 1/2W	1	62PAR10K	73138
R14	RESISTOR, FIXED, COMPOSITION: 8.2 kΩ, 5%, 1/4W	1	RCR07G822JS	81349
R15	Same as R5			
R16	RESISTOR, FIXED, COMPOSITION: 390 Ω, 5%, 1/4W	1	RCR07G391JS	81349

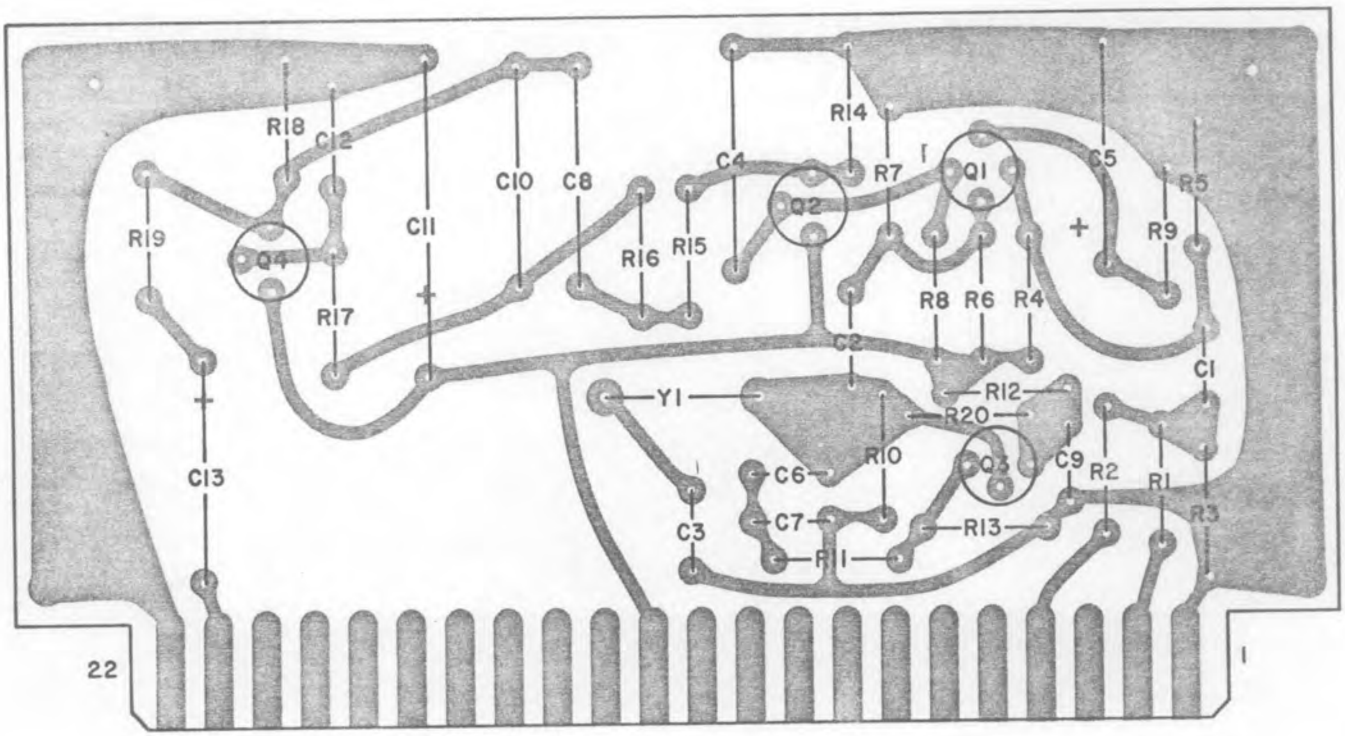


Figure 5-8. Type 79751 SSB Detector (A5), Component Locations

5.4.5 Type 79751 SSB Detector

REF DESIG PREFIX A5

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: .01 μF, 20%, 100V	2	C023B101F103M	56289
C2	CAPACITOR, CERAMIC, TUBULAR: 22 pF, 5%, 500V	1	301-000-C0G0-220J	72982
C3	CAPACITOR, MICA, DIPPED: 33 pF, 5%, 500V	1	CM05ED330J03	81349
C4	CAPACITOR, MYLAR, TUBULAR: .047 μF, 5%, 100V	1	MPCW(.047μF, J, 100V)	04099
C5	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 15V	1	CS13BD226K	81349
C6	CAPACITOR, MICA, DIPPED: 560 pF, 5%, 300V	2	DM15-561J	72136
C7	Same as C6			
C8	CAPACITOR, MYLAR, TUBULAR: .01 μF, 5%, 100V	2	663UW-103-5-1-W	84411
C9	Same as C1			
C10	Same as C8			
C11	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 10%, 35V	1	CS13BF476K	81349
C12	CAPACITOR, MICA, DIPPED: 2200 pF, 5%, 500V	1	CM06FD222J03	81349
C13	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 35V	1	CS13BF475K	81349
Q1	TRANSISTOR	1	3N187	80131
Q2	TRANSISTOR	2	2N929	80131
Q3	TRANSISTOR	1	2N2222	80131
Q4	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 56 Ω, 5%, 1/4W	2	RCR07G560JS	81349
R2	Same as R1			
R3	RESISTOR, FIXED, COMPOSITION: 10 Ω, 5%, 1/4W	1	RCR07G100JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 120 kΩ, 5%, 1/4W	1	RCR07G124JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 33 kΩ, 5%, 1/4W	1	RCR07G333JS	81349

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R6	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 18 kΩ, 5%, 1/4W	1	RCR07G183JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 1.3 kΩ, 5%, 1/4W	1	RCR07G132JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	2	RCR07G102JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	2	RCR07G104JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349
R12	Same as R9			
R13	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	1	RCR07G272JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349
R15	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	3	RCR07G392JS	81349
R16	Same as R15			
R17	Same as R15			
R18	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349
R19	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349
R20	Same as R10			
Y1	CRYSTAL, QUARTZ: 455 kHz	1	CR-46/U	81349

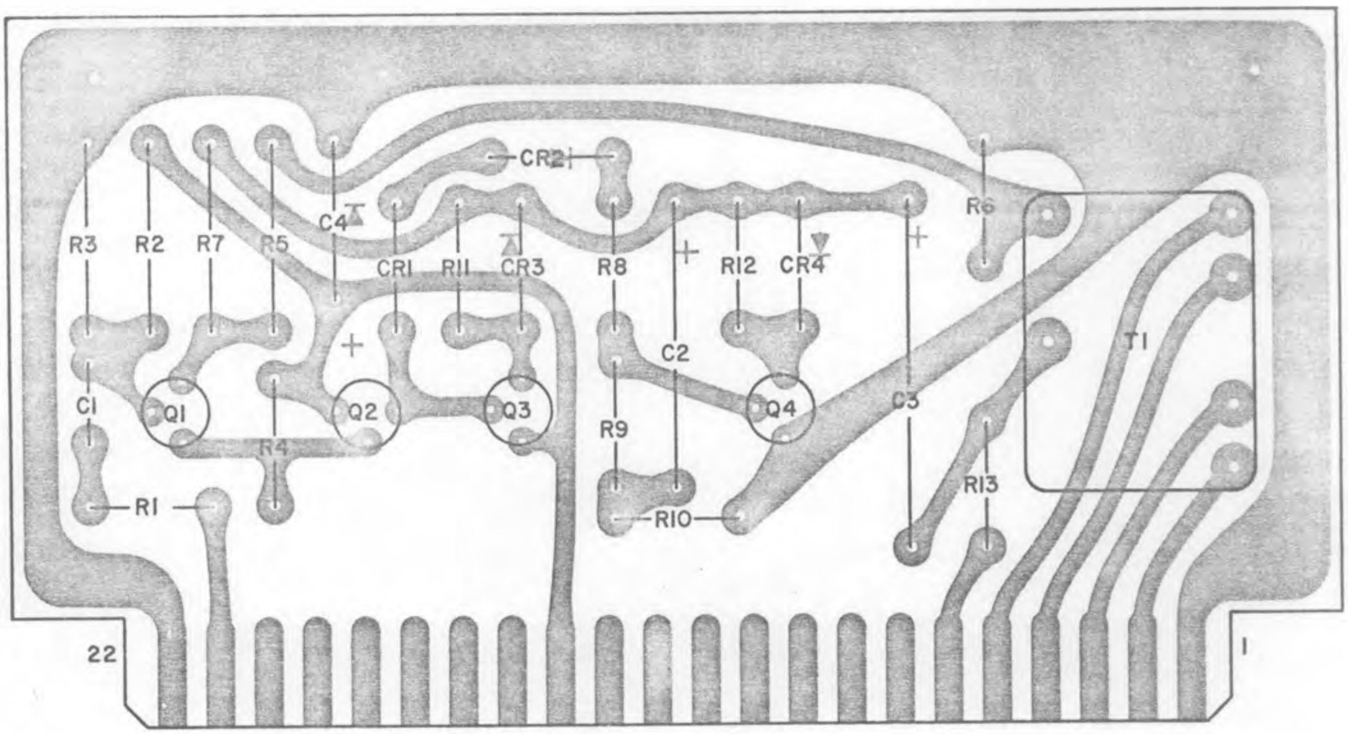


Figure 5-9. Type 7440 Audio Amplifier (A6), Component Locations

5.4.6 Type 7440 Audio Amplifier REF DESIG PREFIX A6

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 0.1 µF, +80-20%, 50V	1	8131-100-651-104M	72982
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 µF, 10%, 15V	1	CS13BD226K	81349
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 100 µF, 10%, 20V	1	CS13BE107K	81349
C4	CAPACITOR, ELECTROLYTIC, TANTALUM: 1.0 µF, 10%, 35V	1	CS13BF105K	81349
CR1	DIODE	4	1N462A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
Q1	TRANSISTOR	1	2N4074	80131
Q2	TRANSISTOR	1	2N3251	80131
Q3	TRANSISTOR	1	2N2270	80131
Q4	TRANSISTOR	1	2N4037	80131
R1	RESISTOR, FIXED, COMPOSITION: 470 Ω, 5%, 1/4W	2	RCR07G471JS	81349
R2	RESISTOR, FIXED, FILM: 274 kΩ, 1%, 1/4W	1	RN60D2743F	81349
R3	RESISTOR, FIXED, FILM: 24.3 kΩ, 1%, 1/4W	1	RN60D2432F	81349
R4	RESISTOR, FIXED, COMPOSITION: 2.2 kΩ, 5%, 1/4W	1	RCR07G222JS	81349
R5	RESISTOR, FIXED, FILM: 681 Ω, 1%, 1/4W	1	RN60D6810F	81349
R6	RESISTOR, FIXED, COMPOSITION: 2.7 kΩ, 5%, 1/4W	1	RCR07G272JS	81349
R7	RESISTOR, FIXED, FILM: 10 kΩ, 1%, 1/4W	1	RN60D1002F	81349
R8	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	1	RCR07G101JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 1.0 kΩ, 5%, 1/4W	2	RCR07G102JS	81349
R10	Same as R9			

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R11	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	2	RCR07G470JS	81349
R12	Same as R11			
R13	Same as R1			
T1	TRANSFORMER	1	14006	14632

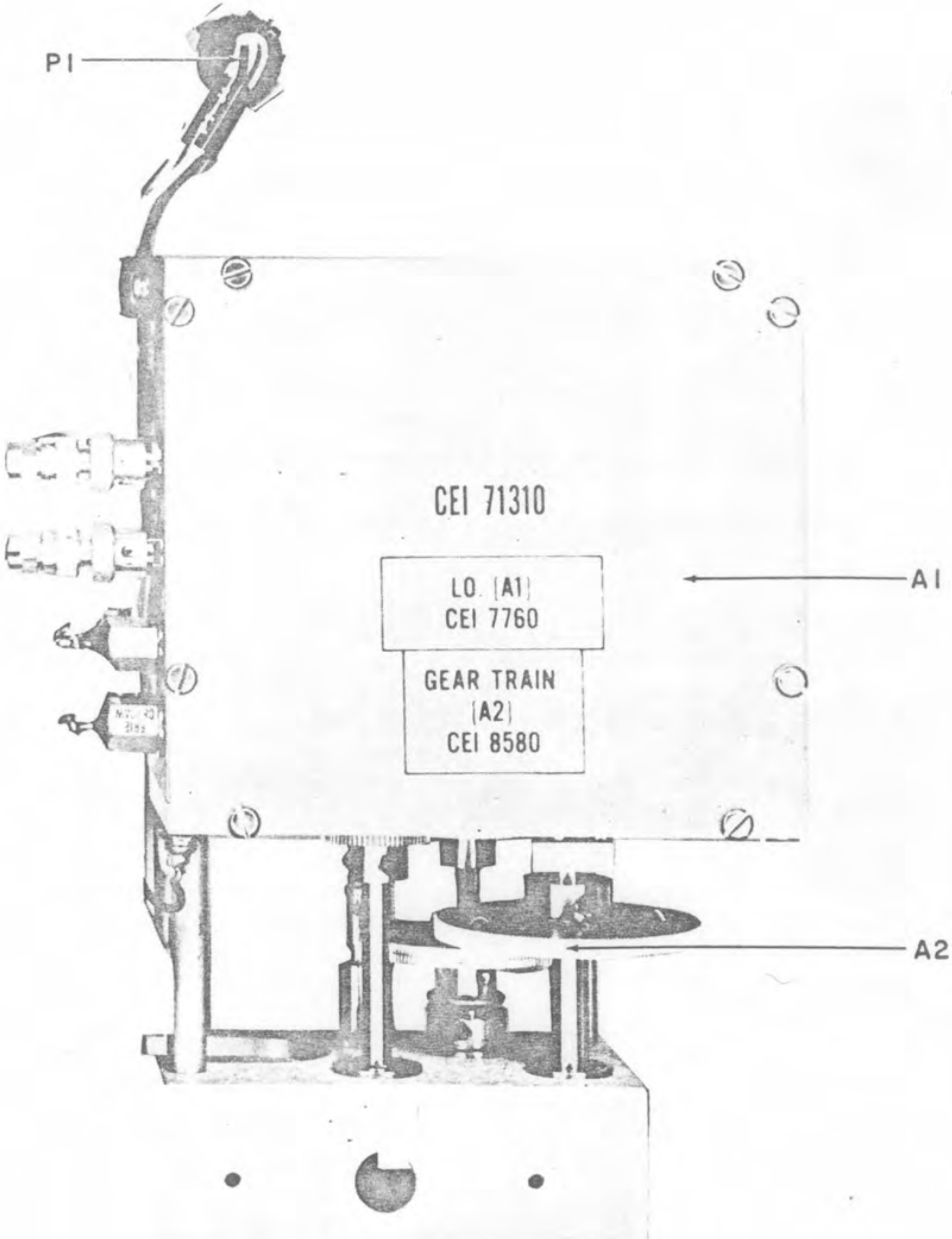


Figure 5-10. Type 71310 Tuning Assembly (A7), Component Locations

5.4.7 Type 71310 Tuning Assembly

REF DESIG PREFIX A7

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	LOCAL OSCILLATOR	1	7760	14632
A2	TUNING DRIVE ASSEMBLY (See Exploded View)	1	8580	14632
MP1	COVER	1	12180-2	14632
P1	CONNECTOR, PLUG, MULTIPIN	1	M4P-LSH10C	81312

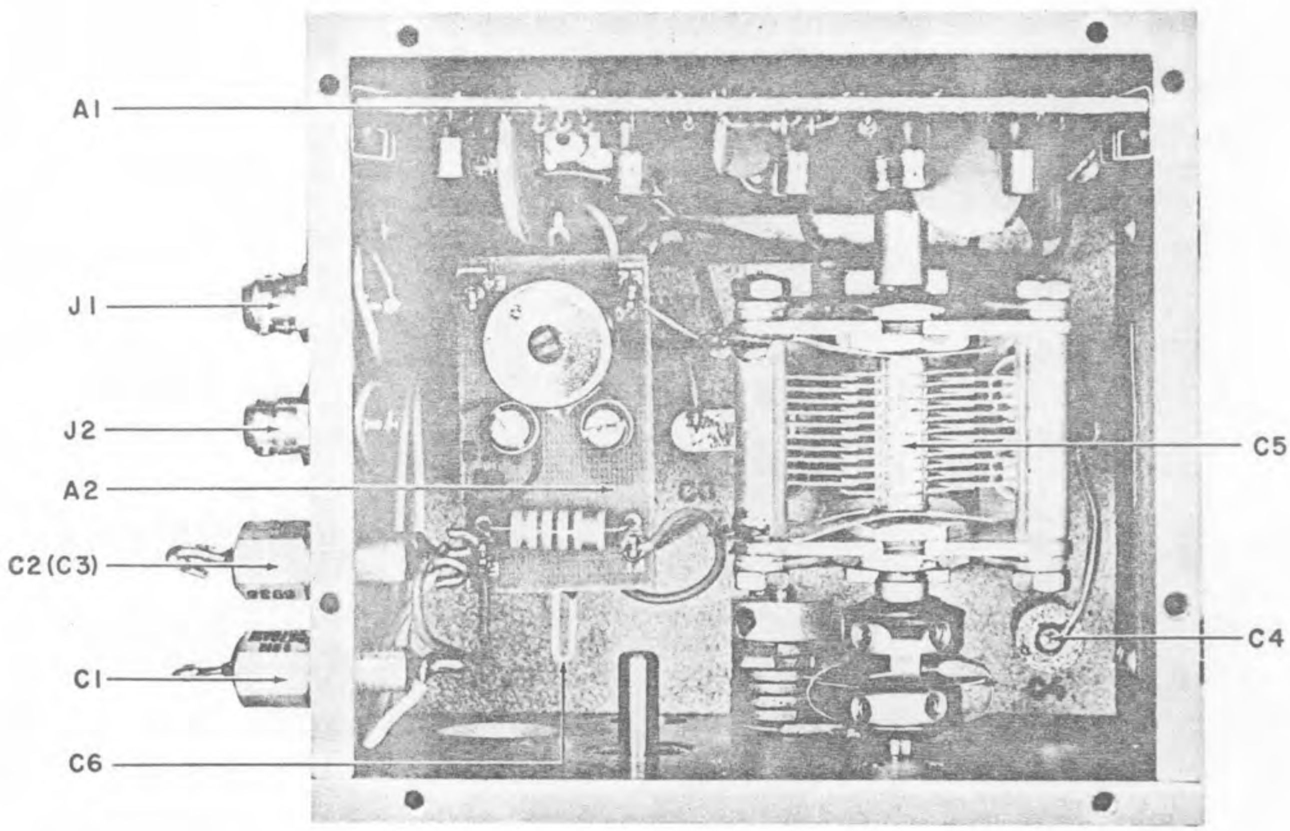


Figure 5-11. Type 7760 Local Oscillator (A7A1), Component Locations

5.4.7.1 Type 7760 Local Oscillator

REF DESIG PREFIX A7A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	LOCAL OSCILLATOR BOARD	1	79511	14632
A2	INDUCTOR BOARD	1	16071	14632
C1	CAPACITOR, CERAMIC, FEED-THRU: 1000 pF, 20%, 500V	3	CK70AW102M	81349
C2	Same as C1			
C3	Same as C1			
C4	CAPACITOR, VARIABLE, GLASS: 1-28 pF	1	MC-603	73899
C5	CAPACITOR, VARIABLE, AIR: 6.50-62.36 pF, (single section)	1	C-28-341, 20/.012	23783
C6	CAPACITOR, VARIABLE, AIR: 6.5 pF, (Temp. Comp)	1	TC	23783
J1	CONNECTOR, RECEPTACLE, MB SERIES	2	46025	74868
J2	Same as J1			
MP1	COUPLING	1	14286-1	14632
MP2	COVER	1	12180-2	14632

5.4.7.1.1 Type 79511 Local Oscillator Board

REF DESIG PREFIX A7A1A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 0.05 μF, 20%, 100V	4	29C212A7	56289
C2	CAPACITOR, MYLAR, TUBULAR: 0.01 μF, 10%, 100V	1	663UW-103-9-1-W	84411
C3	CAPACITOR, MICA, DIPPED: 91 pF, 5%, 500V	2	CM05FD910J03	81349
C4	Same as C3			
C5	CAPACITOR, CERAMIC, TUBULAR: 8.2 pF, ±.5 pF, 500V	1	301-000-C0H0-829D	72982
C6	CAPACITOR, CERAMIC, TUBULAR: 3 pF, ±.25 pF, 500V	1	301-000-C0J0-309C	72982
C7	CAPACITOR, CERAMIC, TUBULAR: 2.0 pF, ±.25 pF, 500V	1	301-000-C0K0-209C	72982
C8	CAPACITOR, MICA, DIPPED: 100 pF, 5%, 500V	1	CM05FD101J03	81349
C9	CAPACITOR, CERAMIC, DISC: 0.005 μF, 20%, 100V	4	C023B101E502M	56289
C10	Same as C9			
C11	Same as C1			
C12	Same as C9			
C13	Same as C9			
C14	Same as C1			
C15	CAPACITOR, CERAMIC, TUBULAR: 4.7 pF, ±.25 pF, 500V	1	301-000-C0H0-479C	72982
C16	Same as C1			
CR1	DIODE	4	1N462A	80131
CR2	DIODE	2	V27E	01281
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR2			
CR6	Same as CR1			

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
Q1	TRANSISTOR	1	2N3478	80131
Q2	TRANSISTOR	4	2N929	80131
Q3	TRANSISTOR	2	2N2222	80131
Q4	Same as Q2			
Q5	TRANSISTOR	2	2N3251	80131
Q6	Same as Q2			
Q7	Same as Q3			
Q8	Same as Q2			
Q9	Same as Q5			
R1	RESISTOR, FIXED, COMPOSITION: 82 kΩ, 5%, 1/4W	1	RCR07G823JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 47 kΩ, 5%, 1/4W	1	RCR07G473JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 100 Ω, 5%, 1/4W	3	RCR07G101JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	3	RCR07G102JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	3	RCR07G103JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	3	RCR07G472JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	4	RCR07G152JS	81349
R8	Same as R4			
R9	Same as R7			
R10	Same as R5			
R11	RESISTOR, FIXED, COMPOSITION: 24 Ω, 5%, 1/4W	4	RCR07G240JS	81349
R12	Same as R6			
R13	Same as R7			

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R14	Same as R4			
R15	Same as R11			
R16	Same as R11			
R17	RESISTOR, FIXED, COMPOSITION: 82 Ω, 5%, 1/4W	1	RCR07G820JS	81349
R18	Same as R11			
R19	RESISTOR, FIXED, COMPOSITION: 120 Ω, 5%, 1/4W	1	RCR07G121JS	81349
R20	Same as R3			
R21	RESISTOR, FIXED, COMPOSITION: 5.6 Ω, 5%, 1/4W	1	RCR07G5R6JS	81349
R22	Same as R7			
R23	Same as R5			
R24	RESISTOR, FIXED, COMPOSITION: 470 kΩ, 5%, 1/4W	2	RCR07G474JS	81349
R25	Same as R6			
R26	NOT USED			
R27	Same as R24			
R28	Same as R3			

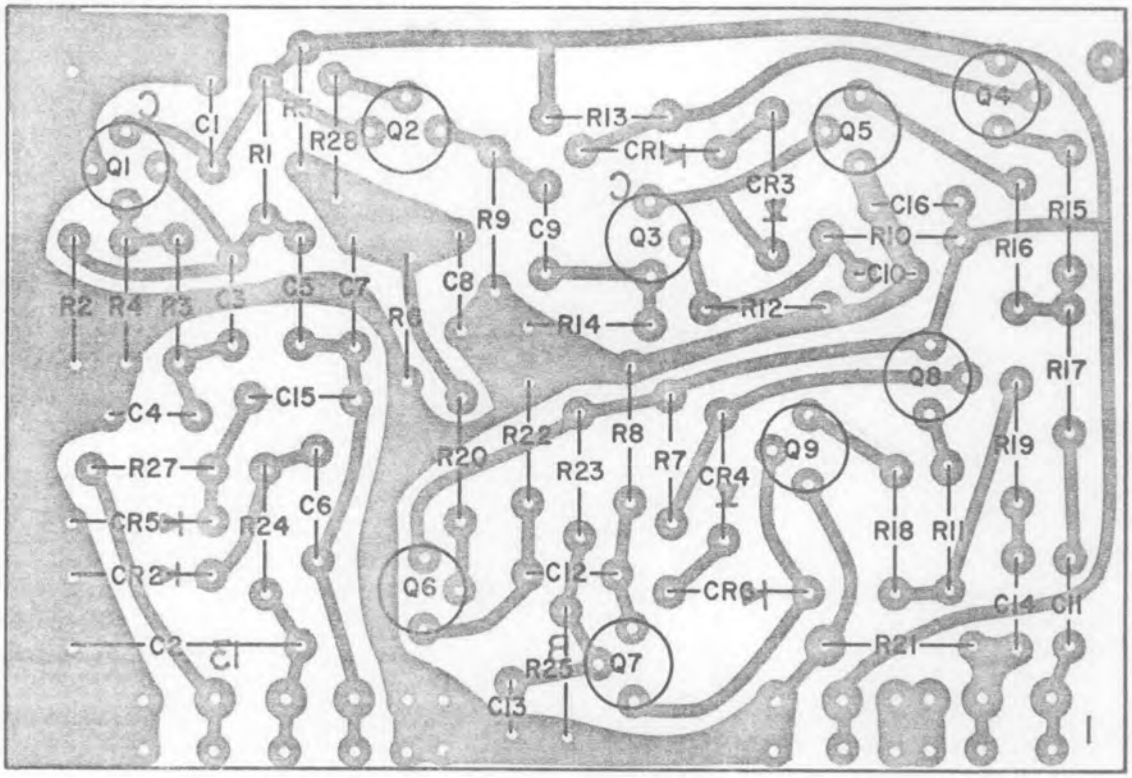


Figure 5-12. Type 79511 Local Oscillator Board (A7A1A1), Component Locations

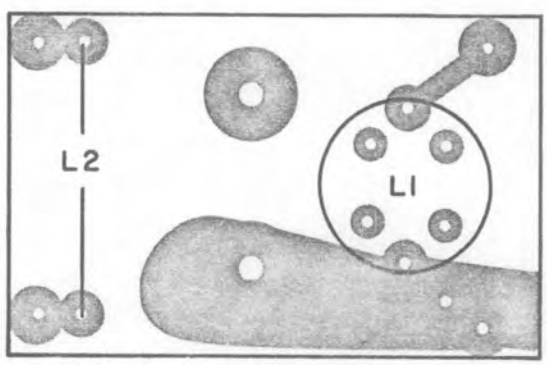


Figure 5-13. Part 16071 Inductor Board (A7A1A2), Component Locations

5.4.7.1.2 Part 16071 Inductor Board

REF DESIG PREFIX A7A1A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
L1	COIL, VARIABLE	1	30312-94	14632
L2	COIL, FIXED: 1000 μH	1	2500-28	99800

MFR. CODE
14632
14632
14632
79136
79136
88044
.88044
96906
96906
96906
96906
96906
96906
96906

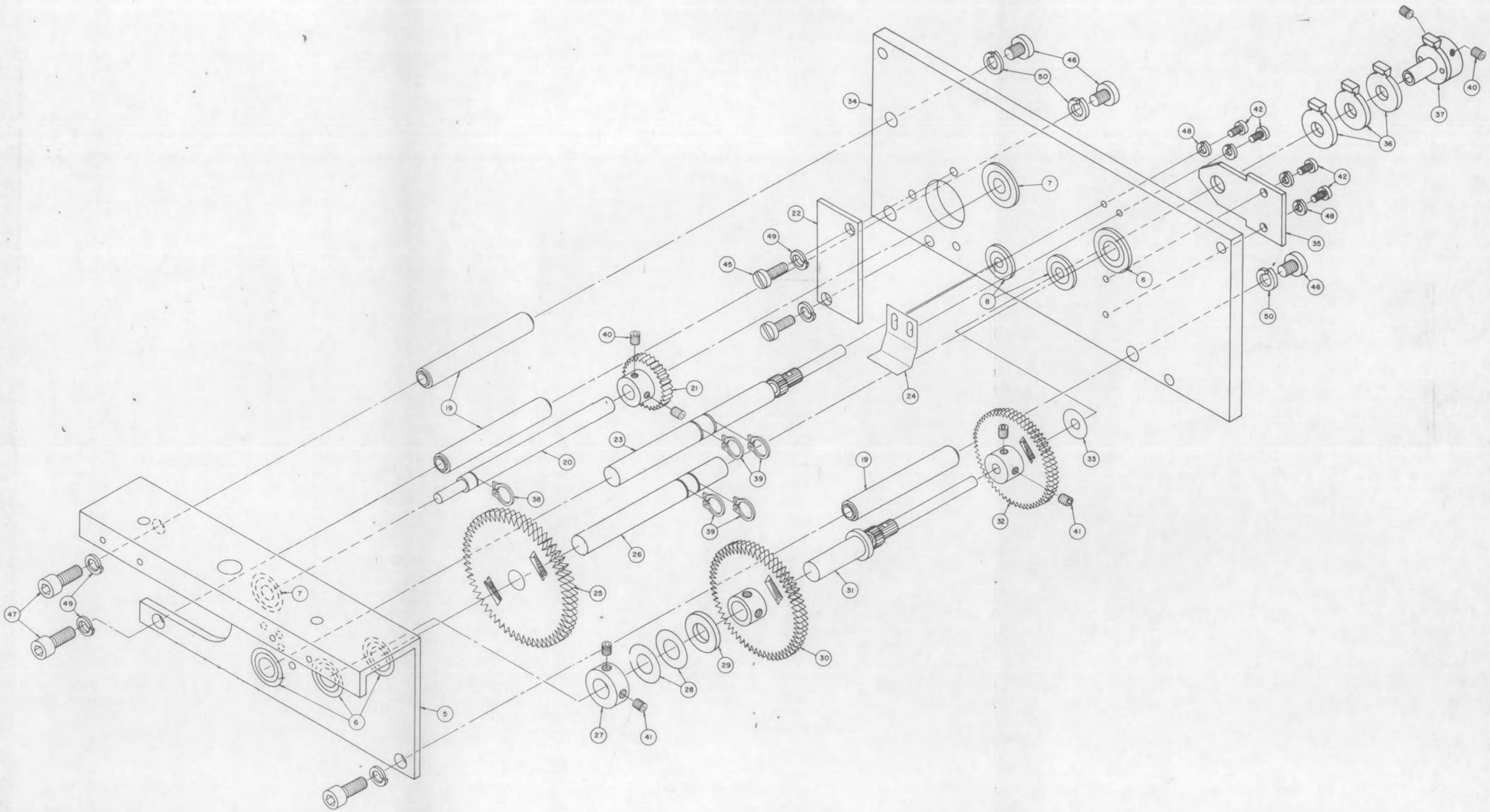
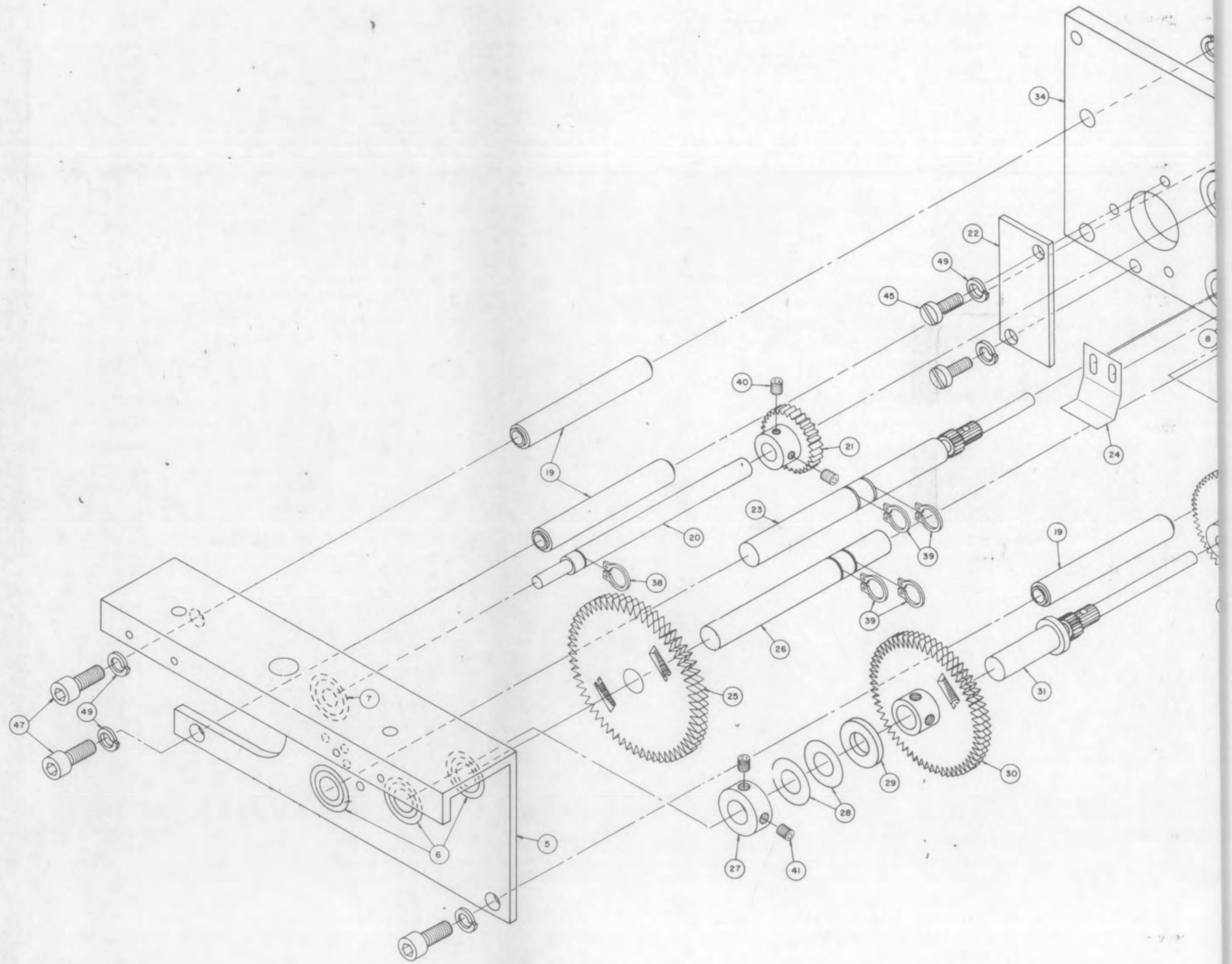


Figure 5-14. Type 8580 Tuning Drive (A7A2), Exploded View

REF DESIG PREFIX A7A2

DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
' PLATE	1	14255-1	14632
' WASHER	5	13863-1	14632
' RETAINER ASSEMBLY	1	13865-1	14632
AINING RING	1	5100-18	79136
AINING RING	4	5100-25	79136
x 1/8 LONG SETSCREW	AR	AN565DC2-2	88044
x 1/8 LONG SETSCREW	AR	AN565DC4-2	88044
x 1/4 LONG PAN HEAD MACHINE SCREW	AR	MS35233-3	96906
USED			
USED			
x 5/16 LONG PAN HEAD MACHINE SCREW	AR	MS35233-14	96906
x 1/4 LONG PAN HEAD MACHINE SCREW	AR	MS35233-26	96906
x 3/8 LONG SOCKET HEAD CAP SCREW	AR	MS24674-2	96906
LIT LOCK WASHER	AR	MS35338-134	96906
LIT LOCK WASHER	AR	MS35338-135	96906
LIT LOCK WASHER	AR	MS35338-136	96906



5.4.7.2 Type 8580 Tuning Drive

REF DESIG PREFIX A7A2

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
1	NOT USED			
2	NOT USED			
3	NOT USED			
4	NOT USED			
5	FRONT PLATE ASSEMBLY	1	21456-2	14632
6	BEARING	4	SFR-1883MM	83086
7	BEARING	2	SFR-33MM	83086
8	BEARING	2	SFR2-63MM	83086
9	NOT USED			
10	NOT USED			
11	NOT USED			
12	NOT USED			
13	NOT USED			
14	NOT USED			
15	NOT USED			
16	NOT USED			
17	NOT USED			
18	NOT USED			
19	SPACER	3	20757-15	14632
20	SHAFT	1	12974-3	14632
21	GEAR, SPUR	1	20191-8	14632
22	PLATE, HELIPOT COVER	1	14323-1	14632
23	SHAFT, TUNING ASSEMBLY	1	21414-2	14632
24	GROUNDING CLIP	1	14308-1	14632
25	GEAR, ANTI-BACKLASH	1	20466-16	14632
26	SHAFT	1	1002-87	14632
27	SPACER	1	1451-1	14632
28	SPRING, FRICTION WASHER	AR	7754	04941
29	BEARING THRUST	1	TT-504	70417
30	GEAR, ANTI-BACKLASH	1	20466-15	14632
31	SHAFT ASSEMBLY	1	14190-1	14632
32	GEAR, ANTI-BACKLASH	1	20184-5	14632
33	SPACER, SHIM	AR	SSS-33	01351
34	REAR PLATE	1	21412-1	14632

REF DESIG	DESCRIPTION
35	STOP PLATE
36	STOP WASHER
37	STOP RETAINER ASSEMBLY
38	RETAINING RING
39	RETAINING RING
40	2-56 x 1/8 LONG SETSCREW
41	4-40 x 1/8 LONG SETSCREW
42	2-56 x 1/4 LONG PAN HEAD MACHINE SCREW
43	NOT USED
44	NOT USED
45	4-40 x 5/16 LONG PAN HEAD MACHINE SCREW
46	6-32 x 1/4 LONG PAN HEAD MACHINE SCREW
47	6-32 x 3/8 LONG SOCKET HEAD CAP SCREW
48	#2 SPLIT LOCK WASHER
49	#4 SPLIT LOCK WASHER
50	#6 SPLIT LOCK WASHER

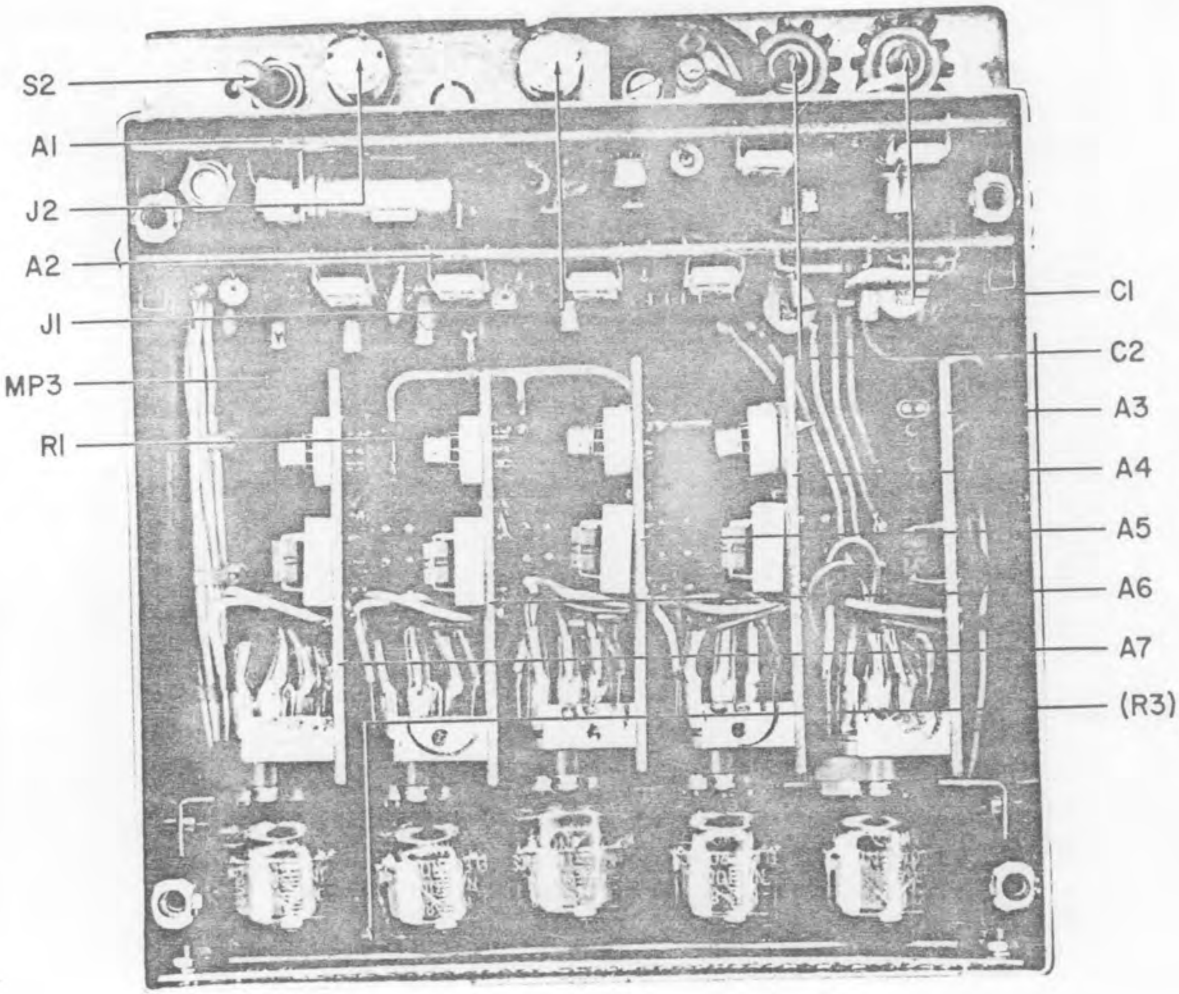


Figure 5-15. Type 79386 Counter Assembly (A8), Component Locations

5.4.8 Type 79386 Counter Assembly

REF DESIG PREFIX A8

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
A1	GATE GENERATOR	1	79409	14632
A2	HIGH SPEED COUNTER	1	79410	14632
A3	DECODE & DISPLAY	1	79352	14632
A4	COUNT, DECODE & DISPLAY	4	79353	14632
A5	Same as A4			
A6	Same as A4			
A7	Same as A4			
C1	CAPACITOR, PAPER, THRUPASS: 0.01 μF, 20%, 600V	2	102P515	56289
C2	Same as C1			
J1	CONNECTOR, RECEPTACLE, MB SERIES	2	46025	74868
J2	Same as J1			
MP1	COVER, TOP	1	21628-1	14632
MP2	COVER, BOTTOM	1	21629-1	14632
MP3	MOTHER BOARD	1	21654	14632
P1	CONNECTOR, PLUG, MULTIPIN	1	M4P-LSH10C	81312
R1	RESISTOR, FIXED, COMPOSITION: 2 kΩ, 5%, 1/4W	1	RCR07G202JS	81349
R2	NOT USED			
R3	RESISTOR, FIXED, COMPOSITION: 10 MΩ, 5%, 1/4W	1	RCR07G106JS	81349
S1	SWITCH, ROTARY: 2 Section, 4 Pole, 2-6 Position	1	1128-03	14632
S2	SWITCH, TOGGLE: SPDT	1	MST-115D	95146
S3	SWITCH, ROTARY: 2 Section, 2 Pole	1	263283-BA2	76854

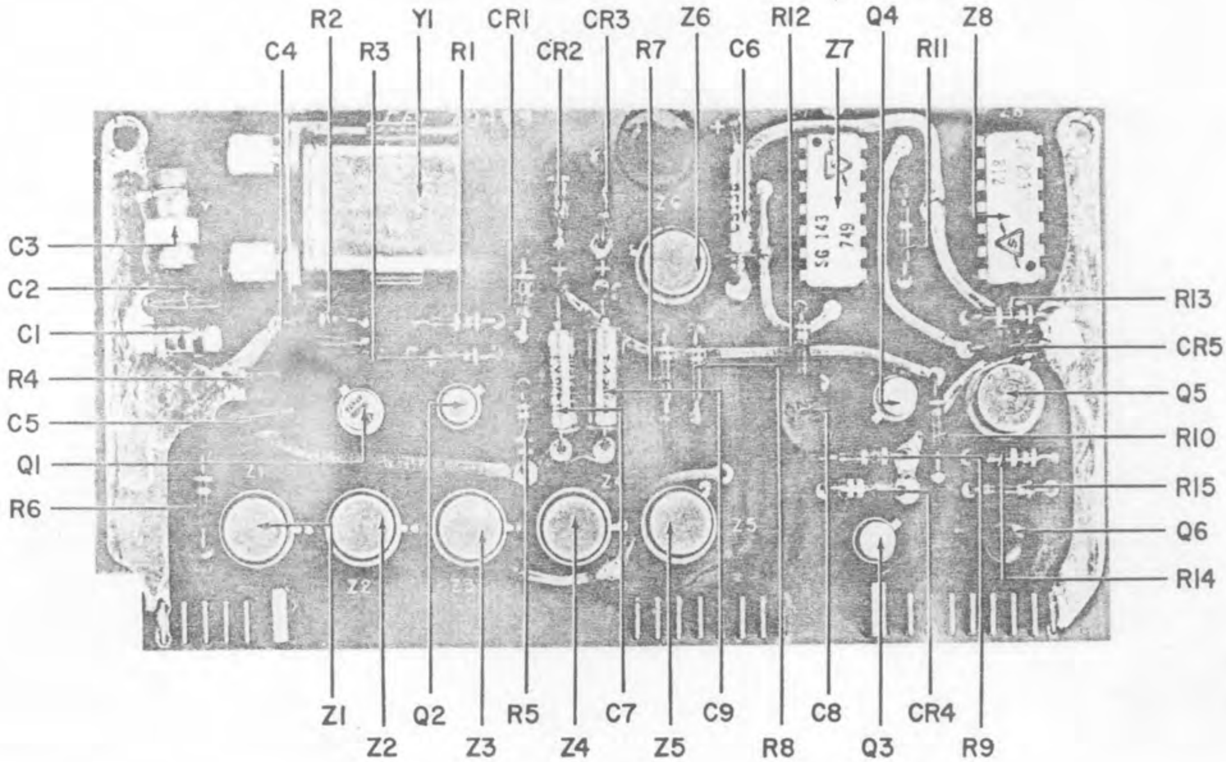


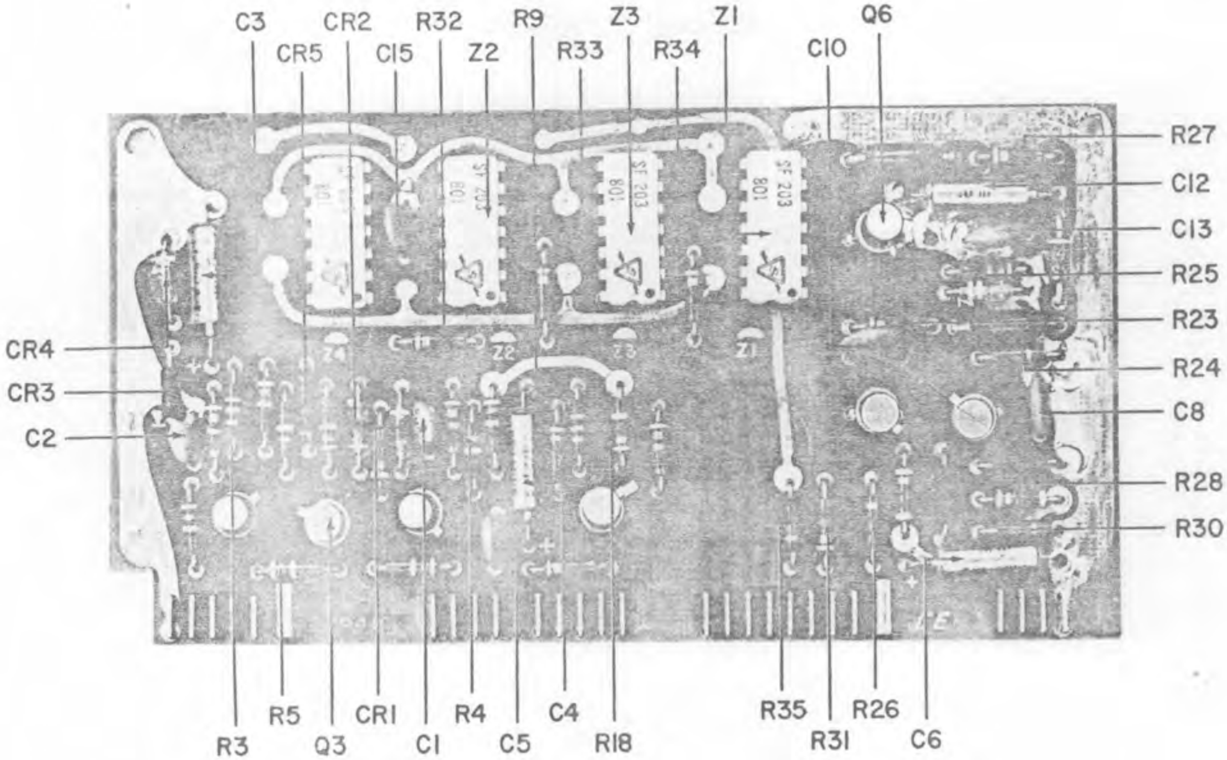
Figure 5-16. Type 79409 Gate Generator (A8A1), Component Locations

5.4.8.1 Type 79409 Gate Generator

REF DESIG PREFIX A8A1

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, TUBULAR: 10.0 pF, ±.5 pF, 500V	1	TCL-10	71590
C2	CAPACITOR, MICA, DIPPED: 18 pF, 5%, 500V	1	CM05C180J03	81349
C3	CAPACITOR, VARIABLE, AIR: .8-10 pF, 250V	1	2951	91293
C4	CAPACITOR, MICA, DIPPED: 750 pF, 5%, 500V	2	DM15-751J	72136
C5	Same as C4			
C6	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 10%, 6V	3	150D476X9006B2	56289
C7	Same as C6			
C8	CAPACITOR, CERAMIC, DISC: 0.1 pF, +80-20%, 10V	1	UK10-104	71590
C9	Same as C6			
CR1	DIODE	3	1N4003	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	DIODE	1	1N995	80131
CR5	DIODE	1	1N752A	80131
Q1	TRANSISTOR	1	2N929	80131
Q2	TRANSISTOR	1	2N3251	80131
Q3	TRANSISTOR	2	2N706	80131
Q4	Same as Q3			
Q5	TRANSISTOR	1	2N3440	80131
Q6	TRANSISTOR	1	2N4888	80131
R1	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	2	RCR07G104JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 150 kΩ, 5%, 1/4W	1	RCR07G154JS	81349

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R3	RESISTOR, FIXED, COMPOSITION: 300 Ω, 5%, 1/4W	1	RCR07G301JS	81349
R4	RESISTOR, FIXED, COMPOSITION: 3 kΩ, 5%, 1/4W	1	RCR07G302JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 2 kΩ, 5%, 1/4W	1	RCR07G202JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 1.5 kΩ, 5%, 1/4W	2	RCR07G152JS	81349
R8	Same as R7			
R9	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 270 Ω, 5%, 1/4W	1	RCR07G271JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 200 Ω, 5%, 1/4W	1	RCR07G201JS	81349
R12	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	2	RCR07G102JS	81349
R13	RESISTOR, FIXED, COMPOSITION: 2.4 kΩ, 5%, 1/4W	1	RCR07G242JS	81349
R14	Same as R1			
R15	Same as R12			
Y1	CRYSTAL, QUARTZ: 1.000 MHz	1	91804-01	14632
Z1	INTEGRATED CIRCUIT	5	U5B995879X	07263
Z2	Same as Z1			
Z3	Same as Z1			
Z4	Same as Z1			
Z5	Same as Z1			
Z6	INTEGRATED CIRCUIT	1	U5F992729X	07263
Z7	INTEGRATED CIRCUIT	1	SG-143-03	93332
Z8	INTEGRATED CIRCUIT	1	RF3202D	49956



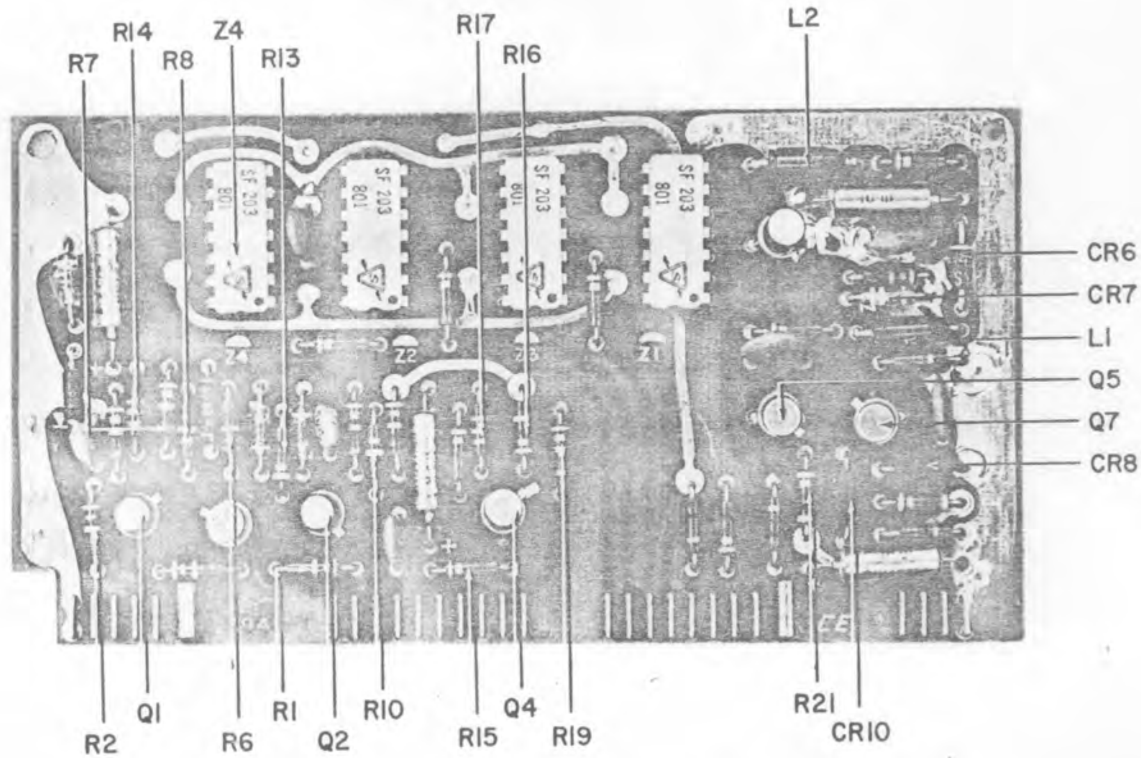


Figure 5-17. Type 79410 High Speed Counter (A8A2), Component Locations

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, CERAMIC, DISC: 0.001 μF, GMV, 500V	2	SM(.001μF, GMV)	91418
C2	Same as C1			
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 4.7 μF, 10%, 35V	2	150D475X9035B2	56289
C4	Same as C3			
C5	CAPACITOR, CERAMIC, DISC: 0.005 μF, 20%, 100V	2	C023B101E502M	56289
C6	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 10%, 20V	2	150D106X9020B2	56289
C7	NOT USED			
C8	CAPACITOR, CERAMIC, DISC: 0.01 μF, 20%, 100V	3	C023B101F103M	56289
C9	NOT USED			
C10	Same as C8			
C11	NOT USED			
C12	Same as C6			
C13	Same as C8			
C14	NOT USED			
C15	Same as C5			
CR1	DIODE	3	1N462A	80131
CR2	Same as CR1			
CR3	DIODE	1	1N756A	80131
CR4	Same as CR1			
CR5	DIODE	1	1N972A	80131
CR6	DIODE	1	1N4003	80131
CR7	DIODE	1	1N995	80131

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
CR8	DIODE	2	1N746A	80131
CR9	NOT USED			
CR10	Same as CR8			
L1	COIL, FIXED: 1.0 μH	2	205-11	99848
L2	Same as L1			
Q1	TRANSISTOR	2	2N3251	80131
Q2	Same as Q1			
Q3	TRANSISTOR	1	2N929	80131
Q4	TRANSISTOR	1	3N128	80131
Q5	TRANSISTOR	3	2N709A	80131
Q6	Same as Q5			
Q7	Same as Q5			
R1	RESISTOR, FIXED, COMPOSITION: 510 kΩ, 5%, 1/4W	2	RCR07G514JS	81349
R2	Same as R1			
R3	RESISTOR, FIXED, COMPOSITION: 62 kΩ, 5%, 1/4W	2	RCR07G623JS	81349
R4	Same as R3			
R5	RESISTOR, FIXED, COMPOSITION: 200 kΩ, 5%, 1/4W	1	RCR07G204JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 100 kΩ, 5%, 1/4W	1	RCR07G104JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 20 kΩ, 5%, 1/4W	3	RCR07G203JS	81349
R8	RESISTOR, FIXED, COMPOSITION: 270 kΩ, 5%, 1/4W	2	RCR07G274JS	81349
R9	Same as R7			
R10	Same as R8			

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R11	NOT USED			
R12	NOT USED			
R13	RESISTOR, FIXED, COMPOSITION: 1 MΩ, 5%, 1/4W	1	RCR07G105JS	81349
R14	RESISTOR, FIXED, COMPOSITION: 24 kΩ, 5%, 1/4W	2	RCR07G243JS	81349
R15	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	7	RCR07G102JS	81349
R16	RESISTOR, FIXED, COMPOSITION: 2.4 kΩ, 5%, 1/4W	1	RCR07G242JS	81349
R17	Same as R14			
R18	RESISTOR, FIXED, COMPOSITION: 5.1 kΩ, 5%, 1/4W	1	RCR07G512JS	81349
R19	RESISTOR, FIXED, COMPOSITION: 62 kΩ, 5%, 1W	1	RCR07G623JS	81349
R20	NOT USED			
R21	RESISTOR, FIXED, COMPOSITION: 3 kΩ, 5%, 1/4W	2	RCR07G302JS	81349
R22	NOT USED			
R23	Same as R15			
R24	RESISTOR, FIXED, COMPOSITION: 120 Ω, 5%, 1/4W	1	RCR07G121JS	81349
R25	RESISTOR, FIXED, COMPOSITION: 10 kΩ, 5%, 1/4W	1	RCR07G103JS	81349
R26	Same as R7			
R27	Same as R15			
R28	Same as R21			
R29	NOT USED			
R30	RESISTOR, FIXED, COMPOSITION: 51 Ω, 5%, 1/4W	1	RCR07G510JS	81349
R31	Same as R15			
R32	Same as R15			

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R33	Same as R15			
R34	Same as R15			
R35	RESISTOR, FIXED, COMPOSITION: 200 Ω, 5%, 1/4W	1	RCR07G201JS	81349
Z1	INTEGRATED CIRCUIT	4	RF3202D	49956
Z2	Same as Z1			
Z3	Same as Z1			
Z4	Same as Z1			

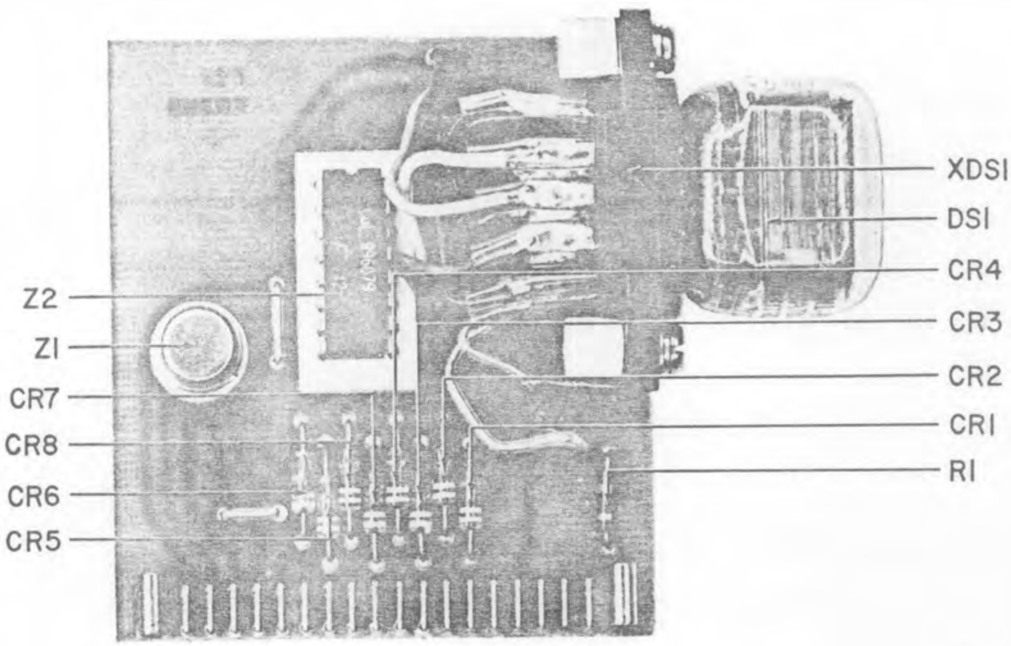


Figure 5-18. Type 79352 Decode and Display (A8A3), Component Locations

5.4.8.3 Type 79352 Decode and Display

REF DESIG PREFIX A8A3

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
CR1	DIODE	10	1N198A	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
CR9	Same as CR1			
CR10	Same as CR1			
DS1	READOUT TUBE	1	NL809	83781
R1	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349
XDS1	SOCKET, READOUT TUBE	1	RTS4	83781
Z1	INTEGRATED CIRCUIT	1	U6B996079X	07663

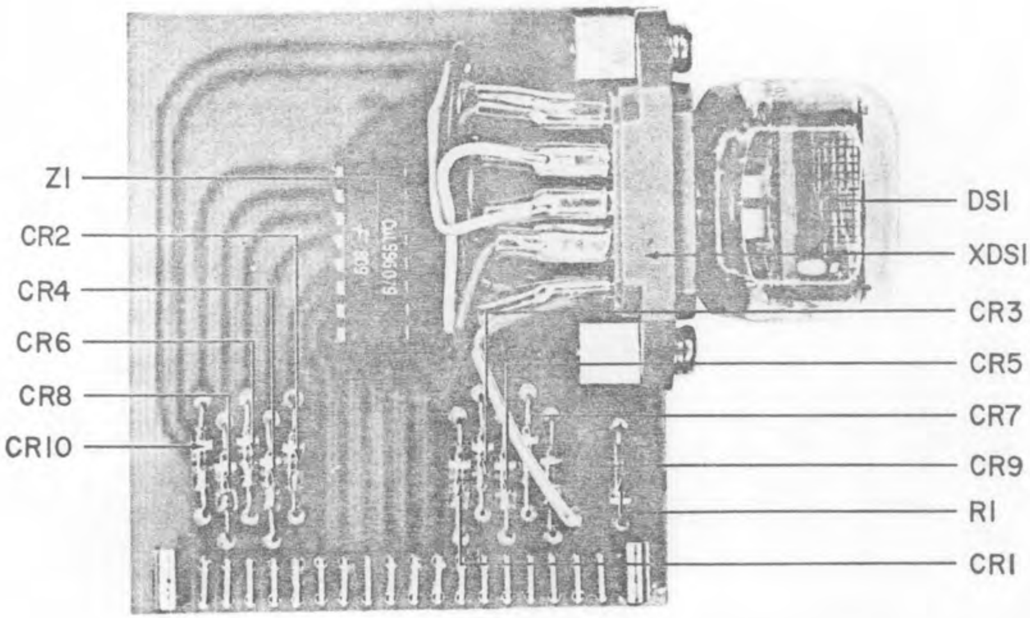


Figure 5-19. Type 79353 Count, Decode and Display (A8A4 thru A8A7), Component Locations

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
CR1	DIODE	8	1N995	80131
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	Same as CR1			
CR7	Same as CR1			
CR8	Same as CR1			
DS1	READOUT TUBE	1	NL809	83781
R1	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349
XDS1	SOCKET, READOUT TUBE	1	RTS4	83781
Z1	INTEGRATED CIRCUIT	1	U5B995879X	07263
Z2	INTEGRATED CIRCUIT	1	U6B996079X	07263

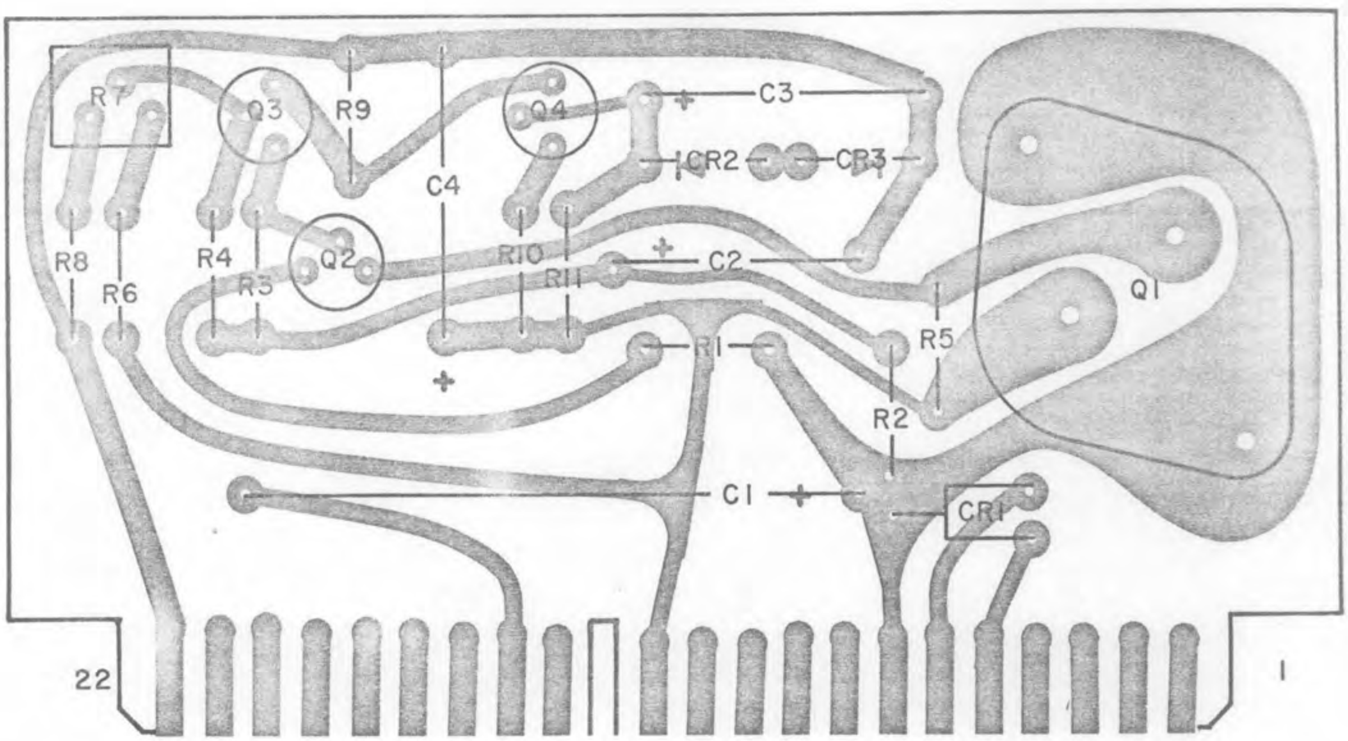


Figure 5-20. Type 76162 + 18V Regulated Power Supply (A9), Component Locations

5.4.9 Type 76162 +18V Regulated Power Supply

REF DESIG PREFIX A9

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 200 μF, -10+75%, 50V	1	39D207G050FJ4	56289
C2	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 50V	1	30D106G050CB2	56289
C3	CAPACITOR, ELECTROLYTIC, ALUMINUM: 10 μF, -10+75%, 25V	1	30D106G025BB2	56289
C4	CAPACITOR, ELECTROLYTIC, ALUMINUM: 15 μF, 10%, 20V	1	CS13BE156K	81349
CR1	DIODE	1	MDA940A-3	04713
CR2	DIODE	1	1N754A	80131
CR3	DIODE	1	1N462A	80131
Q1	TRANSISTOR	1	2N3055	80131
Q2	TRANSISTOR	3	2N4074	80131
Q3	Same as Q2			
Q4	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 47 Ω, 5%, 1/4W	1	RCR07G470JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 6.8 kΩ, 5%, 1/4W	2	RCR07G682JS	81349
R3	Same as R2			
R4	RESISTOR, FIXED, COMPOSITION: 220 kΩ, 5%, 1/4W	1	RCR07G224JS	81349
R5	RESISTOR, FIXED, COMPOSITION: 1 kΩ, 5%, 1/4W	1	RCR07G102JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 5.6 kΩ, 5%, 1/4W	1	RCR07G562JS	81349
R7	RESISTOR, VARIABLE, FILM: 1 kΩ, 30%, 1/2W	1	62PAR1K	73138
R8	RESISTOR, FIXED, COMPOSITION: 3.9 kΩ, 5%, 1/4W	1	RCR07G392JS	81349
R9	RESISTOR, FIXED, COMPOSITION: 1.8 kΩ, 5%, 1/4W	1	RCR07G182JS	81349
R10	RESISTOR, FIXED, COMPOSITION: 220 Ω, 5%, 1/4W	1	RCR07G221JS	81349
R11	RESISTOR, FIXED, COMPOSITION: 4.7 kΩ, 5%, 1/4W	1	RCR07G472JS	81349

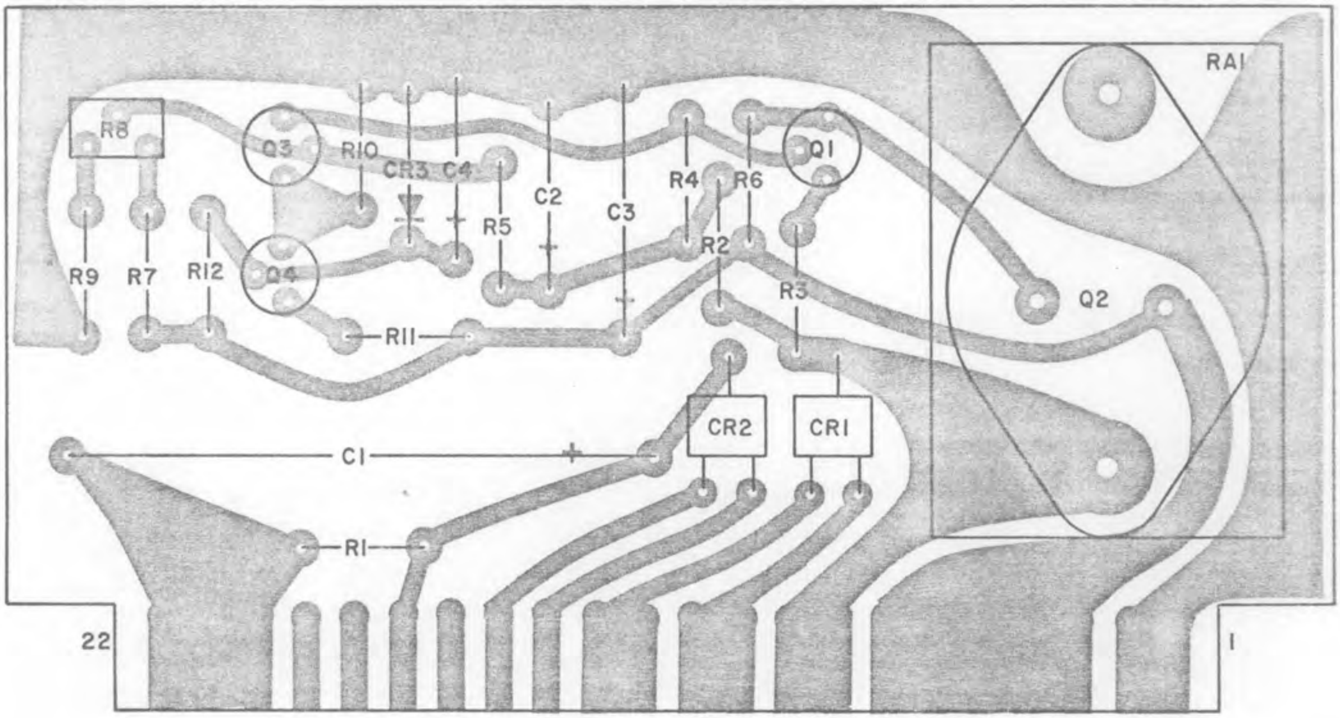


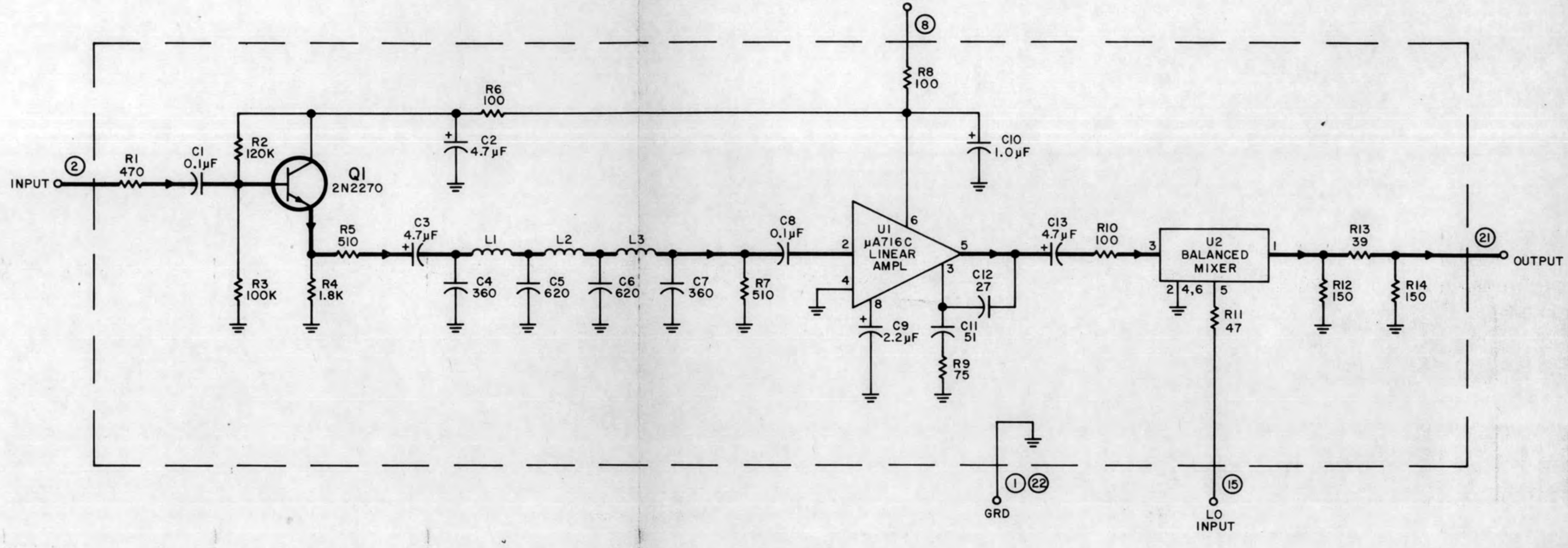
Figure 5-21. Type 76156 + 6V/+200V Regulated Power Supply (A10), Component Locations

5.4.10 Type 76156 +6V/+200V Regulated Power Supply REF DESIG PREFIX A10

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
C1	CAPACITOR, ELECTROLYTIC, ALUMINUM: 15 μF, -10+50%, 250V	1	39D156F250EJ4	56289
C2	CAPACITOR, ELECTROLYTIC, TANTALUM: 22 μF, 10%, 15V	1	CS13BD226K	81349
C3	CAPACITOR, ELECTROLYTIC, TANTALUM: 47 μF, 10%, 20V	1	CS13BE476K	81349
C4	CAPACITOR, ELECTROLYTIC, TANTALUM: 10 μF, 10%, 20V	1	CS13BE106K	81349
CR1	DIODE	1	MDA940A-3	04713
CR2	DIODE	1	MDA940A-7	04713
CR3	DIODE	1	1N749A	80131
Q1	TRANSISTOR	3	2N4074	80131
Q2	TRANSISTOR	1	2N3055	80131
Q3	Same as Q1			
Q4	Same as Q1			
R1	RESISTOR, FIXED, COMPOSITION: 180 kΩ, 5%, 1/4W	1	RCR07G184JS	81349
R2	RESISTOR, FIXED, COMPOSITION: 3.3 kΩ, 5%, 1/4W	2	RCR07G332JS	81349
R3	RESISTOR, FIXED, COMPOSITION: 22 Ω, 5%, 1/4W	1	RCR07G220JS	81349
R4	Same as R2			
R5	RESISTOR, FIXED, COMPOSITION: 75 kΩ, 5%, 1/4W	1	RCR07G753JS	81349
R6	RESISTOR, FIXED, COMPOSITION: 510 Ω, 5%, 1/4W	1	RCR07G511JS	81349
R7	RESISTOR, FIXED, COMPOSITION: 1.1 kΩ, 5%, 1/4W	3	RCR07G112JS	81349
R8	RESISTOR, VARIABLE, FILM: 1 kΩ, 30%, 1/2W	1	62PAR1K	73138
R9	RESISTOR, FIXED, COMPOSITION: 2 kΩ, 5%, 1/4W	1	RCR07G202JS	81349
R10	Same as R7			
R11	RESISTOR, FIXED, COMPOSITION: 110 Ω, 5%, 1/4W	1	RCR07G111JS	81349

REF DESIG	DESCRIPTION	QTY. PER ASSY.	MANUFACTURER'S PART NO.	MFR. CODE
R12	Same as R7			
RA1	RADIATOR, TRANSISTOR	1	6103B	13103

SECTION VI
SCHEMATIC DIAGRAMS

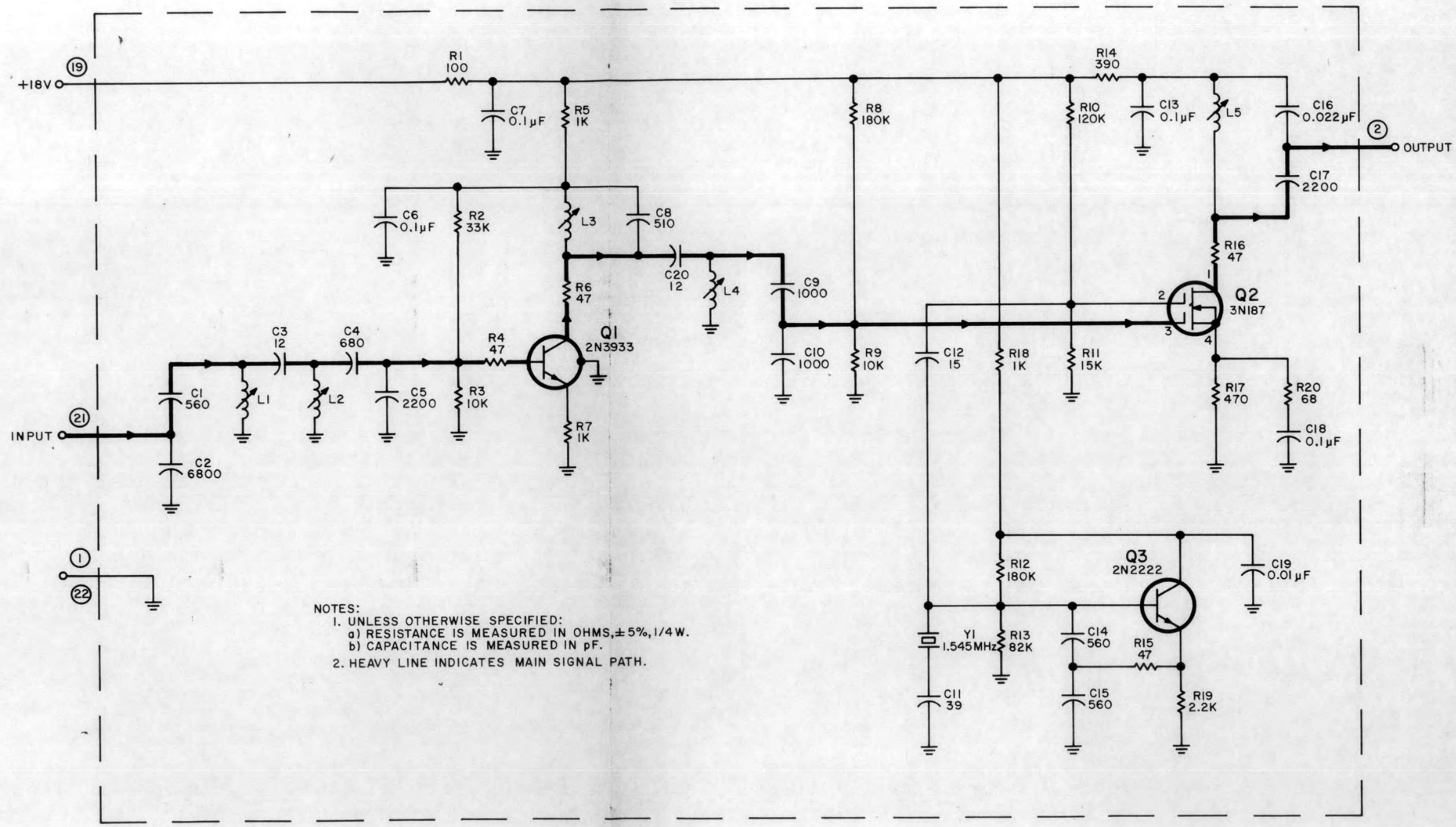


NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. HEAVY LINE INDICATES MAIN SIGNAL PATH.
3. FOR LEAD ARRANGEMENT OF U1 SEE DETAIL A:

DETAIL A

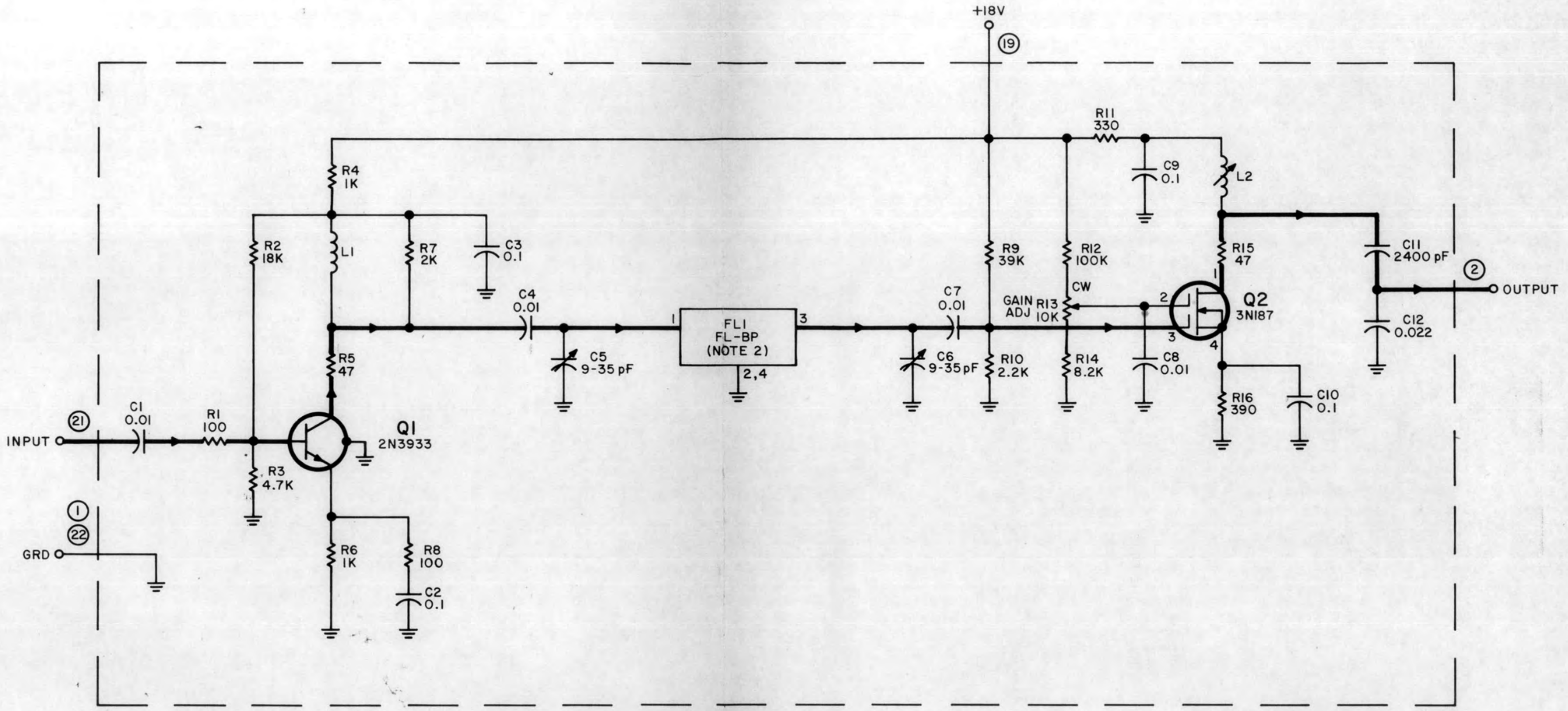
BOTTOM VIEW

Figure 6-1. Type 79749 Input Converter (A1), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN pF.
2. HEAVY LINE INDICATES MAIN SIGNAL PATH.

Figure 6-2. Type 79496 Amplifier/Converter (A2), Schematic Diagram

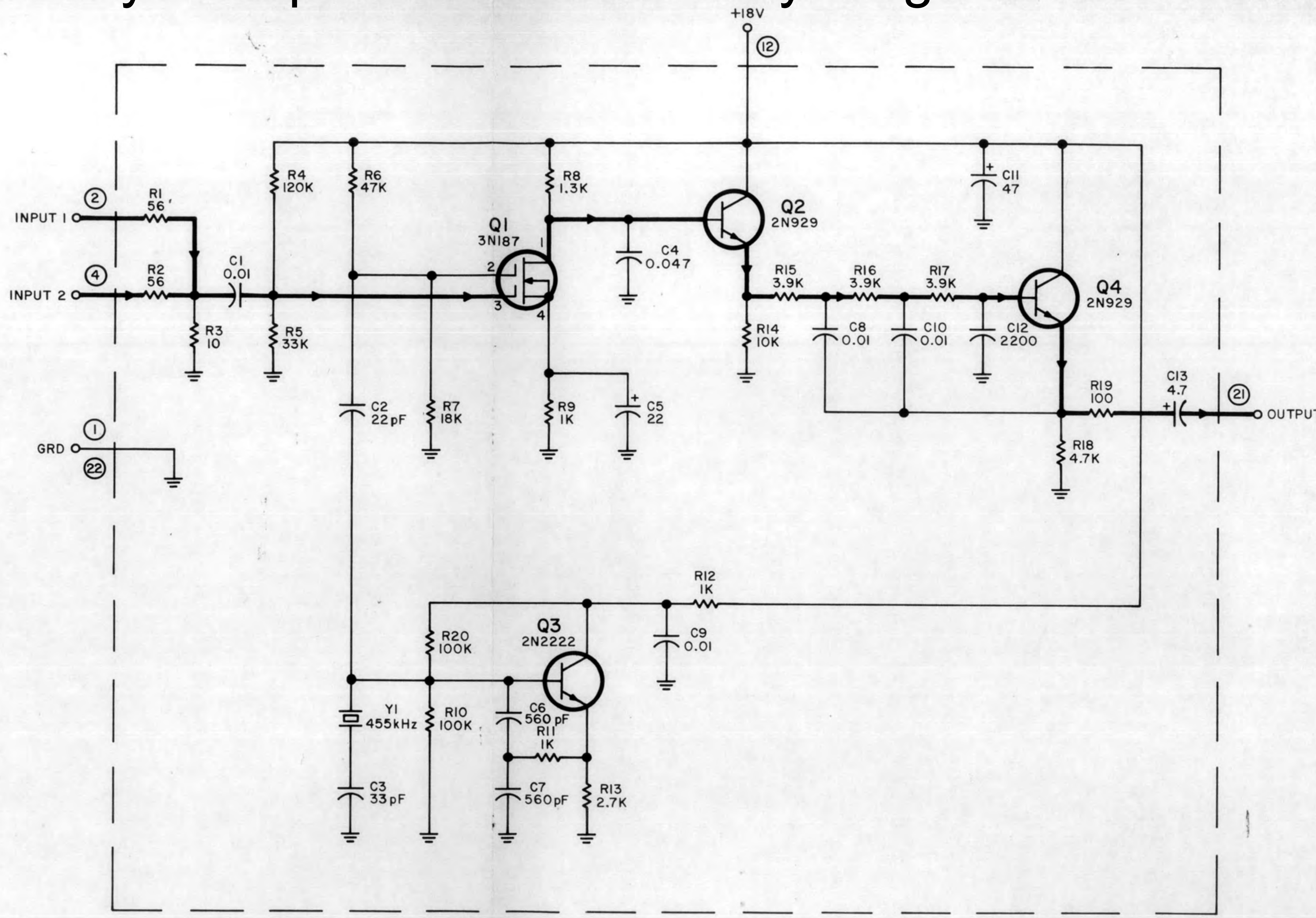


NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2. DIFFERENCES BETWEEN TYPES IS TABULATED IN BLOCK BELOW:

TYPE NO.	FL1 PART NO.	
79748-1	F4552-23C	LSB
79748-2	F4552-24C	USB

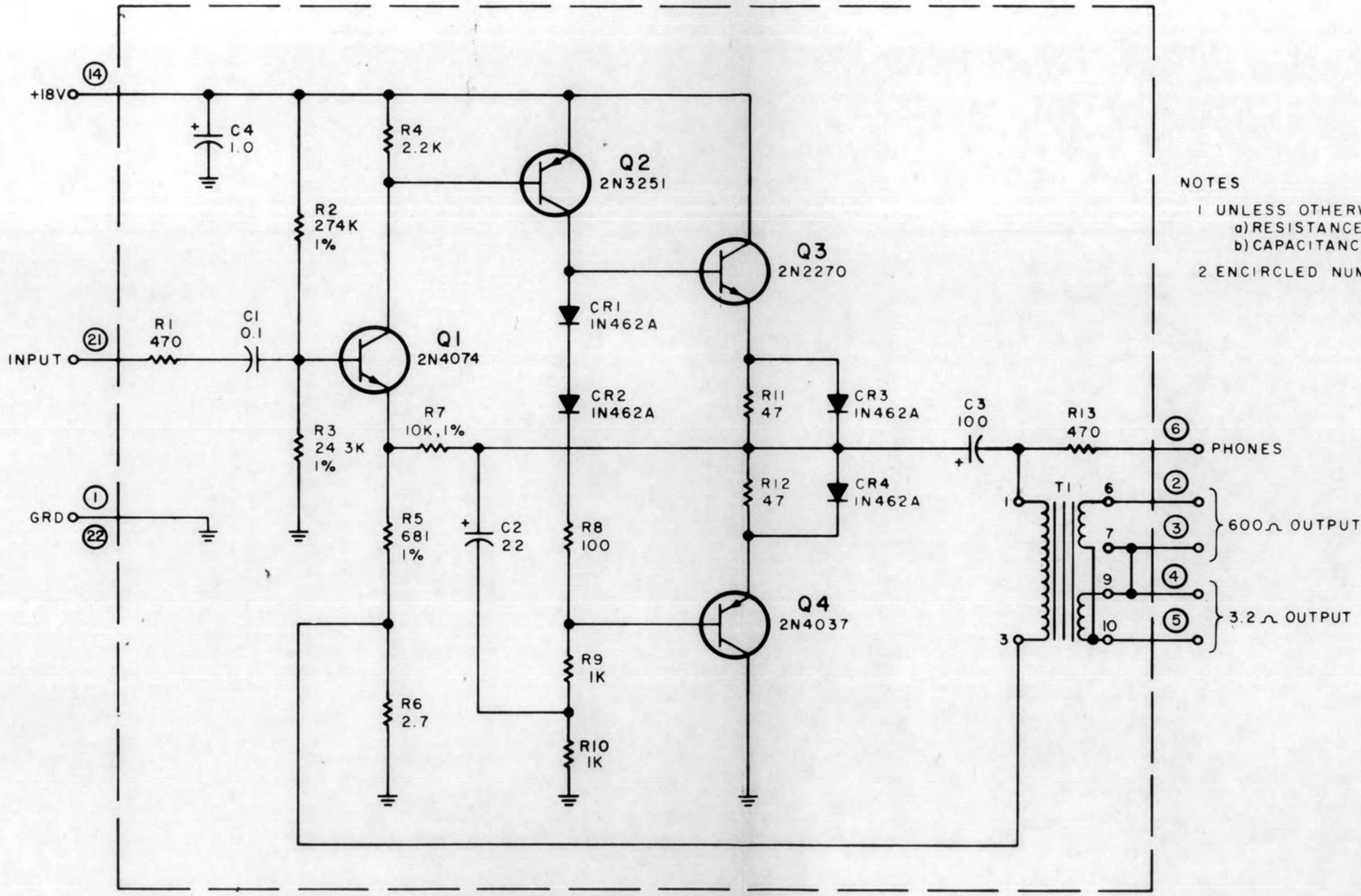
3. HEAVY LINE INDICATES MAIN SIGNAL PATH.
4. CW INDICATES CLOCKWISE ROTATION OF ACTUATOR.

Figure 6-3. Types 79748-1 and 79748-2 LSB-USB Amplifiers (A3, A4), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS MEASURED IN μF.
2. HEAVY LINE INDICATES MAIN SIGNAL PATH.

Figure 6-4. Type 79751 SSB Detector (A5), Schematic Diagram



NOTES

1 UNLESS OTHERWISE SPECIFIED:
a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
b) CAPACITANCE IS MEASURED IN μf.

2 ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

Figure 6-5. Type 7440 Audio Amplifier (A6), Schematic Diagram

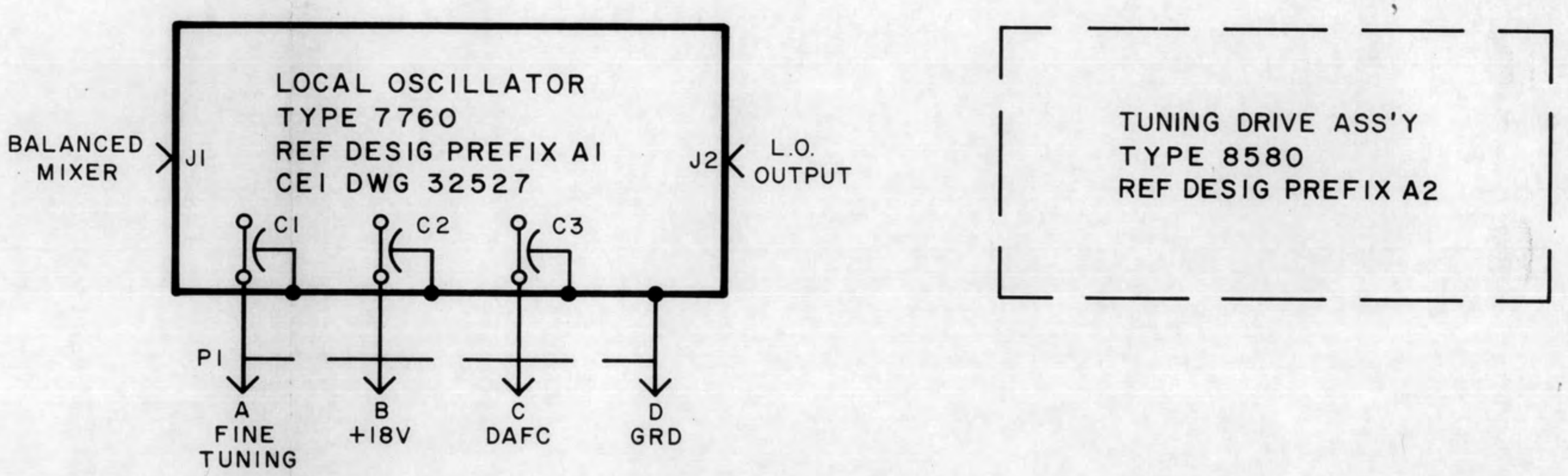
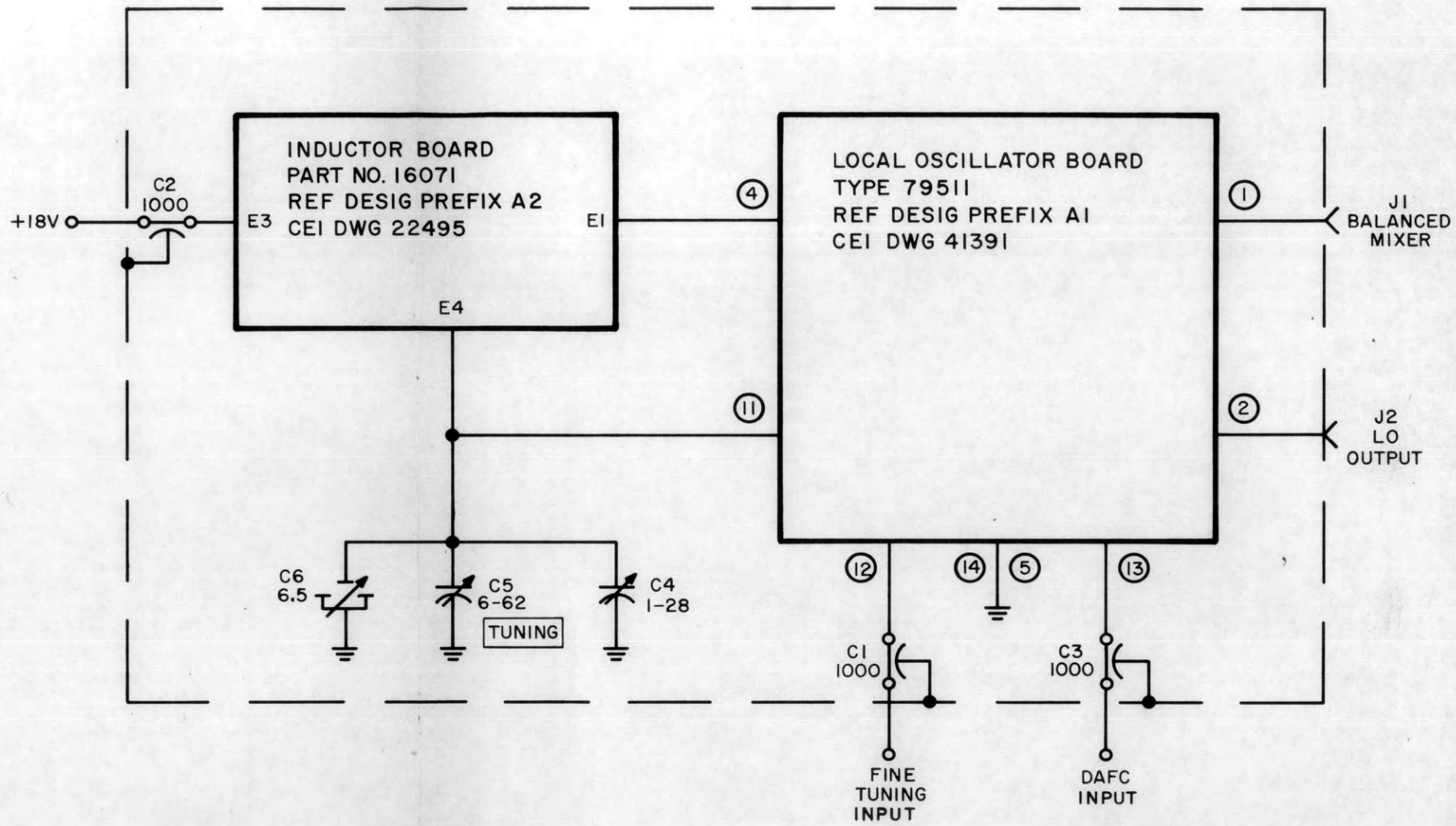


Figure 6-6. Type 71310 Tuning Assembly (A7), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) CAPACITANCE IS MEASURED IN pF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. [ ] INDICATES FRONT PANEL CONTROL.

Figure 6-7. Type 7760 Local Oscillator (A7A1), Schematic Diagram

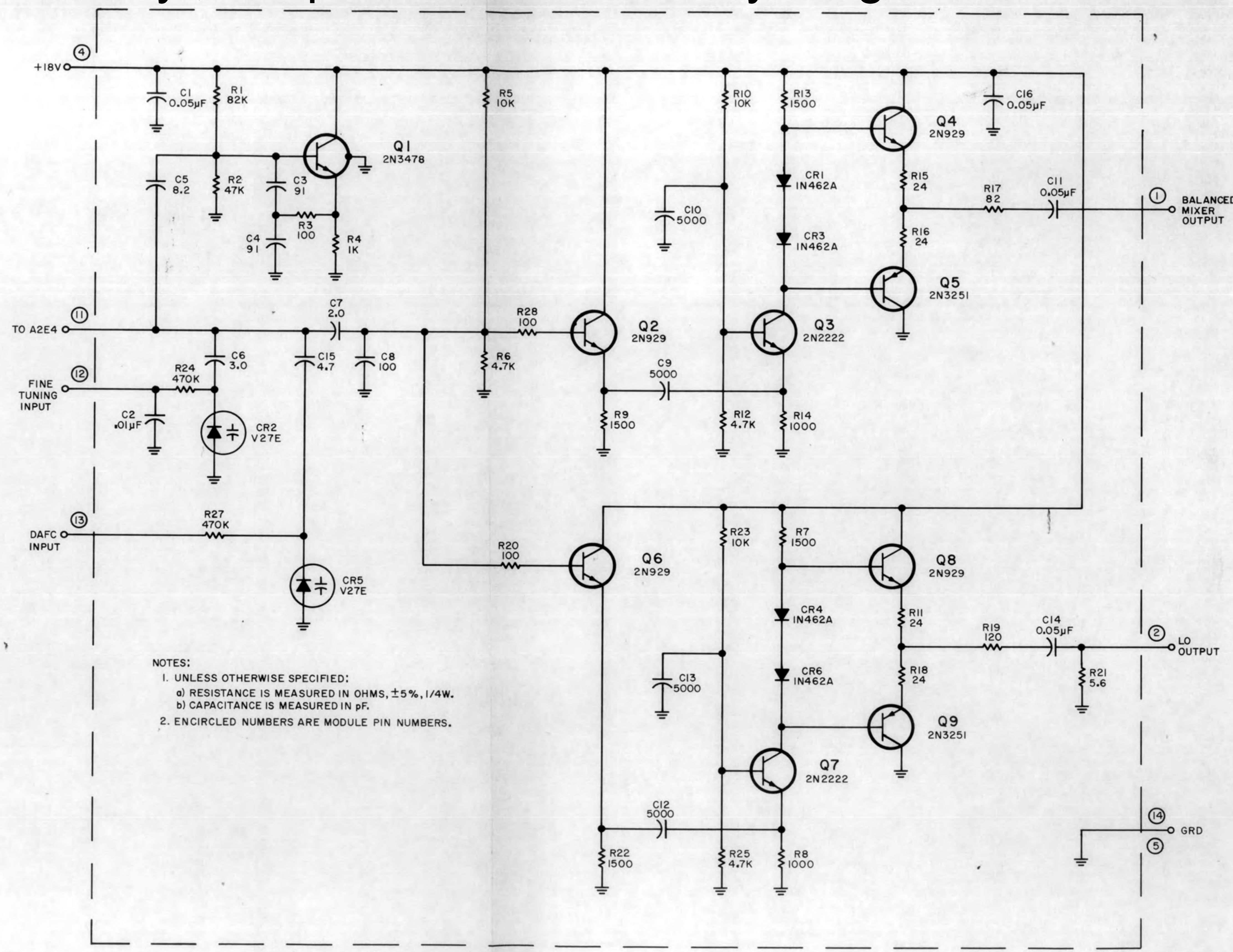


Figure 6-8. Type 79511 Local Oscillator Board (A7A1A1), Schematic Diagram

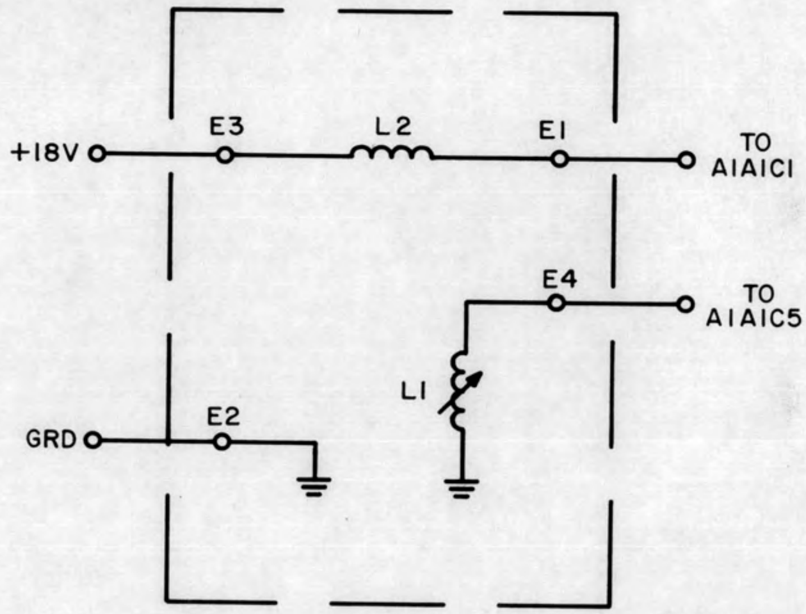


Figure 6-9. Part 16071 Inductor Board (A7A1A2), Schematic Diagram

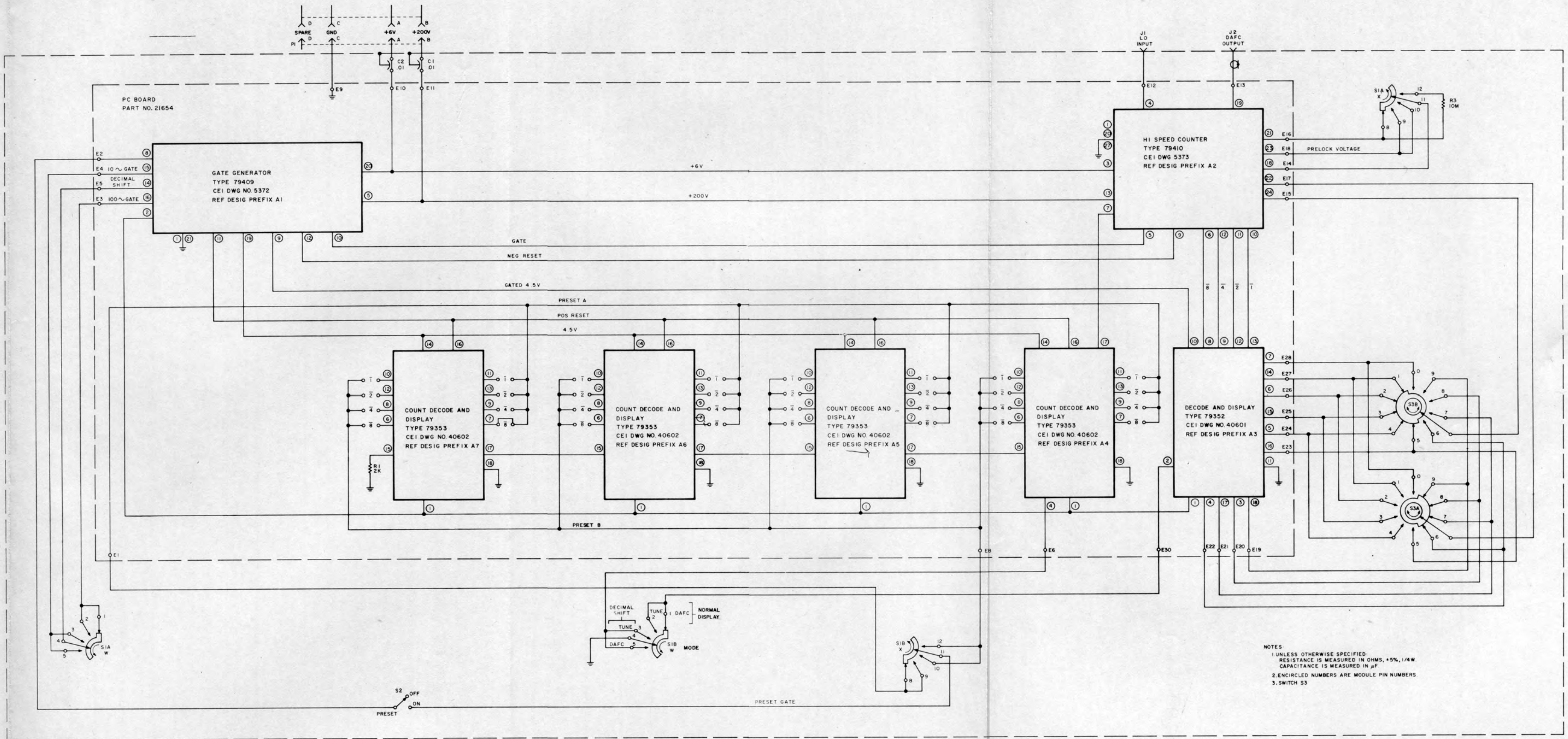
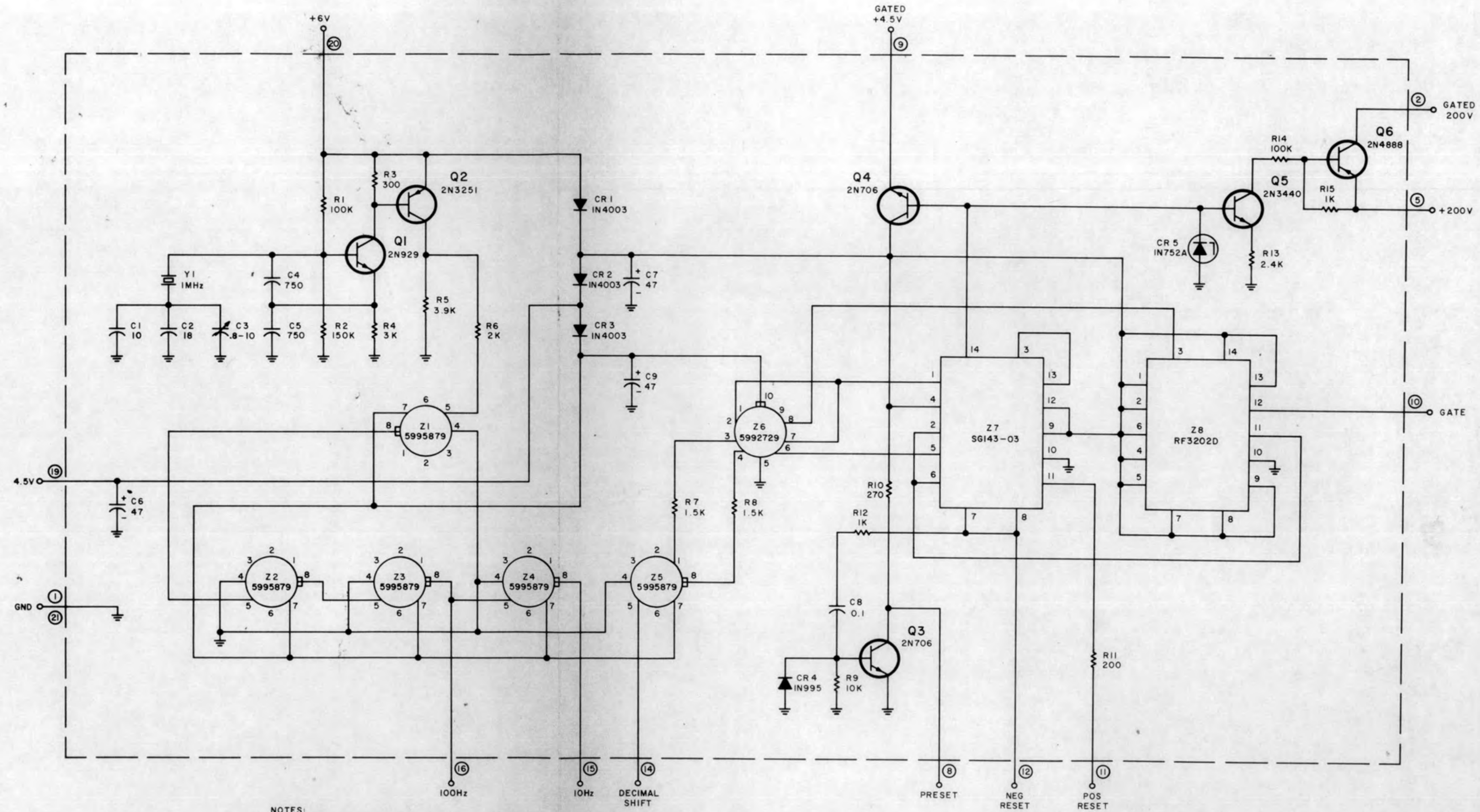
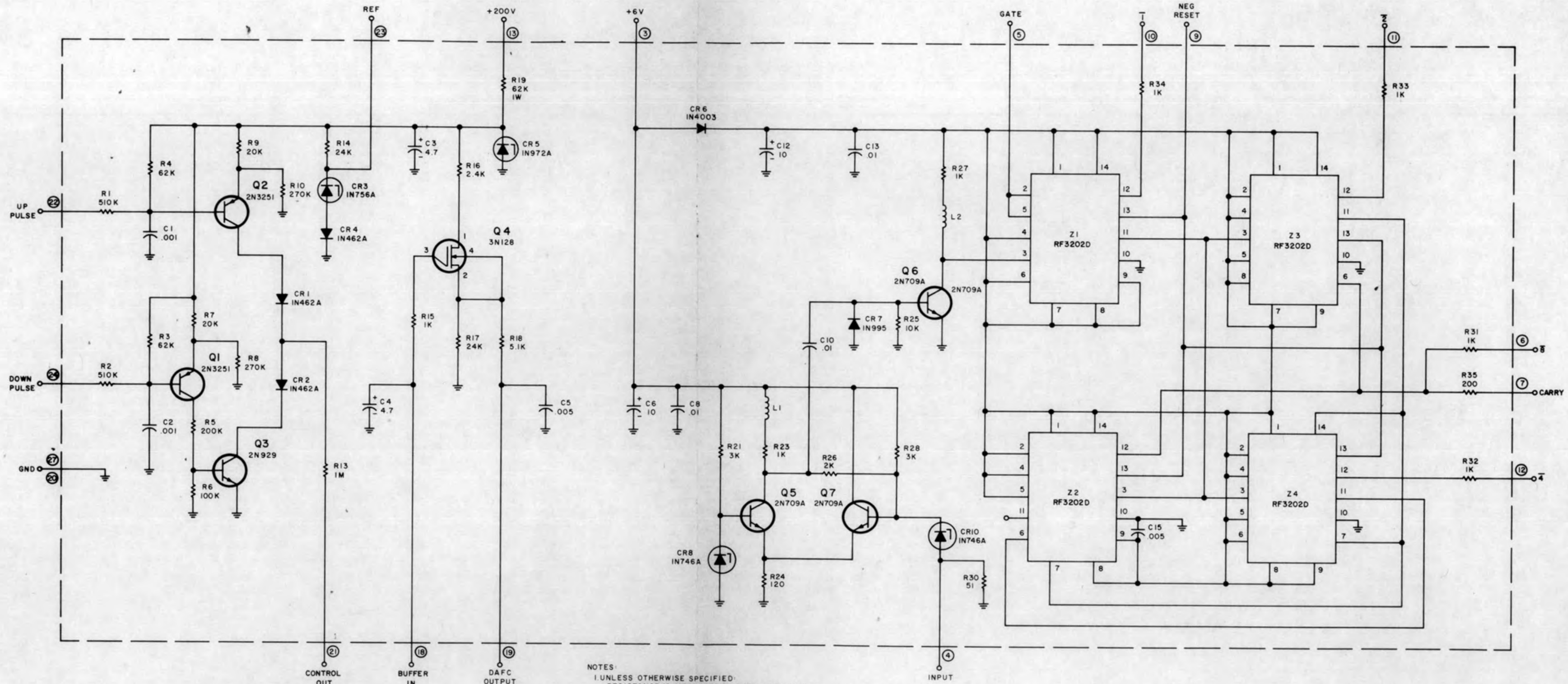


Figure 6-10. Type 79386 Counter Assembly (A8), Schematic Diagram



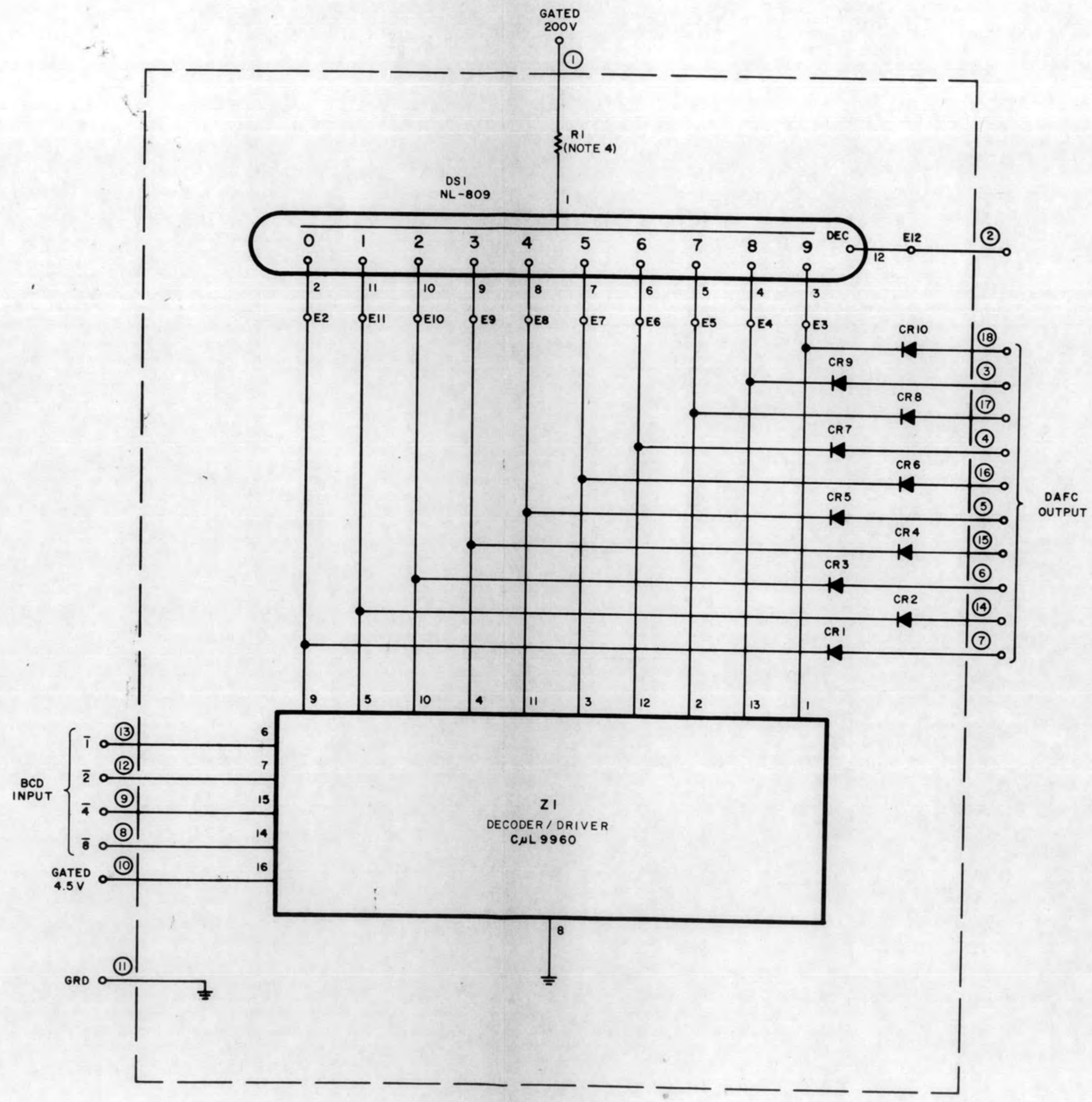
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. DIFFERENCE BETWEEN TYPES IS MECHANICAL.

Figure 6-11. Type 79409 Gate Generator (A8A1), Schematic Diagram



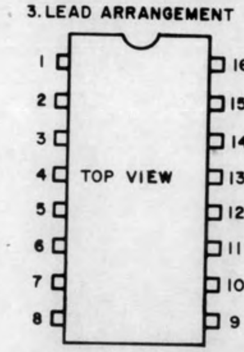
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. DIFFERENCE BETWEEN TYPES IS MECHANICAL ONLY.

Figure 6-12. Type 79410 High Speed Counter (A8A2), Schematic Diagram



NOTES:

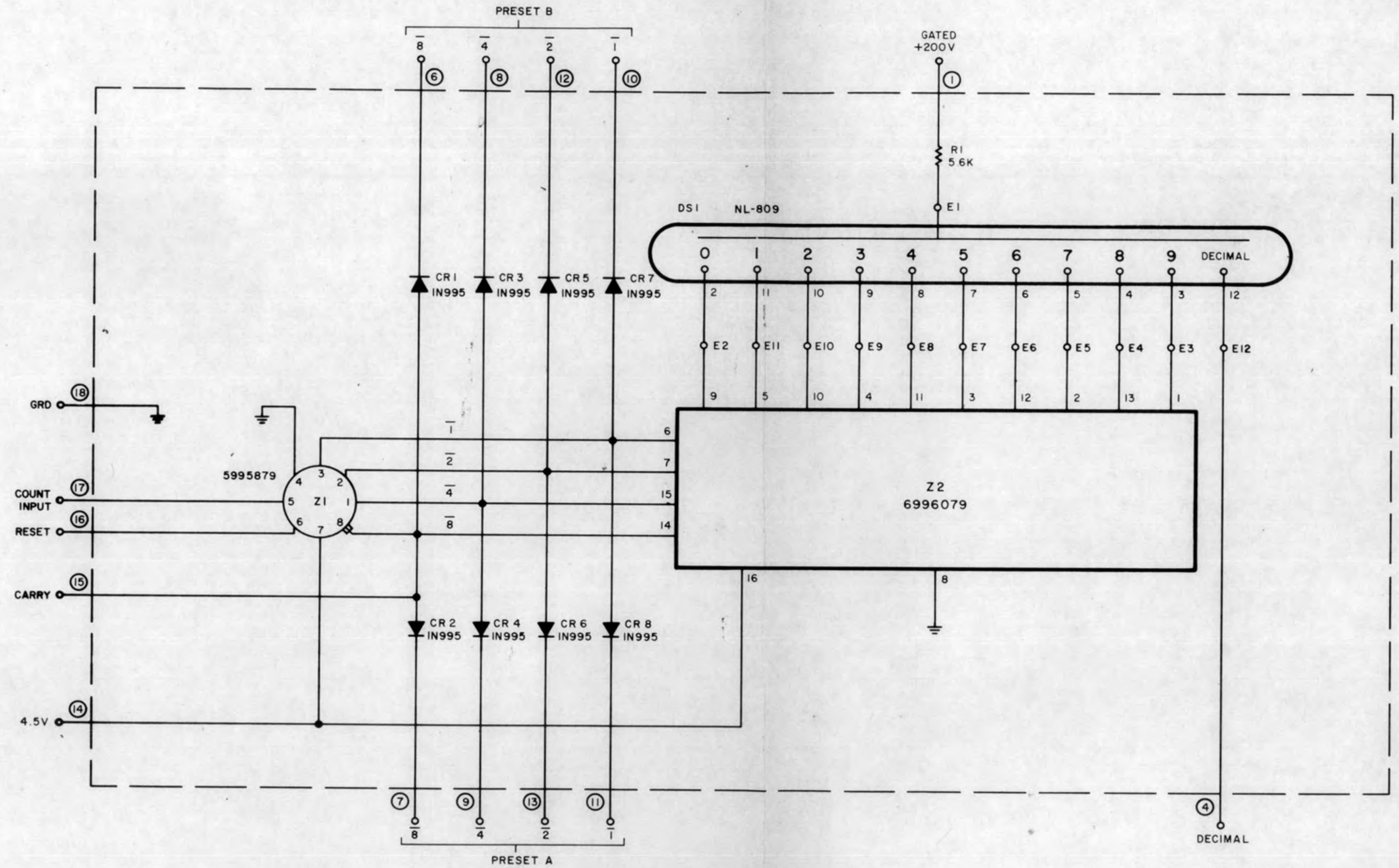
1. UNLESS OTHERWISE SPECIFIED: RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
2. CR1-CR10 ARE 1N198
3. LEAD ARRANGEMENT FOR Z1 IS SHOWN BELOW.



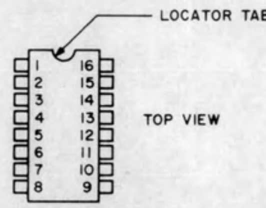
4. DIFFERENCE BETWEEN TYPES IS SHOWN BELOW.

TYPE	R1
79352	5.6K
79660	20K

Figure 6-13. Type 79352 Decode and Display (A8A3), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. PHYSICAL ARRANGEMENT OF PIN Z2 IS SHOWN BELOW



4. PHYSICAL ARRANGEMENT OF PIN Z1 IS SHOWN BELOW

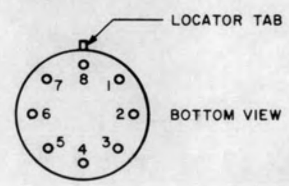
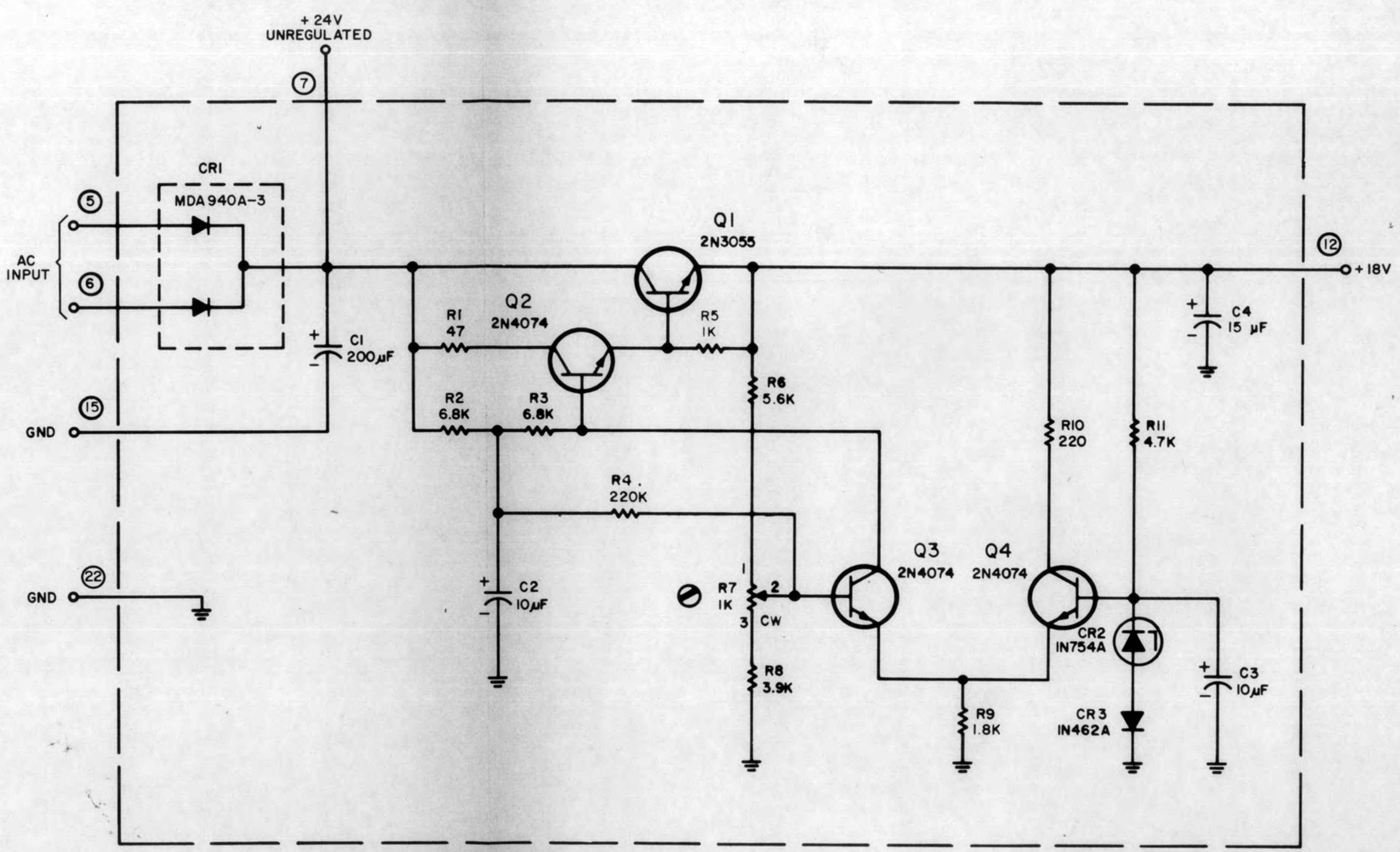


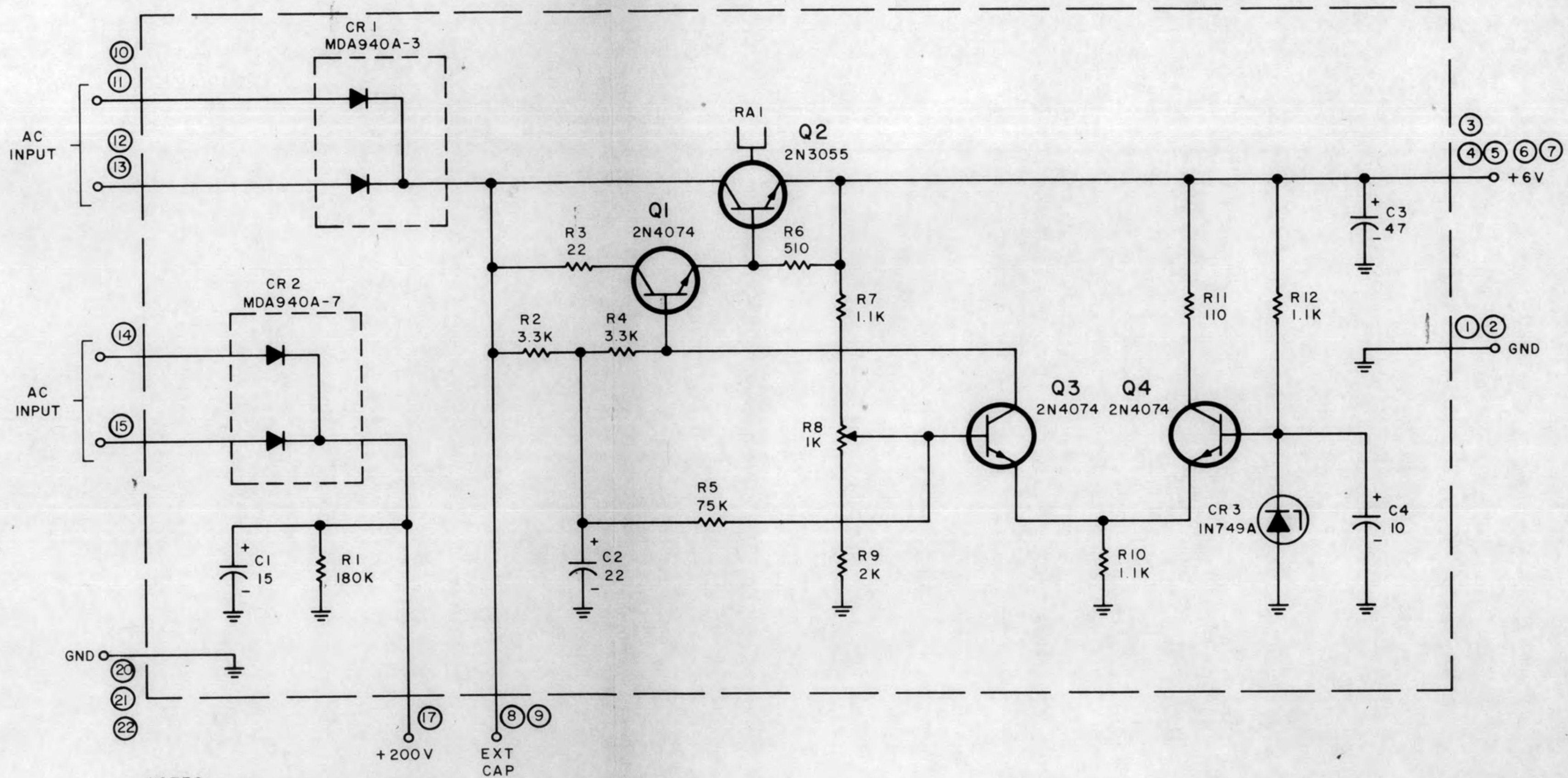
Figure 6-14. Type 79353 Count, Decode and Display (A8A4 thru A8A7), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IS MEASURED OHMS, ±5%, 1/4W
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. THE FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS
   CW INDICATES CLOCKWISE ROTATION
   ⊘ INDICATES SCREWDRIVER ADJUSTMENT

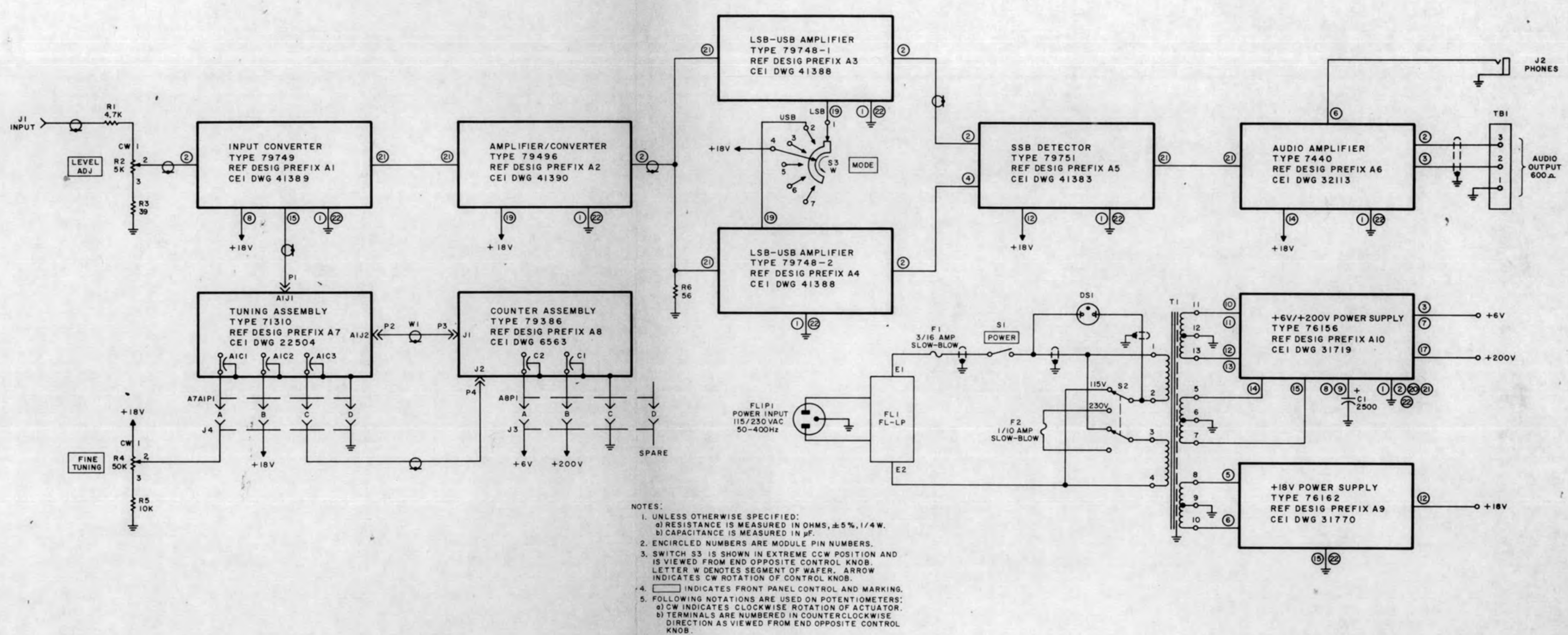
Figure 6-15. Type 76162 +18V Regulated Power Supply (A9), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W.
   CAPACITANCE IS MEASURED IN μF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.

Figure 6-16. Type 76156 +6V/+200V Regulated Power Supply (A10), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4 W.
   b) CAPACITANCE IS MEASURED IN µF.
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS.
3. SWITCH S3 IS SHOWN IN EXTREME CCW POSITION AND IS VIEWED FROM END OPPOSITE CONTROL KNOB. LETTER W DENOTES SEGMENT OF WAFER. ARROW INDICATES CW ROTATION OF CONTROL KNOB.
4. [ ] INDICATES FRONT PANEL CONTROL AND MARKING.
5. FOLLOWING NOTATIONS ARE USED ON POTENTIOMETERS:
   a) CW INDICATES CLOCKWISE ROTATION OF ACTUATOR.
   b) TERMINALS ARE NUMBERED IN COUNTERCLOCKWISE DIRECTION AS VIEWED FROM END OPPOSITE CONTROL KNOB.

Figure 6-17. Type DMS-109 Tunable Demodulator, Main Chassis Schematic Diagram