U.S. Patent No. 3,703,689

Instruction Manual

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MODEL 1112-VT(SYN)
SYNTHESIZED RF TUNER

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TRADE SECRETS

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GENERAL DESCRIPTION

1-1 SCOPE

This manual provides information pertaining to the installation, operation, and maintenance of the Model 1112-VT(SYN) RF Tuner designed and manufactured by Microdyne Corporation, Rockville, Maryland. A replacement parts list and maintenance diagrams are also included herein. The 1112-VT(SYN) is covered under U. S. Patent No. 3,703,689.

1-2 PURPOSE AND CAPABILITIES

The Model 1112-VT(SYN) RF Tuner designed for use in Microdyne single channel fm receivers, offers the ease, convenience and stability of synthesized tuning. Fast frequency selection is accomplished through either a front panel keyboard or from a remote location. A digital readout displays the frequency selected from either the local or the remote location.

The 1112-VT(SYN) operates over the frequency range of 215 MHz to 320 MHz. Step frequencies are 100 kHz enabling selection of any standard IRIG channel. Using the parent receiver's second l-o fine tuning, the operator has complete coverage of the entire frequency band.

Remote selection of frequency is accomplished simply by externally programming the BCD code equivalent of the desired rf frequency.

The 1112-VT(SYN) RF Tuner features electronically tuned four-pole preselection and l-o multipliers. A digital-to-analog converter translates the locally or remotely selected BCD code to the proper tuning voltage, thereby all tuning is accomplished by digital selection.

The rf tuner is constructed as a complete front panel plug-in module. All signal and power connections between the tuner and receiver are made automatically upon installation through a push-on coaxial connector and a miniature ribbon-type connector.

Table 1-1. Specifications

Frequency Range	215 - 320 MHz.
Operating Modes	Local or Remote; selectable.
Remote Control	BCD; TTL compatible.
Input Impedance	Operates from 50 ohm source.
Noise Figure	6.5 dB maximum.
Image Rejection	80 dB minimum.
IF Rejection	80 dB minimum.
Spurious Rejection	60 dB minimum.
First Local Oscillator:	
Type	Frequency Synthesizer.
Frequency Selection	Keyboard entry with digital display of selected RF frequency.
Frequency Steps	100 kHz.
Stability	±0.0005%; 0 to 50°C ambient. 1 part in 10^6 for three months' aging.
Settability	Reference oscillator adjustable for in excess of ten years' aging.
LO Monitor Output	One-fourth (1/4) LO injection frequency.
First IF Output:	
Frequency	50 MHz.
Bandwidth	4.5 MHz (standard).

SECTION II
INSTALLATION

2-1 GENERAL

The rf tuner is shipped separately from the receiver in which it is to be installed. It is sealed in a polyethylene bag, wrapped in shock absorbing insulation, and packaged in a rugged shipping container.

2-2 UNPACKING AND HANDLING

Upon receipt of the tuner carton, cut the sealing tape and lift the package from the box. Open the bag and remove the tuner. (Do not discard the packing material if the unit is to be reshipped; see paragraph 2-6.) Check the tuner for intransit damage; broken connectors, dents, etc. If damaged, notify the proper authority immediately.

2-3 STORAGE

Storage conditions should be within the environmental limits specified in table 1-1.

2-4 INSTALLATION

The tuner is held in place in the receiver with a module lock and spring actuated latch handle. To install the module, move the lock portion of the mechanism up and pull the handle marked PULL forward. Insert the tuner into the receiver slot. Return the PULL handle to its original position until the locks snap into place.

2-5 REMOVAL

To remove the tuner from the receiver, lift the module lock up to disengage the release. Pull the handle marked PULL forward and slide the tuner out of the receiver.

2-6 PACKAGING FOR RESHIPMENT

To package the tuner for reshipment, proceed as follows:

a. Place the tuner and a quantity of desiccant into a moisture-proof polyethylene bag and seal.

b. Place the unit in a cardboard container, preferably a padded type, using enough shock absorbing material to prevent any movement within the carton.

c. Seal the carton.

d. Affix the necessary "Delicate Equipment" and "Fragile" labels.

SECTION III
OPERATION

3-1 INTRODUCTION

This section provides the operating procedures only for the rf tuner and should be used in conjunction with the overall operating procedure for the parent receiver.

The tuner is activated upon the application of receiver power, regardless of the position of the 1ST LO switch on the receiver. Thus, the receiver cannot be slaved when SYN(VT) series tuners are employed; the 1ST LO INput, J4, (if wired) is not functional.

3-2 OPERATING INSTRUCTIONS

The rf tuner may be operated either in the local or in the remote mode. In the local mode, frequency selection is by means of the front panel keyboard. In the remote mode, frequency selection is by the application of an appropriate BCD code. In both cases, the operating frequency is selectable in 100 kHz steps over the range of the tuner.

3-2.1 LOCAL MODE

a. Place the tuner in the local mode, the local indicator should be lit. If necessary, select the local mode by depressing the # key.

b. Depress the enter key, *.

c. Program the desired frequency on the keyboard. The display will indicate the selected frequency.

3-2.2 REMOTE MODE

Six control lines are required for remote programming of the tuners. These control lines are wired through the receiver to pin 12 (BCD 8), pin 10 (BCD 4), pin 9 (BCD 2), pin 8 (BCD 1), pin 13 (initiate), and pin 22 (advance) of the tuner receptacle.

Initiate Line

This line is used to set up the internal logic such that it is ready to display and enter the BCD digits starting from the left most position. This line must be taken from a logical HIGH to a logical LOW and back to a logical HIGH. This sequence prepares an internal counter for reception of the most significant digit.

Advance Line

The advance (Positive TTL Pulse) is a strobing pulse used to advance the digit counter so that each BCD digit value is updated on the display.

BCD Lines

The BCD lines are for frequency selection. TTL, BCD positive signals are required:

Logical HIGH - 3 - 4.5V DC
Logical LOW - 0 - 0.3V DC

The BCD information for each digit must be applied in a sequential manner.

Entry Sequence

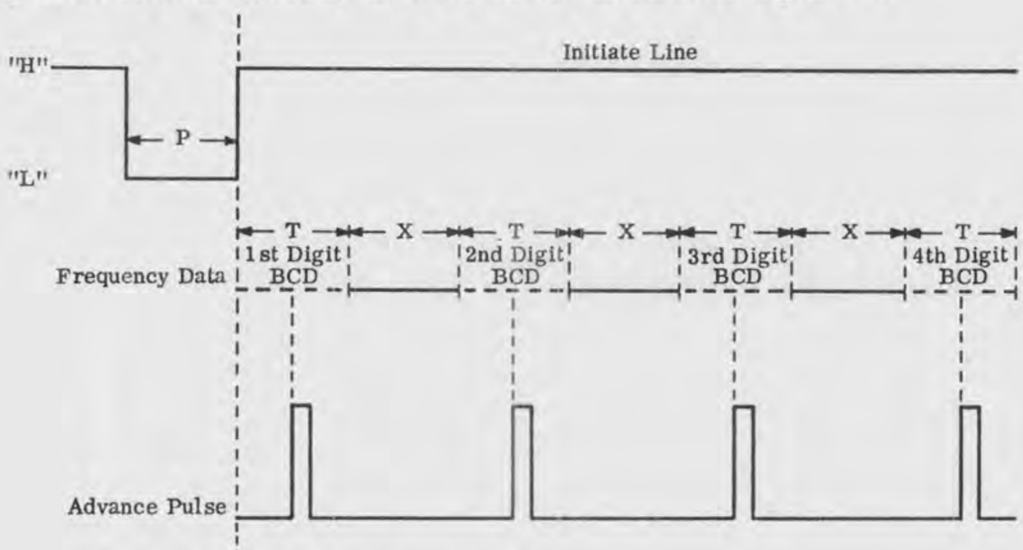
a. The Initiate Line must sequence from a HIGH to a LOW to a HIGH; a minimum LOW time of 10 milliseconds is required. The Initiate Line must remain HIGH during frequency entry.

Present the first digit's BCD TTL data on the BCD lines. The minimum amount of time this BCD information must be present is 10 milliseconds.

After the BCD data is stabilized (or approximately 5 milliseconds after entry of the BCD data) the pulse advance signal is entered to update the display.

d. Allow a minimum of 10 milliseconds, enter the second BCD digit, and permit stabilization as in step c, and enter the advance pulse.

e. Repeat steps c and d for the remaining BCD entries. During the 10 millisecond delay between BCD entries, the BCD lines can assume any state.



P = Low Time, minimum 10 msec.
T = BCD data present, minimum 10 msec.
X = Delay Time between BCD data entry, 10 msec.

Figure 3-1. Remote Programming, Timing Diagram

SECTION IV
THEORY OF OPERATION

4-1 GENERAL

The 1112-VT(SYN) RF Tuner is utilized to select a single frequency in the 215 MHz to 320 MHz range and down converts this selected frequency to 50 MHz for further processing in the receiver. The tuner employs synthesized tuning which permits, either from the front panel keyboard or by the external application of a coded BCD signal, the selection of any standard IRIG channel within the spectrum. The receiver's fine tune control (second l-o) can be used to select between the 100 kHz step frequencies.

The 215 - 320 MHz rf input signal is applied through a lowpass filter to a voltage-tuned rf amplifier whose output is applied to a mixer. In the mixer the rf signal is heterodyned with a local oscillator signal to produce a 50 MHz i-f signal. This 50 MHz signal is then applied through an i-f amplifier to the receiver i-f circuitry.

The local oscillator signal is generated by the frequency synthesizer system. The system consists of a frequency entry subsystem and a frequency synthesizer subsystem. The frequency entry subsystem decodes the selected BCD input from the keyboard or from the external source to generate a digital frequency word. This word is used to drive the front panel display and used by the frequency synthesizer subsystem to generate the fundamental l-o signal. The l-o signal is multiplied and filtered to supply a mixer injection signal that is 50 MHz above the rf signal.

4-2 CIRCUIT DESCRIPTION

The applicable schematic diagram in Section VII should be referenced during the following discussions.

4-2.1 RF CIRCUITRY (Figure 7-4)

The 215 - 320 MHz rf signal is applied through lowpass filter A1 (figure 7-2) to J1 on the rf chassis A3.

In the rf chassis, the rf signal is applied through impedance matching transformer L4 to double-tuned circuit CR1-CR4. The signal is then coupled to rf amplifier Q1-Q3 which is configured as a differential amplifier driven from a constant current source. In actual operation, however, Q1 and Q3 function as a cascode amplifier with Q2 operating as a signal shunt for gain control purposes. Gain control voltage from the receiver is applied to the gate of Q3 via sensitivity adjustment R18. Since the total flow through the differential stage is held constant by Q1, any change in the current flow through Q3 caused by the biasing effects of the agc voltage will be compensated for by an increased or decreased current flow through Q2. For example, if the agc voltage applied to Q3 caused the current through Q3 to decrease, the current through Q2 would increase by a corresponding amount thereby shunting a larger portion of the signal out of the signal path. This configuration and method of gain minimizes the effects of load changes on the amplifier bandpass and enhances the large signal handling capability of the tuner. The output of the amplifier is taken from the drain of Q3 and applied through a second double-tuned circuit (CR5-CR8) to the mixer Q4.

The double-tuned input and output stages of the amplifier are tuned by a control voltage applied to the cathode of tuning elements CR1 through CR8. This voltage is provided by the dual shaper board A2 and is employed to adjust the capacitance of the tuning elements to set the resonant frequency of the tuned circuit. CR1, CR4, CR5, and CR8 are utilized to control the resonance of the circuits and elements CR2, CR3, CR6, and CR7 are utilized to maintain the 7.5 MHz bandwidth by constantly optimizing the coupling.

4-2.2 FIRST MIXER AND IF AMPLIFIER (Figure 7-4)
Mixer Q4 accepts the rf input from the rf amplifier and the l-o input from the oscillator multiplier chain. The two signals are heterodyned to produce a 50 MHz intermediate frequency (i-f). This signal is further amplified by Q5 and applied to the tuner i-f output at P1-A1 for application to the receiver i-f circuitry. An output impedance of 50 ohms is established by the collector circuit of Q5 for interface purposes.

4-2.3 LOCAL OSCILLATOR
The local oscillator comprises A4 synthesizer, A2 dual shaper board, and multiplier circuitry located in A3.

4-2.3.1 A4, SYNTHESIZER - The synthesizer can be functionally subdivided into a frequency entry subsystem and a frequency synthesizer subsystem. The frequency entry subsystem consists of the front panel keyboard A4A2, the digital interface module A4A4, and the display assembly A4A3. The frequency synthesizer subsystem consists of the synthesizer module A4A1.

The frequency entry subsystem processes the remote or local frequency selection to generate a corresponding digital frequency word. The latter (four-digit BCD) is:

a. Applied to the display which provides a readout of the selected frequency.

b. Converted to an analog voltage which functions (after processing by the dual shaping board) as the tuning voltages for the rf amplifier and the l-o multiplier circuitry.

c. Applied through a 50 MHz adder circuit (which compensates for the l-o injection signal being 50 MHz above the incoming rf signal) to the frequency synthesizer.

d. Processed to generate a crystal oscillator frequency select control signal for the frequency synthesizer.

Reference figures 4-1 and 7-6. Frequency entries may be made either from the front panel keyboard or through remote BCD input lines. The keyboard entries appear on the appropriate lines at the input (J4) to the digital interface module. Here, the selections are applied to U1, the keyboard decoder. U1 generates a BCD code equal to the numerical value of the depressed keys. This BCD is outputted from U1 at pins 22 (LSB), 21, 2, and 3 (MSB), and inputted to data multiplexer U22. U1 also outputs a strobe pulse at pin 4 which is routed through inverter U8 to U9. U9, a one-shot multivibrator, generates a clock pulse which is applied to data multiplexer U23. Also applied to U23 is the decoded (by Q1) local enter command.

The remote BCD word is applied to pins 14, 11, 5, and 2 of data multiplexer U22. The remote enter (initiate) command and the remote clock (advance) are applied to pins 5 and 2, respectively, of U23.

The acceptance of either the remote or local data depends on the status of the remote/local control line at pin 1 of U22 and U23. The front panel remote/local switch selection is made available at E4 and routed to Q2. The output of Q2 pulses a flip-flop formed from cross-coupled NAND gates U7. The pulse from U7 drives a binary counter U6 whose output determines the local/remote condition. The local/remote control line at pin 1 of multiplexers U22 and U23 will be a logic high when the tuner is in the local mode. The binary counter U6 also drives the front panel local and remote indicators.

The BCD output of data multiplexer U22 applied to the inputs for four stage registers, U16 through U19. A particular BCD value is loaded into only one of the four registers. The loading of the registers is controlled by a digit-load decoder formed by decode counter U4 and one-of-ten decoder U10. U4 and U10 form a ring counter. In the local mode, this counter is initialized to zero when the enter key is depressed and in the remote mode, when the initiate line is activated (logic low). The counter is advanced by the internally generated clock pulses (local mode) or by the activation of the advance line (remote mode). The output lines of the counter are jumpered to the load lines of the individual storage registers. The ring counter sequences the registers to permit loading the registers U19 through U16 (LSD) sequentially.

One-of-ten decoder U11, in conjunction with gates U3 and U5, inhibits any undesirable MSD and LSD digits. After the initial programming of the desired five-digit frequency word, four additional entries will inhibit any digit updates, but subsequent entries will cause the ring counter to re-sequence with undesirables or false entries. The storage registers will indefinitely hold the frequency BCD word unless there is a power interruption.

The frequency BCD word in the storage registers is routed directly to the display module A4A3 where it is decoded for use in driving the front panel readout. The BCD word is also routed to U12 and U13, BCD adders. Here, the value of the word is increased by 50 MHz to compensate for the i-f offset. The resultant word is applied to the frequency synthesizer.

The LSD in U16 is routed to the frequency synthesizer module as the 0.5 MHz step control. The frequency BCD word from the storage register is further applied to U2, a digital-to-analog converter. This D/A converter, along with shaping operational amplifiers U14 and U15, generates the drive voltage for the dual shaping board A2.

The display board circuitry is shown in figure 7-5. U1 through U5 are high voltage decoder drivers which drive the 180V dc Beckman gas discharge displays used for the readout. These decoder drivers convert the four bit BCD inputs from the digital interface module to seven line outputs for driving each line of the displays. The power supply for the displays is located on the digital interface board.

In the frequency synthesizer module, the 0.5 MHz step control from the digital interface board functions as a 0.5 MHz step control for a crystal oscillator. The BCD frequency word from the digital interface board is applied to a digital divider. The crystal oscillator and the digital divider are part of a phase lock loop circuit that controls a voltage-controlled oscillator which generates the fundamental l-o signal.

4-2.3.2 LO MULTIPLIER (Figure 7-4) - The 66.25 - 92.5 MHz output of the frequency synthesizer is coupled to J6 on the rf chassis. From J6 the fundamental l-o signal is applied to the l-o multiplier circuit consisting of Q6 through Q9.

Transistor stage Q9 functions as a buffer amplifier whose output is applied to driver Q8. Q8 provides the drive for the l-o monitor output at J5 and for driving doubler Q7. The tuning of this doubler is by means of a tuning voltage applied across diodes CR12, CR13, and CR14; diodes CR14 and CR12 control the tuning and CR13 maintains the correct bandwidth. This tuning voltage is generated in the frequency synthesizer and routed through the dual shaper board to the l-o multiplier. Inductors L14 and L13 are used to match the impedance between the tuned stages.

The 132.50 - 185 MHz output of Q7 is applied to a second doubler stage Q6, which is tuned in the same manner as Q7. The resultant 265 - 370 MHz l-o injection signal is coupled to the mixer.

4-2.3.3 DUAL SHAPER BOARD (Figure 7-3) - The function of the dual shaper board is to process (shape) the analog voltage developed from the BCD frequency word by the frequency synthesizer into tuning voltages for the rf amplifier stages and for the l-o multiplier stages.

The input to the dual shaper board ranges from 0V to +5V (215 MHz - 320 MHz) and is supplied by the digital interface board. The voltage is applied to E1 on the shaper board where it is routed to two independent operational amplifier circuits, U1 and U2. U1 provides the tuning voltage for the rf amplifier stages and U2 provides the tuning voltages for the l-o multiplier stages. Each stage has a shaping network to ensure tracking between the local oscillator and the tuned circuits.

The output of the rf shaping network ranges from +2.49V (215 MHz) to +13.90V (320 MHz). The l-o shaping network outputs a tuning voltage ranging from +2.4V (215 MHz) to +13.8V (320 MHz).

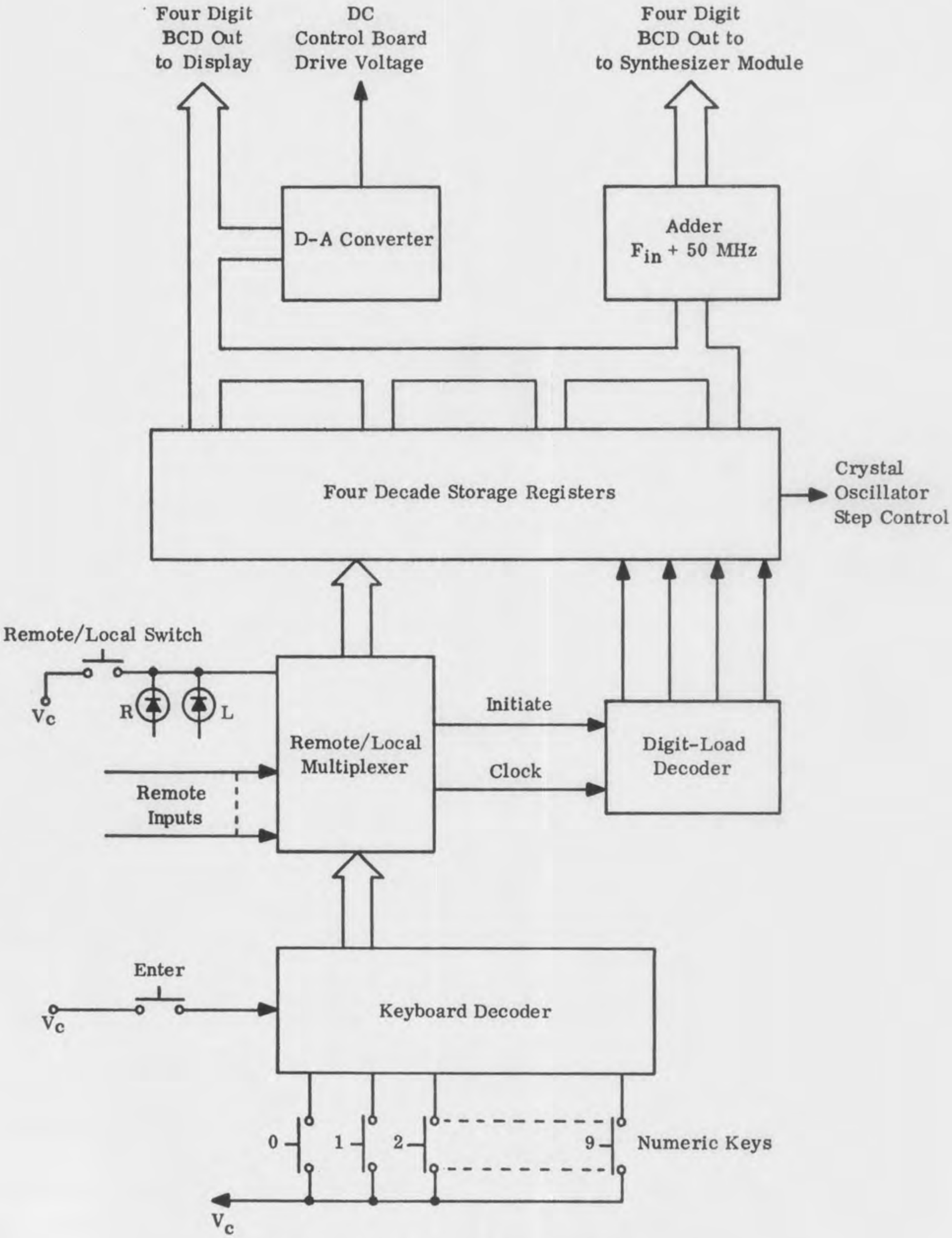


Figure 4-1. Digital Interface Module, Block Diagram

SECTION V
MAINTENANCE

5-1 GENERAL

This section provides the recommended maintenance procedures for the 1112-VT(SYN) Tuner. These procedures include preventive maintenance, troubleshooting, and alignment instructions. The test equipment required for servicing the tuner is listed in table 5-1; direct equivalents may be used.

Table 5-1. Test Equipment

Oscilloscope	HP1202A
Sweep Generator	Texscan VS-50
Spectrum Analyzer	HP141T/8553B/8552A
Frequency Counter	HP5245L
Frequency Converter	HP5253B
RF Detector	HP8471A
Digital Voltmeter	Fluke 8300A
RF Millivoltmeter	HP3406A
VHF Noise Source	HP343A
Noise Figure Meter	HP342A
Power Amplifier	Boonton 230A
Rhotector Kit	Telonic TRK-2A
BNC to Selectro Adapters (2)	Sealectro 50-077-6801
Extender Cables	Microdyne 200-452, 200-453
Test Cable	Microdyne 200-729
Signal Generator	HP608

The extender cables listed in table 5-1 allow access to the tuner circuitry while connected to the receiver. If desired, the cables may be fabricated as follows:

a. Obtain the following material:

1. RG174/U cable — length should be sufficient to make three equal-length cables approximately three feet long.
2. RG223/U cable, approximately three feet long.
3. One roll of #24 insulated multistrand wire.
4. One set Cannon DCM-25W3P and DCM-25W3S connectors with coaxial inserts.
5. One Gremar 11749-1 and one Gremar 16908-1 connector.

b. Cut the #24 wire into twenty-two three-foot lengths and make connections between corresponding pins of the two Cannon connectors.

c. Connect the RG174/U cable between corresponding coaxial inserts in the two Cannon connectors (A1-A2-A3). These inserts should not be permanently affixed to connectors since they must be removed for alignment. This completes fabrication of the i-f/power cable.

d. Connect the Gremar 11749-1 and 16908-1 connectors to the length of RG223/U cable. This completes fabrication of the rf cable.

5-2 PREVENTIVE MAINTENANCE

Preventive maintenance requirements consist of periodic visual inspection and certain performance checks.

The visual inspection should include a check of the connectors for looseness and corrosion, electrical components for evidence of overheating, and screws and nuts for looseness. All loose hardware should be tightened immediately. Damaged components should be replaced after determining and correcting the source.

Performance checks should include:

a. Noise Figure — See paragraph 5-4.2.

b. LO Frequency —

1. Connect the HP5245L/HP5253B counter to the receiver first l-o monitor output.

2. Check and note the frequency at the low, middle, and high ends of the band.

3. Multiply the counter indication by 4 and subtract 50 MHz. The resultant frequency should be within 0.1% of the display indication.

4. Disconnect the counter.

c. Transfer Gain — See paragraph 5-4.3.

5-3 TROUBLESHOOTING

Once it is determined that a malfunction exists in the tuner, troubleshooting should consist of those steps necessary to isolate the fault to one of the functional areas; rf section, frequency synthesizer, l-o multiplier, or i-f amplifier.

LO Frequency

A check of the l-o signal provides a check of the frequency synthesizer and of the multiplier chain. LO test points are given below.

A3J2	-	LO injection frequency, 265-370 MHz, 0 (low end) to -12 dBm (high end), 50 dBm load.
A3J5	-	LO monitor output, 1/4 injection frequency, greater than -5(±1) dBm.
A4A1-J4	-	Frequency synthesizer output, 1/4 injection frequency, 0 to +3 dBm.

If the l-o frequency at J5 of the rf chassis is incorrect, check the local oscillator calibration adjustment on the frequency synthesizer; see steps a through g of paragraph 5-4.1. Ensure a suitable warmup time is allowed before the adjustments are attempted.

Gain

A check of the transfer gain will provide a check of the lowpass filter, the rf amplifier, mixer and i-f amplifier. Check the gain using the procedures given in paragraph 5-4.3. The lowpass filter hasa 0.5 dB insertion loss.

The above should enable the isolation of any fault to one of the functional areas. A troubleshooting guide for the modules is given in the following paragraphs.

5-3.1 A2, DUAL SHAPER BOARD

The dual shaper board receives its drive voltage from the frequency synthesizer and should range between 0V dc and 5.00V dc. The shaper board should output an rf tuning voltage ranging between +2.49 and +13.90V dc. The shaper board should output a l-o tuning voltage ranging betqeen +2.4V and 13.8V. Voltage measurements are recommended in troubleshooting the board.

5-3.2 A1, LOWPASS FILTER

To troubleshoot the filter, conduct steps ac through ah of the alignment procedures given under paragraph 5-4.1.

5-3.3 A3, RF CHASSIS

The rf chassis contains the rf amplifier, mixer, 50 MHz i-f amplifier, and the l-o multiplier circuits. The recommended troubleshooting procedure is to attempt the applicable positions of the alignment procedure (paragraph 5-4.1). This should enable the isolation of any fault to a stage. Reference dc voltages are given in table 5-2.

Table 5-2. RF Chassis Voltage Chart (Static)

Device	E	B	C	S	G	D
Q1	-10.3	- 9.6	+ 0.9			
Q2				+0.9	-0.91	+14.8
Q3				+0.9	0	+14.8
Q4	- 7.9	- 7.2	+14.6			
Q5	-12.2	-11.4	- 0.14			
Q6	+ 6.1	+ 6.8	+14.7			
Q7	+ 6.5	+ 7.1	+14.9			
Q8	- 8.6	- 7.9	- 1.3			

1. All voltages were measured with a Fluke 8300A digital voltmeter.
2. Voltages may vary up to ±10% between units.

5-3.4 A4, FREQUENCY SYNTHESIZER

The first step is to isolate the problem to one of the modules that composes the frequency synthesizer. This requires familiarity with the function of each module as given in Section IV of this manual. A limited fault isolation chart is given below.

Fault	Probable Cause
Local operation/no remote operation	A4A4 - L/R decoder circuit
Remote operation/no local operation	Keyboard, A4A4 - Keyboard decoder
No display	A4A3, A4A4 - 180V dc supply
DC control board drive	A4A4 - D/A converter
Fundamental l-o signal	A4A1, A4A4 - BCD adder
No display or l-o signal	A4A4 - multiplexers, storage registers, digit-load decoder

The keyboard A4A2 and the frequency synthesizer module A4A1 are considered nonrepairable. The display board A4A2 and the digital interface board A4A14 are repairable. Check the logic chips of the suspected circuit.

5-4 ALIGNMENT

After any repair to the tuner circuitry, realignment of the affected circuitry is usually required. The following procedures provide the alignment instructions for the complete tuner. However, when minor repairs are limited to one functional area, only those procedures dealing with this circuitry need be conducted.

The tuner is connected to the receiver using the extender cables called out in table 5-1 for alignment. The signal inputs to the tuner may be made at the rf input connector on the receiver. The connections to the i-f output (P11-A3) of the tuner may be made at A1 of XA4 (i-f filter receptacle) of the receiver using the 200-729 test cable. The filter must be removed, if used, to make this connection.

5-4.1 OVERALL ALIGNMENT

Steps a through i of the following procedures are required after any repairs.

a. Connect the tuner to the receiver using the extender cables. Apply power to the receiver. On the receiver, using the Manual Gain control, set the tuner agc voltage to -0.5 (P11-7).

b. Program the tuner to 215.0 MHz LOCAL using the keyboard on the front panel. The LOCAL LED should be on and the digital readout should display 215.0.

c. Connect the digital voltmeter to TP2 on the dual shaper board.

d. Adjust A4R8 offset (digital interface board) for 0.00V on the voltmeter.

e. Program the tuner to 320 MHz.

f. Adjust A4R5 Range for an indication of 5.00V on the voltmeter.

g. Repeat steps b through f until the correct voltages are obtained at the two ends of the board.

h. Program the tuner to 215 MHz and connect a frequency counter to P11-A1 (or to the 1st LO output connector on the receiver).

i. The counter should indicate 66.25 MHz; if necessary, adjust the LO ADJ on the frequency synthesizer module A4A1 for the correct counter reading.

Dual Shaper Board

Steps j through o are required only if repairs are made to the dual shaper board.

j. Program the tuner to 320 MHz.

k. On the dual shaper board:

Adjust R1 for +1.250V at TP1.	Adjust R14 for +1.52V at TP4.
Adjust R2 for +13.90V at TP3.	Adjust R15 for +13.8V at TP5.

l. Program the tuner to 260 MHz.

m. On the dual shaper board:

Adjust R7 for +6.93V at TP3.	Adjust R20 for +6.3V at TP5.

n. Program the tuner to 215 MHz.

o. On the dual shaper board:

Adjust R8 for +2.49V at TP3.	Adjust R21 for +2.4V at TP5.

LO Multiplier

p. Connect the sampling voltmeter with tee probe and 50 ohm load to A3J2.

q. Program the tuner to 320 MHz. Adjust C53, C48, C43, and C38 for maximum voltmeter indication.

r. Program the tuner to 215 MHz. Adjust L14, L13, L12, and L11 for maximum voltmeter indication.

s. Repeat steps q and r for maximum voltmeter indication at 215 MHz and at 320 MHz.

t. Program the tuner to 305 MHz.

u. Adjust R14 on the dual shaper board for maximum voltmeter indication.

v. Program the tuner to 320 MHz.

w. Adjust R15 on the dual shaper board for maximum voltmeter indication.

x. Because R14 and R15 interact with each other, it is necessary to repeat steps t through w until maximum voltmeter indication is obtained at 305 MHz.

y. Program the tuner to 260 MHz.

z. Adjust R20 on the dual shaper board for maximum voltmeter indication.

aa. Program the tuner to 215 MHz.

ab. Adjust R21 on the dual shaper board for maximum voltmeter indication.

RF Circuits

ac. Remove power from the receiver. Connect the sweep generator to the rf input of the receiver (J1 of the tuner) and a 50 ohm detector to A1J2 (lowpass filter). Set the generator for a -30 dBm output.

ad. Adjust L1, L2, and L3 of the lowpass filter for a flat response. Insertion loss should be less than 0.5 dB at 320 MHz.

ae. Connect a 50 ohm termination to A1J2. Using the rhotector, calibrate the oscilloscope with the 1.4:1 VSWR load.

af. Connect the rhotector to the rf input of the receiver.

ag. Readjust, if necessary, L1, L2, and L3 of the lowpass filter for a VSWR of less than 1.4:1 across the band of 215 - 320 MHz.

ah. Remove termination and reconnect the filter into the tuner. Disconnect P6 from A3J6 (rf chassis), on the receiver, select automatic gain control.

ai. Program the tuner to 320 MHz and adjust C2 and C7 on the rf chassis for a VSWR of less than 1.5:1 at 320 MHz.

aj. Program the tuner to 215 MHz and adjust L1 and L2 for a VSWR of less than 1.5:1 at 215 MHz.

ak. Repeat steps ai and aj for lowest VSWR at 215 MHz and at 320 MHz.

al. Connect the sweeper to the rf input of the receiver. Set sweeper output for -30 dBm.

am. Connect a detector to A3J2 (rf chassis). Connect the detector output to the oscilloscope.

an. Program the tuner to 320 MHz. Adjust C18 and C23 on the rf chassis for a double-tuned response centered at 320 MHz.

ao. Program the tuner to 215 MHz and adjust L5 and L6 for a double-tuned re- response centered at 215 MHz.

ap. Repeat steps ap and aq until optimum tracking is obtained.

aq. Program the tuner to 305 MHz.

ar. Adjust R1 on the dual shaper board to center the rf response at 305 MHz.

as. Program the tuner for 320 MHz and adjust R2 on the dual shaper board to center the rf response at 320 MHz.

at. Repeat steps aq through as until the rf response is centered at 305 MHz and 320 MHz.

au. Program the tuner to 260 MHz. Adjust R7 on the dual shaper board to center response.

av. Program the tuner to 215 MHz and adjust R8 on the dual shaper board to center response.

aw. Reconnect P6 to A3J6.

IF Amplifier

ax. Temporarily remove Q6 from its socket.

ay. Connect a 50 ohm detector to P11A3 (A3J3).

az. Connect the sweep generator to A3J2.

ba. Set the output of the sweep generator for 50 MHz at -10 dBm.

bb. Adjust L7 and L8 on the rf chassis for a response centered at 50 MHz and a 3 dB bandwidth of approximately 6.0 MHz.

bc. Disconnect the sweep generator and the detector. Reinstall Q6 in its socket.

5-4.2 NOISE FIGURE CHECK

a. Connect the noise figure meter to the Boonton 230A rf amplifier and connect P11-A3 (i-f output) on the tuner to the 230A.

b. Connect the noise source to the rf input of the receiver.

c. Program the tuner to 215 MHz and note the noise figure on the meter. Program the tuner to 320 MHz and measure the noise figure. The noise figure should not exceed 7.0 dB. Disconnect the test equipment.

5-4.3 GAIN REDUCTION ALIGNMENT

a. Program the tuner to 250 MHz.

b. Connect an HP608 signal generator, set to 250 MHz at -40 dBm, to the rf input of the receiver. Connect an rf voltmeter to the i-f output (P11-A3) of the tuner.

c. On the receiver, set the Manual Gain Control for tuner agc of 0.0V dc at P11-7.

d. Adjust R30 on the rf chassis until the transfer gain, as indicated on the voltmeter, is 16(±0.5) dB.

e. Set the agc to -5.0V using the Manual Gain Control.

f. Adjust R20 on the rf chassis for maximum gain reduction.

5-5 ASSEMBLY/DISASSEMBLY

The design of the tuner permits access to all repairable modules for alignment and test. The dual shaper board must be removed to permit repairs; it does not require disconnecting from the tuner circuitry. The lead lengths permit positioning the module outside the tuner chassis, allowing access to the circuit board.

CAUTION

> After any repairs in and around the synthesizer, before applying power, measure the resistance between A4A4-E3 and ground (>400K). A short at this point will damage the 180V power supply (display readout) located on A4A4.

The digital interface module A4A4 is readily accessible. It is recommended that repairs be attempted as replacement is complicated due to the number of interconnections.

To gain access to the display card A4A3, the front panel must be removed. This requires the removal of the latches. As with the digital interface module, repairs should be attempted as replacement is complicated.

A component located drawing for the dual shaper is provided below. Modules A4A3 and A4A4 have the integrated circuits identified on the boards. Adjustable components on the rf chassis are identified.

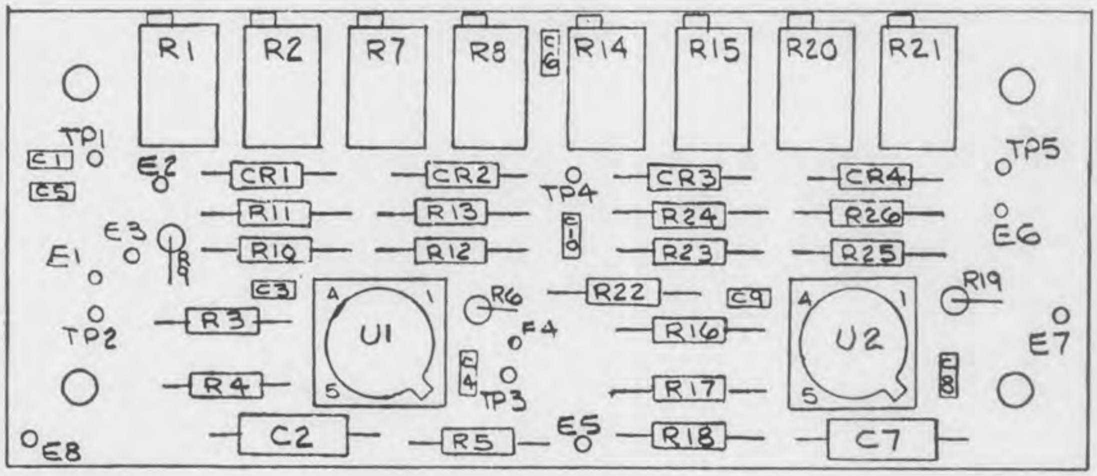


Figure 5-1. A2, Dual Shaper Board,
Component Location Drawing

SECTION VI
REPLACEABLE PARTS LIST

6-1 GENERAL

This section contains the replaceable parts list for the 1112-VT(SYN) Synthesized RF Tuner. Components are listed alphanumerically by subassembly and provide the reference designator, description, manufacturer, and manufacturer's part number. Include all information when ordering spare or replaceable components.

6-2 BASE CHASSIS

Reference Designation	Description
A1	Lowpass Filter, Microdyne 103-344; see paragraph 6-3 for breakdown listing.
A2	Dual Shaper Board, Microdyne 103-398; see paragraph 6-4 for breakdown listing.
A3	RF Chassis, Microdyne 103-336; see paragraph 6-5 for breakdown listing.
A4	Synthesizer, Microdyne 103-333-1; see paragraph 6-6 for breakdown listing
C1	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
DS1	Light Emitting Diode, (red), HP5082-4440
DS2	Light Emitting Diode, (red), HP5082-4440
J1	Connector, p/o W1, Gremar 16908-1
P1	Connector, p/o W1, UG1465/U
P2	Connector, p/o W2, UG1465/U
P3	Connector, p/o W2, UG1465/U
P4	Connector, p/o W3, UG1465/U
P5	Connector, p/o W4, UG1465/U
P6	Connector, p/o W5, UG1465/U
P7	Connector, p/o W5, Phelps Dodge 546-001
P8	Connector, p/o W6, Phelps Dodge 522-004
P9	Connector, p/o W6, Phelps Dodge 522-004
P10	Connector, p/o W7, Phelps Dodge 522-004
P11	Connector, Cannon DCM25W3P
P11A1	Insert, p/o W4, Cannon DM53740-1
P11A2	Not Assigned
P11A3	Insert, p/o W3, Cannon DM53740-1

Replaceable Parts List - Base Chassis, cont'd.

Reference Designation	Description
P12	Connector, p/o W7, Phelps Dodge 522-004
P13 thru P19	Connector, dip, 3M 3416-0002
W1	Cable Assembly, Microdyne 201-842-7
W2	Cable Assembly, Microdyne 201-941-10
W3	Cable Assembly, Microdyne 201-845-14
W4	Cable Assembly, Microdyne 201-845-9
W5	Cable Assembly, Microdyne 201-961-25
W6	Cable Assembly, Microdyne 203-650
W7	Cable Assembly, Microdyne 203-669

6-3 A1, LOWPASS FILTER

Reference Designation	Description
C1	Capacitor, ceramic, 4.3 pF ±0.25 pF, 100V, Erie 8101-100-COG-439C
C2	Capacitor, ceramic, 9.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-919C
C3	Capacitor, ceramic, 9.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-919C
C4	Capacitor, ceramic, 4.3 pF ±0.25 pF, 100V, Erie 8101-100-COG-439C
E1	Termination, standoff, teflon, Sealectro ST-SM-1
E2	Termination, standoff, teflon, Sealectro ST-SM-1
J1	Connector, UG1619/U
J2	Connector, UG1619/U
L1	Inductor, Microdyne 201-129
L2	Inductor, Microdyne 201-130
L3	Inductor, Microdyne 201-129

Replaceable Parts List, continued

6-4 A2, DUAL SHAPER BOARD

Reference Designation	Description
C1	Capacitor, ceramic, 1000 pF ±20%, 100V, Erie 8111-100-X5R-102M
C2	Capacitor, tantalum, 1 µF ±20%, 35V, Sprague 150D105X0035A2
C3	Capacitor, ceramic, 1000 pF ±20%, 100V, Erie 8111-100-X5R-102M
C4	Capacitor, ceramic, 51 pF ±5%, 100V, Erie 8131-100-COG-510J
C5	Capacitor, ceramic, 1000 pF ±20%, 100V, Erie 8111-100-X5R-102M
C6	Capacitor, ceramic, 1000 pF ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, tantalum, 1 µF ±20%, 35V, Sprague 150D105X0035A2
C8	Capacitor, ceramic, 51 pF ±20%, 100V, Erie 8131-100-COG-510J
C9	Capacitor, ceramic, 1000 pF ±20%, 100V, Erie 8111-100-X5R-102M
C10	Capacitor, ceramic, 1000 pF ±20%, 100V, Erie 8111-100-X5R-102M
CR1 thru CR4	Diode, JEDEC 1N462A
E1	Termination, AMP 61067-1
E2	Termination, AMP 61067-1
E3	Termination, AMP 61067-1
E4	Termination, AMP 61067-1
E5	Termination, AMP 61067-1
E6	Termination, AMP 61067-1
E7	Termination, AMP 61067-1
E8	Termination, AMP 61067-1
R1	Potentiometer, 100K, Bourns 3299X-1-104
R2	Potentiometer, 1 Meg, Bourns 3299X-1-105
R3	Resistor, metal film, 1MΩ ±1%, 1/8W, RN55D1004F
R4	Resistor, metal film, 2MΩ ±1%, 1/8w, RN55D2004F
R5	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R6	Resistor, metal film, 10KΩ ±1%, 1/8w, RN55D1002F
R7	Potentiometer, 1 Meg, Bourns 3299X-1-105
R8	Potentiometer, 1 Meg, Bourns 3299X-1-105
R9	Resistor, metal film, 1KΩ ±1%, 1/8w, RN55D1001F
R10	Resistor, metal film, 68.1KΩ ±1%, 1/8w, RN55D6812F
R11	Resistor, metal film, 56.2KΩ ±1%, 1/8w, RN55D5622F
R12	Resistor, metal film, 51.1KΩ ±1%, 1/8w, RN55D5112F
R13	Resistor, metal film, 33.2KΩ ±1%, 1/8w, RN55D3322F
R14	Potentiometer, 100KΩ, Bourns 3299X-1-104
R15	Potentiometer, 1 Meg, Bourns 3299X-1-105
R16	Resistor, metal film, 1MΩ ±1%, 1/8w, RN55D1004F

Replaceable Parts List - A2, Dual Shaper Board, cont'd.

Reference Designation	Description
R17	Resistor, metal film, 2MΩ ±1%, 1/8w, RN55D2004F
R18	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R19	Resistor, metal film, 10KΩ ±1%, 1/8w, RN55D1002F
R20	Potentiometer, 1 Meg, Bourns 3299X-1-105
R21	Potentiometer, 1 Meg, Bourns 3299X-1-105
R22	Resistor, metal film, 1KΩ ±1%, 1/8w, RN55D1001F
R23	Resistor, metal film, 68.1KΩ ±1%, 1/8w, RN55D6812F
R24	Resistor, metal film, 56.2KΩ ±1%, 1/8w, RN55D5622F
R25	Resistor, metal film, 51.1KΩ ±1%, 1/8w, RN55D5112F
R26	Resistor, metal film, 33.2KΩ ±1%, 1/8w, RN55D3322F
TP1 thru TP5	Test Point, AMP 61067-1
U1	Operational Amplifier, RCA CA3130S
U2	Operational Amplifier, RCA CA3130S
XU1	Socket, 8-pin, Augat 508-AG1D
XU2	Socket, 8-pin, Augat 508-AG1D

6-5 A3, RF CHASSIS

Reference Designation	Description
C1	Capacitor, ceramic, 100 pF ±20%, 100V, Erie 8101-100-X5R-101M
C2	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C3	Capacitor, ceramic, 2.4 pF ±0.1 pF, 100V, Erie 8101-100-COG-249B
C4 thru C6	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C7	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C8	Capacitor, ceramic, 100 pF ±20%, 100V, Erie 8101-100-X5R-101M
C9 thru C12	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C13	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C14	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C15	Capacitor, feedthru, 47 pF ±20%, Erie 2482-001-X5U-470M
C16	Capacitor, feedthru, 47 pF ±20%, Erie 2482-001-X5U-470M

Replaceable Parts List - A3, RF Chassis, cont'd.

Reference Designation	Description
C17	Capacitor, ceramic, 100 pF ±20%, 100V, Erie 8101-100-X5R-101M
C18	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C19	Capacitor, ceramic, 0.75 pF ±5%, Quality Component M.C. 0.75, nominal value
C20 thru C22	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C23	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C24	Capacitor, ceramic, 100 pF ±20%, 100V, Erie 8101-100-X5R-101M
C25	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C26	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C27	Capacitor, ceramic, 4.7 pF ±0.25 pF, 100V, Erie 8101-100-COG-479C
C28	Capacitor, ceramic, 0.91 pF ±5%, Quality Component M.C. 0.91, nominal value
C29	Capacitor, ceramic, 100 pF ±20%, 100V, Erie 8101-100-X5R1-101M
C30	Capacitor, ceramic, 4.7 pF ±0.25 pF, 100V, Erie 8101-100-COG-479C
C31	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8121-100-COG-910J
C32	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C33	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C34	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C35	Capacitor, ceramic, 43 pF ±5%, 100V, Erie 8121-100-COG-430J
C36	Capacitor, ceramic, 43 pF ±5%, 100V, Erie 8121-100-COG-430J
C37	Capacitor, ceramic, 47 pF ±20%, 100V, Erie 8101-100-X5R-470M
C38	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C39	Capacitor, ceramic, 1.5 pF ±0.1 pF, 100V, Erie 8101-100-COG-159B
C40 thru C42	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C43	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C44	Capacitor, ceramic, 47 pF ±20%, 100V, Erie 8101-100-X5R-470M
C45	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C46	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C47	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8121-100-COG-100J
C48	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C49	Capacitor, ceramic, 0.75 pF ±5%, Quality Component M.C. 0.75
C50 thru C52	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C53	Capacitor, variable, 0.8 - 8.5 pF, LRC 682237
C54	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C55	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W5T-102P
C56	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-001-W6T-102P

Replaceable Parts List - A3, RF Chassis, cont'd.

Reference Designation	Description
C57	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C58	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C59 thru C61	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-100-W5T-102P
C62	Capacitor, ceramic, 2 pF ±0.1 pF, 100V, Erie 8101-100-COG-209J
C63	Capacitor, feedthru, 0.001 μF, 1000V, Erie 2482-100-W5T-102P
C64	Capacitor, cdramic, 100 pF ±20%, 100V, Erie 8101-100-X5R-101M
CR1 thru CR4	Diode, Microdyne 301-476-1
CR5	Diode, Microdyne 301-476-2
CR6	Diode, Microdyne 301-476-1
CR7	Diode, Microdyne 301-476-1
CR8	Diode, Microdyne 301-476-2
CR9 thru CR14	Diode, Microdyne 301-476-1
E1	Termination, standoff, teflon, Sealectro ST-SM-1
E2	Termination, feedthru, teflon, Sealectro FT-SM-1
E3	Termination, standoff, teflon, Sealectro ST-SM-1
E4	Termination, feedthru, teflon, Sealectro FT-SM-1
E5	Termination, standoff, teflon, Sealectro ST-SM-1
E6	Termination, standoff, teflon, Sealectro ST-SM-1
E7	Termination, feedthru, teflon, Sealectro FT-SM-1
E8 thru E10	Termination, standoff, teflon, Sealectro ST-SM-1
E11	Termination, feedthru, teflon, Sealectro FT-SM-1
E12	Termination, standoff, teflon, Sealectro ST-SM-1
E13	Termination, standoff, teflon, Sealectro ST-SM-1
E14	Termination, feedthru, teflon, Sealectro FT-SM-1
E15 thru E17	Termination, standoff, teflon, Sealectro ST-SM-1
J1 thru J3	Connector, UG1619/U
J4	Not Assigned

Replaceable Parts List - A3, RF Chassis, cont'd.

Reference Designation	Description
J5	Connector, UG1619/U
J6	Connector, UG1619/U
L1	Inductor, variable, Microdyne 201-298
L2	Inductor, variable, Microdyne 201-298
L3	Inductor, fixed, 0.22 μH, Jeffers 4416-5K
L4	Inductor, fixed, 0.15 μH, Jeffers 4415-1M
L5	Inductor, variable, Microdyne 201-299
L6	Inductor, variable, Microdyne 201-298
L7	Inductor, variable, 0.9 μH, Cambion 1507-5
L8	Inductor, variable, 0.9 μH, Cambion 1507-5
L9	Inductor, fixed, Microdyne 200-720
L10	Inductor, variable, Microdyne 201-301
L11	Inductor, variable, Microdyne 201-301
L12	Inductor, fixed, 0.15 μH, Jeffers 4415-1M
L13	Inductor, variable, Microdyne 201-300
L14	Inductor, variable, Microdyne 201-300
L15	Inductor, fixed, 0.47 μH, Jeffers 4425-2M
L16	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L17	Inductor, fixed, 5.6 μH, Jeffers 4435-1K
L18	Not Assigned
L19	Inductor, fixed, Microdyne 201-302
Q1	Transistor, RCA 2N6389
Q2	Transistor, Union Carbide 2N4416
Q3	Transistor, Union Carbide 2N4416
Q4 thru Q9	Transistor, RCA 2N5179
R1	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R2	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R3	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R4	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R5	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R6	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125
R7	Resistor, fixed composition, 2.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2725
R8	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 750Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB7515
R11	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R12	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005

Replaceable Parts List - A3, RF Chassis, cont'd.

Reference Designation	Description
R13	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R14	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R15	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R16	Resistor, fixed composition, 200KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R17	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R18	Potentiometer, 10K ±10%, 1/2w, Allen Bradley WA2L040S103UC
R19	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R20	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R21	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R22	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R23	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R24	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R25	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R26	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R27	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R28	Resistor, fixed composition, 1.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1325
R29	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R30	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R31	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R32	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R33	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725, nominal value
R34	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125
R35	Resistor, fixed composition, 1.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1225
R36	Potentiometer, 10K ±10%, 1/2w, Allen Bradley WA2L040S103UC
R37	Resistor, fixed composition, 680Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6815
R38	Resistor, fixed composition, 20Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2005, nominal value
R39	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R40	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R41	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R42	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R43	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R44	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R45	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R46	Resistor, fixed composition, 16KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1635
R47	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R48	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R49	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R50	Resistor, fixed composition, 620Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6215
R51	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R52	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R53	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115

Replaceable Parts List - A3, RF Chassis, cont'd.

Reference Designation	Description
R54	Resistor, fixed composition, 750Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB7515
R55	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R56	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R57	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R58	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R59	Resistor, fixed composition, 750Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB7515
R60	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R61	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R62	Resistor, fixed composition, 220Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2215
R63	Resistor, fixed composition, 24Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2405
R64	Resistor, fixed composition, 220Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2215
R65	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
XQ1 thru XQ9	Transistor, socket, Augat 8060-1G8
Z1	Ferrite Bead, Fair Rite 2673000101
Z2	Ferrite Bead, Fair Rite 2673000101

6-6 A4, SYNTHESIZER

Reference Designation	Description
A1	Synthesizer, Microdyne 302-627-1; nonrepairable
A2	Keyboard Assembly, Microdyne 302-628; nonrepairable
A3	Display Card Assembly, Microdyne 302-629; see paragraph 6-6.1 for breakdown listing
A4	Digital Interface Module, Microdyne 302-626; see paragraph 6-6.2 for breakdown listing

6-6.1 A4A3, DISPLAY CARD ASSEMBLY

Reference Designation	Description
J3	Connector, 16-pin, Augat 516AG11D
J4	Connector, 16-pin, Augat 516AG11D
R1 thru R5	Resistor, fixed composition, 15K ±5%, RC07GF153J

Replaceable Parts List - A4A3, Display Card Assembly, cont'd.

Reference Designation	Description
R6 thru R13	Not Assigned
R14	Resistor, fixed composition, 15K ±5%, RC07GF153J
U1 thru U5	Decoder Driver, Beckman DD-700
U6	Display, 3-digit, Beckman SP3300
U7	Display, 3-digit, Beckman SP3300
XU1 thru XU5	Socket, 16-pin, Augat 516AG11D
XU6	Socket, Beckman CS3300
XU7	Socket, Beckman CS3300

6-6.2 A4A4, DIGITAL INTERFACE MODULE

Reference Designation	Description
C1	Not Assigned
C2	Not Assigned
C3	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C4	Capacitor, tantalum, 10 μF ±20%, Sprague T368A105K020AS
C5	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C6	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C7	Capacitor, tantalum, 2.2 μF ±20%, Sprague T368A22K035AS
C8	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C9	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V-103M
C10 thru C14	Capacitor, tantalum, 1 μF ±20%, Sprague T368A105K035AS
CR1	Diode, Fairchild 1N914
Q1	Transistor, npn, Motorola 2N2222
Q2	Transistor, npn, Motorola 2N2222

Replaceable Parts List - A4A4, Digital Interface Module, cont'd.

Reference Designation	Description
R1	Not Assigned
R2	Resistor, metal film, 10KΩ ±1%, 1/8w, RN55D1002F
R3	Resistor, metal film, 10KΩ ±1%, 1/8w, RN55D1002F
R4	Resistor, metal film, 6.8K ±1%, 1/8w, RN55D6811F
R5	Potentiometer, 10K ±10%, 1/2w, Beckman 66WR10K
R6	Factory Selectable
R7	Factory Selectable
R8	Potentiometer, 10K ±10%, 1/2w, Beckman 66WR10K
R9	Factory Selectable
R10	Factory Selectable
R11	Resistor, fixed composition, 1K ±5%, RC07GF102J
R12 thru R14	Not Assigned
R15	Resistor, fixed composition, 15K ±5%, RC07GF153J
R16	Resistor, fixed composition, 10K ±5%, RC07103J
R17	Not Assigned
R18	Resistor, fixed composition, 1K ±5%, RC07GF102J
U1	Integrated Circuit, Keyboard Encoder, Harris Semiconductor HD-0165
U2	Integrated Circuit, Digital-to-Analog Converter, Micronetworks Corp. MN3212
U3	Integrated Circuit, Dual 4-NAND gates, Texas Instruments SN7420N
U4	Integrated Circuit, Decade Counter, Texas Instrument SN74192N
U5	Not Assigned
U6	Integrated Circuit, Dual Flip-Flop, Texas Instrument SN74107N
U7	Integrated Circuit, Quad NAND gates, Texas Instrument SN7400N
U8	Integrated Circuit, Quad NAND gates, Texas Instrument SN7400N
U9	Integrated Circuit, Monostable one-shot, Fairchild F9602PC
U10	Integrated Circuit, Decoder, Texas Instrument SN7442N
U11	Integrated Circuit, Decoder, Texas Instrument SN7442N
U12	Integrated Circuit, BCD adder, Signetics N82S83B
U13	Integrated Circuit, BCD adder, Signetics N82S83B
U14	Integrated Circuit, Operational Amplifier, National Semiconductor 741C
U15	Integrated Circuit, Operational Amplifier, National Semiconductor 741C
U16 thru U19	Integrated Circuit, Four-bit Storage Registers, Texas Instrument SN7419N
U20	Not Assigned
U21	Not Assigned
U22	Integrated Circuit, Multiplexer, Texas Instrument SN74157N
U23	Integrated Circuit, Multiplexer, Texas Instrument SN74157N
U24	Integrated Circuit, DC to DC Converter, Endicott Coil E715-215U

Replaceable Parts List - A4A4, Digital Interface Module, cont'd.

Reference Designation	Description
XU1	Socket, 24-pin, Augat 524AG11D
XU2	Socket, 16-pin, Augat 516AG11D
XU3	Socket, 14-pin, Augat 514AG11D
XU4	Socket, 16-pin, Augat 516AG11D
XU5	Not Assigned
XU6 thru XU8	Socket, 14-pin, Augat 514AG11D
XU9 thru XU13	Socket, 16-pin, Augat 516AG11D
XU14	Socket, 8-pin, Augat 508AG11D
XU15	Socket, 8-pin, Augat 508AG11D
XU16 thru XU19	Socket, 14-pin, Augat 514AG11D
XU20	Not Assigned
XU21	Not Assigned
XU22	Socket, 16-pin, Augat 516AG11D
XU23	Socket, 16-pin, Augat 516AG11D

SECTION VII
MAINTENANCE DIAGRAMS

7-1 INTRODUCTION

This section of the manual contains the schematic-wiring diagrams for the 1112-VT(SYN) Synthesized RF Tuner. Unless otherwise specified, the following information applies to each schematic diagram:

a. Capacitor values greater than 1.0 are in picofarads.

b. Capacitor values less than 1.0 are in microfarads.

c. Inductor values are in microhenrys.

d. Resistor values are in ohms: k = x 1000; m = 1,000,000.

e. * denotes selected value.

f.  ferrite bead.

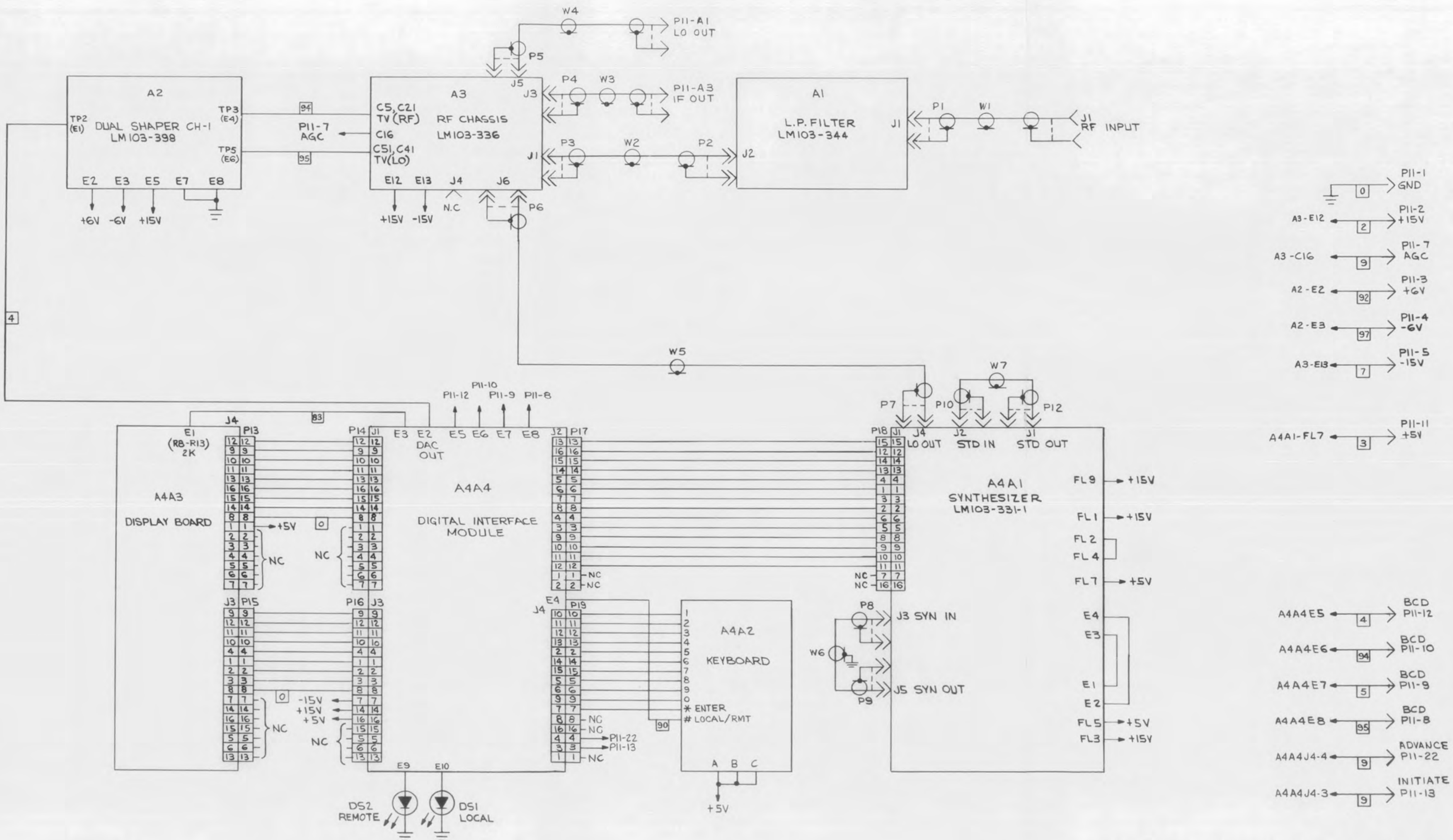


Figure 7-1. Main Chassis Wiring Diagram

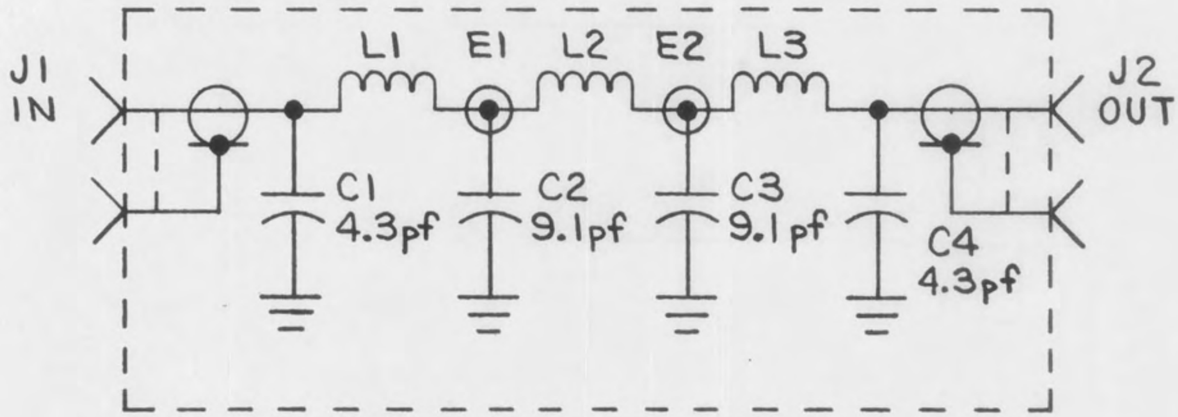


Figure 7-2. A1, Lowpass Filter, Schematic Diagram

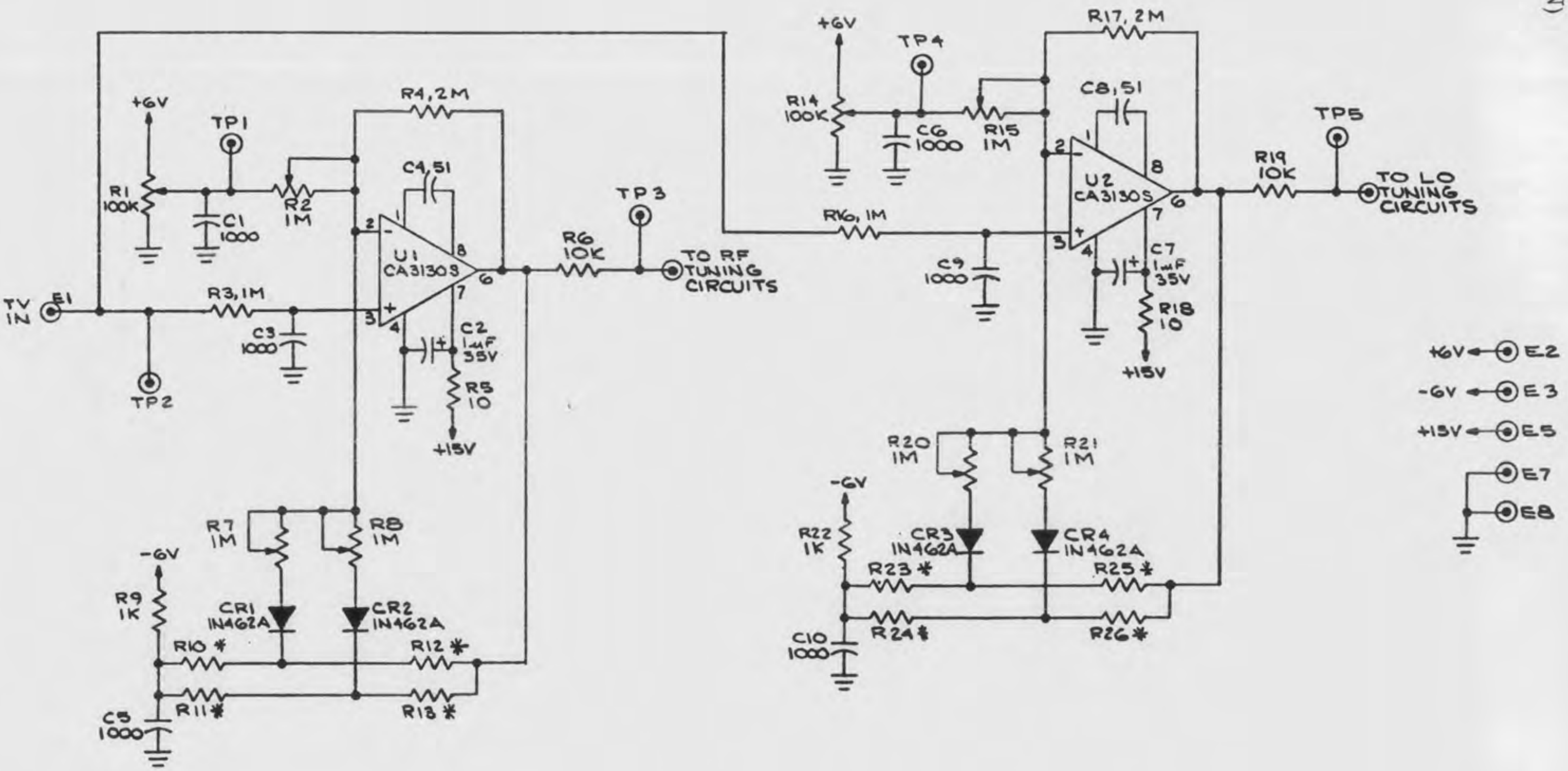
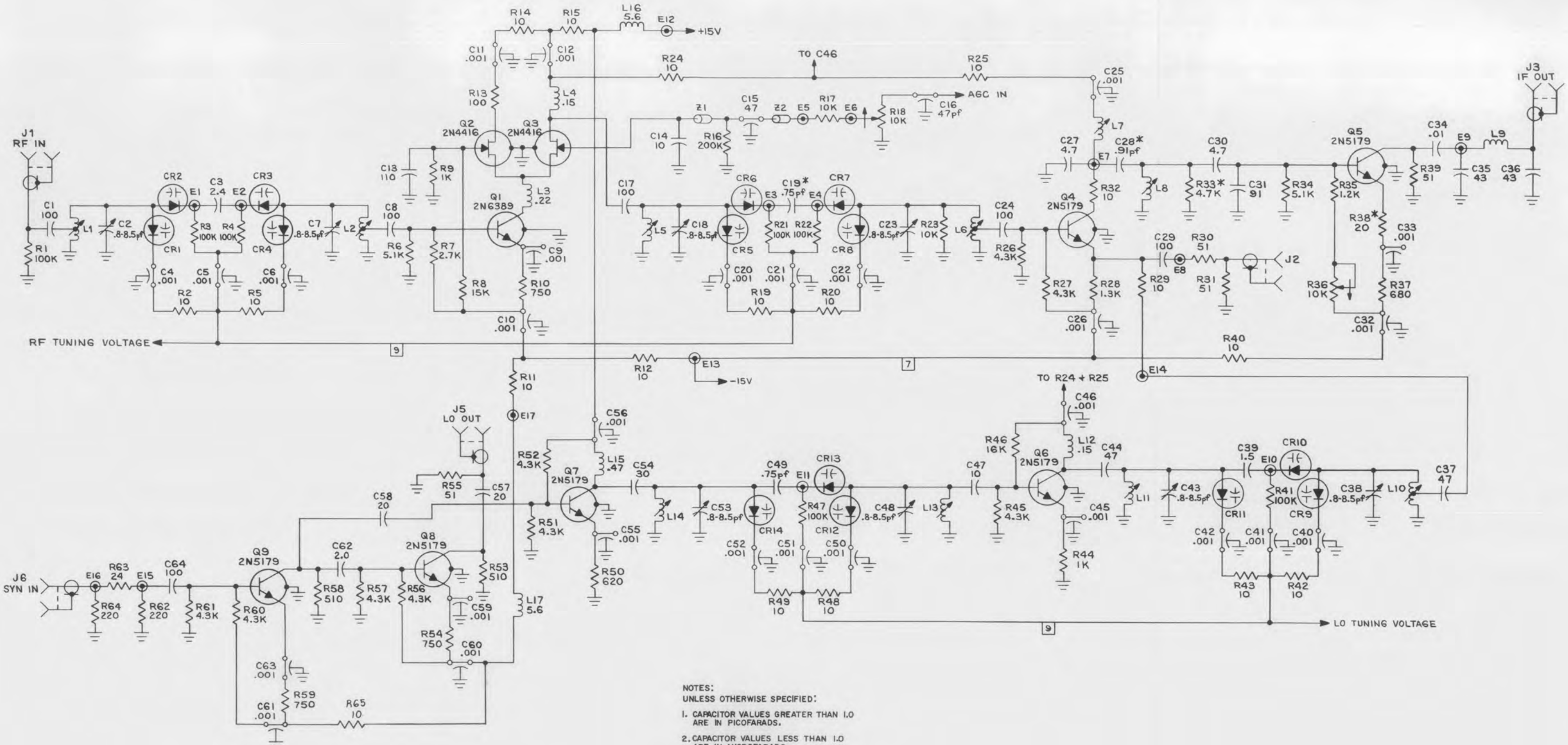


Figure 7-3. A3, Dual Shaper Board,
Schematic Diagram

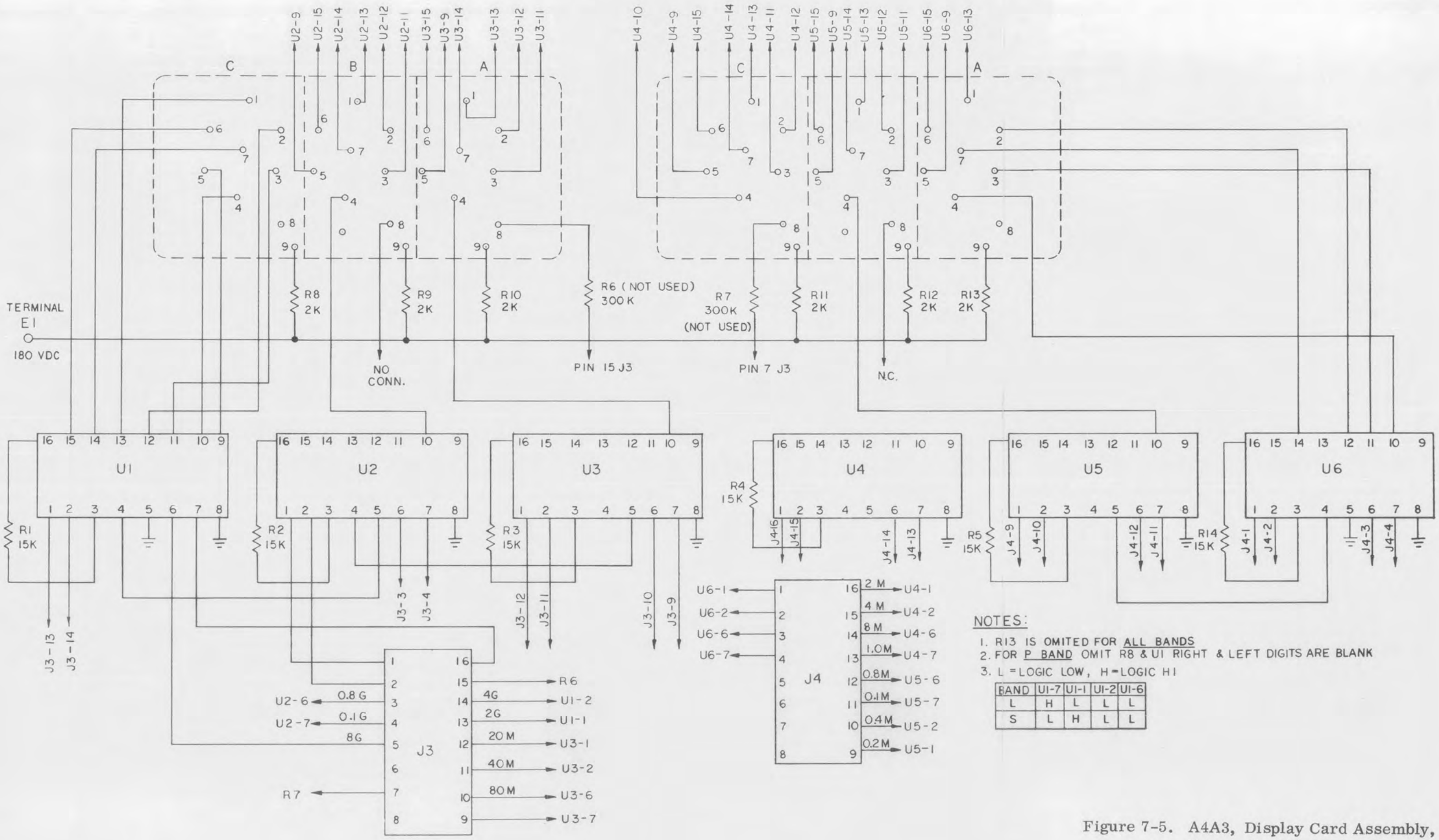


NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. * DENOTES SELECTED VALUE.
6. —⊂⊃— FERRITE BEAD.

HIGHEST REFERENCE DESIGNATION USED			
REFERENCE DESIG. NOT USED			

Figure 7-4. A2, RF Chassis, Schematic Diagram



NOTES:

1. R13 IS OMITED FOR ALL BANDS
2. FOR P BAND OMIT R8 & U1 RIGHT & LEFT DIGITS ARE BLANK
3. L = LOGIC LOW, H = LOGIC HI

BAND	U1-7	U1-1	U1-2	U1-6
L	H	L	L	L
S	L	H	L	L

Figure 7-5. A4A3, Display Card Assembly, Schematic Diagram

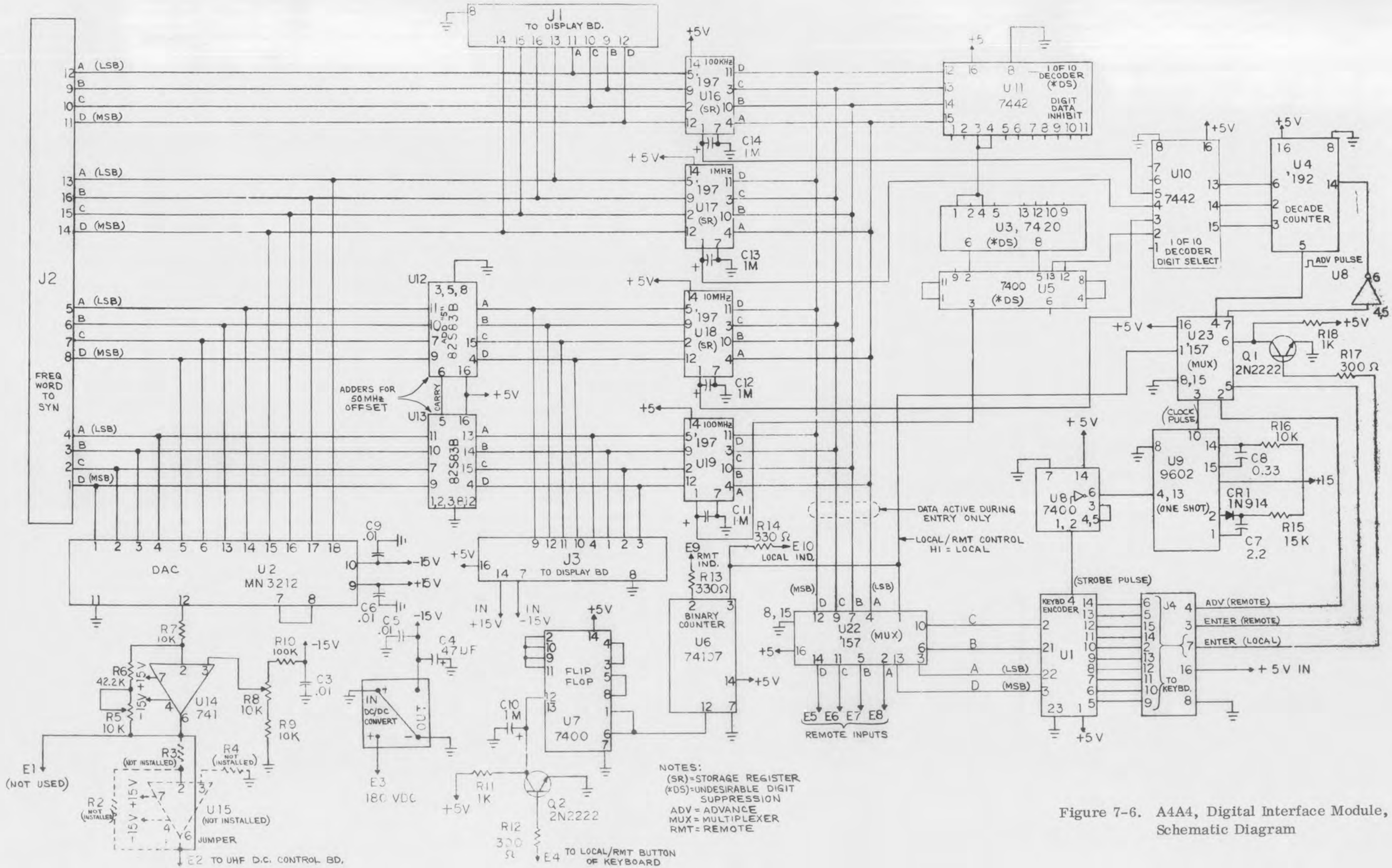


Figure 7-6. A4A4, Digital Interface Module, Schematic Diagram