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1. INTRODUCTION

IF/Audio Assembly A5 (10073-5400) consists of the following two PWBs:

- IF/Audio Motherboard A5A1 (10073-5410)
- AGC Board A5A2 (10073-5450)

2. A5A1 MOTHERBOARD ASSEMBLY – GENERAL DESCRIPTION

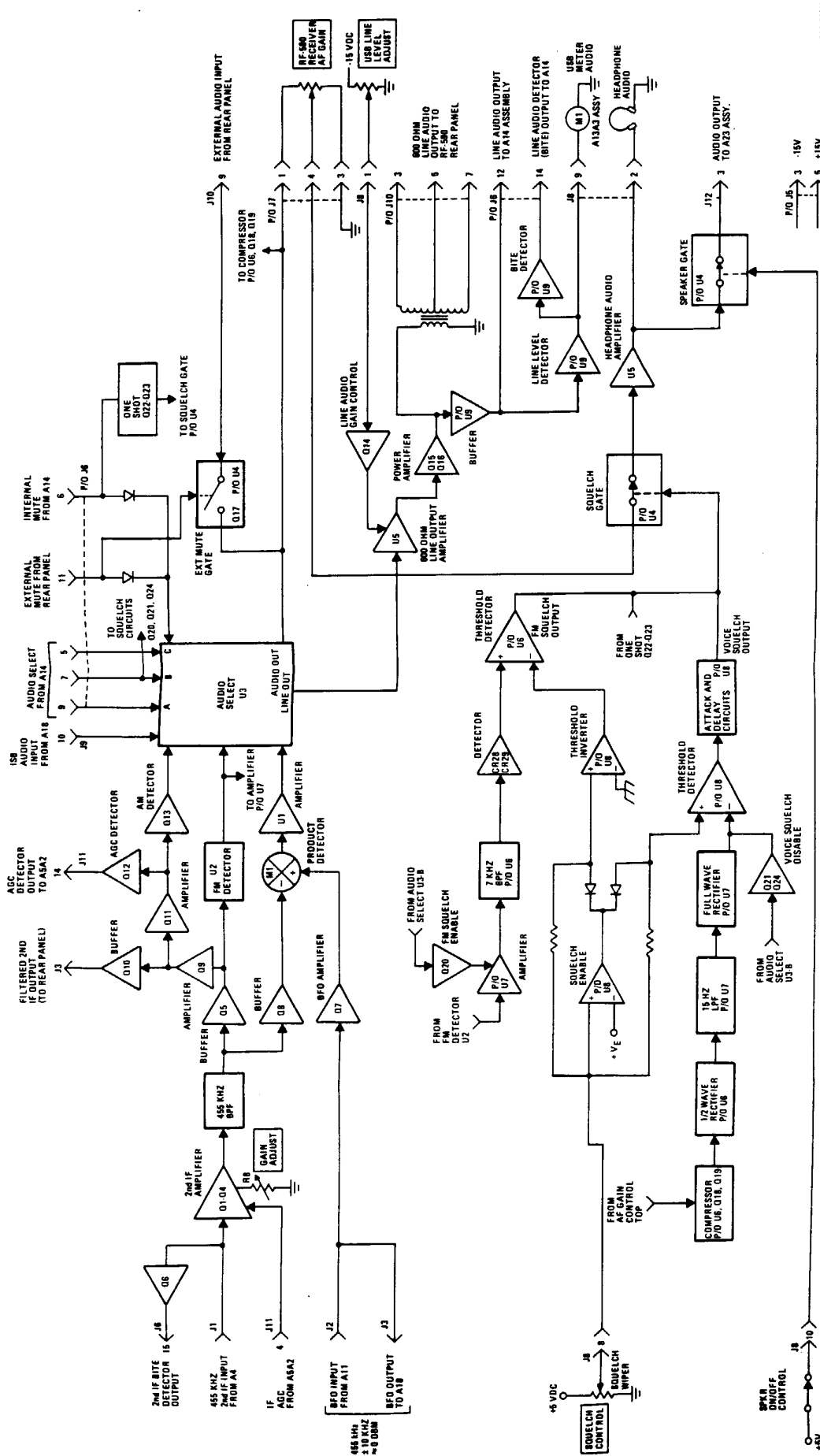
The A5A1 assembly provides most of the receiver gain utilizing a cascaded 455 kHz, second IF AGC controlled amplifier chain. The total gain range of this stage is 80 dB. This stage works in conjunction with amplifiers on the A2, A3, and A4 assemblies to provide a nominal -7 dBm output over an RF input level range of -120 to +10 dBm. Additionally, the assembly contains circuits for the following functions.

- a. Signal demodulation selection:
 - AM
 - FM
 - Product detection (for CW, USB, and LSB)
- b. Audio amplification and control, including the following audio outputs:
 - Headphone (+10 dBm/600 ohms)
 - Line (-16 dBm to +10 dBm, 600 ohms)
- c. Squelch control:
 - Voice operated (CW, AM, SB)
 - Carrier operated (FM)
- d. Signal monitoring:
 - Line level (via RF-590 front panel metering)
 - BITE detection (line audio level and second IF input level)

Table 1 details the various input/output connections and other relevant data.

Table 1. A5A1 IF/Audio Assembly Interface Connections

Connector	Function	Characteristics
J1	IF Input	455 kHz, -97/-5 dBm, 50 ohms
J2	BFO Input	455 kHz \pm 10 kHz, 0 dBm, 50 ohms
J3	BFO Output	455 kHz \pm 10 kHz, 0 dBm, 50 ohms
J4	Filtered IF Output	455 kHz, -7 dBm (under AGC control), 50 ohms
J5-1	Spare	
J5-2	Spare	
J5-3	Power	-15 Vdc, \approx 50 mA
J5-4	Index Key	
J5-5	Power	+15 Vdc, \approx 130 mA
J5-6	RF AGC	See A5A2
J6-1	Ground	
J6-2	RF Gain	See A5A2
J6-3	Special Data	See A5A2
J6-4	AGC Off	See A5A2
J6-5	Audio Select C	See table 2
J6-6	Internal Mute	+5 Vdc = Mute
J6-7	Audio Select B	see table 2
J6-8	AGC Fast	See A5A2
J6-9	Audio Select A	see table 2
J6-10	AGC Medium	see A5A2
J6-11	External Mute	+5 Vdc = Mute
J6-12	Line Audio Out	-16/+10 dBm, 600 ohms
J6-13	Line Audio Ground	
J6-14	Line Audio Det. BITE	
J6-15	BITE IF DET	
J6-16	AGC BITE	



58-5713

IF/Audio Motherboard Assembly A5A1
Functional Block Diagram

Table 1. A5A1 IF/Audio Assembly Interface Connections (Cont.)

Connector	Function	Characteristics
J7-1	Volume Potentiometer - Top	
J7-2	Index Key	
J7-3	Volume Potentiometer - Ground	
J7-4	Volume Potentiometer - Wiper	
J8-1	USB Line Level Adj.	0 to -15 Vdc
J8-2	Headphones Audio	+10 dBm/600 ohms, maximum
J8-3	USB Meter - RF	See A5A2
J8-4	Spare	
J8-5	Spare	
J8-6	Spare	
J8-7	Index Key	
J8-8	Squelch Wiper	0 to +5 Vdc
J8-9	USB Meter Audio	
J8-10	Speaker on/off	+5 Vdc = speaker on
J9-1	Special Data	See A5A2
J9-2	Power, +15 V	See A5A2
J9-3	Power, -15 V	See A5A2
J9-4	Index Key	
J9-5	RF Gain	See A5A2
J9-6	AGC Off	See A5A2
J9-7	AGC Fast	See A5A2
J9-8	AGC Med	See A5A2
J9-9	ISB AGC	See A5A2
J9-10	ISB Audio In	See A5A2

Table 1. A5A1 IF/Audio Assembly Interface Connections (Cont.)

Connector	Function	Characteristics
J10-1	AGC Out	See A5A2
J10-2	Comb. AGC Out	See A5A2
J10-3	600 ohm Line Audio	-16/+10 dBm
J10-4	AGC In	See A5A2
J10-5	600 ohm Line Audio	Center Tap
J10-6	AGC Dump	See A5A2
J10-7	600 ohm Line Audio	-16/+10 dBm
J10-8	Ground	
J10-9	External Audio In	Typically 50 mVrms
J10-10	Spare	
J11-1	ISB AGC	See A5A2
J11-2	AGC Med	See A5A2
J11-3	AGC BITE	See A5A2
J11-4	IF AGC In	0 to -3 Vdc
J11-5	Spare	
J11-6	AGC Fast	See A5A2
J11-7	Special Data	See A5A2
J11-8	AGC Off	See A5A2
J11-9	Spare	
J11-10	Spare	
J11-11	Power, +15 V	
J11-12	RF Gain	
J11-13	USB Meter RF	See A5A2
J11-14	AGC Det. Out	Typically -1 Vdc

Table 1. A5A1 IF/Audio Assembly Interface Connections (Cont.)

Connector	Function	Characteristics
J11-15	RF AGC	See A5A2
J11-16	AGC Dump	See A5A2
J11-17	Spare	
J11-18	AGC In	See A5A2
J11-19	AGC Out	See A5A2
J11-20	Comb AGC	See A5A2
J12-1	Index Key	
J12-2	Audio Ground	
J12-3	Audio Output	

3. A5A1 CIRCUIT DESCRIPTIONS

3.1 455 kHz Second IF Amplifier Chain

Low level signals at 455 kHz from IF Filter Assembly A4 enter the A5A1 assembly at coax connector J1. At this point, it goes to both the input of the IF amplifier and the input BITE detector. The BITE detector consists of Q6 and its associated components. Q6 is an amplifier with 26 dB of gain that feeds a diode detector consisting of CR4, CR5, R32, and C27. CR6 is a 4.7 volt Zener diode that protects the BITE circuitry against overvoltage. This detector serves to check the output of the IF Filter board and the input to the IF/AF board.

Q1 is a grounded gate FET amplifier that is the input stage to the IF strip amplifier, and has approximately 20 dB of gain. Q2, Q3, and Q4 are common emitter amplifiers with an overall gain of 46 dB \pm 6 dB. This 12 dB gain adjustment is available at R8, and allows the user to trim the overall gain of the IF strip to its desired value.

Receiver Automatic Gain Control (AGC) of the IF strip is accomplished through the use of PIN diodes CR1, CR2, and CR3. A negative voltage applied to the IF AGC IN line, J11-4, forward biases the PIN diodes and decreases the gain of the IF strip by decreasing the load impedance of each stage. Normal receiver operation requires 80 dB of available gain reduction in the strip, which is accomplished with approximately -3.0 volts on the IF AGC line.

L3, L4, C17, C18, and C19 form a bandpass filter which is adjusted during alignment to be centered at 455 kHz. This filter has approximately 9 dB of insertion loss for an overall gain to TP1 of 56 dB. The output of this filter drives Q5, (an emitter follower that buffers the rest of the IF strip) and Q8 (a dual gate MOSFET that is the input to the product detector).

Q5 serves as a buffer to provide inputs to U12 (FM demodulator) and Q9 (IF output gain stage). Q9 is a common emitter amplifier that has 30 dB of gain to provide the high level IF output, and drive amplifier Q11. Q10 is an emitter follower that buffers the high level IF output, nominally -7 dBm. Resistor R60 serves to set the IF output impedance at 50 ohms to J4. This output is then routed to rear panel connector J4 and is referred to as the filtered IF output. Overall IF strip gain to the IF output is nominally 80 dB. Q11 is a common emitter amplifier with 11 dB of gain that drives Q12 (the AGC detector) and Q13 (AM detector).

3.2 Demodulator Circuits

The A5A1 assembly contains four detector circuits whose inputs are derived from the 455 kHz IF chain. The AM, FM, and product detectors all feed audio select circuit U3. The AGC detector output is routed to AGC Assembly A5A2, where it is used as part of the feedback loop that controls the gain characteristics of the receiver.

3.2.1 AM and AGC Detectors

Q12 and Q13 serve as the AGC detector and AM detector, respectively. Both of these detectors are temperature compensated and provide envelope detection to their respective outputs. The output of the AM detector is ac coupled and attenuated by R85, C65, and R86. The AGC detector output is dc coupled and goes to the A5A2 AGC PWB by way of J11-14.

3.2.2 Product Detector

Sideband signals are demodulated using a mixer as a product detector. The 455 kHz input to the mixer RF port is buffered through dual gate MOSFET Q8. LO input is 455 kHz, ± 10 kHz, 0 dBm, and is supplied by BFO Assembly A11 at J2. Q7 provides 10 dB of gain to 50 ohm matching network R39, R40, R41, which in turn provides 7 dBm of LO drive to M1. LO leakage back into the IF chain is prevented by the 40 dB LO to RF isolation of M1 as well as the high reverse isolation of buffer Q8. Sideband inversion occurs in the mixing process. This produces an audio signal whose bandwidth is determined by the particular A4 filter selected, but may be translated in frequency by ± 10 kHz. Typical audio output level of 2.5 mVrms at the M1 IF port is boosted to approximately 150 mV4ms by amplifier U1.

3.2.3 FM Detector

FM demodulation is accomplished by quadrature detector U2. IF input from Q5 is fed to pin 4, and maximum recovered audio occurs at pin 1 when tuned circuit L7-C55 is peaked for resonance at 455 kHz, the second IF center frequency.

3.3 Audio Selection

U3 is a CMOS analog switch that provides audio selection and muting functions. The IC is configured as three SPDT switches. In the receiver, these switches are connected in series to allow selection between the three demodulator outputs along with the audio output of the ISB board. Actual signal selection is con-

trolled by the receiver microprocessor on Control Board Assembly A14. Table 2 lists the control logic required at the audio select inputs (pins 9, 10, and 11) which allow the desired demodulator output to pass to the audio select outputs (pins 5, 15, and 4).

Table 2. Audio Select Data

Function Selected	Input Lines		
	A	B	C
AM	0	0	0
ISB	1	0	1
FM	0	1	0
SB (Product Detector)	1	0	0

+5 Vdc = 1
0 Vdc = 0

There is also an inhibit input that allows complete muting of the inputs. This function is controlled by the internal mute and external mute lines at U3, pin 6. A logic 1 causes muting. The CD4053 IC has a limited supply voltage range. To provide true bipolar signal operation, it was provided with regulated ± 5 volt supplies (VR1, VR2). This also makes the logic levels compatible with the TTL control logic from the receiver control processor.

3.4 Audio Output Circuitry

There are two different audio paths in the receiver, both derived from different switched outputs of audio select U3. U3 pins, 5 and 15, provide audio for the 600 ohm line audio output, while U3, pin 4, provides audio for the speaker and headphone outputs.

3.4.1 600 Ohm Line Audio

The 600 ohm line audio output at J10 (pins 3, 5, and 7) is driving long lines. This output is the secondary of transformer T2 and along with the center tap it is available at both the rear panel terminal strip TB1 and D connector J7.

The input to the 600 ohm line out amplifier is from the audio selection IC, U3 (pins 5 and 15). Any of the three demodulators (AM, FM, and Product Detector) is capable of being output. The gain of the output amplifier is adjusted by a 20 turn trim potentiometer at the front panel meter. The output level in dBm 600 ohms may be read from the meter to ease adjustment.

The output amplifier is a FET input, low noise, wideband op amp (U5A) with a complementary current buffer Q15 and Q16. Gain control is accomplished by varying the gate bias on FET Q14. Q14 is configured as a voltage variable resistor and acts as the shunt leg in the amplifier feedback network. Total gain control range is 30 dB from -20 dBm to +10 dBm. The two endpoints can be set independently. The minimum gain is controlled by resistor R90 which is in parallel with Q14. The maximum gain is set by the minimum on resistance of Q14.

The current buffer output stage of this amplifier is formed by Q15 and Q16, a class AB complementary amplifier. The 600 ohm output impedance is set by resistor R96 whose 180 ohm value is transformed to 600 ohms by the 1.82:1 ratio of T2.

The line level is monitored at the top of R96, and a buffered single ended line output to the processor is available at J6-12. The output of this buffer (U9A) also drives the precision half-wave detector (U9C) that provides the USB AF meter and line audio detector BITE outputs. This circuit is a precision wideband, temperature compensated detector that provides meter drive through R101. The value of R101 is chosen so that the meter reads calibrated line output level in dBm 600 ohms. R169 provides a discharge path for C68 when the meter is not in circuit. There is also a buffered version of the peak detector output available for the line audio detector BITE line to the processor. A 4.7 volt Zener diode (CR17) provides overvoltage protection for the BITE circuitry.

3.4.2 Speaker and Headphone Audio

The second audio signal path in the receiver involves the local audio. It consists of the front panel, external speaker, and the headphones. The local audio output of audio select IC, U3 (pin 4) provides the signal input for the top of the volume potentiometer and the squelch circuitry. This point is also where the external audio is injected during an external mute. An external mute signal at U3, pin 6, inhibits the audio select chip and closes an analog switch that is connected to the external audio input.

The signal connection to the front panel volume potentiometer is through a shielded cable to protect the low level signal from external interference. The wiper of the volume potentiometer is returned to the A5A1 assembly through this same cable and is routed to an analog switch (U4B) that functions as a squelch gate. This gate is paralleled with resistor R107 that sets the depth of squelch by forming an attenuator with R110. Depth of squelch is 25 dB.

The output of the squelch gate is fed into the input of U5B, a low noise, wideband op amp that serves as the headphone amplifier. This stage has 50 dB of gain and is ac coupled into the headphone output. A series resistor R113 sets the 600 ohm output impedance. The output of this amplifier is also attenuated through R111 and R112 and fed into an analog gate (U4C) that provides a speaker on/off function. The output of this gate is then routed through J12, pin 3, to the speaker audio amplifier located on Audio Assembly A23.

3.5 Squelch Circuitry

The receiver has two separate mutually exclusive squelch circuits. The first is a noise squelch that operates only when the FM mode is chosen. The other type is a syllabic rate voice squelch which operates in all

other modes of operation. Both types use the variable squelch signal provided by the front panel Squelch control to establish a squelch threshold. Both control the squelch gate analog switch, (U4B), which mutes audio to headphone audio and speaker audio amplifier circuits. Note that the 600 ohm line audio is not squelch controlled, and that squelch action may also be accomplished at the squelch gate by signals provided automatically during receiver self-test (BITE).

3.5.1 Squelch Enabling

Two enabling schemes are used to allow the squelch circuits to function. The first selectively activates either the FM noise squelch or the voice squelch, but not both. The second allows the actual variable threshold signal from the front panel Squelch control to reach the squelch circuits.

3.5.1.1 Squelch Selection

The logic signal from the B input of audio select circuit U3 is a logic 1 (5 volts) only when the FM mode is chosen. This signal may be used to selectively activate FM squelch/deactivate voice squelch, or vice versa.

FM squelch selection occurs when U3, pin 10, is a logic 1. This turns Q20 on, providing a low impedance to ground for R144. This allows the audio at U7, pin 12 (derived from FM detector U2) to pass through amplifier U7 and be processed by the rest of the FM squelch circuitry. Simultaneously, the same logic signal from U3 turns Q21 and then Q24 on. This shorts out the voice squelch signal (derived from audio supplied by the other detectors) at U8, pin 6. This action disables the voice squelch.

Voice squelch selection occurs when U3, pin 10, is a logic 0. Q21 and Q24 turn off, and the voice squelch derived signal at U8, pin 6, is no longer shorted out. Simultaneously, Q20 turns off removing the ground return at R144, and FM squelch derived signals are prevented from passing through U7.

3.5.1.2 Squelch Threshold Enabling

A variable dc voltage provided by the front panel Squelch control wiper arm functions as the squelch threshold signal to both squelch circuits. This level must first exceed the potential V_e at U8 (pin 2, 27 mV) before it is applied to the squelch circuits. This action is the electronic equivalent of a hardwired mechanical switch that would provide a squelch off function. This causes no squelching action to occur for the first few degrees of the squelch control rotation.

Once V_e is exceeded, U8, pin 1, switches from -15 Vdc to +15 Vdc, reverse biases CR31 and CR34, and allows the squelch control wiper voltage to feed through R153 (to the FM squelch circuits) and R156 (to the voice squelch circuits). When the threshold is below V_e , U8 (pin 1) is at -15 Vdc. This forward biases the diodes and shorts out the squelch threshold inputs to the two squelch circuits. Note that despite this threshold value being applied to both squelch circuits simultaneously, only the squelch circuit enabled at the time will process it to cause squelch gating.

3.5.2 Voice Squelch Operation

The voice squelch in the receiver operates on the principle that the human voice has characteristic modulation in the 5 Hz to 15 Hz range.

The local audio is tapped off at the top of the volume potentiometer and run into a compressor comprising U6A, Q18, and Q19. The action of the compressor enables the squelch to operate on low level signals below the AGC threshold of the receiver. It also cancels any difference there may be in the level of recovered audio between the various detectors in the signal path.

The output of the compressor is fed into a precision temperature compensated, half-wave detector, U6B. This detector contains a limiting circuit that reduces its slew rate, and correspondingly reduces its ability to reproduce transient peaks greater than the nominal level of the highest frequency of interest. The output of this detector is run into a 15 Hz low pass filter (U7B) to separate out the syllabic rate component of the signal envelope. The output of the low pass filter is ac coupled to provide some highpass characteristic and reject frequencies below 5 Hz. The ac coupled low pass output is then fed into a precision temperature compensated, full-wave rectifier/integrator (U7C). The output of this detector is integrated to provide a desirable transient response, and offer additional rejection of higher frequency information. This integrated output is then compared against the variable threshold from the squelch control at U8C, pins 5 and 6. The output of this comparator charges and discharges an RC network that controls the squelch open and close timing.

The time constants chosen (determined by R140, R141, and C82) will cause U8, pin 14, to switch within 50m seconds of detected voice. This applies +15 Vdc at squelch gate U4, pin 9, which allows audio at pin 11 to pass through the gate headphone amplifier U5B. Similarly, the time constants will allow U8, pin 14, to remain at +15 Vdc for three seconds after voice activity stops. This allows the squelch gate to stay open, and allows normal interruptions of the human speech pattern to occur without annoying squelching activity between words, sentences, etc.

3.5.3 FM Squelch Operation

When the receiver is set to FM mode the voice squelch is disabled, and the FM noise squelch enabled. The input to the FM squelch is the attenuated output of the FM detector U2. This input goes into an amplifier (U7, pin 12) that also provides the enable function (at pin 13). After being amplified, the FM audio is fed into a bandpass filter (U6C) that is centered at 7 kHz. This filter was designed to reject signal information while amplifying any accompanying noise. The noise output of this filter is then detected by CR28 and CR29 and compared against the variable threshold at U6 pins 9 and 10 to make the squelch decision. Once the detected squelch signal exceeds the squelch threshold, U6, pin 8, swings to +15 Vdc and closes the squelch gate at U4, pin 9. Audio will now pass through to succeeding audio stages.

The threshold that the detected noise level is compared against is not the same threshold that the voice squelch uses, although it is generated from the same control. The operation of the two squelches is opposite in the sense that the voice squelch operates from the increasing presence of a signal (voice), and the FM squelch operates from the decreasing presence of a signal (as the signal strength increases, the

signal to noise ratio increases and the detected noise level will decrease). Both of these thresholds must operate from the same control potentiometer with a logical increase in squelch threshold with CW rotation. This necessitates inverting the sense and offsetting the level of the FM squelch threshold voltage. It is this altered threshold that is used to open and close the squelch gate in FM squelch.

3.5.4 Miscellaneous Squelch Circuits

There is one additional circuit on the A5A1 board that is capable of squelching the audio. A discrete one shot with a duration of approximately 500 mseconds is triggered off the falling edge of the internal mute line. This serves to mute the receiver audio during the BITE sequence so that the operator does not hear the various signals that are injected into the signal path by the processor controlled BITE operation. This one shot consists of Q22 and Q23 and their associated components.

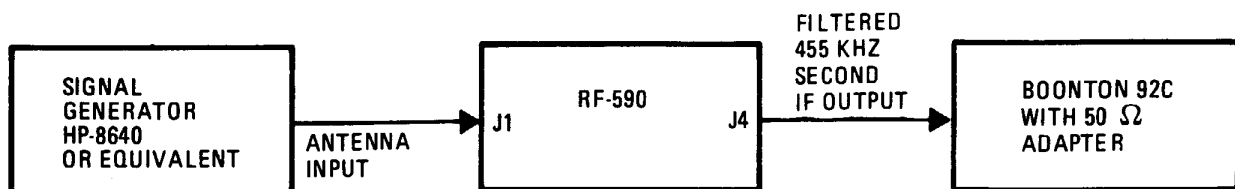
4. MAINTENANCE

The following adjustments should not be performed as routine maintenance procedures, but only when a failure indicates a definite need. All tests are performed with all assembly connections in normal contact, unless otherwise specified.

4.1 Second IF Chain Alignment

Perform the following procedure to align the second IF chain.

- a. Disconnect the ribbon cable connecting the AGC Assembly A5A2 to the IF/Audio Assembly A5A1 at A5A1J11.
- b. Connect equipment as shown in figure 1.



590-81(B)

Figure 1. Second IF Chain Alignment

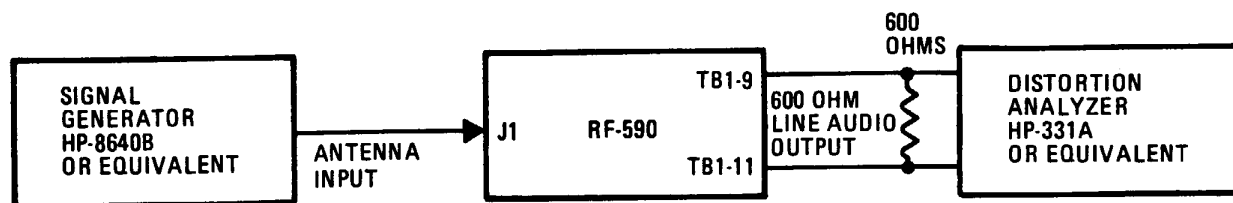
- c. Set RF-590 controls as follows:
 - Frequency to 10.000000 MHz.
 - Mode to USB
 - USB meter button to USB/RF
 - AGC to OFF
 - RF Gain to fully clockwise (cw)

- d. Set signal generator to 10.0015 MHz, -70 dBm RF output.
- e. Disconnect the coax from A4J4 on the IF/Filter Assembly A4. Connect the RF millivoltmeter, with 50 ohm adapter, to A4J4 and verify that the level is -44 dBm. (If the level at A4J4 is not -44 dBm, alignment is required ahead of IF/Audio Assembly A5.) Disconnect RF millivoltmeter and reconnect coax to A4J4.
- f. Connect RF millivoltmeter with 50 ohm adapter to RF-590 rear panel connector J4, Filtered IF output.
- g. Set signal generator RF output to 0.5 uVrms.
- h. Monitoring the Boonton 92C, adjust A5A1L3 and A5A1L4 for maximum output indication on an RF millivoltmeter. (Adjustments may be some what interactive, so repeat as necessary.)
- i. Adjust A5A1R8 for -7 dBm (100 mVrms) output indication on the RF millivoltmeter.
- j. Turn RF-590 power off. Reconnect ribbon cable to A5A1. Test is complete.

4.2 FM Detector Alignment

Perform the following procedure to align the FM detector.

- a. Connect equipment as shown in figure 2. Set signal generator to 10.000000 MHz, 10 uV, 4.7 kHz FM deviation, and 1 kHz modulation.



590-82(A)

Figure 2. FM Detector Alignment

- b. Set RF-590 controls as follows:
 - Frequency to 10.000000 MHz
 - Mode to FM
 - AGC to MEDIUM
 - RF Gain to fully clockwise (cw)
 - Meter to USB Audio
- c. Adjust L7 for maximum audio output at TB1. (More than one setting may produce a peaked response choose the setting which gives the most response.)

The audio output level should be 0 dBm, ± 4 dB. (This assumes that the USB audio control located to the left of the meter had been previously set to 0 dBm for USB operation).

- d. Activate receiver BITE self-test. Receiver must pass all tests associated with the A5A1 assembly. Test is complete.

5. PARTS LIST

Table 3 is a comprehensive parts list of all replaceable components in IF/Audio Motherboard Assembly A5A1. When ordering parts from the factory, include a full description of the part. Use figure 3, IF/Audio Motherboard Assembly A5A1 Component Location Diagram to identify parts.

6. SCHEMATIC DIAGRAM

Figure 4 is the IF/Audio Motherboard A5A1 schematic diagram.

Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410)

Ref. Desig.	Part Number	Description
	10073-5410	PWB ASSEMBLY
C1	M39014/02-1310	CAP .1UF 10% 100V CER-R
C2 - C4	M39014/02-1320	CAP .47UF 10% 50V CER-R
C5	M39014/02-1310	CAP .1UF 10% 100V CER-R
C6 - C8	M39014/02-1320	CAP .47UF 10% 50V CER-R
C9	M39014/02-1310	CAP .1UF 10% 100V CER-R
C10	M39014/02-1320	CAP .47UF 10% 50V CER-R
C11	M39014/02-1320	CAP .47UF 10% 50V CER-R
C12	C26-0025-220	CAP 22UF 20% 25V TANT
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	M39014/02-1320	CAP .47UF 10% 50V CER-R
C15	M39014/02-1320	CAP .47UF 10% 50V CER-R
C16	CM04FD181J03	CAP 180PF 5% 500V MICA
C17	CM06FD112J03	CAP 1100PF 5% 500V MICA
C18	CM04ED680J03	CAP 68PF 5% 500V MICA
C19	CM06FD122J03	CAP 1200PF 5% 500V MICA
C20	M39014/02-1310	CAP .1UF 10% 100V CER-R
C21	M39014/02-1320	CAP .47UF 10% 50V CER-R
C22	M39014/02-1320	CAP .47UF 10% 50V CER-R
C23	M39014/02-1310	CAP .1UF 10% 100V CER-R
C24	M39014/02-1310	CAP .1UF 10% 100V CER-R
C25	M39014/02-1310	CAP .1UF 10% 100V CER-R
C26	M39014/02-1320	CAP .47UF 10% 50V CER-R
C27	M39014/02-1310	CAP .1UF 10% 100V CER-R
C28	M39014/02-1310	CAP .1UF 10% 100V CER-R
C29	M39014/02-1310	CAP .1UF 10% 100V CER-R
C30	M39014/02-1320	CAP .47UF 10% 50V CER-R
C31	M39014/02-1310	CAP .1UF 10% 100V CER-R
C32	M39014/02-1320	CAP .47UF 10% 50V CER-R
C33	CK05BX102M	CAP 1000PF 20% 200V CER

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Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410) (Cont.)

Ref. Desig.	Part Number	Description
C34	M39014/02-1310	CAP .1UF 10% 100V CER-R
C35	M39014/02-1320	CAP .47UF 10% 50V CER-R
C36	CK05BX102M	CAP 1000PF 20% 200V CER
C37	M39014/02-1320	CAP .47UF 10% 50V CER-R
C38	M39014/02-1320	CAP .47UF 10% 50V CER-R
C39	M39014/02-1320	CAP .47UF 10% 50V CER-R
C40	M39014/02-1310	CAP .1UF 10% 100V CER-R
C41	M39014/02-1320	CAP .47UF 10% 50V CER-R
C42	M39014/02-1310	CAP .1UF 10% 100V CER-R
C43	M39014/02-1310	CAP .1UF 10% 100V CER-R
C44	C26-0025-339	CAP 3.3UF 20% 25V TANT
C45	CK05BX472M	CAP 4700PF 20% 100V CER
C46	M39014/02-1310	CAP .1UF 10% 100V CER-R
C47	M39014/02-1320	CAP .47UF 10% 50V CER-R
C48	M39014/02-1310	CAP .1UF 10% 100V CER-R
C49	M39014/02-1310	CAP .1UF 10% 100V CER-R
C50	M39014/02-1310	CAP .1UF 10% 100V CER-R
C51	C26-0025-339	CAP 3.3UF 20% 25V TANT
C52	CK05BX102M	CAP 1000PF 20% 200V CER
C53	C26-0025-339	CAP 3.3UF 20% 25V TANT
C54	M39014/02-1310	CAP .1UF 10% 100V CER-R
C55	CM06FD362J03	CAP 3600PF 5% 500V MICA
C56	CM04ED750J03	CAP 75PF 5% 500V MICA
C57	M39014/02-1320	CAP .47UF 10% 50V CER-R
C58	C26-0025-339	CAP 3.3UF 20% 25V TANT
C59	M39014/02-1310	CAP .1UF 10% 100V CER-R
C60	M39014/02-1310	CAP .1UF 10% 100V CER-R
C61	M39014/02-1310	CAP .1UF 10% 100V CER-R
C62	M39014/02-1310	CAP .1UF 10% 100V CER-R
C63	C26-0025-339	CAP 3.3UF 20% 25V TANT
C64	M39014/01-1535	CAP .01UF 20% 100V CER
C65	C26-0025-339	CAP 3.3UF 20% 25V TANT
C66	CK05BX332M	CAP 3300PF 20% 100V CER
C67	C26-0025-339	CAP 3.3UF 20% 25V TANT
C68	C26-0025-339	CAP 3.3UF 20% 25V TANT
C69	M39014/02-1320	CAP .47UF 10% 50V CER-R
C70	M39014/02-1320	CAP .47UF 10% 50V CER-R
C71	C26-0025-339	CAP 3.3UF 20% 25V TANT
C72	C26-0035-100	CAP 10UF 20% 35V TANT
C73	C26-0025-339	CAP 3.3UF 20% 25V TANT
C74	M39014/02-1310	CAP .1UF 10% 100V CER-R
C75	M39014/02-1302	CAP .022UF 20% 100V CER
C76	M39014/02-1320	CAP .47UF 10% 50V CER-R
C77	C26-0025-339	CAP 3.3UF 20% 25V TANT
C79	M39014/02-1316	CAP .22UF 20% 50V CER

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Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410) (Cont.)

Ref. Desig.	Part Number	Description
C80	M39014/02-1316	CAP .22UF 20% 50V CER
C81	C26-0025-479	CAP 4.7UF 20% 25V TANT
C82	C26-0035-100	CAP 10UF 20% 35V TANT
C83	M39014/02-1310	CAP .1UF 10% 100V CER-R
C84	CK05BX821K	CAP 820PF 10% 200V CER
C85	CK05BX821K	CAP 820PF 10% 200V CER
C86	M39014/02-1310	CAP .1UF 10% 100V CER-R
C87	C26-0025-339	CAP 3.3UF 20% 25V TANT
C88	M39014/02-1320	CAP .47UF 10% 50V CER-R
C89	C26-0025-339	CAP 3.3UF 20% 25V TANT
C90	C26-0035-159	CAP 1.5UF 20% 35V TANT
C91	C26-0025-470	CAP 47UF 20% 25V TANT
C92	C26-0025-470	CAP 47UF 20% 25V TANT
C93	M39014/02-1310	CAP .1UF 10% 100V CER-R
C94	CK05BX221M	CAP 220PF 20% 200V CER
C95	M39014/02-1320	CAP .47UF 10% 50V CER-R
C96	M39014/02-1310	CAP .1UF 10% 100V CER-R
C97	M39014/02-1320	CAP .47UF 10% 50V CER-R
C98	M39014/02-1310	CAP .1UF 10% 100V CER-R
CR1	10073-5412	DIODE PIN
CR2	10073-5412	DIODE PIN
CR3	10073-5412	DIODE PIN
CR4	1N4454	DIODE 200mA 75V SW
CR5	1N4454	DIODE 200mA 75V SW
CR6	1N4732	DIODE 4.7V 10% 1W ZENER
CR7	1N4454	DIODE 200mA 75V SW
CR8	1N4454	DIODE 200mA 75V SW
CR9	1N4454	DIODE 200mA 75V SW
CR10	1N4454	DIODE 200mA 75V SW
CR11	1N4454	DIODE 200mA 75V SW
CR12	1N4454	DIODE 200mA 75V SW
CR13	1N4454	DIODE 200mA 75V SW
CR14	1N4454	DIODE 200mA 75V SW
CR15	1N4454	DIODE 200mA 75V SW
CR16	1N4454	DIODE 200mA 75V SW
CR17	1N4732	DIODE 4.7V 10% 1W ZENER
CR18	1N4454	DIODE 200mA 75V SW
CR19	1N4454	DIODE 200mA 75V SW
CR21	1N4454	DIODE 200mA 75V SW
CR22	1N4454	DIODE 200mA 75V SW
CR23	1N4454	DIODE 200mA 75V SW
CR24	1N4454	DIODE 200mA 75V SW
CR25	1N4454	DIODE 200mA 75V SW
CR26	1N4454	DIODE 200mA 75V SW
CR27	1N4454	DIODE 200mA 75V SW

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Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410) (Cont.)

Ref. Desig.	Part Number	Description
CR28	1N4454	DIODE 200mA 75V SW
CR29	1N4454	DIODE 200mA 75V SW
CR30	1N4454	DIODE 200mA 75V SW
CR31	1N4454	DIODE 200mA 75V SW
CR32	1N4454	DIODE 200mA 75V SW
CR33	1N4454	DIODE 200mA 75V SW
CR34	1N4454	DIODE 200mA 75V SW
J1	J-0031	CONN SMB VERT PCB F
J2	J90-0014-001	CONN SMB VERT PCB MT M
J3	J-0031	CONN SMB VERT PCB F
J4	J-0031	CONN SMB VERT PCB F
J5	J46-0022-006	HDR 6 PIN 0.100" SR LKG
J6	J46-0013-016	HDR 16 PIN 0.100" DR SHRD
J7	J46-0022-004	HDR 4 PIN 0.100" SR LKG
J8	J46-0032-010	HDR 10 PIN 0.100" SR
J9	J46-0032-010	HDR 10 PIN 0.100" SR
J10	J-0870	CONN, 10 PIN
J11	J46-0013-020	HDR 20 PIN 0.100" DR SHRD
J12	J46-0022-003	HDR 3 PIN 0.100" SR LKG
JMP1	MP-1142	CIRCUIT JUMPER
L1	MS75085-19	COIL 1000UH 10% FXD RF
L2	MS75085-19	COIL 1000UH 10% FXD RF
L3	L11-0004-037	INDUCT SH VAR 90.0-110 UH
L4	L11-0004-037	INDUCT SH VAR 90.0-110 UH
L5	MS75085-19	COIL 1000UH 10% FXD RF
L6	MS75085-11	COIL 220UH 10% FXD RF
L7	L11-0004-031	INDUCT SH VAR 29.7-36.3UH
L8	MS75085-19	COIL 1000UH 10% FXD RF
L9	MS75085-19	COIL 1000UH 10% FXD RF
L10	MS75085-19	COIL 1000UH 10% FXD RF
M1	I51-0003-001	MIXER DB 50mW 500MHZ
Q1	Q35-0001-001	XSTR JFET J310
Q2	2N2222A	XSTR SS/GP NPN TO-18
Q3	2N2222A	XSTR SS/GP NPN TO-18
Q4	2N2222A	XSTR SS/GP NPN TO-18
Q5	2N2222A	XSTR SS/GP NPN TO-18
Q6	2N2222A	XSTR SS/GP NPN TO-18
Q7	2N2222A	XSTR SS/GP NPN TO-18
Q8	Q03-0187-000	XSTR MOSFET
Q9	2N2222A	XSTR SS/GP NPN TO-18
Q10	2N2222A	XSTR SS/GP NPN TO-18
Q11	2N2222A	XSTR SS/GP NPN TO-18
Q12	2N2907A	XSTR SS/GP PNP TO-18
Q13	2N2222A	XSTR SS/GP NPN TO-18
Q14	2N4091	XSTR JFET N-CH TO-18

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**Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410)
(Cont.)**

Ref. Desig.	Part Number	Description
Q15	2N2222A	XSTR 5S/GP NPN TO-18
Q16	2N2907A	XSTR 5S/GP PNP TO-18
Q17	2N2222A	XSTR 5S/GP NPN TO-18
Q18	Q05-0002-000	XSTR JFET
Q19	2N2907A	XSTR 5S/GP PNP TO-18
Q20	2N2222A	XSTR 5S/GP NPN TO-18
Q21	2N2222A	XSTR 5S/GP NPN TO-18
Q22	2N2222A	XSTR 5S/GP NPN TO-18
Q23	2N2907A	XSTR 5S/GP PNP TO-18
Q24	2N2907A	XSTR 5S/GP PNP TO-18
R1	R65-0003-181	RES 180 5% 1/4W CAR FILM
R2	R65-0003-561	RES 560 5% 1/4W CAR FILM
R3	R65-0003-101	RES 100 5% 1/4W CAR FILM
R4	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R5	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R6	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R7	R65-0003-200	RES 20 5% 1/4W CAR FILM
R8	R40-0008-101	RES,VAR , 100
R9	R65-0003-431	RES 430 5% 1/4W CAR FILM
R10	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R11	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R12	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R13	R65-0003-221	RES 220 5% 1/4W CAR FILM
R14	R65-0003-390	RES 39 5% 1/4W CAR FILM
R15	R65-0003-431	RES 430 5% 1/4W CAR FILM
R16	R65-0003-101	RES 100 5% 1/4W CAR FILM
R17	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R18	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R19	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R20	R65-0003-561	RES 560 5% 1/4W CAR FILM
R21	R65-0003-101	RES 100 5% 1/4W CAR FILM
R22	R65-0003-361	RES 360 5% 1/4W CAR FILM
R23	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R24	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R25	R65-0003-271	RES 270 5% 1/4W CAR FILM
R26	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R27	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R28	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R29	R65-0003-561	RES 560 5% 1/4W CAR FILM
R30	R65-0003-270	RES 27 5% 1/4W CAR FILM
R31	R65-0003-431	RES 430 5% 1/4W CAR FILM
R32	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R33	R65-0003-221	RES 220 5% 1/4W CAR FILM
R34	R65-0003-431	RES 430 5% 1/4W CAR FILM
R35	R65-0003-101	RES 100 5% 1/4W CAR FILM

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**Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410)
(Cont.)**

Ref. Desig.	Part Number	Description
R36	R65-0003-242	RES 2.4K 5% 1/4W CAR FILM
R37	R65-0003-120	RES 12 5% 1/4W CAR FILM
R38	R65-0003-101	RES 100 5% 1/4W CAR FILM
R39	R65-0003-301	RES 300 5% 1/4W CAR FILM
R40	R65-0003-180	RES 18 5% 1/4W CAR FILM
R41	R65-0003-301	RES 300 5% 1/4W CAR FILM
R42	R65-0003-510	RES 51 5% 1/4W CAR FILM
R43	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R44	R65-0003-183	RES 18K 5% 1/4W CAR FILM
R45	R65-0003-201	RES 200 5% 1/4W CAR FILM
R46	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R47	R65-0003-201	RES 200 5% 1/4W CAR FILM
R48	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R49	R65-0003-221	RES 220 5% 1/4W CAR FILM
R50	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R51	R65-0003-562	RES 5.6K 5% 1/4W CAR FILM
R52	R65-0003-201	RES 200 5% 1/4W CAR FILM
R53	R65-0003-561	RES 560 5% 1/4W CAR FILM
R54	R65-0003-100	RES 10 5% 1/4W CAR FILM
R55	R65-0003-431	RES 430 5% 1/4W CAR FILM
R56	R65-0003-433	RES 43K 5% 1/4W CAR FILM
R57	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R58	R65-0003-100	RES 10 5% 1/4W CAR FILM
R59	R65-0003-331	RES 330 5% 1/4W CAR FILM
R60	R65-0003-510	RES 51 5% 1/4W CAR FILM
R70	R65-0003-271	RES 270 5% 1/4W CAR FILM
R71	R65-0003-242	RES 2.4K 5% 1/4W CAR FILM
R72	R65-0003-562	RES 5.6K 5% 1/4W CAR FILM
R73	R65-0003-751	RES 750 5% 1/4W CAR FILM
R74	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R75	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R76	R65-0003-561	RES 560 5% 1/4W CAR FILM
R77	R65-0003-161	RES 160 5% 1/4W CAR FILM
R78	R65-0003-561	RES 560 5% 1/4W CAR FILM
R79	R65-0003-122	RES 1.2K 5% 1/4W CAR FILM
R80	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R81	R65-0003-101	RES 100 5% 1/4W CAR FILM
R82	R65-0003-101	RES 100 5% 1/4W CAR FILM
R83	R65-0003-273	RES 27K 5% 1/4W CAR FILM
R84	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R85	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R86	R65-0003-681	RES 680 5% 1/4W CAR FILM
R87	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R88	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R89	R65-0003-104	RES 100K 5% 1/4W CAR FILM

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**Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410)
(Cont.)**

Ref. Desig.	Part Number	Description
R90	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R92	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R93	R65-0003-910	RES 91 5% 1/4W CAR FILM
R94	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R95	R65-0003-910	RES 91 5% 1/4W CAR FILM
R96	R65-0003-181	RES 180 5% 1/4W CAR FILM
R97	R65-0003-621	RES 620 5% 1/4W CAR FILM
R98	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R99	R65-0003-152	RES 1.5K 5% 1/4W CAR FILM
R100	R65-0003-244	RES 240K 5% 1/4W CAR FILM
R101	R65-0003-273	RES 27K 5% 1/4W CAR FILM
R102	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R103	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R104	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R105	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R106	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R107	R65-0003-184	RES 180K 5% 1/4W CAR FILM
R108	R65-0003-470	RES 47 5% 1/4W CAR FILM
R109	R65-0003-153	RES 15K 5% 1/4W CAR FILM
R110	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R111	R65-0003-303	RES 30K 5% 1/4W CAR FILM
R112	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R113	R65-0003-561	RES 560 5% 1/4W CAR FILM
R114	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R115	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R116	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R117	R65-0003-334	RES 330K 5% 1/4W CAR FILM
R118	R65-0003-124	RES 120K 5% 1/4W CAR FILM
R119	R65-0003-513	RES 51K 5% 1/4W CAR FILM
R120	R65-0003-222	RES 2.2K 5% 1/4W CAR FILM
R121	R65-0003-202	RES 2.0K 5% 1/4W CAR FILM
R122	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R123	R65-0003-105	RES 1.0M 5% 1/4W CAR FILM
R125	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R126	R65-0003-513	RES 51K 5% 1/4W CAR FILM
R127	R65-0003-393	RES 39K 5% 1/4W CAR FILM
R128	R65-0003-511	RES 510 5% 1/4W CAR FILM
R129 - R131	R65-0003-393	RES 39K 5% 1/4W CAR FILM
R132 - R135	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R136	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R137	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R138	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R140	R65-0003-132	RES 1.3K 5% 1/4W CAR FILM
R141	R65-0003-244	RES 240K 5% 1/4W CAR FILM
R142, R143	R65-0003-473	RES 47K 5% 1/4W CAR FILM

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**Table 3. IF/Audio Motherboard Assembly A5A1 Maintenance Parts List (PL 10073-5410)
(Cont.)**

Ref. Desig.	Part Number	Description
R144	R65-0003-302	RES 3.0K 5% 1/4W CAR FILM
R145	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R146	R65-0003-392	RES 3.9K 5% 1/4W CAR FILM
R147	R65-0003-244	RES 240K 5% 1/4W CAR FILM
R148	R65-0003-184	RES 180K 5% 1/4W CAR FILM
R149	R65-0003-272	RES 2.7K 5% 1/4W CAR FILM
R150	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R151	R65-0003-623	RES 62K 5% 1/4W CAR FILM
R152	R65-0003-754	RES 750K 5% 1/4W CAR FILM
R153	R65-0003-563	RES 56K 5% 1/4W CAR FILM
R154	R65-0003-153	RES 15K 5% 1/4W CAR FILM
R155	R65-0003-270	RES 27 5% 1/4W CAR FILM
R156	R65-0003-513	RES 51K 5% 1/4W CAR FILM
R157 R158	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R159	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R161	R65-0003-202	RES 2.0K 5% 1/4W CAR FILM
R162	R65-0003-471	RES 470 5% 1/4W CAR FILM
R163	R65-0003-101	RES 100 5% 1/4W CAR FILM
R164	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R165	R65-0003-511	RES 510 5% 1/4W CAR FILM
R166 - R168	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R169	R65-0003-302	RES 3.0K 5% 1/4W CAR FILM
R170	D40-0004-004	THERM,2K, 5%
R171	R65-0003-273	RES 27K 5% 1/4W CAR FILM
R172	R65-0003-511	RES 510 5% 1/4W CAR FILM
T1	10073-7026	TRANSFORMER, RF, FIXED
T2	T60-0004-001	TRANSFORMER
TP1	J-0071	TP PWB BRN TOP ACCS .080"
TP2	J-0066	TP PWB RED TOP ACCS .080"
TP3	J-0069	TP PWB ORN TOP ACCS .080"
TP4	J-0070	TP PWB YEL TOP ACCS .080"
TP5	J-0068	TP PWB GRN TOP ACCS .080"
TP7	J-0073	TP PWB VIO TOP ACCS .080"
TP8	J-0074	TP PWB GRA TOP ACCS .080"
TP9	J-0065	TP PWB WHT TOP ACCS .080"
TP10	J-0067	TP PWB BLK TOP ACCS .080"
TP11	J-0071	TP PWB BRN TOP ACCS .080"
TP12	J-0066	TP PWB RED TOP ACCS .080"
U1	I30-0036-001	IC 5534 OP AMP PLASTIC
U2	I60-0003-001	IC FM IF AMP
U3	I01-0000-252	IC 4053B PLASTIC CMOS
U4	I06-0002-001	IC DG211 PLASTIC CMOS
U5	I30-0035-000	IC 072 OP AMP PLASTIC
U6 - U9	I30-0003-000	IC 324 OP AMP PLASTIC
VR1	I12-0010-005	IC VR 79L05A -5V .10A 4%
VR2	I12-0005-005	IC VR 78L05 +5V .10A 10

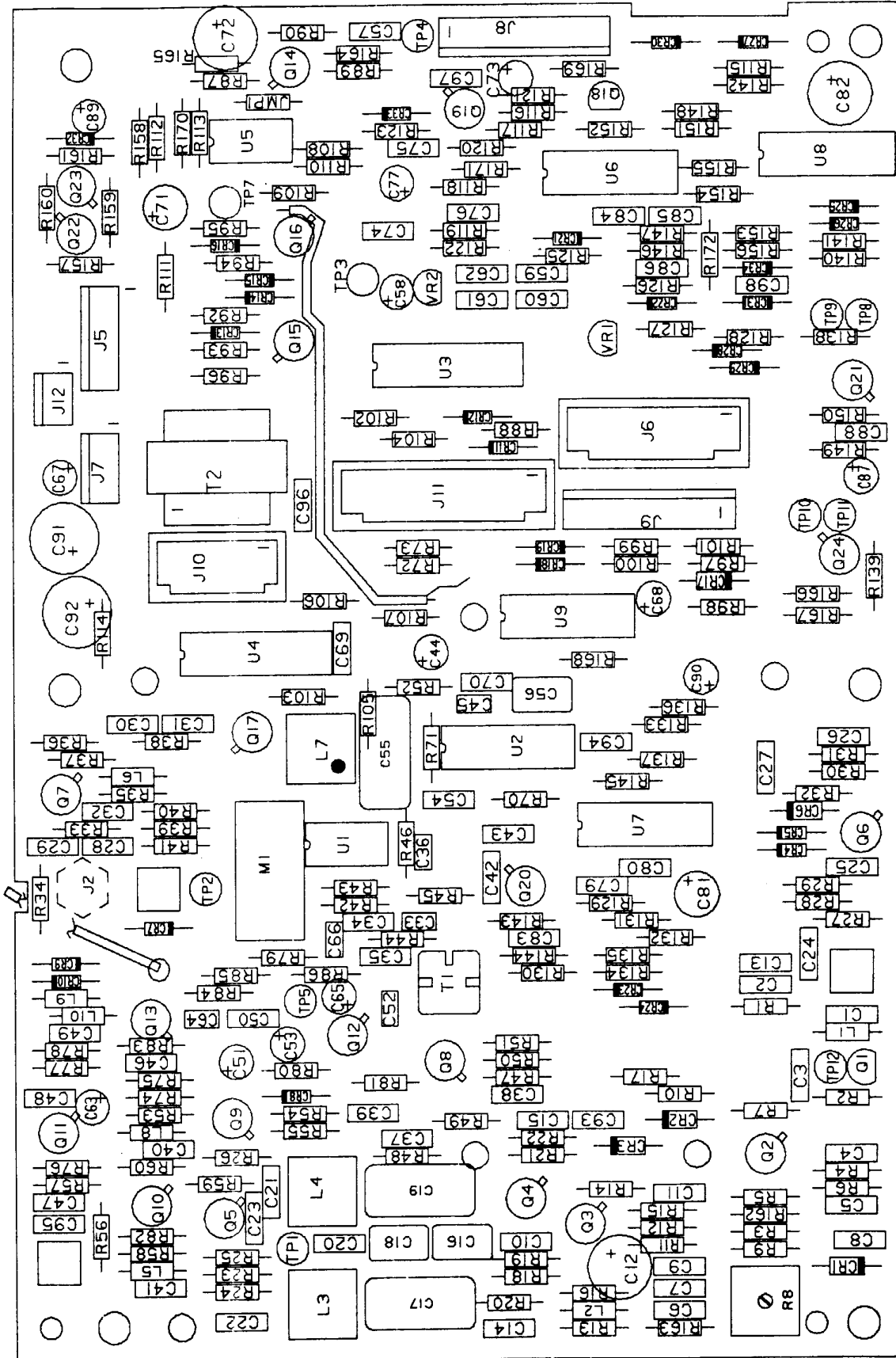


Figure 3. IF/Audio Motherboard Assembly A5A1 Component Location Diagram (10073-5410, Rev. E)

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- NOTE: UNLESS OTHERWISE SPECIFIED:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. COMPLETE DESIGNATION, PREFIX, UNIT NO., AND/OR ASSEMBLY NO. DESIGNATION.
 2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 15%.
 3. ALL CAPACITOR VALUES ARE IN MICROFARADS, 200VDC.
 4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.
 5. ▽ INDICATES SINGLE POINT GROUND.

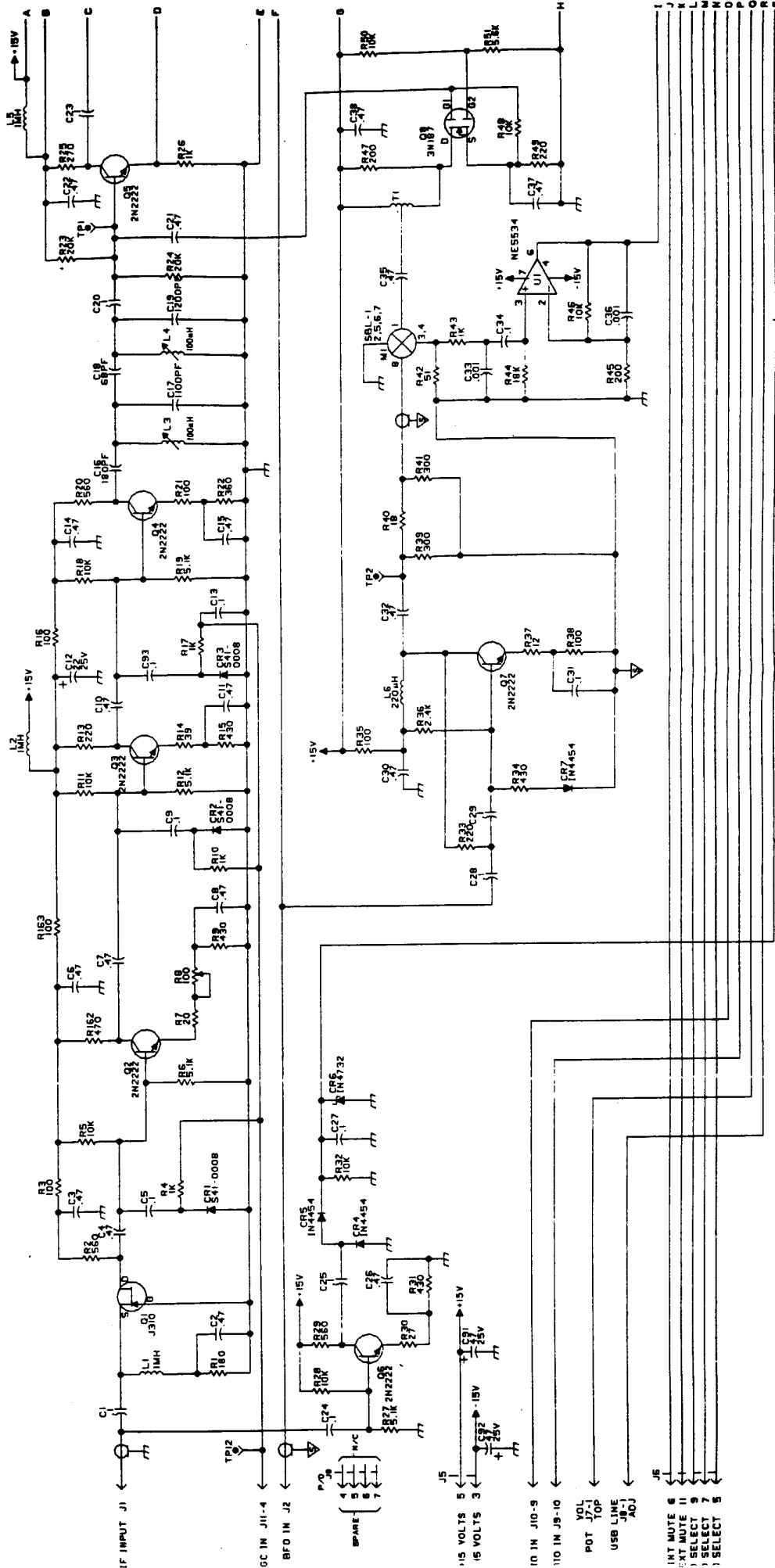


Figure 4. IF/Audio Motherboard ASB1 Schematic
Diagram (10073-5411, Rev. J)
(Sheet 1 of 4)

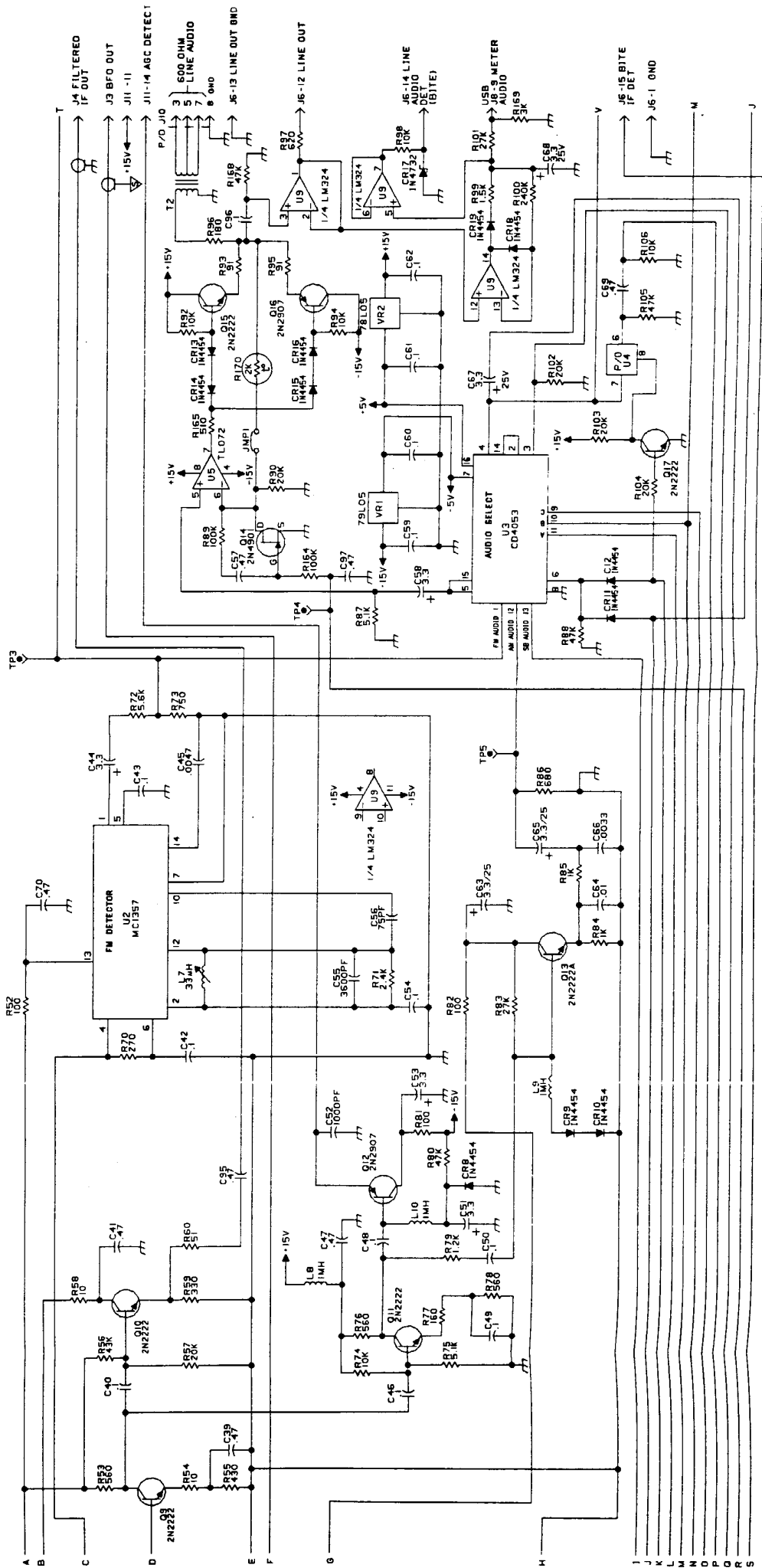


Figure 4. IF/Audio Motherboard A5A1 Schematic
Diagram (10073-5411, Rev. J)
(Sheet 2 of 4)

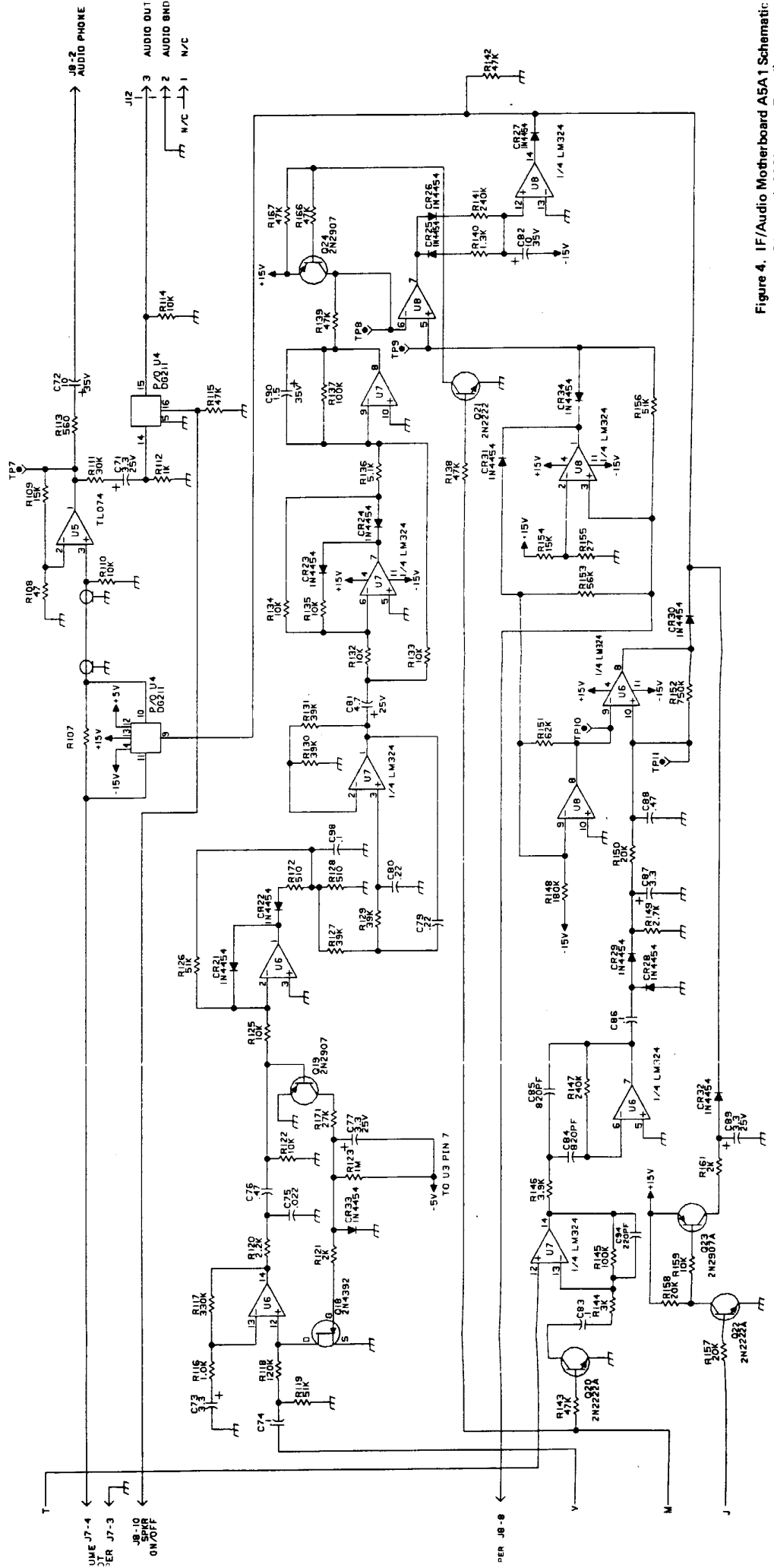


Figure 4. IF/Audio Motherboard A5A1 Schematic Diagram (10073-5411, Rev. J) (Sheet 3 of 4)

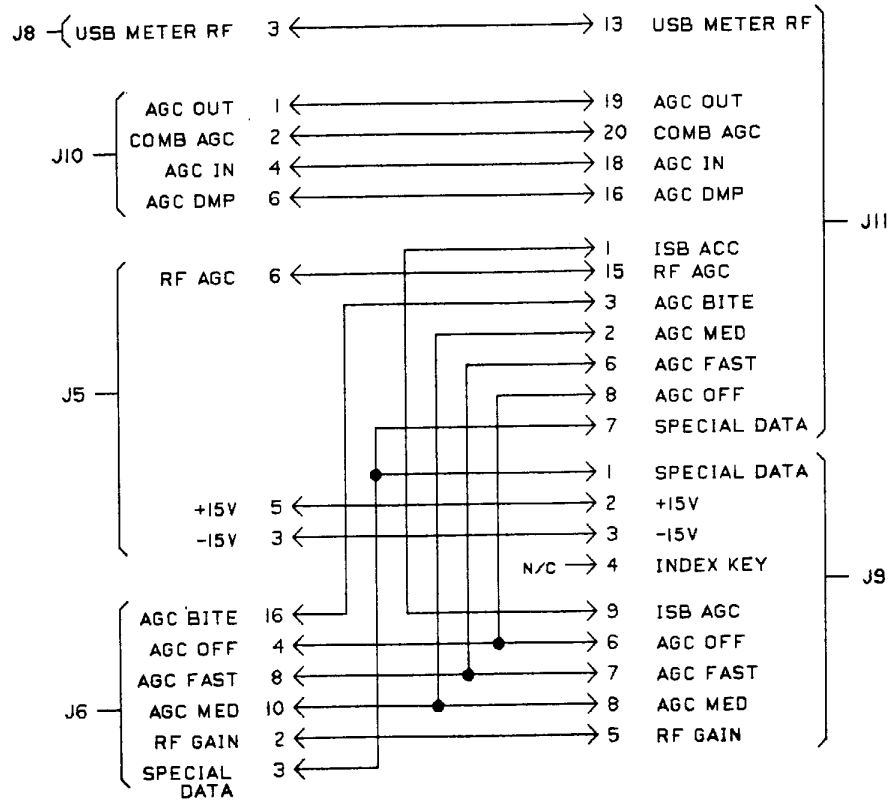
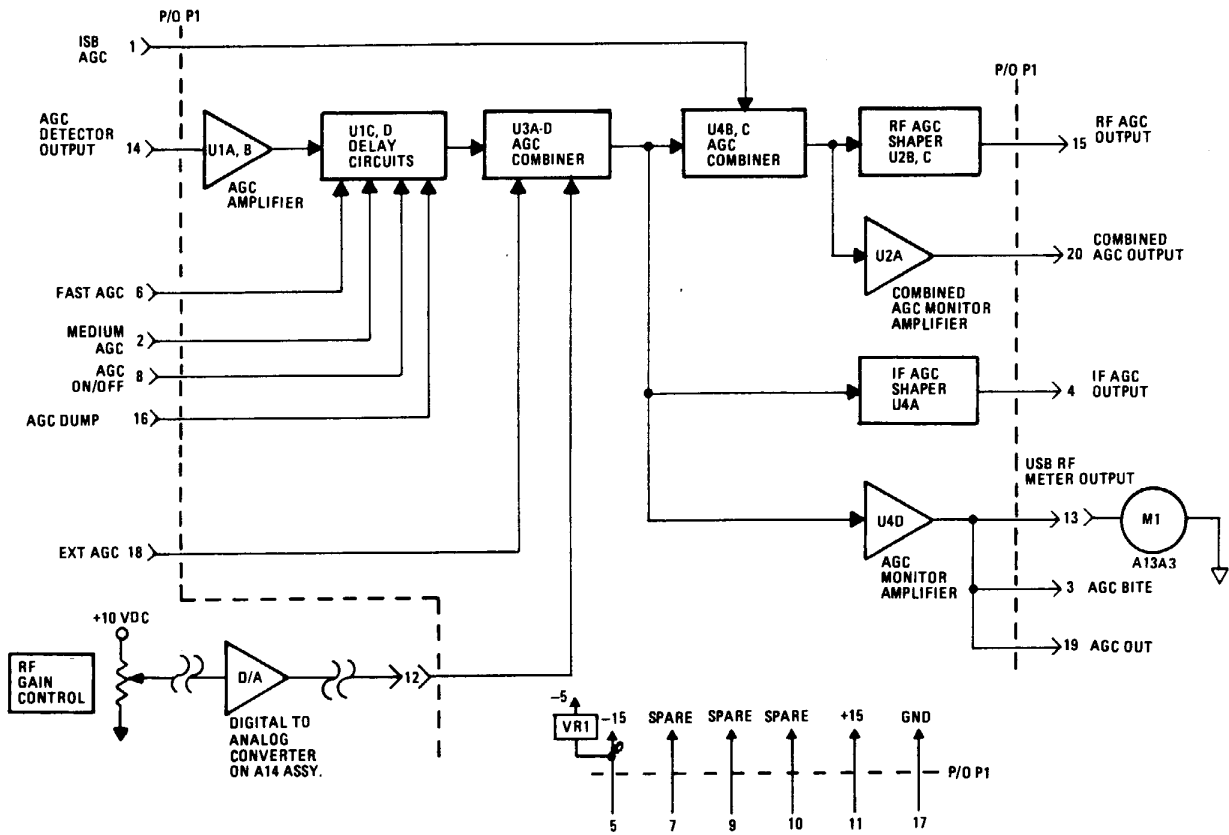


Figure 4. IF/Audio Motherboard A5A1 Schematic Diagram (10073-5411, Rev. J) (Sheet 4 of 4)



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IF/Audio AGC Assembly A5A2 Functional Block Diagram

7. A5A2 AGC ASSEMBLY GENERAL DESCRIPTION

AGC Assembly A5A2 contains circuits that automatically control receiver gain over a 120 dB dynamic range. RF input levels at the antenna input from 1 uVrms to 1 Vrms will produce no more than a 3 dB change in audio output level.

Shaping circuitry on the A5A2 assembly provides the following automatic gain control characteristics:

- Attack time – fixed: less than 20 mseconds
- Decay time – selectable: fast, less than 30 mseconds; medium, 200 ± 50 mseconds; slow, 4 ± 1 second

Signal monitoring circuits include the following:

- RF signal strength via RF-590 front panel metering
- BITE detection of the AGC output level

Receiver gain control may also be accomplished when any of the following signals are present:

- RF Gain (Local manual control from the RF-590 front panel.)
- External AGC (A rear panel input for remote control of the gain controlling circuits.)
- ISB AGC (Used when the ISB option is installed in the receiver. In this case, the stronger of the two received sideband signals will control receiver gain.)

Additionally, AGC output and combined AGC output (when ISB operation is utilized) signals are available at the receiver rear panel.

The A5A2 assembly is mounted to the A5A1 assembly, and signals flow from A5A2P1 to A5A1J9 and J11. Once these signals arrive at the A5A1 assembly, they are directed to various other connectors on the A5A1 assembly and then routed to other assemblies in the radio. Table 4 details the input/output connections and any relevant data.

Table 4. AGC Assembly A5A2 Interface Connections

Connector	Function	Characteristics
P1-1	ISB AGC	
P1-2	MED AGC	+5 Vdc = Selected
P1-3	AGC BITE	Typically 1.5 Vdc during BITE Test

Table 4. AGC Assembly A5A2 Interface Connections (Cont.)

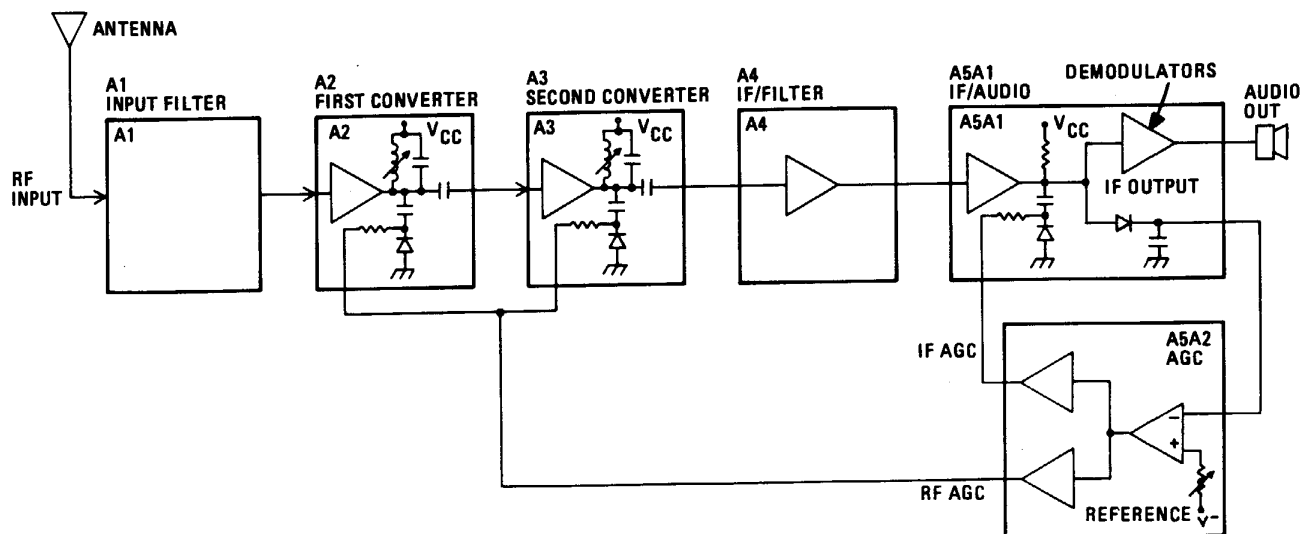
Connector	Function	Characteristics
P1-4	IF AGC	0 to -3 Vdc
P1-5	Power	-15 Vdc
P1-6	FAST AGC	+5 Vdc = Selected
P1-7	Spare	
P1-8	AGC ON/OFF	+5 Vdc = AGC OFF
P1-9	Spare	
P1-10	Spare	
P1-11	Power	+15 Vdc
P1-12	RF Gain	0 to +12 Vdc
P1-13	USB RF Meter Output	
P1-14	AGC Detector	Typically -1 Vdc
P1-15	RF AGC Output	Typically 0 to -6 Vdc
P1-16	AGC Dump	+5 Vdc = AGC off
P1-17	Ground	
P1-18	External AGC	Typically 0 to +6 Vdc
P1-19	AGC Output	Typically 0 to -6 Vdc
P1-20	Combined AGC Output	

8. CIRCUIT DESCRIPTIONS

8.1 AGC Operation

Figure 5 is a simplified block diagram which shows the relationship of the AGC assembly to the rest of the radio.

The AGC circuitry in the receiver maintains a constant peak level at the A5A1 IF output. The strength of the IF output is a function of the received RF signal strength at the antenna as well as the gain of all the stages preceding the IF output. If the gain of the receiver could be decreased in proportion to the increasing strength of a received signal (and vice versa), then a constant IF output and audio output will be maintained.



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Figure 5. AGC Operation

The RF-590 AGC circuits accomplish this by sampling the IF output signal, converting it into a dc signal whose amplitude is a function of signal strength and comparing it to a reference signal. Any difference in amplitude between these two signals will cause an error signal to develop. This error signal is fed back to PIN diode attenuator circuits throughout the radio, and causes the diodes to alter the impedance of the output stages of selected amplifier stages. In so doing, they have modified the stage gain. Therefore, for large RF input signals (and IF output signals) there will be a large error voltage generated, a large change in amplifier output impedance, and a large decrease in receiver gain. The converse is true for small RF input signals, although there is an AGC threshold limit at which low level RF signals will not cause gain reduction.

8.2 AGC Amplifiers

The circuits which produce the actual AGC voltage consist of the four sections of U1. U1A is a noninverting buffer which amplifies the detected AGC signal provided by the A5A1 assembly. Section U1B is the AGC loop error amplifier which generates the AGC error voltage that controls the receiver gain. This differential amplifier has a gain of 10 for inputs greater than the error reference, and a gain of 0 for inputs below the error reference. The error reference signal is set by potentiometer R5 at the noninverting input of the amplifier.

The decay time of the AGC voltage is set by the discharge time constant of C3. The discharge rate is a function of the shunt resistance of C3, and is altered by adding or removing resistance via Q1 and Q2. When Q1 and Q2 are off, only R11 is the discharge path (corresponding to slow AGC speed). Turning Q2 on, shunts R11 with R10 (decreasing the total shunt resistance, etc). These decay speeds are front panel selectable.

Shorting C3 out via a low resistance to ground through Q3 disables the AGC entirely. This will happen in response to the AGC off command from the front panel (so that manual gain control may be used) or to the rear panel AGC dump signal.

U1D is strictly a noninverting buffer stage which presents C3 with a high impedance input so that charge will not leak off and alter the AGC time constants.

8.3 AGC Combination and Control Circuits

The receiver is designed to have a great deal of flexibility in controlling the receiver gain. The first method, as discussed above, is the receiver Automatic Gain Control (AGC). Also available from the front panel is an RF GAIN control, and from the rear panel connector there is an external AGC control.

The different gain controls are combined together using quad op amp U3. The combination is implemented using an analog OR gate that passes the largest of the four inputs on the gain control bus (TP5). The fourth input is an internal adjustment, potentiometer R19, that can be used to reduce the receiver gain, and thereby increase the AGC threshold.

None of these four inputs are ever disabled, so take care when using the receiver so that the gain control bus is not overridden by an undesired input. The best example of this is the front panel RF GAIN control. The RF GAIN control is supplied by the processor and is selected either from the front panel or the remote controller. It is the output of a digital to analog converter and is under direct processor control. (The converter output has a low pass filter to remove processor noise and to eliminate any ripple on the gain control voltage that would produce undesired modulation in the signal path.)

For proper operation of the AGC circuitry, the RF GAIN control should be at its maximum position to ensure full receiver sensitivity.

The output of the IF gain combiner U3 provides the input to the IF AGC shaping circuitry. It is also compared to the ISB AGC input for control of the RF AGC. The larger of the two AGC levels will then be the input to the RF AGC shaping circuitry. This will ensure that the gain of the input RF amplifiers will be at the correct level to avoid overload by the greater of the two sidebands when ISB operation is used. The IF strip AGC circuits will then control their own gain as required.

8.4 AGC Outputs

8.4.1 Shaping Circuitry

As previously mentioned, the AGC action maintains a constant level at the IF output. This is accomplished by supplying an increasing linear AGC voltage to the PIN diode attenuators in the signal path (in response

to a logarithmic increase in RF signal strength). The RF AGC and IF AGC shaping circuitry provides a means to control the response of the PIN diodes to accomplish this.

Temperature compensation for the PIN diodes is provided by summing a temperature dependent offset voltage into the input of each shaping network. The temperature coefficient of gain of each gain controlled stage can be maintained at an acceptable minimum.

Note that two AGC shaping networks are required, since it is desirable to have RF AGC reduction (A2, A3 assemblies) begin at a higher RF input level than IF AGC reduction (A5A1 assembly). IF AGC reduction typically begins at RF signal levels on the order of .5 μVrms , while RF AGC reduction begins approximately 50 dB above this threshold.

8.4.1.1 IF AGC Shaping

The shaping and compensation circuitry for the IF strip on the A5A2 assembly consists of op amp U4A and its associated circuitry. Q4 serves as a current buffer and is included within the circuit's feedback network. R30 acts to limit the maximum output current and protect Q4. Potentiometer R28 provides an adjustment in the shaping circuitry to compensate for variations between individual PIN diodes so that the meter indication of signal strength is calibrated in each receiver. The input to this circuit at TP5 is the AGC voltage which increases from 0 to 6 volts as the receiver gain decreases by 120 dB. The IF strip provides 80 dB of the necessary attenuation, and this requires approximately -2 volts on the IF AGC output. There is one gain breakpoint caused by CR10, and this occurs at the point when the AGC in the RF amplifiers begins (approximately 50 dB above AGC threshold). Temperature compensation is provided by CR11, R25, and R24. R24 sets the diode offset and R25 sets the offset temperature coefficient.

8.4.1.2 RF AGC Shaping

The shaping circuitry for the RF AGC consists of op amp sections U2B, U2C, and their associated components. U2B is used to implement the necessary temperature compensation, along with the RF AGC threshold. The RF AGC threshold is set so that AGC action to the RF amplifiers in the receiver does not begin until 50 dB above AGC threshold. This was done to ensure that the S/N ratio of the receiver would increase linearly to at least 50 dB before the noise figure of the receiver input was degraded by RF AGC action. The RF threshold circuit subtracts 2.5 volts from the AGC input voltage to shaping circuit U2C. Temperature compensation for the RF AGC is provided by CR17 and R37. R37 sets the diode offset and temperature coefficient gain. The operation of U2B is noninverting.

U2C performs the shaping for the RF AGC. There are two breakpoints in the nonlinear approximation set by CR18 and CR19. These diodes are reverse biased by resistor pairs R42 and R43, and R40 and R41 respectively. When the diodes become forward biased by the increasing input, they conduct and increase the circuit gain by lowering the input impedance of the inverting amplifier. Potentiometer R45 provides adjustment of the shaping circuit gain to compensate for individual PIN diode variations. Q5 acts as a current buffer and is included in the amplifier feedback network. R47 provides current limiting protection for Q5.

The input to the shaping circuit is the receiver AGC voltage minus 2.5 volts. The input can be found at TP4. (The receiver AGC voltage is available at TP5). The output of the shaping circuit is a negative voltage that increases to approximately -8 volts (maximum) at full gain reduction, and is available at TP6. RF AGC action provides typically 40 dB of attenuation at maximum AGC voltages, with 20 dB occurring in the A2 assembly and 20 dB occurring in the A3 assembly.

8.4.2 AGC Output Monitor Lines

There are four output monitor lines from the AGC assembly; the AGC OUT line, the AGC BITE line, the USB Meter RF line, and the Comb AGC OUT line. The first is the buffered AGC voltage which goes to the rear panel. The second is the AGC voltage divided by three which goes to the processor BITE circuitry. It has a 4.7 volt Zener diode on its output to protect the BITE circuitry against overvoltage. The USB Meter RF line goes to the front panel meter to provide signal strength information. The AGC voltage is calibrated to provide a linear 6.0 volt rise for an increase of 120 dB of signal strength above AGC threshold. The meter itself is a 100 μ A meter, so R49 (a 62 K resistor) provides the proper meter drive.

The Comb AGC OUT line is the output of the IF AGC and ISB AGC combiner. This line monitors the AGC control voltage going to the RF AGC shaping circuitry.

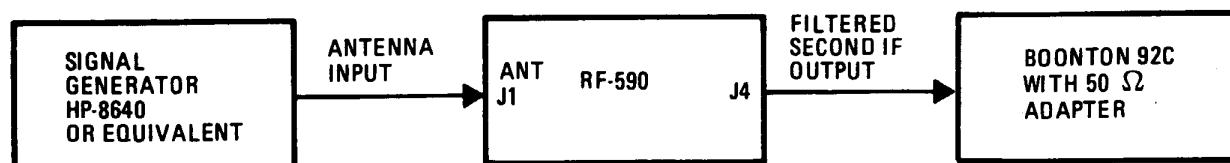
9. MAINTENANCE

The following adjustments should not be performed as routine maintenance procedures, but only when a failure indicates a definite need. All tests are performed with all assembly connections in normal contact, unless otherwise specified. It is further assumed that all other circuits in the RF path are operational and properly aligned.

9.1 AGC Alignment

Perform the following procedure to align the AGC assembly.

- a. Remove the ribbon cable connecting the AGC Assembly A5A2 to the IF/Audio Amp Assembly A5A1.
- b. Connect equipment as shown in figure 6. Set generator to 10.0015 MHz and RF output to OFF. Set spectrum analyzer to the second IF frequency (455 kHz).



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Figure 6. AGC Assembly Alignment

- c. Turn on the receiver and set controls as follows:
 - Frequency to 10.000000 MHz
 - Mode to USB
 - USB meter button to USB/RF
 - RF GAIN to fully clockwise (cw)
 - AGC to OFF
- d. Rotate R19 fully counterclockwise (ccw) and measure TP5 (should be 0 Vdc).
- e. Turn the receiver off and reconnect the ribbon cable between the AGC Assembly A5A2 and the IF/Audio Amp Assembly A5A1.
- f. Turn on the receiver and set AGC to MED and generator output to -60 dBm. Adjust A5A2R5 for -7 dBm at second IF output.
- g. Decrease signal generator to 10 μ Vrms. Adjust A5A2R28 for a 10 μ Vrms reading on the RF-590 front panel meter.
- h. Increase signal generator to 10 mVrms. Adjust A5A2R45 for a 10 mVrms reading on the front panel meter.
- i. Note that the second IF output remains at a constant -7 dBm level between the two RF input extremes in steps g. and h.
- j. Initiate the receiver BITE self-test. The receiver must not fail at 05-01, the AGC test. Test is complete.

10. PARTS LIST

Table 5 is a comprehensive parts list of all replaceable components in IF/Audio AGC Assembly A5A2. When ordering parts from the factory, include a full description of the part. Use figure 7, IF/Audio AGC Assembly A5A2 Component Location Diagram to identify parts.

11. SCHEMATIC DIAGRAM

Figure 8 is the IF/Audio AGC Assembly A5A2 schematic diagram.

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Table 5. IF/Audio AGC Assembly A5A2 Maintenance Parts List (PL 10073-5450)

Ref. Desig.	Part Number	Description
	10073-5450	PWB, IF/AUDIO AGC
C1	C26-0025-100	CAP 10UF 20% 25V TANT
C2	C26-0025-100	CAP 10UF 20% 25V TANT
C3	C25-0003-209	CAP 22UF 10% 25V TANT
C4	M39014/02-1310	CAP .1UF 10% 100V CER-R
C5	M39014/02-1310	CAP .1UF 10% 100V CER-R
C6	M39014/02-1310	CAP .1UF 10% 100V CER-R
CR1	1N4454	DIODE 200mA 75V SW
CR2	1N4454	DIODE 200mA 75V SW
CR3	1N4454	DIODE 200mA 75V SW
CR4	1N4454	DIODE 200mA 75V SW
CR5	1N4454	DIODE 200mA 75V SW
CR6	1N4454	DIODE 200mA 75V SW
CR7	1N4454	DIODE 200mA 75V SW
CR8	1N4454	DIODE 200mA 75V SW
CR9	1N4454	DIODE 200mA 75V SW
CR10	1N4454	DIODE 200mA 75V SW
CR11	1N4454	DIODE 200mA 75V SW
CR12	1N4454	DIODE 200mA 75V SW
CR13	1N4454	DIODE 200mA 75V SW
CR14	1N4454	DIODE 200mA 75V SW
CR15	1N4454	DIODE 200mA 75V SW
CR16	1N4454	DIODE 200mA 75V SW
CR17	1N4454	DIODE 200mA 75V SW
CR18	1N4454	DIODE 200mA 75V SW
CR19	1N4454	DIODE 200mA 75V SW
CR20	1N4454	DIODE 200mA 75V SW
CR21	1N4732	DIODE 4.7V 10% 1W ZENER
P1	10073-7072	RIBBON CABLE, 20 COND
Q1	2N2222A	XSTR SS/GP NPN TO-18
Q2	2N2222A	XSTR SS/GP NPN TO-18
Q3	2N2222A	XSTR SS/GP NPN TO-18
Q4	2N2907A	XSTR SS/GP PNP TO-18
Q5	2N2907A	XSTR SS/GP PNP TO-18
R1	R65-0003-432	RES 4.3K 5% 1/4W CAR FILM
R2	R65-0003-432	RES 4.3K 5% 1/4W CAR FILM
R3	R65-0003-223	RES 22K 5% 1/4W CAR FILM
R4	R65-0003-432	RES 4.3K 5% 1/4W CAR FILM
R5	R30-0008-203	RES,VAR,PCB 20K 1/2W 10%
R6	R65-0003-433	RES 43K 5% 1/4W CAR FILM
R7	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R8	R65-0003-431	RES 430 5% 1/4W CAR FILM
R9	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R10	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R11	R65-0003-474	RES 470K 5% 1/4W CAR FILM

Table 5. IF/Audio AGC Assembly A5A2 Maintenance Parts List (PL 10073-5450) (Cont.)

Ref. Desig.	Part Number	Description
R12	R65-0003-242	RES 2.4K 5% 1/4W CAR FILM
R13	R65-0003-100	RES 10 5% 1/4W CAR FILM
R14	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R15	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R16	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R17	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R18	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R19	R-2226	RES,VAR,PCB 2K .5 20%
R20	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R21	R65-0003-184	RES 180K 5% 1/4W CAR FILM
R22	R65-0003-683	RES 68K 5% 1/4W CAR FILM
R23	R65-0003-822	RES 8.2K 5% 1/4W CAR FILM
R24	R65-0003-393	RES 39K 5% 1/4W CAR FILM
R25	R65-0003-751	RES 750 5% 1/4W CAR FILM
R26	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R27	R65-0003-681	RES 680 5% 1/4W CAR FILM
R28	R-2205	RES,VAR,PCB 500 .5 20%
R29	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R30	R65-0003-301	RES 300 5% 1/4W CAR FILM
R31	R65-0003-513	RES 51K 5% 1/4W CAR FILM
R32	R65-0003-243	RES 24K 5% 1/4W CAR FILM
R33	R65-0003-302	RES 3.0K 5% 1/4W CAR FILM
R34	R65-0003-751	RES 750 5% 1/4W CAR FILM
R35	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R36	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R37	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R38	R65-0003-153	RES 15K 5% 1/4W CAR FILM
R39	R65-0003-203	RES 20K 5% 1/4W CAR FILM
R40	R65-0003-133	RES 13K 5% 1/4W CAR FILM
R41	R65-0003-363	RES 36K 5% 1/4W CAR FILM
R42	R65-0003-114	RES 110K 5% 1/4W CAR FILM
R43	R65-0003-223	RES 22K 5% 1/4W CAR FILM
R44	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R45	R-2228	RES,VAR,PCB 10K .5 20%
R46	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R47	R65-0003-301	RES 300 5% 1/4W CAR FILM
R48	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R49	R65-0003-623	RES 62K 5% 1/4W CAR FILM
R50	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R51	R65-0003-512	RES 5.1K 5% 1/4W CAR FILM
R52	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
TP1	J-0071	TP PWB BRN TOP ACCS .080"
TP2	J-0066	TP PWB RED TOP ACCS .080"
TP3	J-0069	TP PWB ORN TOP ACCS .080"
TP4	J-0070	TP PWB YEL TOP ACCS .080"

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Table 5. IF/Audio AGC Assembly A5A2 Maintenance Parts List (PL 10073-5450) (Cont.)

Ref. Desig.	Part Number	Description
TP5	J-0068	TP PWB GRN TOP ACCS .080"
TP6	J-0072	TP PWB BLU TOP ACCS .080"
U1	130-0003-000	IC 324 OP AMP PLASTIC
U2	130-0003-000	IC 324 OP AMP PLASTIC
U3	130-0003-000	IC 324 OP AMP PLASTIC
U4	130-0003-000	IC 324 OP AMP PLASTIC
VR1	112-0010-005	IC VR 79L05A -5V .10A 4%

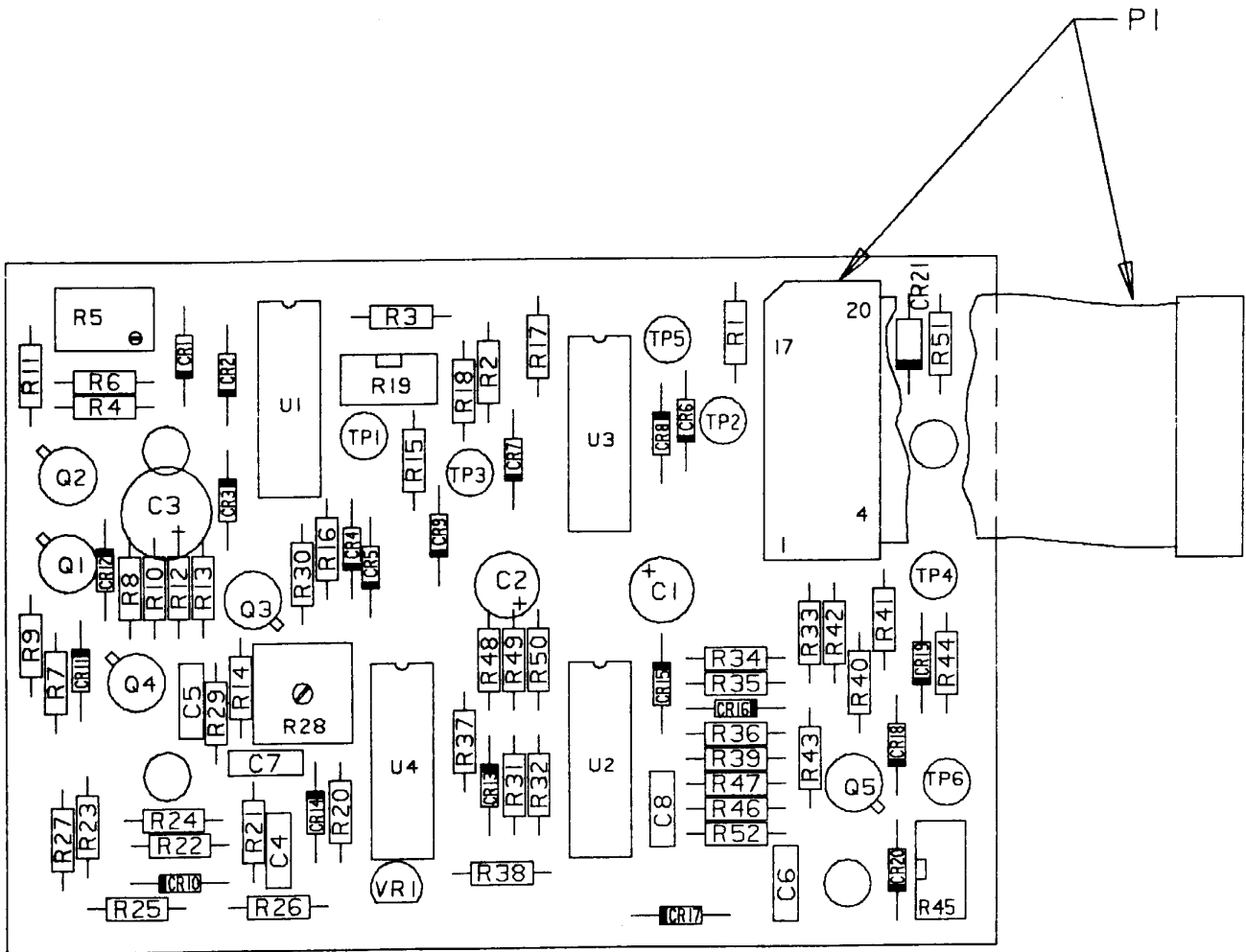


Figure 7. IF/Audio AGC Assembly A5A2 Component Location Diagram (10073-5450, Rev. D)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.

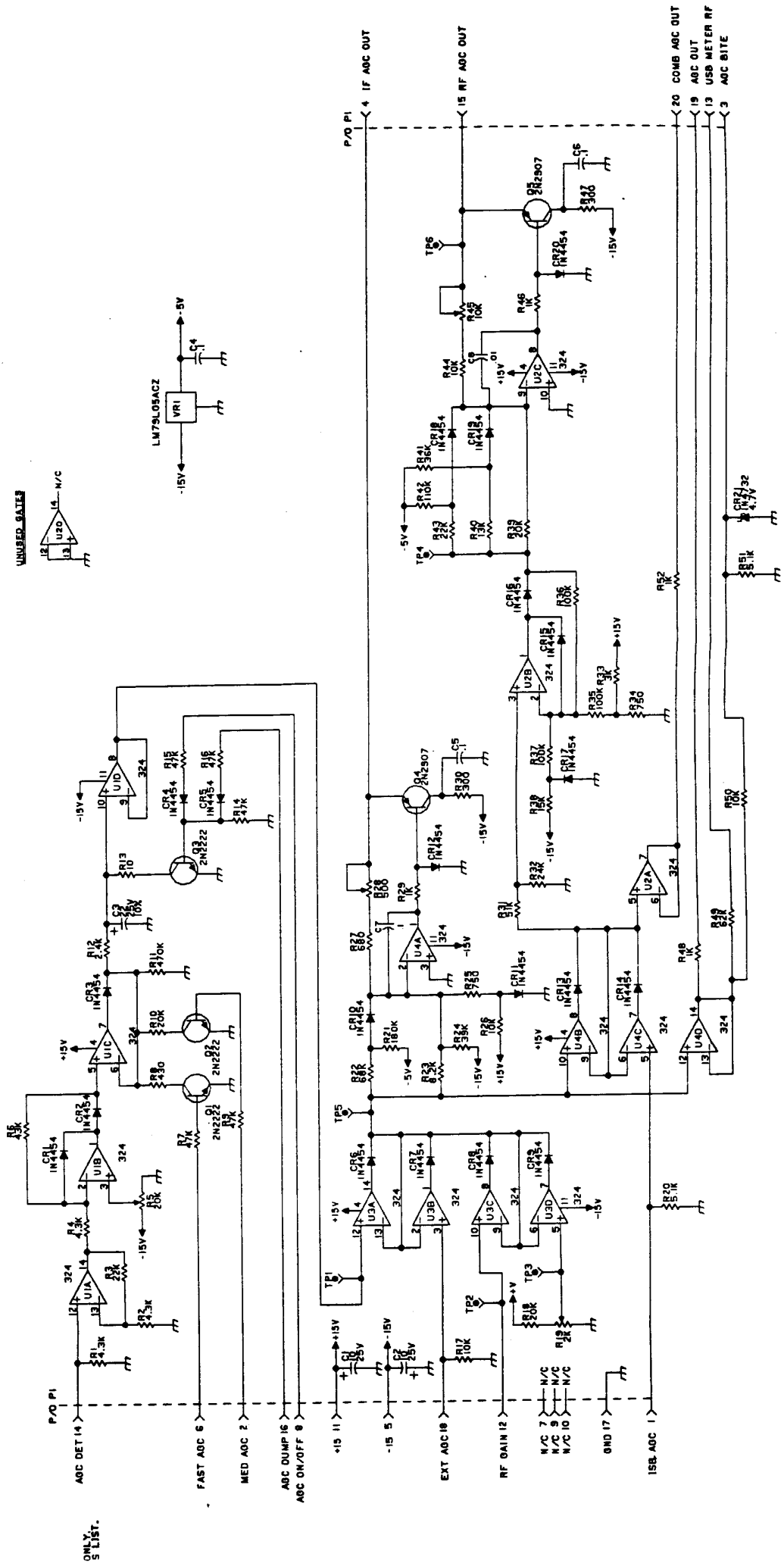


Figure 8. IF/Audio AGC Assembly A5A2
Schematic Diagram (10073-6451, Rev. D)