JOHNSON®

E.F. JOHNSON SERVICE MANUAL

JOHNSON 600 450 - 470 MHz DESKTOP BASE REPEATER

600
30 WATTS UHF
PART NO. 242-0600-XXX

FIRST PRINTING
MARCH, 1984

March 20, 1984

INSTRUCTION MANUAL

UHF FM DESKTOP REPEATER

450-470 MHz

JOHNSON®
E. F. JOHNSON COMPANY, WASECA, MINNESOTA 56093

42-14-038

Contents

Section 1: Specifications

1.1 GENERAL

Frequency Ranges:	450-470 MHz
Number of Channels:	1
Tx/Rx Spacing:	5 MHz
Tx/Rx to Antenna Insertion Loss:	1.5 dB max.
Rx Isolation at Tx Frequency:	60 dB min.
Operating Modes:	Repeater and/or Base Station (switch selectable)
Solid State CTCSS:	Tunable; separate encode and decode circuits; single tone frequency standard; second tone optional
Duplexer:	Internal
Time-Out-Timer:	2-10 minutes (adjustable)
Carrier Delay:	0-5 seconds (adjustable)
Applicable Documents:	The following documents form a part of these specifications to the extent specified herein: FCC parts 21, 90, 95
Temperature Range:	-30°C to +60°C
Dimensions:	Height Width Depth 5 12.5 12.5In 12.7 31.75 31.75Cm
Weight:	20 Lbs. (9.07 kilograms)

1.2 TRANSMITTER PERFORMANCE

RF Power Output at Duplexer Antenna Port:	Internally adjustable to 20W
Spurious and Harmonic Output:	-50 dBc
Frequency Stability:	±2.5 parts per million over the voltage and temperature range
Modulation:	16F3, ±5 kHz deviation
FM Hum and Noise (Base Station Mode):	-50 dB max. (Ref. ±3 kHz Dev)
Audio Response:	Linear deviation in the repeat mode up to ±5 kHz max. Pre-emphasis (+1 to -3 dB) of +6 dB/octave from 0.3 to 3 kHz
Audio Distortion:	3%

1.3 RECEIVER PERFORMANCE

EIA 12 dB SINAD:	.35 uV (-116 dBm) max. at Rx input port .42 uV (-114.5 dBm) at antenna port
20 dB QUIETING:	.5 uV (-113 dBm) max. at Rx input port .6 uV (-111.5 dBm) at antenna port
Intermodulation Response Attenuation:	65 dB min.
EIA Selectivity:	80 dB min. (25 kHz channel spacing)
Spurious Rejection:	70 dB min.
Image Rejection:	70 dB min.
Frequency Stability:	±5 parts per million max. over the voltage and temperature range
Audio Output:	3 Watts into 3.2 ohm speaker
Audio Frequency Response:	Deemphasis 6 dB per octave (+2, -8 dB) 0.4 to 3 kHz.
Audio Distortion:	5% max.

1.4 POWER REQUIREMENTS

AC Power Input:	120/240 VAC ±20%, 50/60 Hz, 85 W max.
AC Power Protection:	3 AG 4 A (120 V) or 2 A (240 V) fuse

Specifications Subject to Change Without Notice

Section 2: General Information

2.1 REPEATER DESCRIPTION

The Desktop Repeater is a completely solid-state FM system capable of 20 watts RF power output and operates from 120 volts or 240 volts of AC (50 or 60 Hz). The unit is unique in that it converts to a repeater and/or a base station at the touch of a button. All controls are located prominently on the front panel for operator ease. The standard repeater is a single-tone, tone-accessed system with a second tone available as an option or as a field installable kit (022-3844-269). In addition, each repeater has a Time-Out-Timer (TOT), adjustable for 2 to 10 minutes, to prevent excessively long transmissions and promote more open and efficient use of the frequency channel. An external audio/control connector is available as an option or may be ordered as a field installable kit (022-3897-027).

The Desktop Repeater was designed to be user friendly. All of the operating controls are located on the front panel for user convenience and indicator lights, also located on the front panel, illuminate to display selected functions. The three basic modes available to the operator through the Desktop Repeater are:

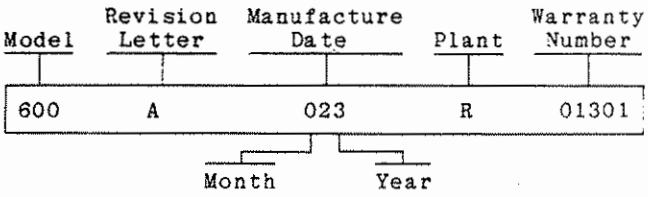
- the Base Station Mode
- the Repeater Mode
- the Base Station/Repeater Mode

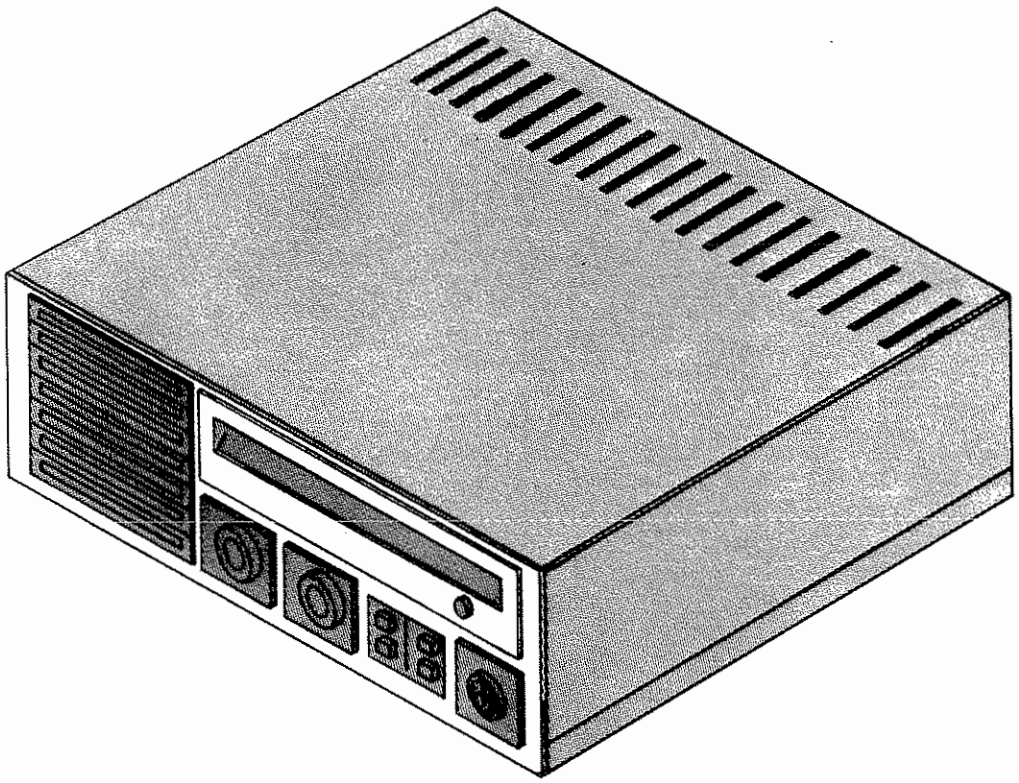
Refer to the Operation Section of this manual for further information on each of these modes.

2.2 REPEATER IDENTIFICATION MARKING

For repeater identification, a sticker is attached to the bottom of the repeater. This sticker identifies the repeater model, revision letter, manufacture date, plant location and warranty number.

Example:





Section 3: Operation

3.1 GENERAL

The controls of the Desktop Repeater have been designed to provide the operator with easy access to all available functions. Indicator lights show the mode of operation selected, and status lights on the upper display strip indicate the operating status of the unit at any given moment. Before operating the Desktop Repeater, it is suggested that you review the following procedure for a better understanding of all of the operational modes possible with this unit.

3.2 ACTIVATION

The unit is placed in operation by simply pressing the power on/off switch located on the right side of the control panel. The display light directly above the power switch should illuminate when the unit is on. Select the desired mode of operation by following one of the three procedures listed below.

3.3 MODES OF OPERATION

3.3.1 REPEATER OPERATION MODE

In the repeater mode, the unit allows all of the mobile and handheld units utilizing the repeater to communicate with one another. The repeater operator, however, cannot communicate with these units. Both the transmit bar on the microphone and the front panel squelch control are disabled in this mode (the squelch function is controlled by a preset internal squelch control). The operator can monitor repeater activity by pulling out the volume control knob (the volume indicator light will illuminate) and adjusting it to a comfortable listening level.

Repeater Operating Procedure

a. Depress the mode switch labeled "RPT" (the indicator light will illuminate). Check to make sure that the "BASE" switch is not activated.

b. If repeater activity monitoring is desired, pull out the volume control knob (the volume indicator light will illuminate).

c. Verify that the red squelch indicator light is not illuminated. In this operational mode the squelch function is controlled by a preset internal squelch control.

3.3.2 BASE STATION OPERATION MODE

In the base station mode, the repeat function is disabled and the unit operates as a typical fixed location transceiver. The operator can communicate directly with any mobile or handheld unit within the system; however, these units cannot communicate with one another through the repeater. In this mode the operator controls both the volume and squelch functions. The operator transmits to units within the system by depressing the transmit bar on the base of the microphone and speaking into the screened portion of the microphone (the unit's receiver is disabled when the transmitter is activated). To receive a reply, release the transmit bar. NOTE: The transmit bar is mechanically interlocked with the tone monitor bar on the microphone so that the monitor bar must be depressed before the transmit bar can be actuated. This insures that the operator disables the tone squelch and monitors the channel prior to making a transmission.

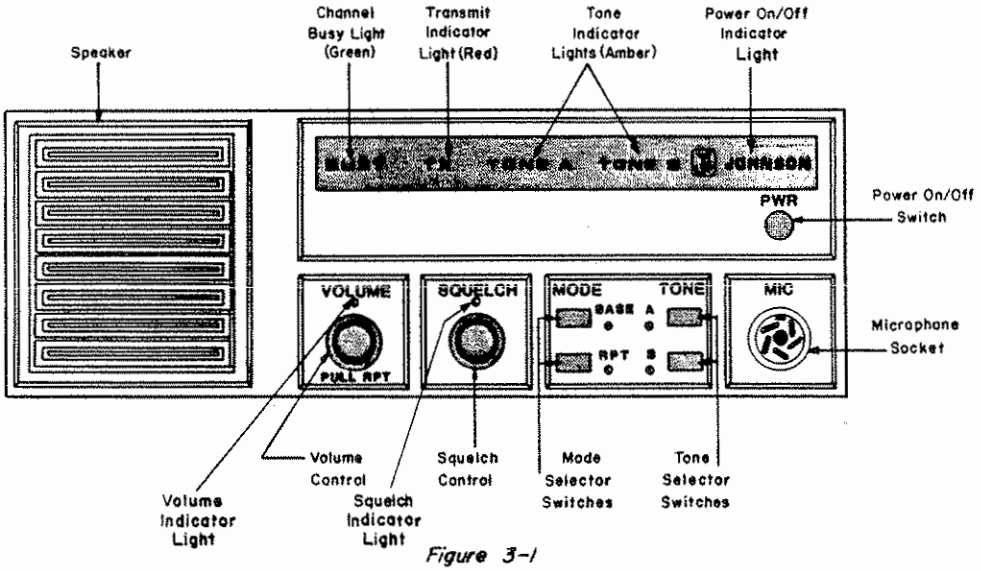


Figure 3-1

Base Station Operating Procedure

a. Depress the mode switch labeled "BASE" (the indicator light will illuminate). Check to make sure that the "RPT" switch is not activated.

b. Turn the squelch control completely counterclockwise and adjust the volume control to a comfortable listening level (if the tone squelch is in use, depress the tone monitor bar on the microphone for this and the following step). A hissing noise should be heard if the channel is not in use.

c. Rotate the squelch control clockwise until the hissing noise is stopped.

d. To transmit, depress the microphone transmit bar and speak in a normal voice into the microphone grille.

3.3.3 BASE STATION/REPEATER OPERATION MODE

The combined base station/repeater mode of operation allows the handheld and mobile units within the system to converse with one another through the repeater as well as with the base station operator. In this mode the front panel squelch control is disabled and the squelch function is controlled by a preset internal squelch control. The operator transmits to units within the system by depressing the transmit bar on the base of the microphone (the unit's receiver is muted when the transmitter is activated). To receive a reply, release the transmit bar. With the unit set in this mode, the operator will also be able to monitor all repeater activity. The transmit bar is mechanically interlocked with the tone monitor bar on the microphone. As a result, the monitor bar must be depressed before the transmit bar can be actuated. This insures that the operator disables the tone squelch and monitors the channel prior to making a transmission.

Base Station/Repeater Operating Procedure

a. Depress both the "BASE" and "RPT" mode switches on the front panel. The red indicator lights adjacent to those buttons will illuminate.

b. Verify that the red squelch indicator light is not illuminated. In this operational mode the squelch function is controlled by a preset internal squelch control.

c. To transmit, depress the microphone transmit bar and speak in a normal voice. Depressing the transmit bar disables the unit's receiver and also interrupts the repeater function.

3.4 TRANSMIT INDICATOR LIGHT

The red transmit indicator light illuminates each time the transmitter is keyed by the operator, or when one of the mobile or handheld units in the system keys the transmitter through the repeater.

3.5 CHANNEL BUSY INDICATOR LIGHT

The green channel busy light will be illuminated any time the unit's receive channel is in use. It should be noted that transmissions from nearby systems, operating on the same frequency, may also illuminate the busy light. With the tone squelch activated, the channel busy light will still illuminate for uncoded signals, even though these transmissions will not be heard in the loudspeaker. If the unit is in the base station only mode, constant illumination of the busy light may indicate improper adjustment of the squelch control knob (rotation too far counterclockwise). For proper threshold squelch adjustment see the section on squelch control.

3.6 VOLUME CONTROL

The volume control is used to adjust the level of the sound heard from the loudspeaker. Counterclockwise rotation decreases the volume level, while turning the control clockwise will cause an increase. In the Repeater mode of operation, no sound will be present at the loudspeaker if the volume control switch is pushed in. To monitor repeater activity in this mode, pull the volume control switch out and adjust the volume level normally.

3.7 SQUELCH CONTROL

The unit is equipped with a front panel squelch control; however, this control is activated only in the Base Station mode. In the Base Station/Repeater and Repeater modes, the squelch function is controlled by a preset internal squelch.

When the Base Station mode is selected, the front panel squelch control is used to quiet the receiver in the absence of a received carrier. In the extreme counterclockwise position the receiver is unsquelched, and (unless there is a transmitted carrier on the channel or CTCSS is activated) there will be noise at the loudspeaker. Rotating the squelch control in the clockwise direction quiets the receiver. The position at which receiver noise becomes undetected is called the threshold squelch position. Occasional noise bursts at this setting may cause the receiver to chatter (continuous opening and closing of the audio output). A slight clockwise rotation should overcome the receiver chatter. The extreme clockwise position is the tight squelch position. At this control setting it will require a stronger signal to open the audio output. It should be noted that the squelch control will establish the threshold signal level at which a decoded signal will be heard and/or repeated.

3.8 TONE SQUELCH (CTCSS)

When the continuous tone "coded" squelch system (CTCSS) is activated, the receiver

will be unsquelched only by transmissions which are coded with the proper subaudible tone. All units come equipped with one tone (Tone A) as a standard feature. An optional second tone (Tone B) is available and gives the operator a choice of three possible tone modes (Tone A only, Tone B only, and Tones A and B).

To place the unit in either the Tone A only or Tone B only mode, depress the button corresponding to the desired tone. The red indicator light next to the button will illuminate (verify that the indicator light for the other tone is off). In either of these modes, the selected tone will be transmitted when the transmitter is keyed and the receiver will unsquelch only for properly coded transmissions. The amber tone indicator lights on the status light strip will illuminate the corresponding display when Tone A or Tone B is transmitted or received.

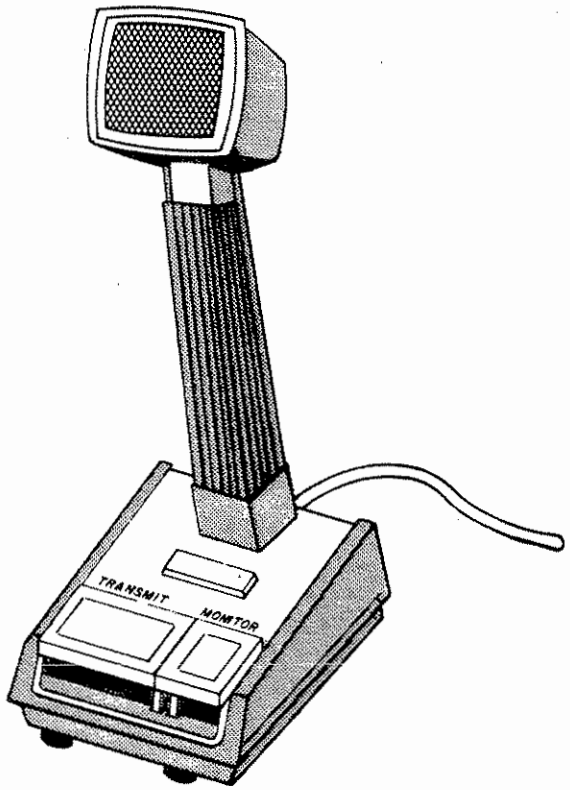
To place the unit in the Tone A and Tone B mode, depress both the Tone A and Tone B buttons and check to see that the red light adjacent to each is illuminated. In this mode, transmissions coded with either Tone A or Tone B will unsquelch the receiver. The amber status light corresponding to the received tone will illuminate when a coded transmission is received. Transmissions generated via the repeat function will be encoded with a regenerated A or B tone corresponding to the received tone. Transmissions generated through the microphone will automatically be encoded with tone A when both tones are selected.

NOTE: If the tone squelch is activated, the channel must be monitored prior to transmitting. To disable the tone squelch and monitor channel activity, simply depress the monitor bar located on the base of the microphone. The monitor bar can be locked in the monitor position by depressing the bar and pulling it forward until it locks. Repeater operation will not be affected when the monitor bar is depressed.

3.9 TRANSMIT/MONITOR BARS

Located on the base of the microphone (figure 3-2), the transmit and monitor bars allow communication with the system's handheld and mobile radios (the bars are both disabled in the Repeater only mode). The transmit and monitor bars are mechanically interlocked so that the monitor bar must be depressed before the transmit bar can be actuated. This assures that the operator will disable the tone squelch function and monitor the channel prior to making a transmission. Depressing the monitor bar and then pulling it forward will lock it in the monitor position.

To transmit, depress the monitor bar and listen for channel traffic. If the channel is clear, depress the transmit bar and speak into the microphone grille in a normal tone. Release the transmit bar immediately after speaking so that a reply may be heard.



NOTE: This microphone contains an amplifier, preset at manufacture, requiring no field adjustment.

Part # 250-0742-002
Figure 3-2

Section 4: Circuit Description

4.1 EXCITER BOARD

The transmit frequency is determined by crystal Y1 located in the base circuit of the oscillator. Q1 is a crystal controlled oscillator with its collector circuit tuned to three times the crystal frequency. A variable inductor, L1, in series with the crystal is used to adjust the transmit frequency. A varactor diode, CR1, in series with the crystal and Q1, is used for frequency modulating the oscillator, hence the transmitter. Q2 is a tripler, and Q3 a doubler, increasing the multiplication factor to 18. Two test points, R9 (TP1) and R13 (TP2) are provided in the emitter circuit of the multiplier stages, and are used for observing the peak emitter voltage while tuning. Multiple tuned circuits between the oscillator and multipliers enhance the suppression of the crystal and multiplier products. Q4 is the driver stage, and amplifies the FM signal to a level adequate for driving the final stage amplifier, Q5, to over the rated wattage. A low pass filter in the collector circuit of the final amplifier (Q5) provides matching to the R.F.Amplifier module, and assists in the suppression of spurious radiation.

CR2 is a zener diode supplying 8.6 volts to posistor RT1. RT1 is a 33 ohm heater for crystal Y1. Q6 and Q7, along with their associated components, provide protection for CR2 by placing a short across CR2 when RT1 first turns on.

When a TTL level voltage (+2.5V to +5.0V) is applied to the key line (J1-8) the base of Q9 goes high causing it to conduct. This in turn pulls the base of Q8 low allowing it to conduct, supplying voltage to the exciter circuits. U1 serves as a voltage regulator to supply the crystal controlled oscillator with a regulated 8 volts. The tripler, doubler, and driver stages are powered by the switched 13.8 volts while the final stage is supplied directly from the power supply.

The audio input to the transmitter enters at J1-1 and develops across the deviation control, R21. The bias of CR1 varies at the rate of the modulated input as does the capacitance. This causes the frequency of the oscillator to vary at the modulated input rate to produce the desired frequency modulation. The small frequency shift of the oscillator is also multiplied by eighteen to produce the ±5 kHz of deviation. Variable resistor R21 adjusts the level of the modulated input applied to the varactor diode and consequently the deviation of the transmitter. The standard deviation is ±5 kHz and the transmitter should be adjusted so that the peaks of the modulating signal do not cause the deviation to exceed that figure (no limiting action is provided by the transmitter circuitry).

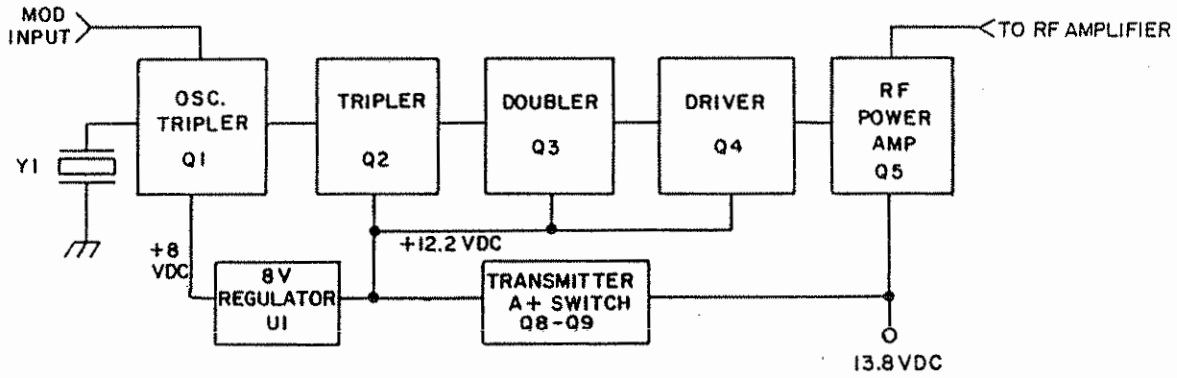


Figure 4-1

4.2 RECEIVER BOARD

Most of the active devices in the receiver are connected in a series parallel configuration across the power source. The supply voltage (13.8 VDC) flows through switching transistor Q13 and is regulated by Q12 to 9.5 V. Variable resistor R45 is used to adjust this voltage.

The received signal from the antenna is fed to the input stage of the receiver, RF amplifier Q1, through a two pole bandpass filter comprised of helical resonators L3 and L4. C1 provides impedance matching to the antenna (input of the filter) and C5 provides matching to the RF amplifier (output of the filter). Q1 is a common emitter RF amplifier. The amplified RF signal at the collector of Q1 is coupled to the base of mixer transistor, Q2, through a two pole helical filter comprised of L6 and L7. Q4 is a crystal controlled oscillator, with its collector tuned to three times the crystal frequency. (A third overtone crystal is used with this oscillator.) The receiver frequency is determined by a crystal (Y2) located in the base circuit of the oscillator and heated by a 33 ohm thermistor (RT1). A variable inductor (L11) in series with the crystal is used to set the receive channel on frequency. The output of the oscillator ($3F_X$) is fed to a tripler, Q5, and the resulting output signal ($9F_X$) is capacitively coupled to the emitter of the mixer, Q2. The difference frequency of 21.4 MHz (the first I.F.) is selected by three series two pole crystal filters (FL1, FL2, and FL3) and amplified by the I.F. amplifier Q3. The output of Q3 is taken from its collector, and fed to a multipurpose integrated circuit U1.

U1 operates as an I.F. amplifier, oscillator, mixer, limiter, detector, amplifier, and in addition has a Schmitt trigger circuit that is used to activate the signal present indicator. The crystal Y1, in the circuit of pins 1 and 2, sets the frequency of the second oscillator to 20.945 MHz, and the second I.F.of 455 kHz is filtered by ceramic filter FL4. Inductor L10 tunes the detector to 455 kHz, and the detector output is taken from pin 9, and developed across the discriminator output level control (R22). Q9 serves as an amplifier/buffer, supplying the audio/control board (pin 5 of J3) with the final amplified discriminator output.

Depending on the operating mode, squelch adjustment is made either on the audio/control board (R53) or by the front panel squelch control (R7). The squelch control is part of a voltage divider network and controls the DC voltage to the Schmitt trigger input at pin 12 of U1. The output of pin 13 is used to activate the signal present light (DS1) and front panel channel busy indicator through switching transistors Q6, Q7, and Q8. With no signal present, pin 13 supplies the base of Q8 with sufficient voltage to cause it to conduct, thus shutting off Q7 and Q6. Upon receipt of a signal, pin 13 goes to ground and Q8 stops conducting. This switches on both Q6 and Q7 by supplying voltage to their bases. Q6 causes pin J3-6 to sink to ground, thus removing the current supplied thru pull-up resistor R53. Q7 allows the signal present light (DS1) to illuminate.

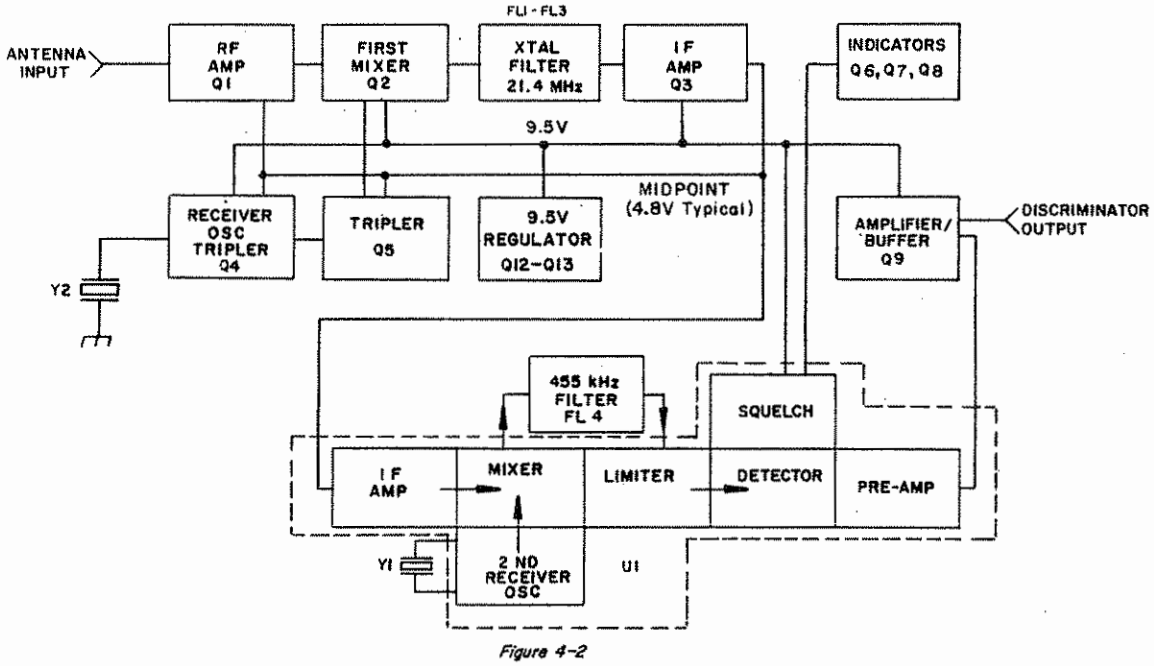


Figure 4-2

4.3 AUDIO/CONTROL BOARD

The audio/control board is a multifunction board containing the audio processing circuitry, the switching control logic circuits, the time-out-timer, and the plug-in tone squelch modules. Adjustments for the time-out-timer (R3), the internal squelch control (R53), and the carrier delay, often referred to as hang time (R11), are easily accessible and clearly labeled. The board receives a regulated 13.8 volts DC from the unit's power supply and a fourteen pin connector (J8), on the audio/control board, can be interfaced with an optional connector on the rear panel to allow for external audio control. As standard equipment the board contains encode and decode modules, inserted into connectors J7 and J4 respectively, for tone "A". Encode and decode modules are available for tone "B", as an option, and are inserted into connectors J6 and J5 respectively.

The discriminator output from the receiver board is fed into the audio/control board at pin 5 of J2. The tone "A" decode module and U5 form a deemphasis network, with the tone module acting as a high pass filter and U5 as a band pass filter. The resulting signal leaves U5, via pin 14, and enters U10-A at pin 1 (see figure 4-4). The signal then passes through a series of switches where it is routed to the transmitter in the repeat mode, and/or to the audio amplifier, (U19) for use as local audio.

U10 is a quad analog switch which uses the control logic inputs to determine the audio signal path. When the local audio is activated, the signal is routed through switches U10-A and U10-C to the front panel volume control (R8). Audio from the wiper on the volume control is returned to the audio control board via pin 12 of J3 and is then fed through C19 to the audio amplifier (U19) at pin 8. The output of U19 is taken from pin 12 and is directed to the 3.2 ohms speaker through C13 and pin 23 of J3. The amplified audio is sufficient to produce over 3 watts of audio for local monitoring.

With the unit in the Repeat mode or Base Station/Repeat mode, the audio from pin 14 of U5 is routed through switches U10-A and U10-B of the quad analog switch U10. The signal then enters U18, through R25, C20 and R37, at pin 2. Quad Operational Amplifier, U18, and its associated components serve as a limiter/preemphasis network supplying audio to the exciter. U18-A and U18-B, along with their associated circuitry, comprise a high pass filter. The filtered signal is then applied to U18-C which functions in conjunction with a diode limiter made up of CR2, CR3, CR4, and CR5. When the signal level at pin 6 of U18-C exceeds 2 volts peak-to-peak, signal limiting action begins. U18-D and its associated circuitry are used as a low pass filter with the resulting signal fed to the exciter through pin 1 of J1.

Hangtime, the amount of time before the repeater unkeys after each transmission, is used only in the repeat mode. The hangtime can be set for between "0" and "5" seconds by adjusting R11 on the audio/control board and is directly proportional to the resistance of R11. When the unit is keyed in the repeat mode, pin 11 of U2 goes high and C4 is charged through CR1 (figure 4-5). As long as C4 is charged, pin 3 of U4 and pin 3 of U2 will remain high keeping the transmitter keyed. CR1 is reverse biased so, when the operator unkeys, C4 will discharge through CR9, R10 and R11. After C4 discharges, pin 3 of U4 goes low, unkeying the transmitter. CR8 is an isolation diode. When U3 times out, pin 3 pulls down CR1 through CR7 to unkey the circuit.

The time-out-timer circuit is also located on the audio/control p.c. board. U3 is a monostable or one-shot multivibrator and, together with its associated components, comprises the time-out-timer for the desktop repeater. When the unit is keyed in the Base and/or the Repeat mode, pin 3 of U1 goes low triggering U3 through C2. U3, when triggered with a low at pin 2, changes its state for a specified period of time and then returns to its normal state.

U5 is a capacitance multiplier for C3 and increases the capacitance of C3 by 100 times (per the ratio of the values assigned to R5 and R6). As a result, what appears to be a 1,000 microfarad capacitor is seen by U3 at pins 6 and 7. By altering the resistance of variable resistor R3, the time required for U3 to time out can be adjusted for two to ten minutes. Once U3 has timed out, the base or mobile operator must unkey and then rekey the microphone to transmit again. Unkeying the transmitter will cause U4 to reset U3 through pin 4 discharging C3 through CR10 and R63.

U14 is a bistable (flip flop) multivibrator used in the tone control circuit (figure 4-7) to insure that correct tone coding continues for the duration of each transmission. U14 will remain in one of two stable states until it is triggered with a high to pins 4 and 10. This triggering occurs after the user has unkeyed shifting U14 to its alternate state. As a result, once the system has been accessed by a signal encoded with an appropriate tone, all subsequent repeated transmissions will be coded with that same tone until the user has completed his transmission, unkeyed, and a hangtime of from zero to five seconds has elapsed. A high at pin 6 of U14 would indicate that U14 is set for signals coded with tone "A" while a high at pin 8 would reflect a setting for "B" tone coded signals.

Figures 4-3, 4-5 and 4-7 indicate the possible signal paths and switching control logic that determines the unit's operating mode. The basic control parameters utilized by the switching logic circuitry are shown in the logic tables (tables 4-a, b, and c) and can be traced through the block diagrams in figures 4-4, 4-6, and 4-8. The various inputs to the control logic are listed on the left side of the logic tables while the outputs of

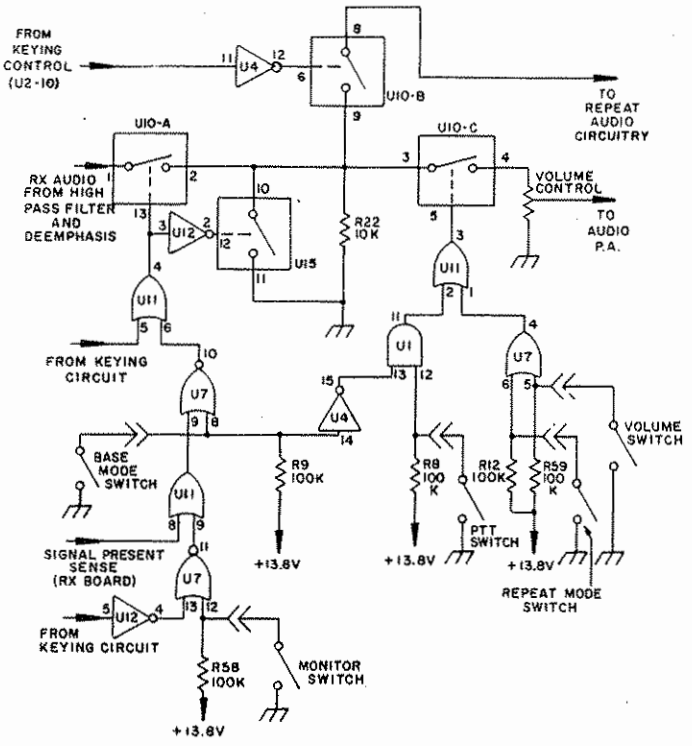
the control logic are expressed to the right of the double lines. The pin numbers referenced on the block diagrams will assist the technician in following the circuitry when used in conjunction with the schematic in the back of the manual.

4.3.1 LOCAL AND REPEAT AUDIO LOGIC

In the Repeat mode, local audio can be monitored by pulling out the volume control knob (this knob is also used to adjust volume level). Repeat audio supplied to the transmitter and local audio are controlled by the carrier squelch and the tone squelch (if activated).

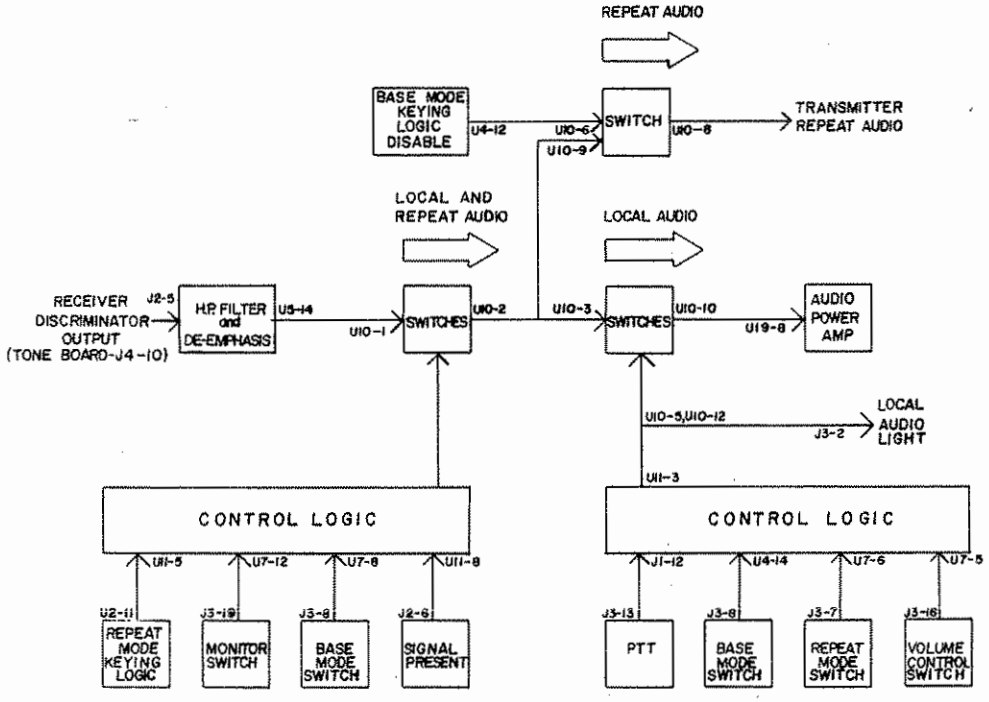
In the Base mode, local audio is controlled by the tone and the carrier squelch but operates independent of the volume control switch position (i.e. the position of the volume control switch can be either in or out). When the push to talk (PTT) button on the microphone is pressed, both local and repeat audios are disabled. The repeat audio is not active in this mode.

In the Repeat/Base mode, local audio operates as if the unit were in the Base mode, Repeat audio operates as if the unit were in the repeat mode, and when the PTT button is pressed, both local and repeat audios are disabled.



LOCAL AND REPEAT AUDIO SWITCHING

Figure 4-3



LOCAL AND REPEAT AUDIO

Figure 4-4

LOCAL AND REPEAT AUDIO LOGIC TABLE

0 = LOW 1 = HIGH RPT MODE KEYING LOGIC	0 = LOW 1 = HIGH MONITOR SWITCH	0 = HIGH 1 = LOW BASE MODE SWITCH	0 = HIGH 1 = LOW SIGNAL PRESENT	0 = HIGH 1 = LOW PTT	0 = HIGH 1 = LOW RPT MODE SWITCH	0 = HIGH 1 = LOW VOLUME CONTROL SWITCH	0 = LOW 1 = HIGH BASE MODE KEYING LOGIC DISABLE	LOCAL AND RPT AUDIO	LOCAL AUDIO	REPEAT AUDIO	LOCAL AUDIO LIGHT
—	—	0	—	—	0	—	—	0	0	0	0
0	—	0	0	—	1	—	—	0	0	0	0
0	—	0	1	—	1	—	—	0	0	0	0
1	—	0	1	—	1	0	0	1	0	1	0
1	—	0	1	—	1	1	0	1	1	1	1
0	0	1	0	0	0	—	0	0	0	0	0
0	0	1	1	0	0	—	0	1	1	0	1
0	1	1	1	0	0	—	0	1	1	1	1
—	—	1	—	1	—	—	—	0	0	0	0
—	—	1	—	1	1	—	—	0	0	0	0

NOTES: 1 0 = Inactive, 1 = Active, — = The State Has No Effect On The Output

2 The Table Repeats Itself In The Base/RPT Mode (I.e. Local Audio As In The Base Mode And Repeated Audio As In The RPT Mode.)

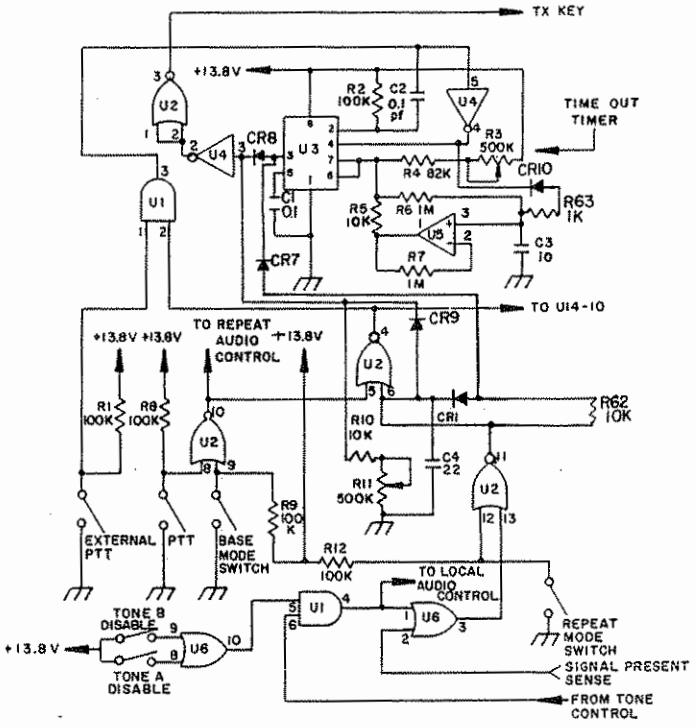
Table 4-a

4.3.2 KEYING LOGIC

In the Repeat mode, the keying logic is controlled by the tone and by the carrier squelch. If neither tone "A" or "B" is activated, the keying is controlled by the carrier squelch only. In this mode, the keying capability of the PTT switch on the microphone is disabled. The hangtimer and the time-out-timer are both active.

When the unit is placed in the Base mode, transmitter keying is accomplished through the push-to-talk (PTT) switch on the microphone. Tone and/or carrier squelch keying capabilities are disabled, as is the hangtimer. The time-out-timer is active. Should a remote PTT be required, it can be accessed through the back of the unit via pin 6 of J8. Remote PTT keying is independent of any mode.

With the unit in the Repeat/Base mode, keying is controlled through the PTT or through the carrier squelch and tone (if activated). The time-out-timer is active and the hangtimer is active only if the keying is done by the Repeat mode keying logic.



TRANSMITTER KEYING

Figure 4-5

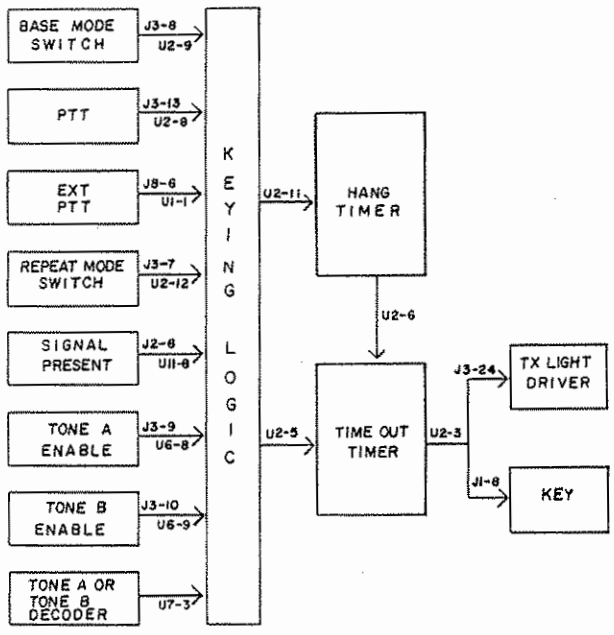
TRANSMITTER KEYING LOGIC TABLE

0 = HIGH 1 = LOW EXT. PTT	0 = HIGH 1 = LOW PTT	0 = HIGH 1 = LOW BASE MODE	0 = HIGH 1 = LOW RPT MODE	0 = HIGH 1 = LOW SIGNAL PRESENT	0 = LOW 1 = HIGH TONE A	0 = LOW 1 = HIGH TONE B	0 = HIGH 1 = LOW TONE A OR B DECODED	KEY TX LIGHT	TOT	HANGTIMER
0	0	0	0	0	0	0	0	0	0	0
1	—	—	—	—	—	—	—	1	1	0
0	1	0	0	0	0	0	0	0	0	0
0	1	1	0	0	0	0	0	1	0	1
0	1	0	1	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	1	1	1
0	0	0	1	1	1	0	0	0	0	0
0	0	0	1	1	0	1	0	0	0	0
0	0	0	1	1	1	1	0	0	0	0
0	0	0	1	1	1	0	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1
0	0	0	1	0	—	—	—	0	0	0

NOTES: 1 0 = Inactive, 1 = Active, — = The State Has No Effect On The Output.

2 For Tone A And Tone B, Active Means A +V Supply Level. For The Rest Of The Inputs It Means Ground Level.

Table 4-b



KEYING

Figure 4-6

4.3.3 TONE CONTROL LOGIC

In the Repeat mode, the tone selected on the front panel is decoded by the unit and re-transmitted. If both tones are selected, the first tone decoded (i.e. the tone that unsquelched the unit) is transmitted. Should a second tone be decoded, while the first tone coded signal is being transmitted, the second tone coded signal will not be transmitted until the first tone user has unkeyed and hangtime has completed.

If the unit is in the Base mode, the tone selected will be transmitted when the PTT button is pressed; however, if both tones are selected, only tone "A" will be transmitted when the PTT is pressed.

When the unit is in the Repeat/Base mode, the tone selected will be transmitted when decoded. If both tones are selected, the tone decoded will be transmitted. Should a second tone be decoded while the first one is being transmitted, the second tone will not be transmitted until the user with the first tone has unkeyed and hangtime has completed. Should the Base Station operator press the PTT (tone A) while tone "B" is being repeated, the tone "B" coded signal would continue to be transmitted until the user has unkeyed and the hangtime has completed. When the PTT is pressed with both tones selected, tone "A" is transmitted.

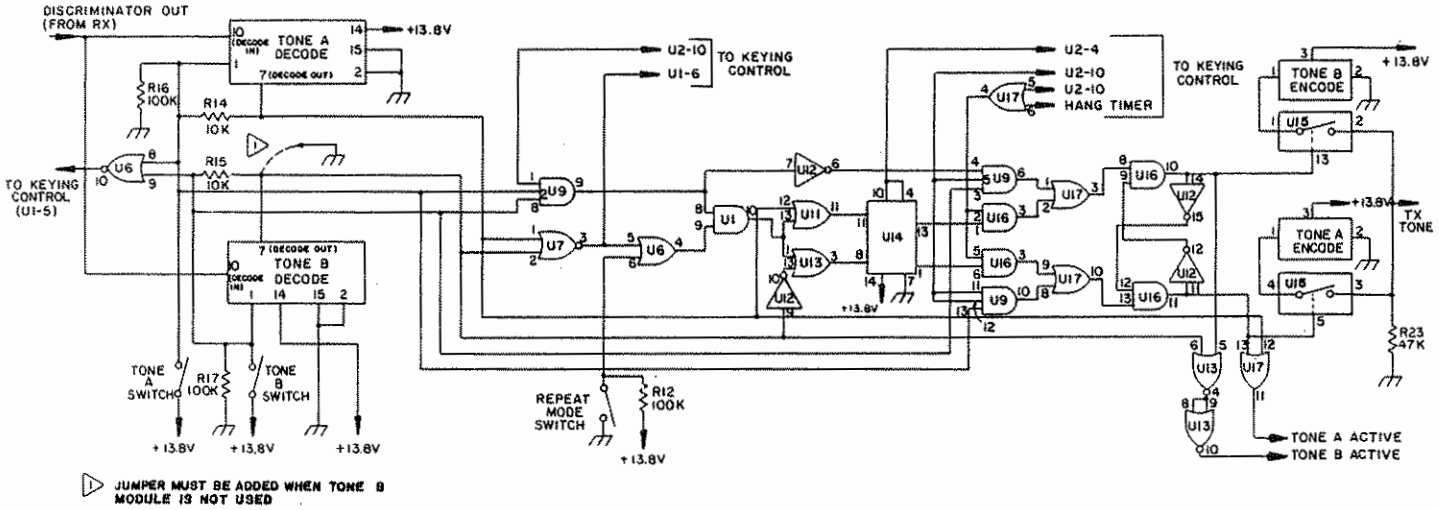
TONE CONTROL LOGIC TABLE

0 = LOW 1 = HIGH BASE MODE KEYING LOGIC	0 = LOW 1 = HIGH HANG TIMER	0 = HIGH 1 = LOW REPEAT MODE SWITCH	0 = HIGH 1 = LOW BASE MODE SWITCH	0 = LOW 1 = HIGH TONE B DECODER	0 = LOW 1 = HIGH TONE A DECODER	0 = LOW 1 = HIGH TONE B ENABLE	0 = LOW 1 = HIGH TONE A ENABLE	TONE OUTPUT	0 = LOW 1 = HIGH TONE A ACTIVE LIGHT DR.	0 = LOW 1 = HIGH TONE B ACTIVE LIGHT DR.
0	0	1	0	0	0	1	1	0	0	0
0	1	1	0	0	1	0	1	1	1	0
0	1	1	0	1	0	1	0	1	0	1
0	1	1	0	1	1	1	1	1	1	1
1	0	0	1	—	—	0	0	0	0	0
0	0	0	1	—	—	0	0	0	0	0
1	0	0	1	—	—	0	1	1	1	0
1	0	0	1	—	—	1	0	1	0	1
1	0	0	1	—	—	1	1	1	1	0

NOTES: 1 0 = Inactive, 1 = Active, — = The State Has No Effect On The Output.

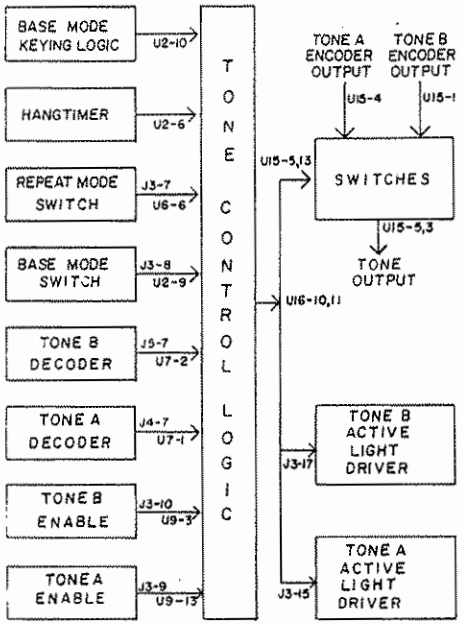
2 The Table Repeats Itself In The Base/Repeat Mode.

Table 4-c



Tone Control

Figure 4-7



TONE CONTROL

Figure 4-8

4.4 VOLTAGE REGULATOR BOARD

U1 is a three-terminal, adjustable voltage regulator and is connected directly to the 13.8 Volt output of the voltage regulator p.c. board. As the load demand at the output varies, current drawn by U1 varies accordingly (typical operating current is 100 mA). U1 controls the emitter/base current of Q1. Q1 supplies current through the discrete Darlington pair consisting of Q2 and the power transistor (part number 48-01-117) located on the heatsink assembly. This Darlington pair is used as a current amplifier for U1 to allow for large current drains while maintaining a regulated 13.8 volt output. CR3, R10, R11 and CR2 form a voltage crowbar circuit which is used for overvoltage protection of the repeater circuitry.

4.5 RF AMPLIFIER BOARD

The signal enters the RF Amplifier, from the 2 watt exciter board, via J1 and is developed across L6, C2 and C1 (a matching network). Q1 is a class "C" amplifier and is biased off when no signal is present. The output of Q1 is taken from its collector and matched to the input of Q2 through components C5, C4, C17 and L2. L2 and its respective RF bead also supply a DC return for the base of Q2. C7, C1, C9 and C10, together with p.c. board striplines L7 and L8, form a filter and matching network to minimize spurious signals. The amplified signal is coupled to J2 through DC blocking capacitor C11.

PRECAUTIONS FOR HANDLING CMOS DEVICES

The extremely low power consumption of CMOS devices makes them ideally suitable for a variety of electronic equipment. Although most CMOS devices have built in protective diode networks which protect the device against damage due to static electric discharge, special care should be exercised in handling any CMOS device. Additional precautions should be followed to assure trouble-free performance after assembly. The following recommendations should be considered and observed prior to handling CMOS devices:

1. Use conductive or static shielding envelopes for storing or transporting CMOS devices. Untreated plastic materials should not be used for this purpose.
2. All work with CMOS devices should be done on a grounded bench surface, and the technician should be kept at ground potential. This can be accomplished by having the technician touch an electrical ground prior to handling the devices and by wearing conductive wrist bands utilizing a one megohm resistor to ground.
3. Nylon clothing should not be worn while handling CMOS devices.
4. When soldering CMOS devices, a grounded soldering iron should be used and the operation should be limited to 5 seconds with 250°C maximum temperature.
5. Do not insert or remove CMOS devices or subassemblies containing CMOS devices when electrical power is applied.

Section 5: Alignment

5.1 GENERAL

All modules should be in place and secured with mounting screws before alignment of the Desktop Repeater is attempted. A test fixture used to facilitate alignment procedures may be constructed as shown in Figure 5-1.

The following test equipment is recommended to properly align and service the Desktop Repeater:

1. DC Voltmeter
2. FM Signal Generator*
3. 30 dB 50 Watts Attenuator
4. RF Wattmeter
5. Test fixture/mic interface (see figure 5-1)
6. Speaker Test Plug (21-01-013)
7. Audio Signal Generator*
8. Modulation Monitor*
9. Frequency Counter*
10. Distortion Analyzer
11. DC Oscilloscope
12. 21.4 MHz Test Oscillator*
13. Splitter/Combiner (4:1)
14. CTCSS Tone Generator
15. Spectrum Analyzer (for duplexer tuning only)

* A communications monitor may be used for these functions where applicable.

Figure 5-2 reflects the proper connections of the test equipment to the Desktop repeater.

NOTE: The RX and TX portions of the repeater may be tested separately by disconnecting the RX and TX cables at the duplexer.

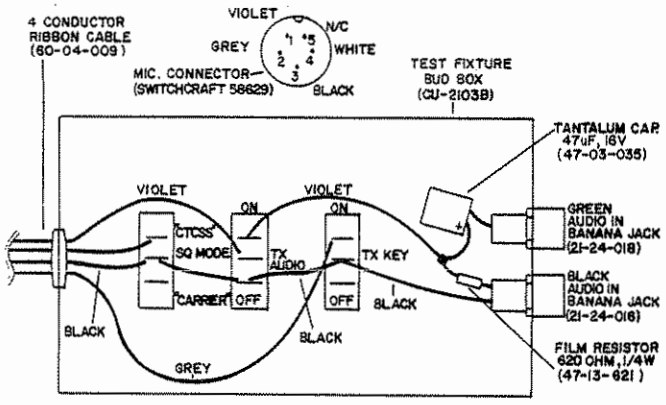


Figure 5-1

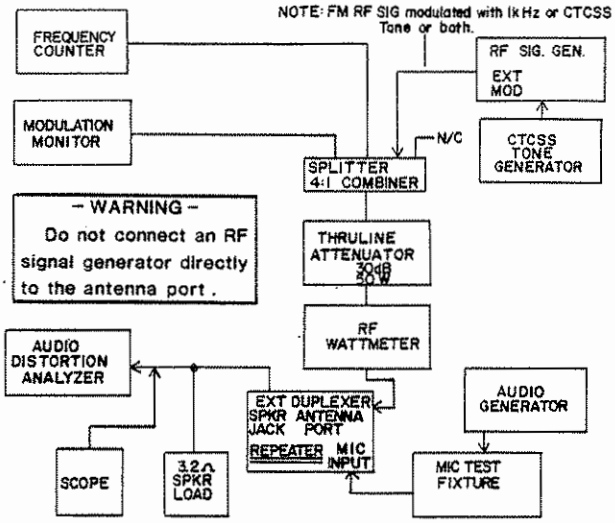


Figure 5-2

5.2 RECEIVER ALIGNMENT PROCEDURE

NOTE: The signal generator settings must reflect the attenuation through the wattmeter/feedthrough power attenuator and signal splitter, so RF levels called out will appear at the antenna port of the duplexer (reference figure 5-2). See Figure 5-3 for the location of test points and tuning adjustments.

1. Connect test equipment as shown in figure 5-2 and preset the repeater controls as follows:

   Power - off
   Mode switch - in Base mode
   Squelch control - counterclockwise
   Volume control - counterclockwise
   Tone controls - off
   Hangtime control- clockwise
   Time-out-timer control- counterclockwise

   Preset the mic test fixture switches as follows:

   Tx key - off
   Tx audio - off
   Squelch mode switch - to "CARRIER"

2. With the power supply voltage on, observe the DC Voltmeter at the 13.8 Volt test point (figure 5-3) and adjust R8 of the power supply module to 13.8 volts ±.1 volts.

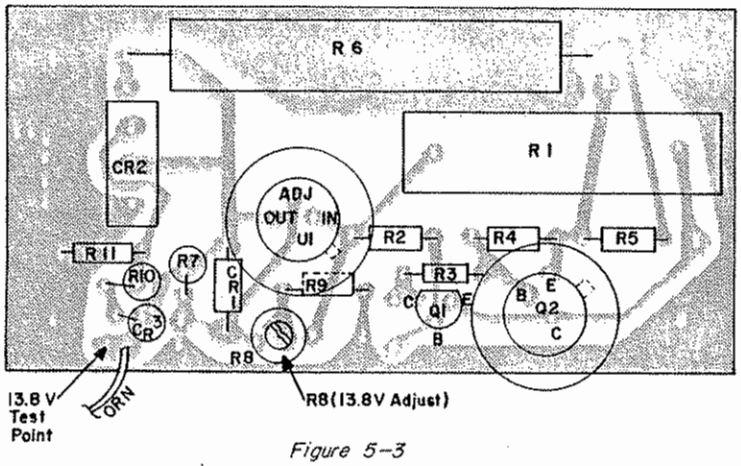


Figure 5-3

3. Set the unit for "Base" mode with both tones (A and B) off. Refer to figure 5-4 and adjust the receiver discriminator output level (R22) to midrange.

4. Check TP3 (C62) for 9.5V ±0.1 volts. Adjust R45 if necessary.

5. Connect the scope to TP1 (R35) and adjust L12 and L13 for maximum (5.7V typical).

6. Connect the scope to TP2 (R7) and adjust L15 and L16 for maximum (0.6V typical).

7. Adjust the volume control for 1 VRMS and adjust L10 for maximum noise on the Distortion Analyzer.

8. Adjust the volume control fully counterclockwise. Remove the audio test jack from the external speaker socket. Adjust the volume control for a comfortable listening level.

9. Set the RF signal generator (unmodulated) to the channel frequency and adjust to quiet the receiver. Then reduce the signal by 10 dB.

10. Using the 21.4 MHz test oscillator coupled near the I.F. amplifier (U1), adjust L11 for zero beat.

11. Plug the audio test jack back into the external speaker socket.

12. Set the RF signal generator to 3 kHz deviation (with 1 kHz audio) and .1 mV output at the antenna port.

13. Adjust the volume control for 3.1 VRMS.

14. Tune L3, L4, L6, L7, L8 and L9 for best 12 dB SINAD. Adjust the signal generator level as required to maintain 12 dB SINAD.

15. Set the generator to 1 mV. Adjust the volume control for 1 VRMS and tune L10 for maximum audio on the distortion analyzer. Adjust R22 for 0.7 VPP (±0.1V) at pin 10 of the tone modules (A or B).

16. Set audio to 3 kHz and deviation to 5 kHz. Set volume control for approximately 1.0 V rms.

17. Tune L8, and L9 for minimum audio distortion. Repeat as required. Distortion should be less than 5%. Reset audio to 1 kHz, deviation to 3 kHz. Recheck distortion for less than 5%.

18. The 12 dB SINAD should be no greater than 0.42 uV (-115 dBm). Note the RF level for use in step 4 of Section 5.8.

19. The 20 dB quieting should be no greater than 0.60 uV (-111 dBm).

20. To set the squelch operating point, adjust the signal generator for 0.1mV

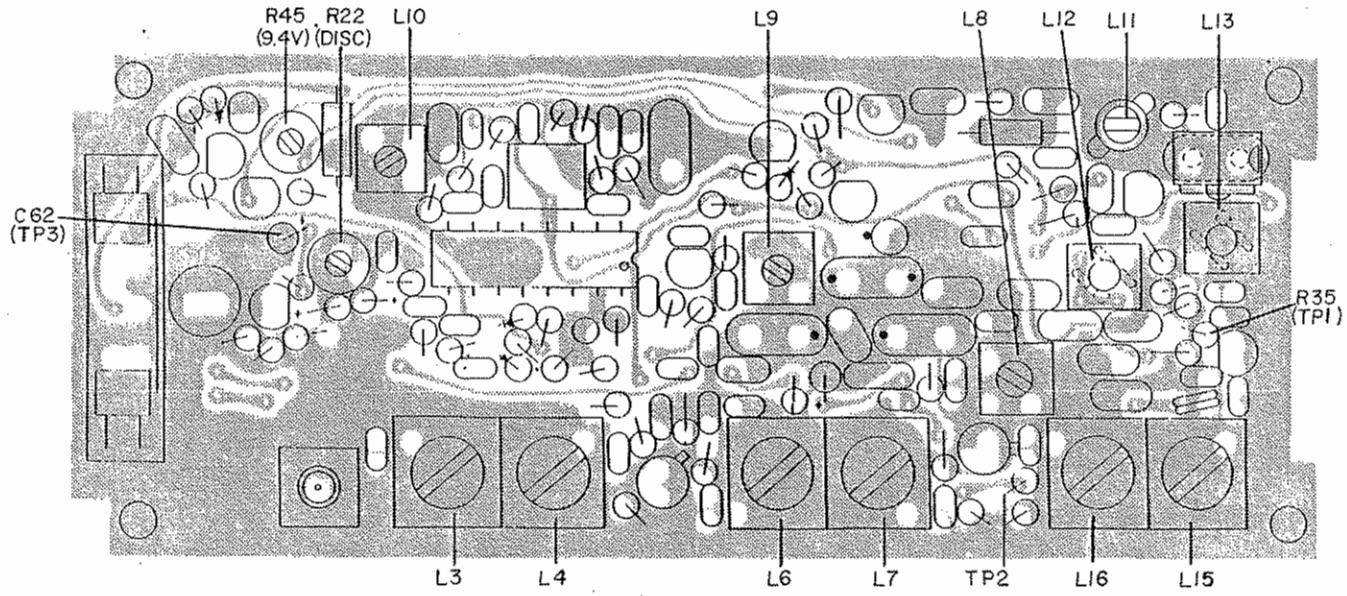


Figure 5-4

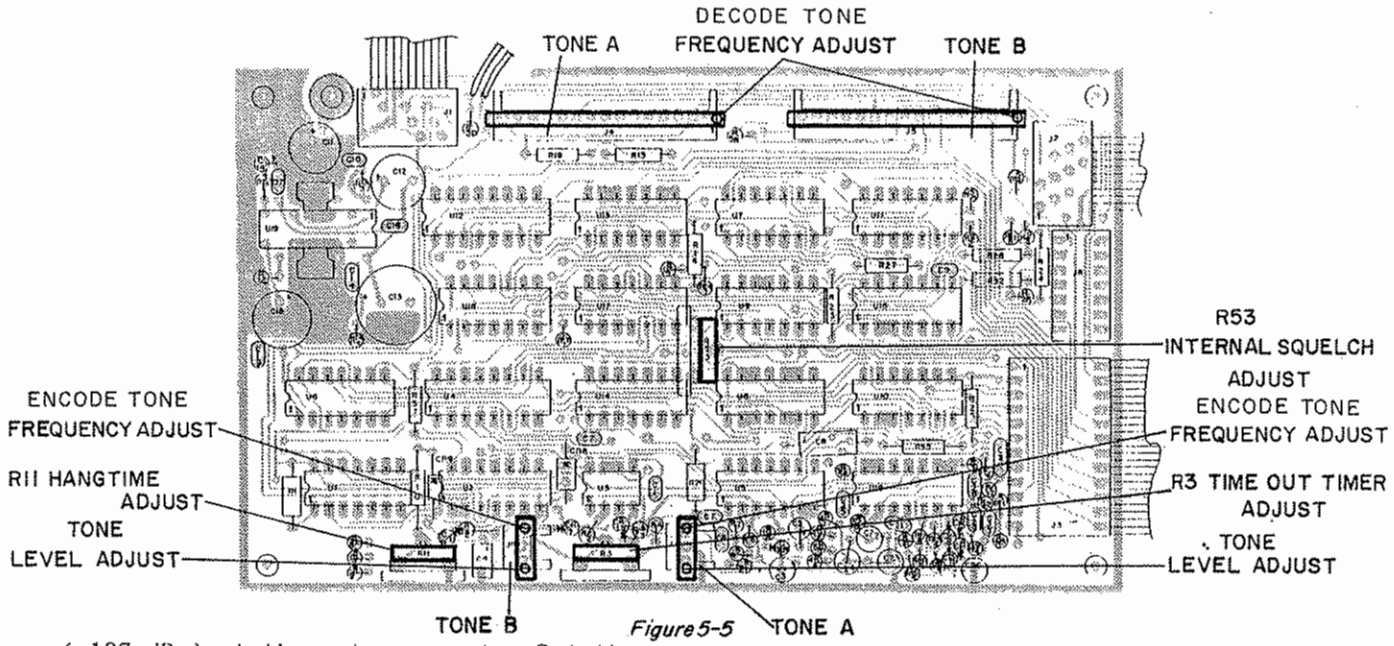


Figure 5-5

(-127 dBm) at the antenna port. Set the squelch control on the front panel completely counterclockwise (unsquelched). The front panel busy light should be illuminated. Rotate the squelch control clockwise until the busy light remains off. Increase the RF level on the signal generator until the busy light remains on. Verify that the RF level is less than 0.25 mV (-119 dBm) at the antenna port.

21. Switch to the "Repeat" mode and adjust the internal squelch (depicted in figure 5-5) as described in step 20. Unsquelched position is counterclockwise (turn control toward rear panel.)

5.3 TRANSMITTER ALIGNMENT PROCEDURE

1. Disconnect the 2W exciter from the RF amplifier and connect it to the 50 ohm wattmeter.

2. Set the unit for "Base" mode with both tones (A and B) off. Refer to Figure 5-6 for the location of test points and tuning adjustments.

3. Set the transmitter power (R27) fully clockwise.

4. Use the microphone test fixture "Tx key" switch to key and align the exciter.

5. Connect the scope to TP1 (R9). Key the transmitter and adjust L2 and L3 for maximum (nominal voltage 1.0 VDC).

6. Connect the scope to TP2 (R13). Key the transmitter and adjust L4 and L5 for maximum (nominal voltage 1.75 VDC).

7. Adjust C26, L6, C30 and C34 for maximum power output. Set transmitter power (R27) to 2W ±0.1W. Readjust L6, C26,

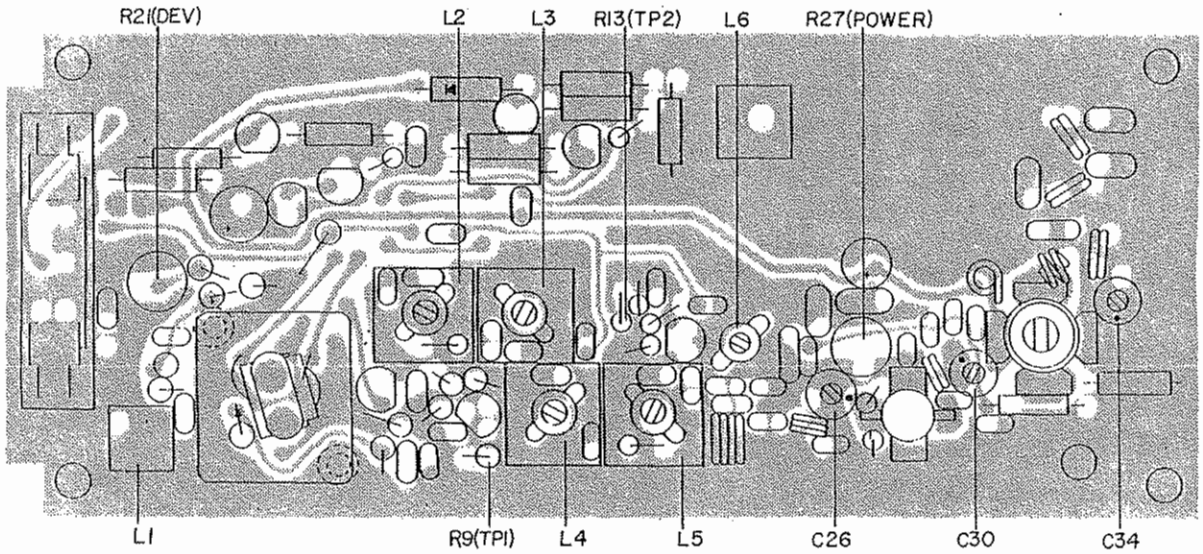


Figure 5-6

C30 and C34 for maximum power output. Set C30 and C34 for maximum power output.

8. Adjust L1 to set transmit frequency. A nonmetallic tuning tool is recommended.

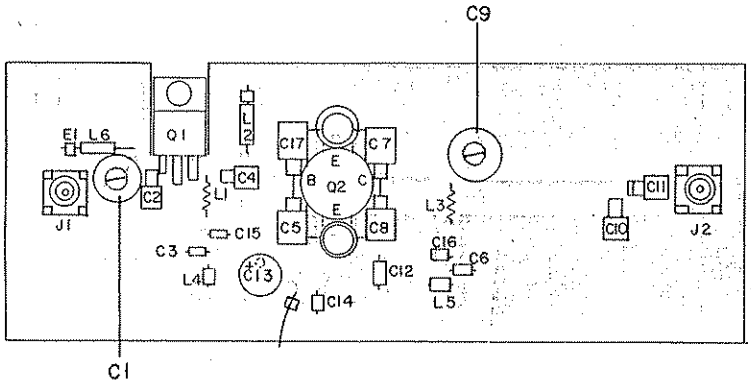


Figure 5-7

Adjust to 1.0 kHz ±(100 Hz) below operating frequency at room temperature. Insure AC power has been applied for a minimum of 2 minutes prior to making this adjustment.

5.4 RF AMPLIFIER ALIGNMENT

1. Reconnect the exciter to the RF Amplifier. Refer to figure 5-7 for the location of tuning adjustments.

2. Connect the 50 ohm wattmeter to the antenna port on the duplexer.

3. Key the transmitter and adjust C1 and C9 on the RF amplifier for maximum power. Adjust C34 on exciter for maximum power.

4. Adjust the transmitter power (R27) on the exciter (figure 5-6) for 20W.

5.5 DECODE TONE ALIGNMENT

NOTE: If "B" Tone is not used, a jumper must be installed between pins 2 an 7 of J5, the tone "B" decoder connector.

1. Preset front panel controls and microphone test fixture controls as follows:

   Base mode-on
   RPT mode-off
   Tone "A"-off
   Tone "B"-off
   Squelch control as set in RX alignment, step 20
   Tx key-off
   Tx Audio-off
   Squelch mode switch- to "CTCSS"

2. Connect a high impedance frequency counter to the left leg (nearest speaker) of the single turn potentiometer on the decoder being adjusted. Make sure both tone switches are in the off position and adjust the multiturn potentiometer for the proper decode frequency.

3. To test the CTCSS squelch opening, modulate the signal generator with the required tone frequency at 500 Hz deviation. Depress the front panel tone switch corresponding to the decoder being tested. Set the RF level of the signal generator to zero, and increase the level until the BUSY and TONE (A or B) lights come on. Verify that audio is present at the speaker or at the external speaker jack. The unit should decode and open the squelch with an RF level of less than .25 uV (-119 dBm) at the antenna port.

4. Return the microphone test fixture squelch mode switch to "carrier."

5.6 DEVIATION ADJUSTMENT

1. Place the unit in "Base" mode with "A" and "B" tones off.

2. Set the audio frequency to 1,000 Hz and the output to 2V P-P (700 mV RMS) as measured on the oscilloscope.

3. Turn on the "Tx Audio" switch located on the microphone test fixture.

4. Key the transmitter and set the transmitter deviation, R21 (figure 5-6), for ±5 kHz deviation.

5. Turn the "Tx Audio" switch to the off position.

5.7 ENCODE TONE ALIGNMENT

1. With the unit in Base mode, depress the tone switch corresponding to the encoder to be tuned (A or B). Set the front panel squelch control fully clockwise.

2. Connect the frequency counter to the output of the modulation monitor.

3. Preset the encoder single turn potentiometer, by turning the level adjustment (figure 5-5) for tone "A" or "B", to mid range.

4. Key the transmitter via the microphone test fixture and adjust the multiturn potentiometer on the appropriate encoder (figure 5-5) for the required frequency ±0.1 Hz on the frequency counter.

5. Adjust the appropriate encoder level adjustment for 750 Hz deviation.

6. Repeat procedure for deviation check as outlined in step 5.6. With tone A on, the deviation should be between 4.7 and 5.0 kHz. If the deviation exceeds 5.0 kHz, adjust R21.

7. Return both front panel tone switches to the off position.

5.8 REPEAT AUDIO ALIGNMENT

1. Adjust the signal generator, at the an-

tenna port, for 1 mV and 3 kHz deviation with a 1 kHz tone.

2. Place the unit in the "Repeat" mode with both tones (A and B) off.

3. Adjust the receiver discriminator output level (R22) for 3 kHz deviation on the modulation monitor (figure 5-4).

4. Place unit in base mode and recheck audio distortion at rated audio (5% max).

5. To test for desense, place the unit in the repeat mode. The 12 dB SINAD level should be no greater than 3dB above the level noted in step 18 of Section 5.2. If necessary, L3 and L4 can be adjusted to achieve best SINAD. Both base and repeat modes should be checked.

5.9 HANGTIME AND TIME-OUT-TIMER ADJUSTMENTS

1. Set hangtime and time-out-timer controls to approximately 75° clockwise from mid-point (2:30 o'clock). These adjustments set hangtime to approximately 2 seconds and time-out-timer to approximately 3 minutes. No test required.

5.10 DUPLEXER TUNING

NOTE: Remove duplexer from the repeater before tuning.

1. Prior to making any adjustments, connect the output of the RF signal generator to the input of the spectrum analyzer for calibration purposes. Set the signal generator to the transmit frequency and increase the output to obtain a reference at the top line of the screen. The noise base should be at least 70dB below the carrier reference.

2. Upon completion of the calibration step, configure the equipment as shown in Figure 5.8.

3. With the appropriate connection made, inject the transmit frequency into the duplexer and adjust the two slugs on the receive side of the duplexer for a notch of -60dB maximum (-65dB typical). Repeat as necessary.

4. Tighten the locking nuts on the slug adjustment screws for the receive side and check the spectrum analyzer to ascertain that the settings have not been disturbed.

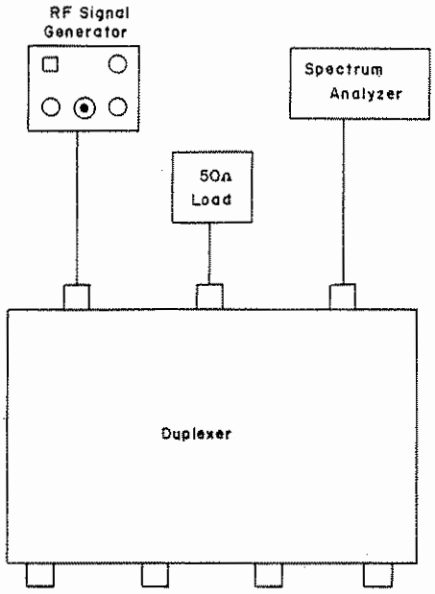


Figure 5-8

5. Set the output of the signal generator to the receive frequency and, while injecting this frequency, adjust the two slugs on the transmit side of the duplexer for a notch of -60dB maximum (-65dB typical). Repeat as necessary.

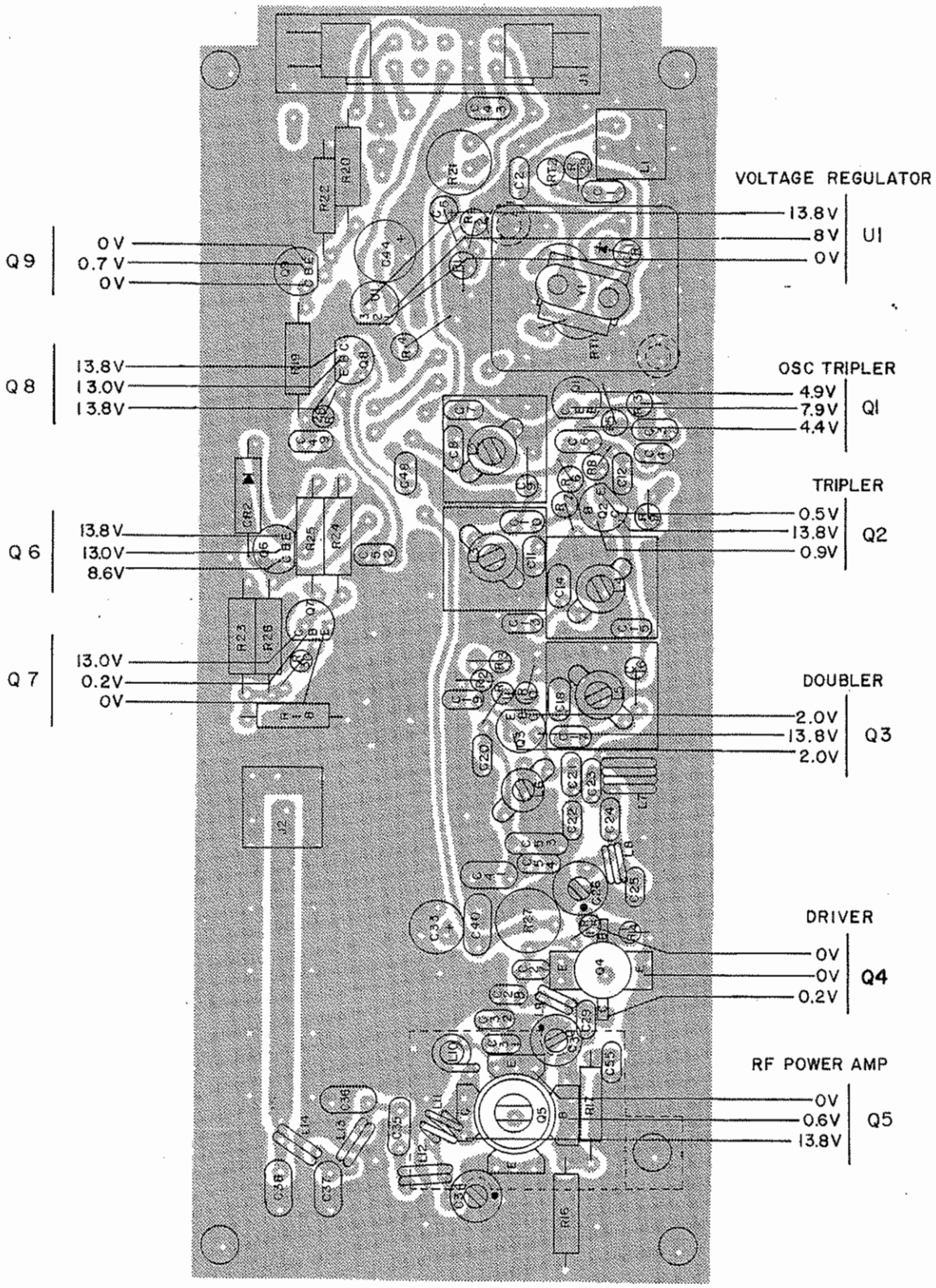
6. Tighten the locking nuts on the slug adjustment screws for the transmit side, and check the spectrum analyzer to ascertain that the settings have not been disturbed.

7. Connect the spectrum analyzer to the antenna port of the duplexer and connect the 50 ohm load to the transmitter port.

8. With the signal generator connected to the receiver port, inject the receive frequency, and confirm an insertion loss of 1.5dB or less. It may be necessary to increase the sensitivity of the spectrum analyzer.

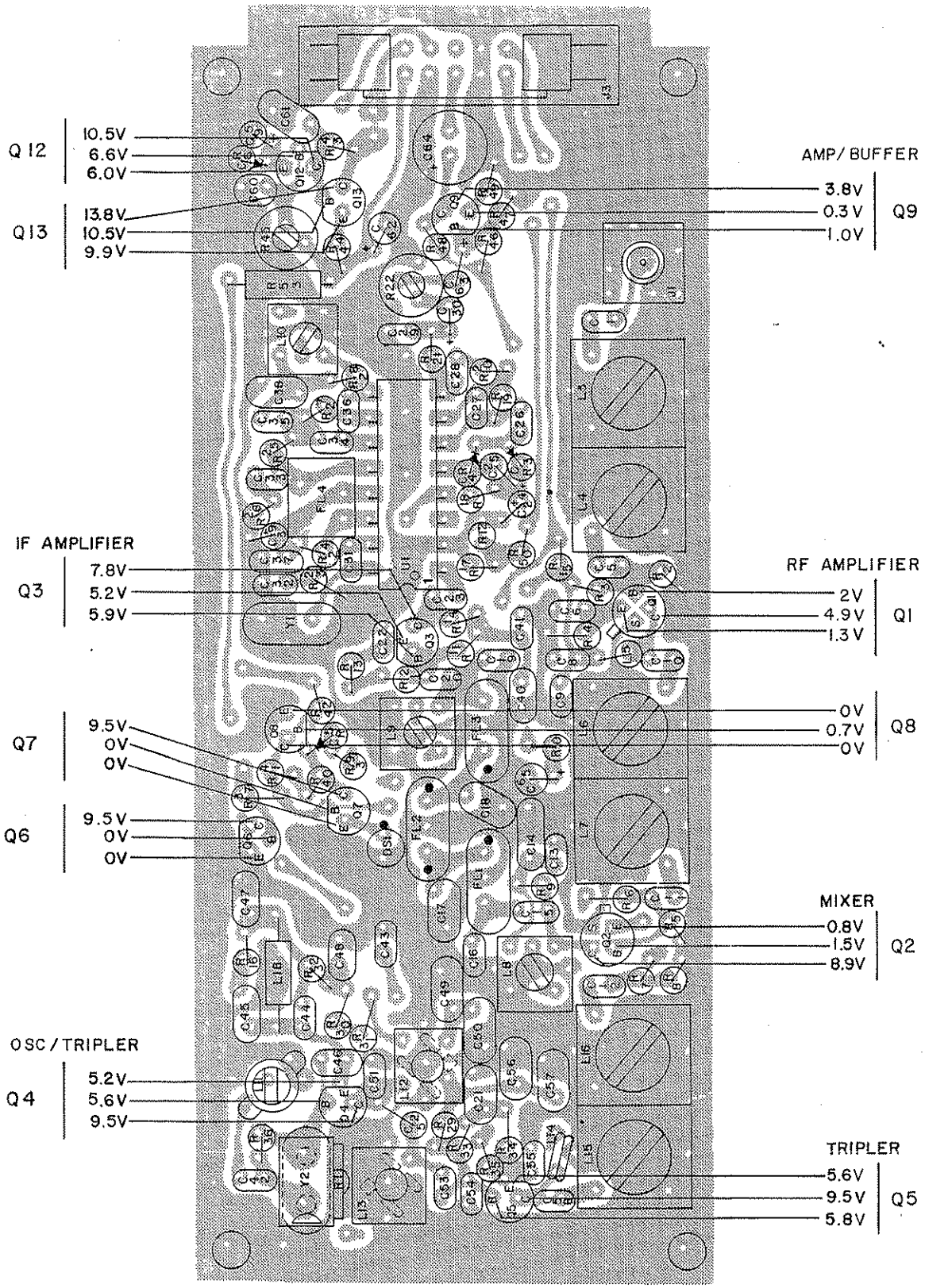
9. With the signal generator connected to the transmitter port, the dummy load to the receiver port, and the spectrum analyzer to the antenna port, inject the transmit frequency, and confirm an insertion loss of 1.5dB or less.

EXCITER TEST VOLTAGES



NOTE: Components shown are Farside

RECEIVER TEST VOLTAGES



NOTE: Components shown are Farside

Section 6: Parts Lists and Schematics

CRYSTAL SPECIFICATIONS

The equipment specifications involving frequency stability are assured only if crystals are supplied by the manufacturer or furnished by manufacturer's approved suppliers.

RECEIVER CRYSTAL 450-470 MHz

Part Number: 23-10-016 1

Case Type: HC-18/U except pin length of .238" and case height of .53"

Type: Third overtone, series resonant

Series resistance: 30 ohms

Freq. Range: 47.622222 to 49.844444 MHz

$$\text{Crystal Freq} = \frac{\text{Operating Frequency*} - 21.4}{9}$$

*(to six decimal places)

TRANSMITTER CRYSTAL 450-470 MHz

Part Number: 23-10-015 1

Case Type: HC-18/U except pin length of .238" and case height of .53"

Type: Fundamental, parallel resonant

Series resistance: 18 ohms

Load capacitance: 43 pF

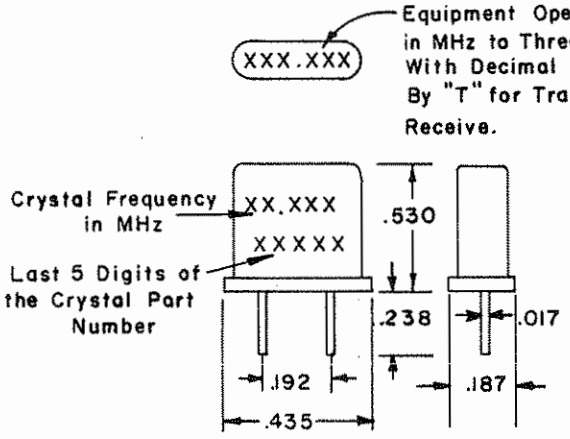
Freq. Range: 25.000000 to 26.111111 MHz (Calculated as follows)

$$\text{Crystal Frequency} = \frac{\text{Operating Frequency*}}{18}$$

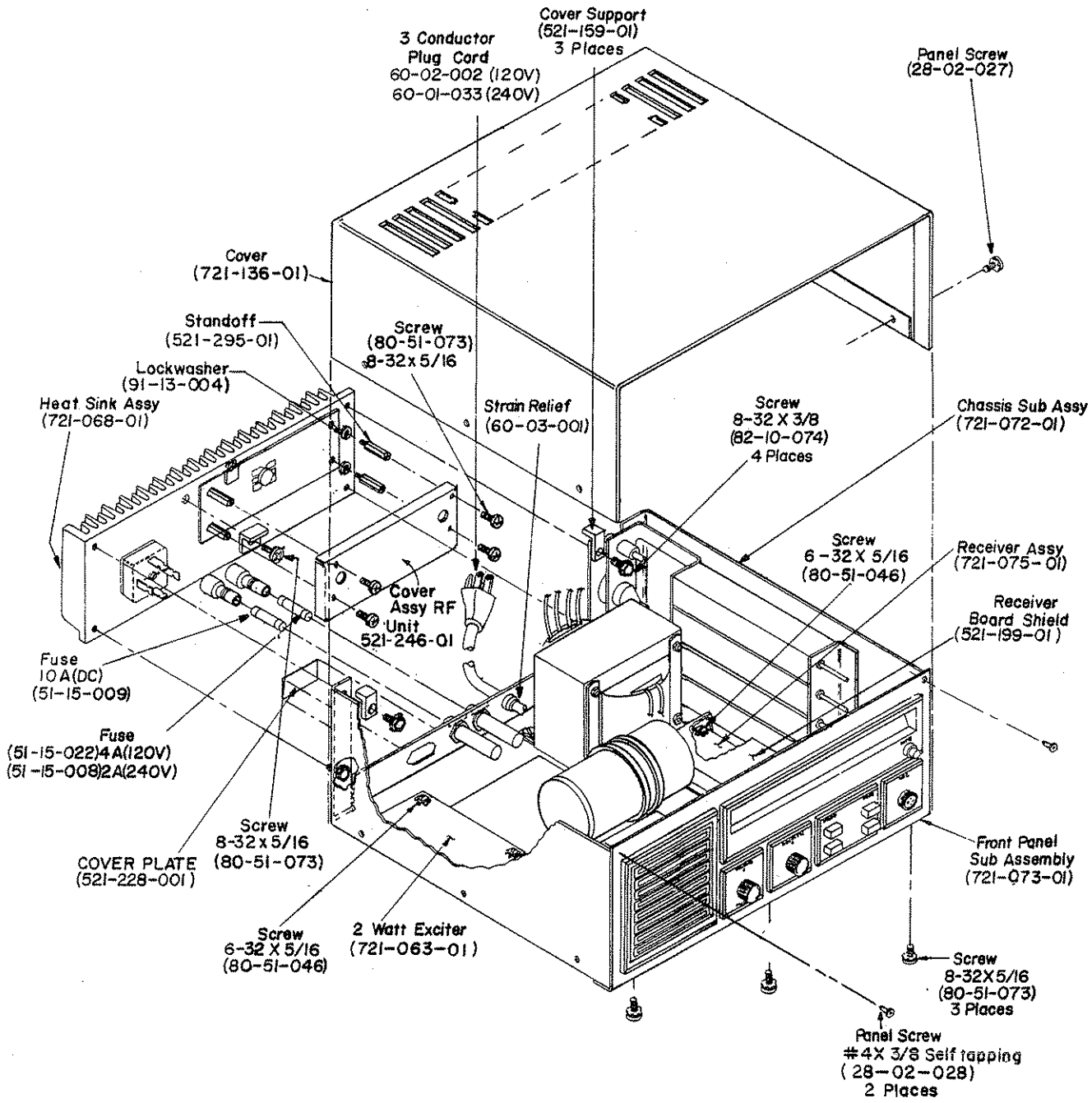
*(to six decimal places)

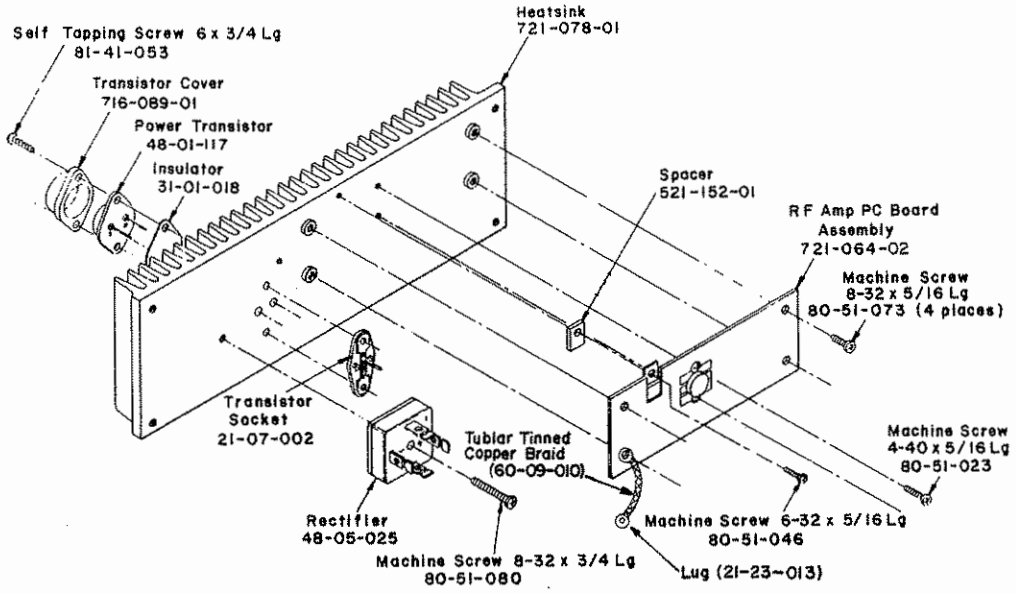
NOTE: To access the transmit crystal, two screws holding the crystal oven must be removed from the bottom of the exciter board (see p. 36).

1 The crystals specified are preferred but can be replaced with receive crystal 23-09-016 or transmit crystal 23-09-015 if necessary. Alternate crystals have a case height of .42" and a pin length of .125".

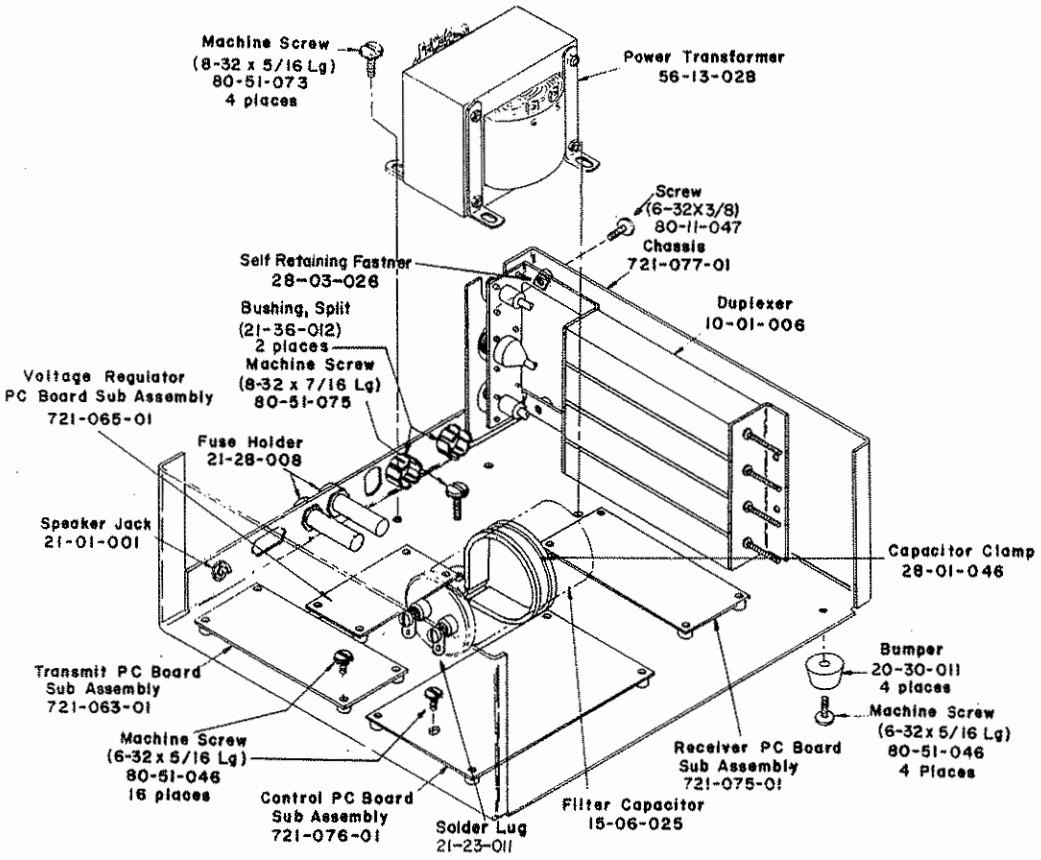


DESKTOP REPEATER ASSEMBLY
821-035-01

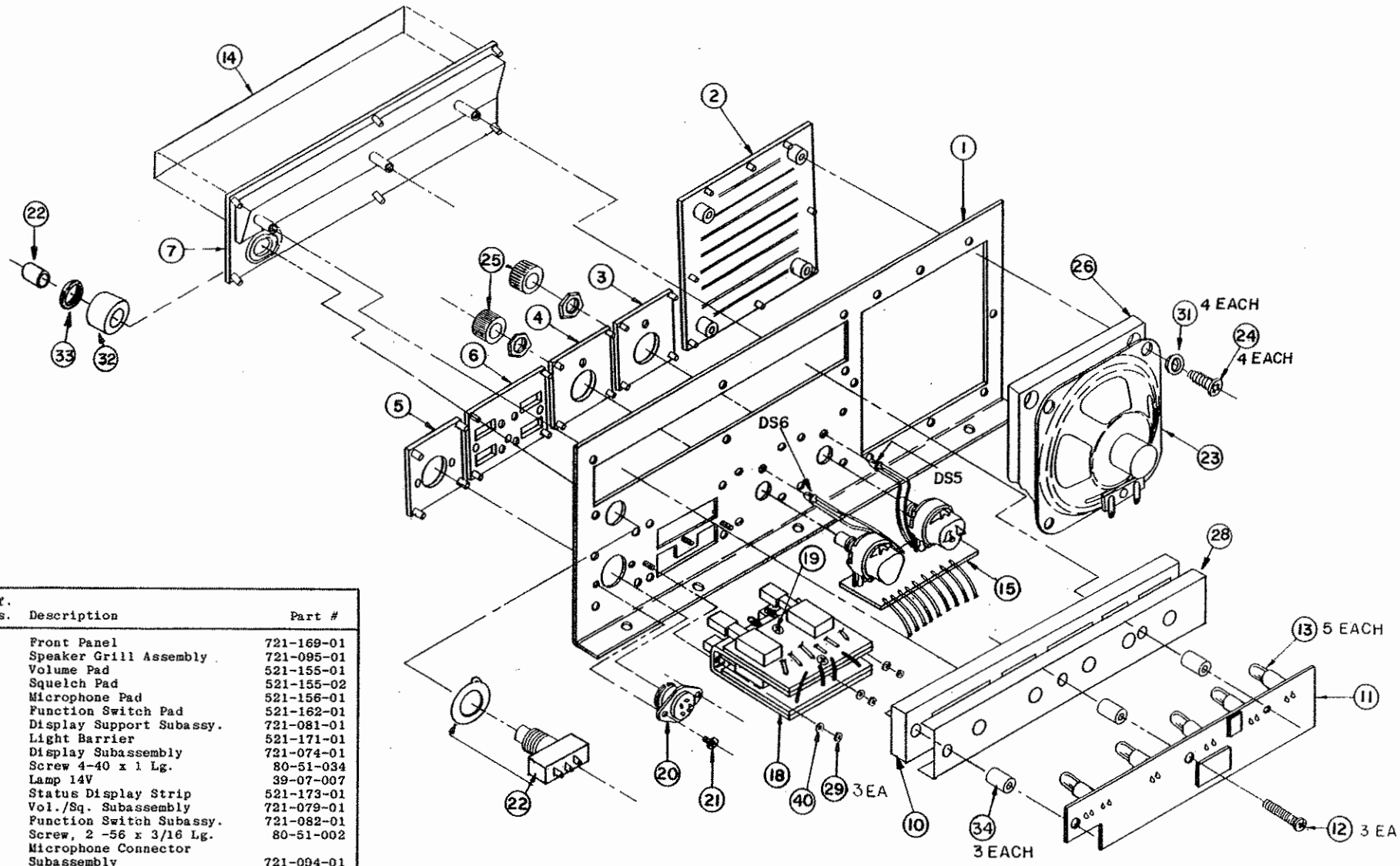




HEATSINK ASSEMBLY
721-068-01



CHASSIS SUBASSEMBLY
721-072-01

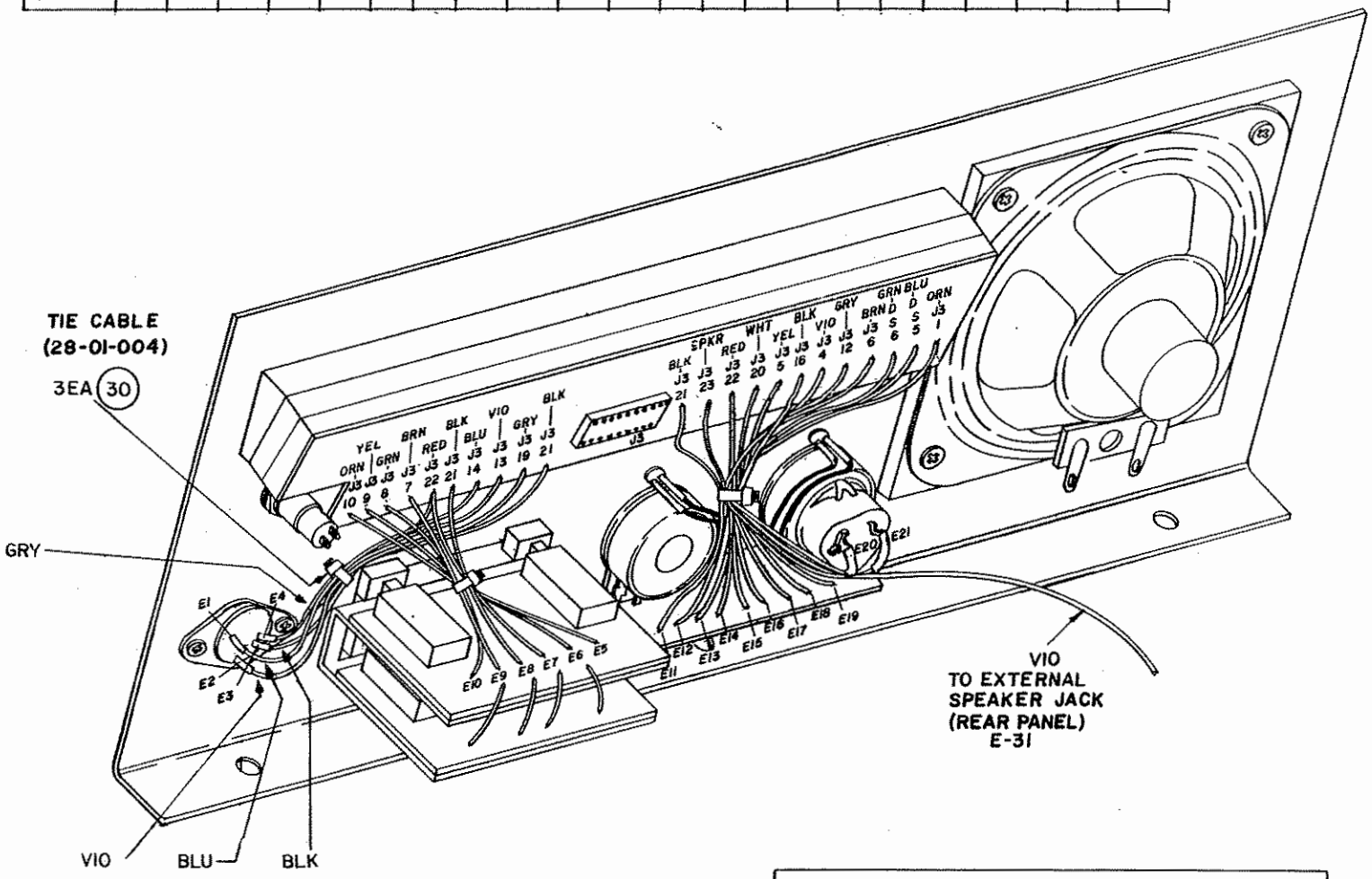


Ref. Des.	Description	Part #
1	Front Panel	721-169-01
2	Speaker Grill Assembly	721-095-01
3	Volume Pad	521-155-01
4	Squelch Pad	521-155-02
5	Microphone Pad	521-156-01
6	Function Switch Pad	521-162-01
7	Display Support Subassy.	721-081-01
10	Light Barrier	521-171-01
11	Display Subassembly	721-074-01
12	Screw 4-40 x 1 Lg.	80-51-034
13	Lamp 14V	39-07-007
14	Status Display Strip	521-173-01
15	Vol./Sq. Subassembly	721-079-01
18	Function Switch Subassy.	721-082-01
19	Screw, 2 -56 x 3/16 Lg.	80-51-002
20	Microphone Connector Subassembly	721-094-01
21	Screw 4-40 x 3/16 Lg.	80-51-021
22	Power Switch	51-06-024
23	Speaker	13-03-017
24	Screw 4-40 x 1/4 Lg.	81-31-003
25	Knob	24-05-007
26	Gasket	521-180-01
28	Display Reflector	521-232-03
29	Nut, Hex 2-56	90-10-006
31	Washer, Flat #4	91-11-002
32	Switch Guard	28-03-028
33	Mounting Nut	510-099-02
34	Spacer	521-300-01
40	Lockwasher #2 Int.	91-13-001
DS5	LED	39-06-004
DS6	LED	39-06-004

FRONT PANEL ASSEMBLY

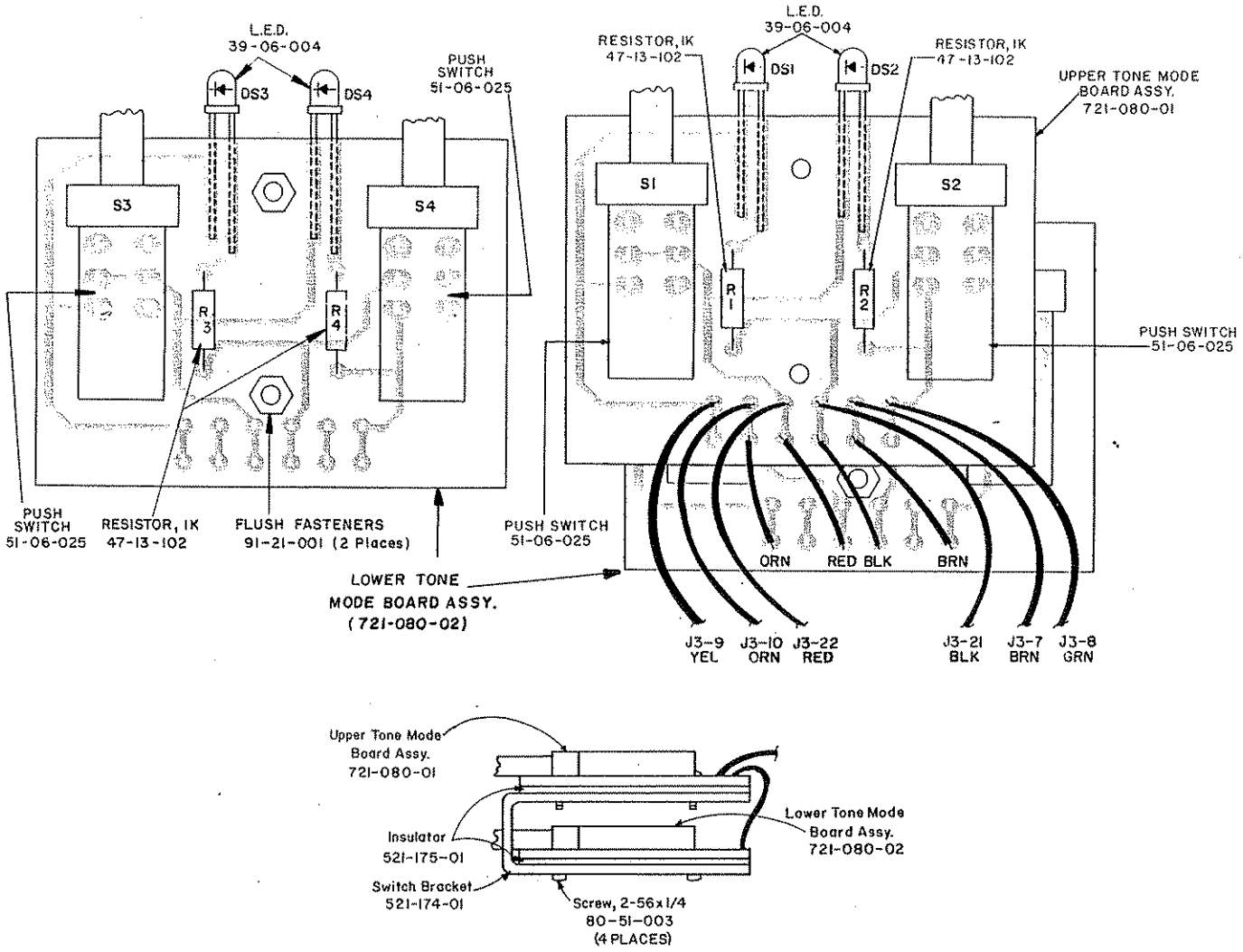
721-073-01

FROM	E1	E2	E3	E4	E31	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15	E16	E17	E18	E19	E20	E21
TO	J3-14	J3-13	J3-21	J3-19	J3-23	J3-8	J3-7	J3-21	J3-22	J3-10	J3-9	J3-6	J3-5	J3-1	J3-22	DS-6	DS-5	J3-4	J3-12	J3-20	J3-21	J3-16
COLOR	BLUE	VIO	BLK	GRY	BLUE	GRN	BRN	BLK	RED	ORN	YEL	BRN	YEL	ORN	RED	GRN	BLUE	VIO	GRY	WHT	BLK	BLK

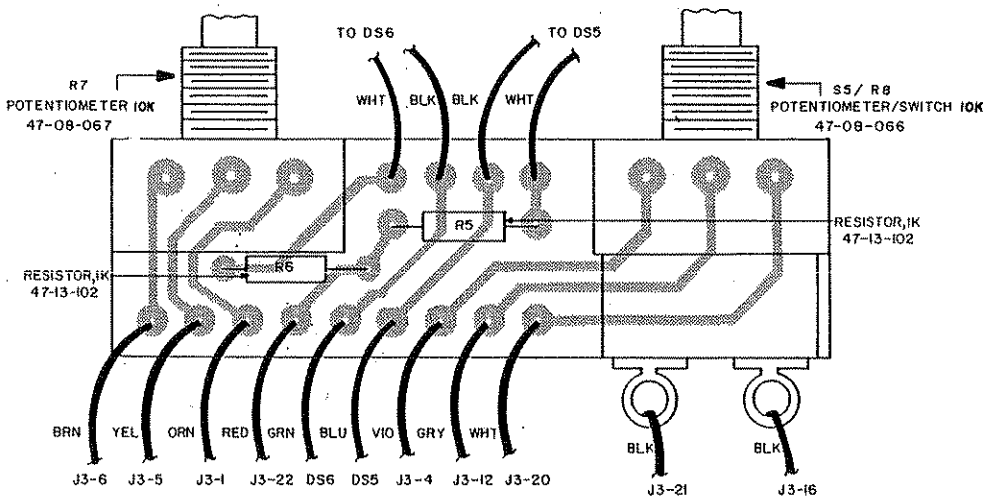


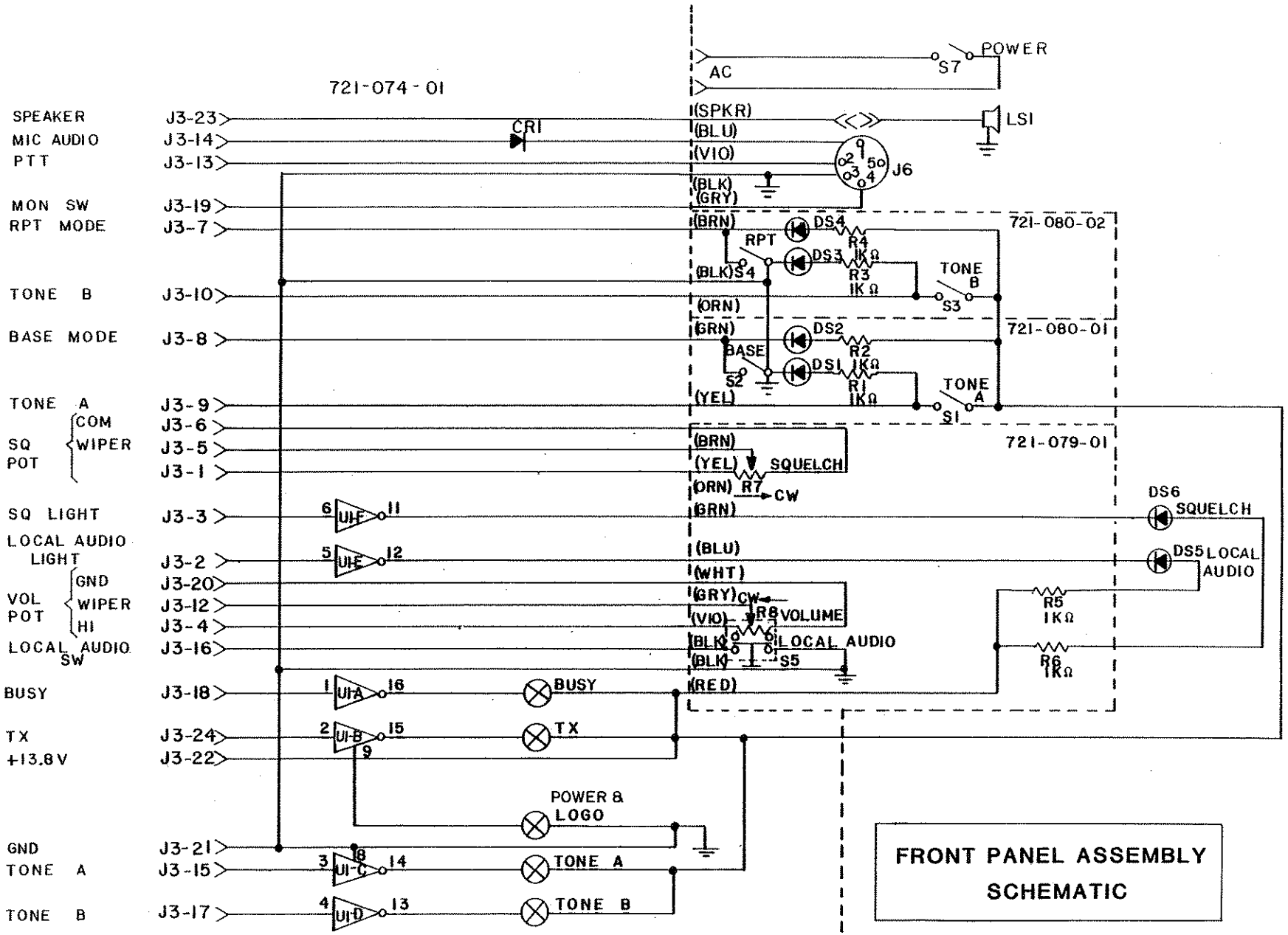
FRONT PANEL WIRING CONNECTIONS

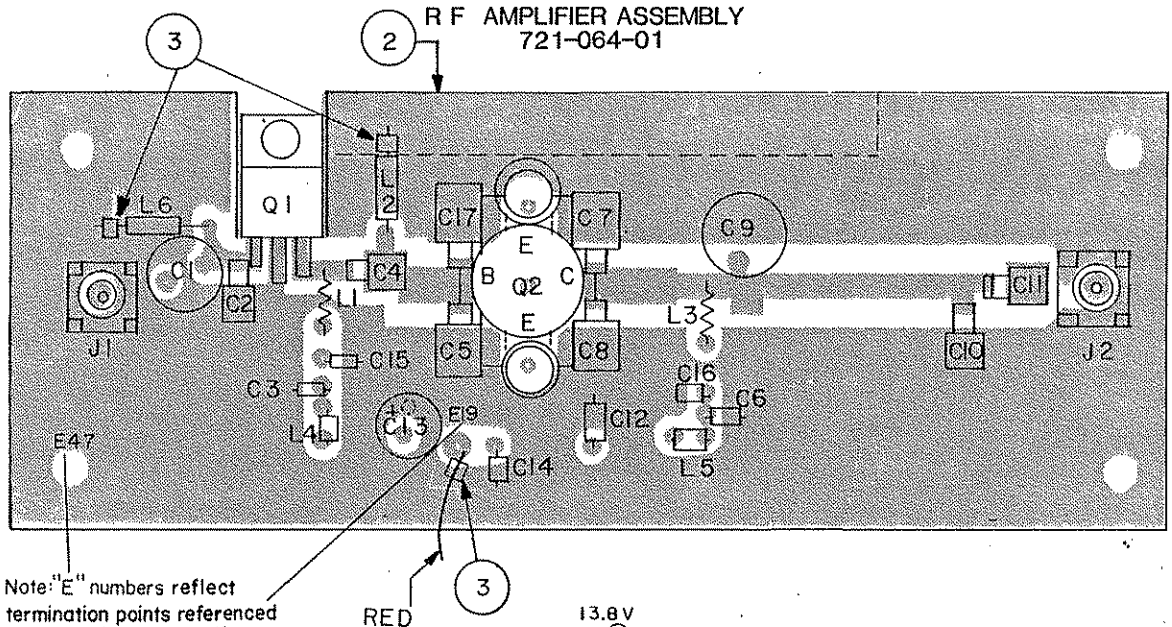
MODE/TONE SWITCH ASSEMBLY 721-080-XX

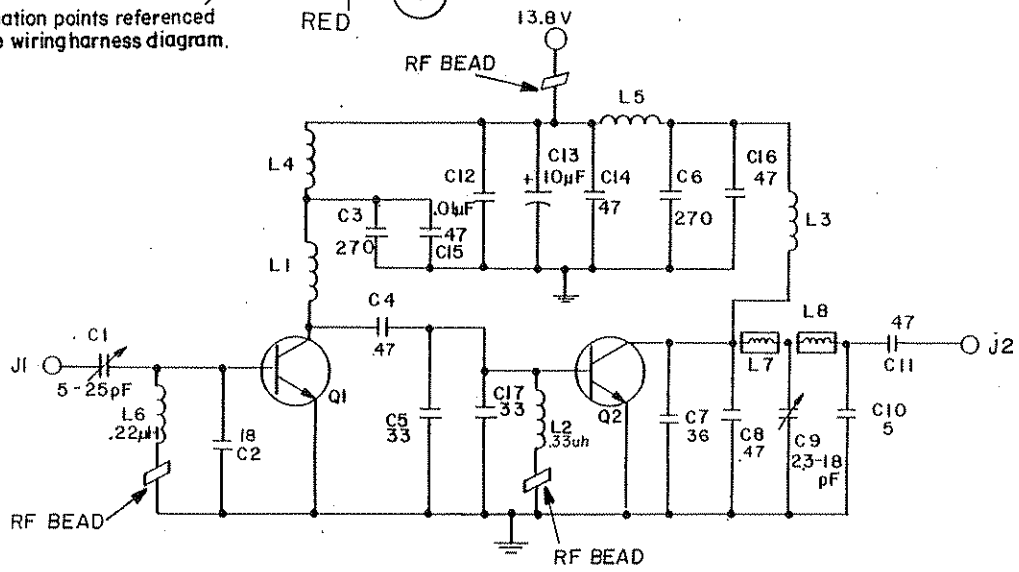


VOLUME/SQUELCH CONTROL ASSEMBLY 721-079-01



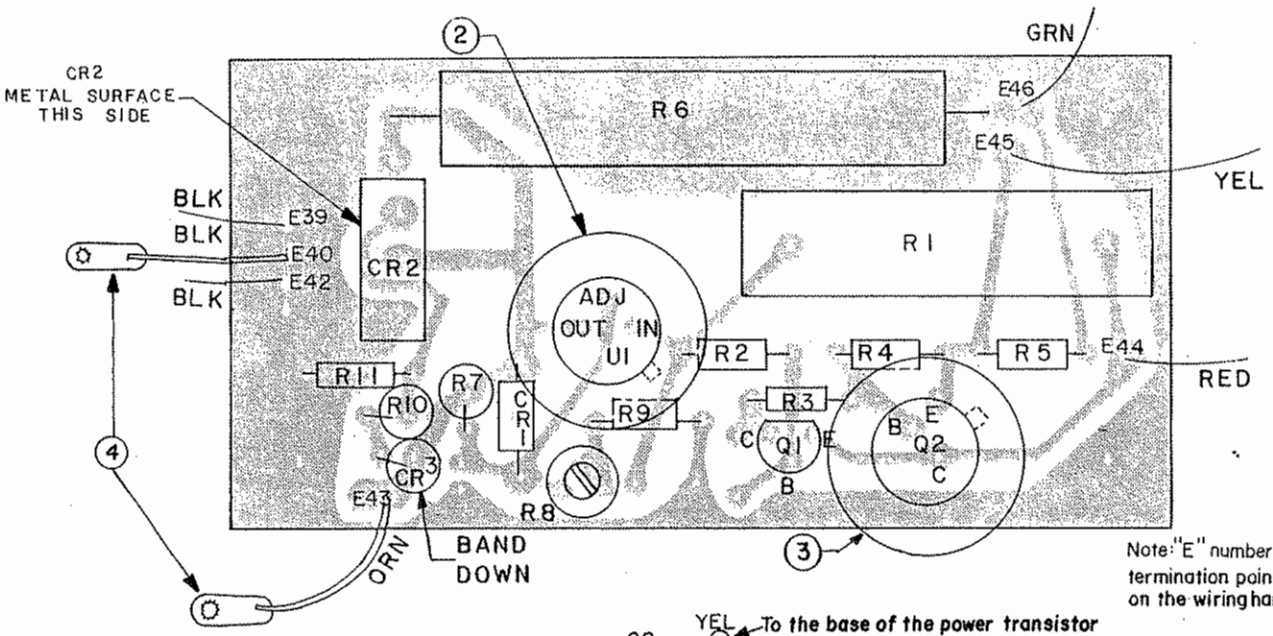

721-074-01
SPEAKER
MIC AUDIO
PTT
MON SW
RPT MODE
TONE B
BASE MODE
TONE A
SQ POT
COM
WIPER
SQ LIGHT
LOCAL AUDIO LIGHT
VOL POT
GND
WIPER
HI
LOCAL AUDIO SW
BUSY
TX
+13.8V
GND
TONE A
TONE B
J3-23
J3-14
J3-13
J3-19
J3-7
J3-10
J3-8
J3-9
J3-6
J3-5
J3-1
J3-3
J3-2
J3-20
J3-12
J3-4
J3-16
J3-18
J3-24
J3-22
J3-21
J3-15
J3-17
CR1
AC
S7
POWER
(SPKR)
LS1
(BLU)
(VIO)
J6
(BLK)
(GRY)
(BRN)
721-080-02
DS4
R4 1KΩ
RPT
DS3
R3 1KΩ
(BLK)S4
TONE B
S3
(ORN)
(GRN)
721-080-01
DS2
R2 1KΩ
BASE
DS1
R1 1KΩ
S2
TONE A
(YEL)
S1
(BRN)
721-079-01
(YEL)
SQUELCH
(ORN) R7
CW
DS6 SQUELCH
(GRN)
(BLU)
DS5 LOCAL AUDIO
(WHT)
(GRY)
CW
R8 VOLUME
(VIO)
R5 1KΩ
BLK
LOCAL AUDIO
(BLK)
S5
R6 1KΩ
(RED)
BUSY
TX
POWER & LOGO
TONE A
TONE B
FRONT PANEL ASSEMBLY SCHEMATIC

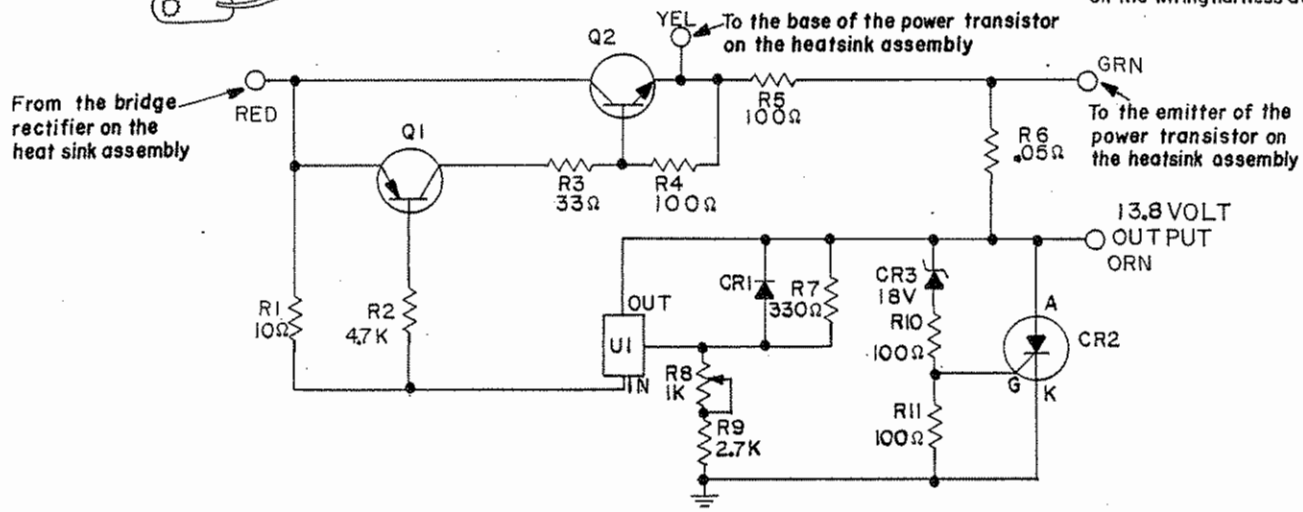




RF AMPLIFIER P.C. BOARD ASSEMBLY 721-064-01		
Ref. Des.	Description	Part #
	CAPACITORS	
C1	Capacitor, 5-25 pF Variable	15-08-021
C2	Capacitor, 18 pF	15-10-016
C3	Capacitor, 270 pF	15-01-166
C4	Capacitor, 47 pF	15-10-012
C5	Capacitor, 33 pF	15-10-013
C6	Capacitor, 270 pF	15-01-166
C7	Capacitor, 36 pF	15-10-020
C8	Capacitor, 47 pF	15-10-012
C9	Capacitor, 2.3-18 pF Variable	15-08-022
C10	Capacitor, 5 pF	15-10-001
C11	Capacitor, 47 pF	15-10-012
C12	Capacitor, .01 uF	15-01-206
C13	Capacitor, Alum., 10 uF 16 V	15-06-021
C14	Capacitor, 47 pF	15-01-165
C15	Capacitor, 47 pF	15-01-165
C16	Capacitor, 47 pF	15-01-165
C17	Capacitor, 33 pF	15-10-013
	CONNECTORS	
J1	Coaxial Connector	21-15-037
J2	Coaxial Connector	21-15-037
	TRANSISTORS	
Q1	Transistor, NPN MRF660 Modif.	521-163-01
Q2	Transistor, NPN MRF644 Modif.	521-164-01
	INDUCTORS	
L1	Coil, Air Wound 3 T	530-070-01
L2	Coil, .33 uH	18-01-059
L3	Coil, Air Wound 3 T	530-070-01
L4	Coil, Balun Wound 1 1/2 T	18-04-007
L5	Coil, Balun Wound 1 1/2 T	18-04-007
L6	Coil, .22 uH	18-01-069
L7	Strip Line RF	
L8	Strip Line RF	
	MISCELLANEOUS	
2	Contact Strip	21-27-003
3	RF Bead	25-07-004

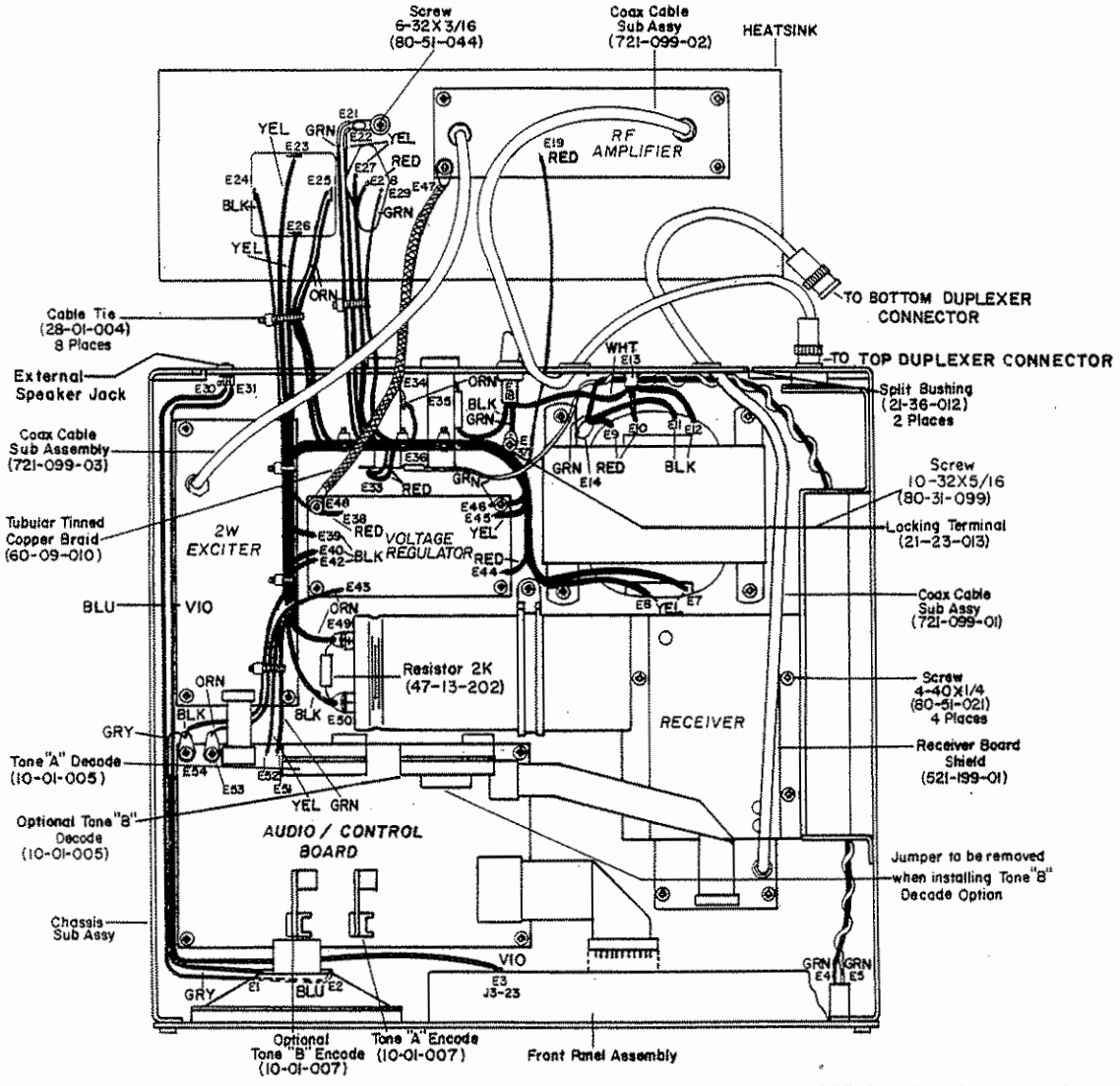
VOLTAGE REGULATOR
721-065-01





VOLTAGE REGULATOR PC BOARD ASSY. 721-065-01		
Ref. Des.	Description	Part #
	DIODES	
CR1	Diode, Silicon Rectifier	48-05-001
CR2	Silicon Controlled Rectifier	48-09-004
CR3	Diode, Zener 18 V	48-11-025
	INTERGRATED CIRCUIT	
U1	Voltage Regulator 1.2-37 V	31-30-027
	TRANSISTORS	
Q1	Transistor, Silicon PNP	48-03-002
Q2	Transistor, Silicon NPN	48-01-068
	RESISTORS	
R1	Resistor, 10 ohm	47-02-029
R2	Resistor, 4.7 K	47-13-472
R3	Resistor, 33 ohm	47-13-330
R4	Resistor, 100 ohm	47-13-101
R5	Resistor, 100 ohm	47-13-101
R6	Resistor, .05 ohm	47-02-030
R7	Resistor, 330 ohm	47-13-331
R8	Resistor, 1 K Variable	47-08-034
R9	Resistor, 2.7 K	47-13-272
R10	Resistor, 100 ohm	47-13-101
R11	Resistor, 100 ohm	47-13-101
	MISCELLANEOUS	
2	Heat Sink for U1	21-26-010
3	Heat Sink for Q2	21-26-010
4	Lug	21-23-019

WIRING HARNESS DIAGRAM



NOTE: SEE FOLLOWING PAGE FOR 240V CONNECTIONS.

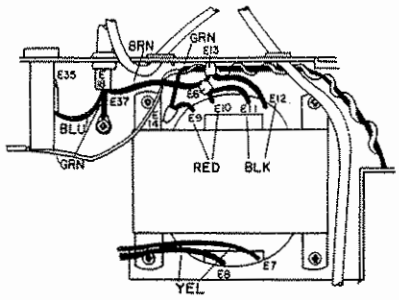
120 VOLT CONNECTIONS

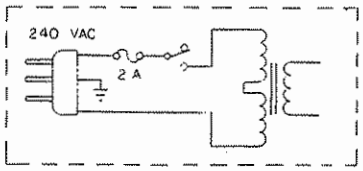
FROM	E3	E2	E1	E4	E5	E8	E7	E9	E10	E11	E12	E18	E18	E18	E19	E29	E27	E44	E25	E25	E24	E42	E40	E43	E22	E21	E28
TO	E31	E30	E54	E14	E36	E23	E26	E14	E13	E14	E13	E13	E37	E35	E38	E46	E45	E33	E34	E49	E39	E50	E54	E53	E52	E51	E33
WIRE COLOR	VIO	BLU	GRY	GRN	GRN	YEL	YEL	RED	RED	BLK	BLK	WHT	GRN	BLK	RED	GRN	YEL	RED	ORN	ORN	BLK	BLK	BLK	ORN	YEL	GRN	RED

240 VOLT WIRING HARNESS DIAGRAM AND SCHEMATIC

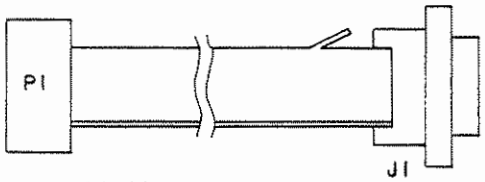
NOTE: All harness wire connections are the same for 120 Volt and 240 Volt units except:

FROM	E10	E11	E18	E18
TO	E6	E6	E13	E35
WIRE COLOR	RED	BLK	BRN	BLU

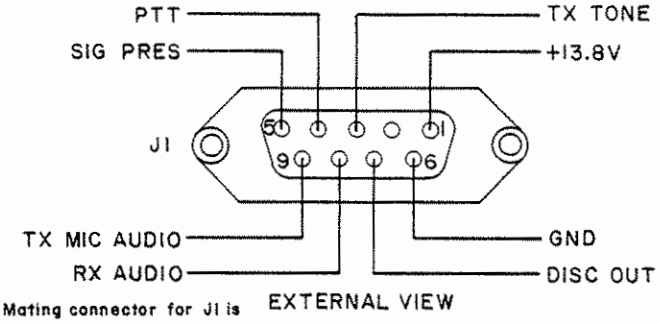




AUDIO/CONTROL CONNECTOR OPTION 022-3897-027

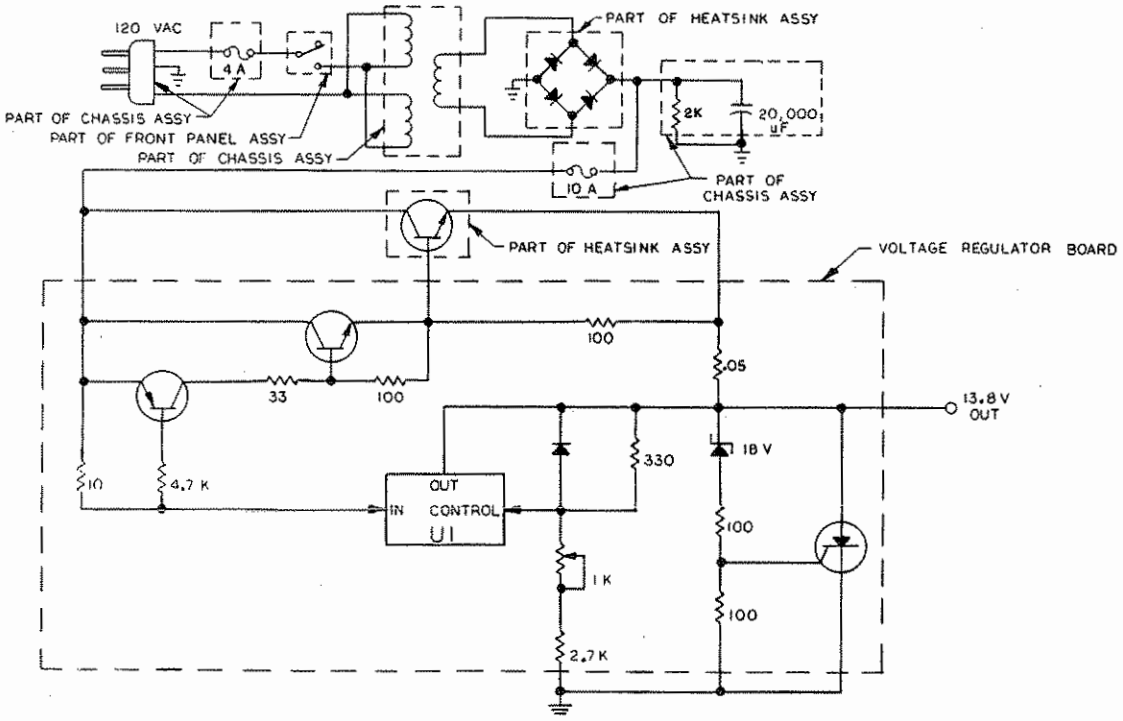


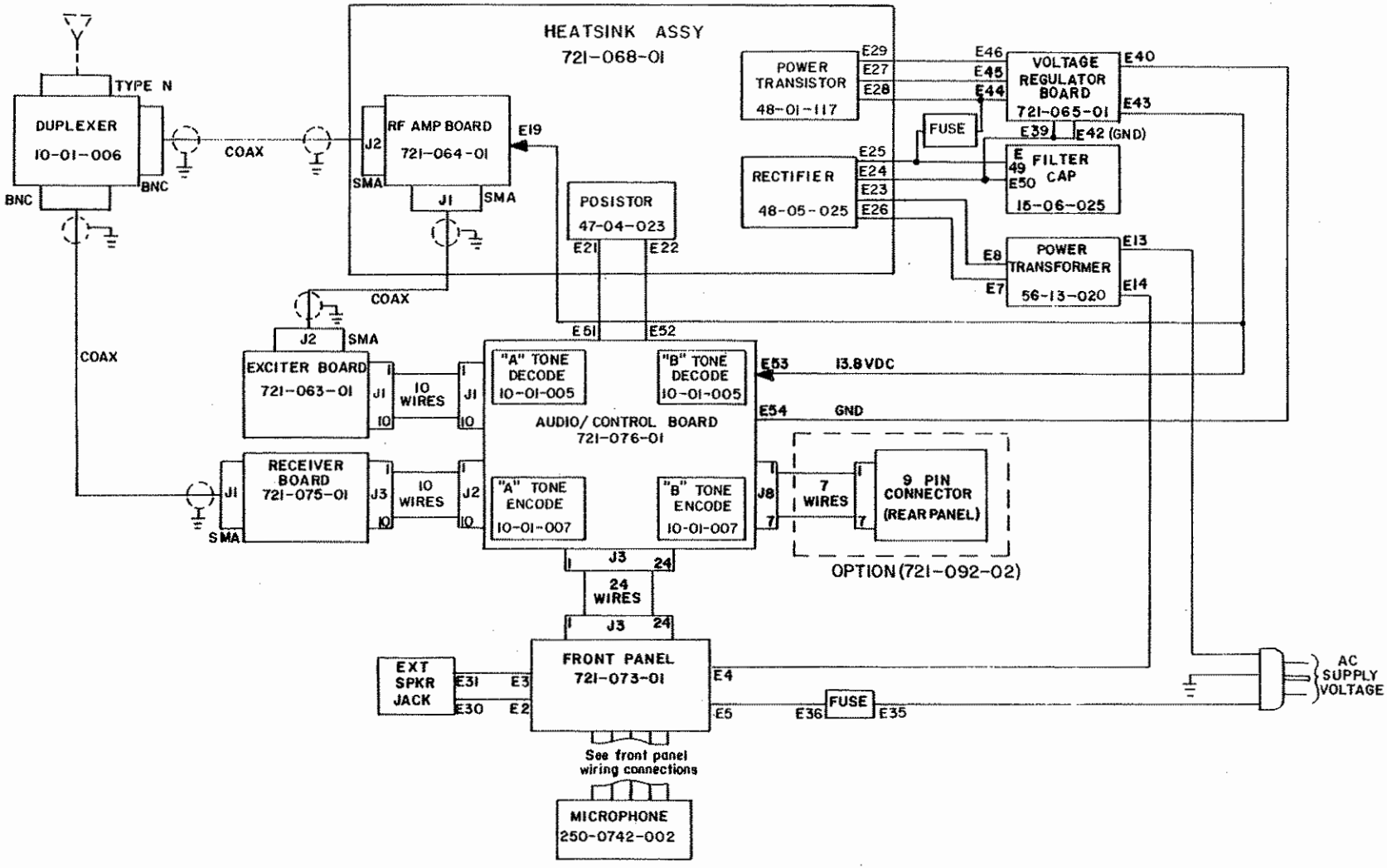
P1 mates with J8 on Audio/Control Board



NOTE: Mating connector for J1 is 21-14-015 (ITT Cannon DECF-9P)

POWER SUPPLY SCHEMATIC



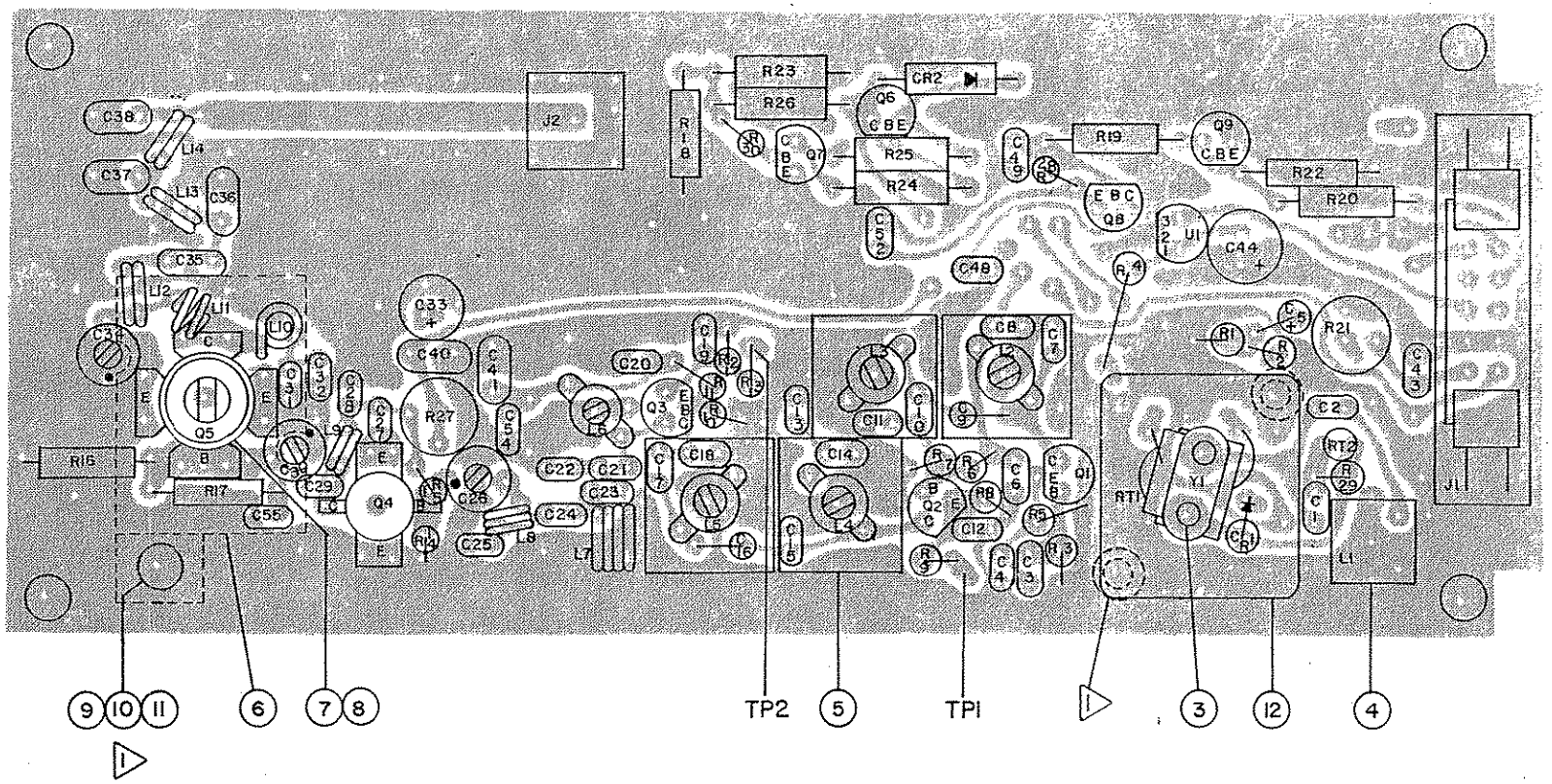


Note: "E" numbers reflect termination points referenced on the wiring harness diagram.

WIRING INTERCONNECTION DIAGRAM

EXCITER P.C. BOARD ASSEMBLY 721-063-01

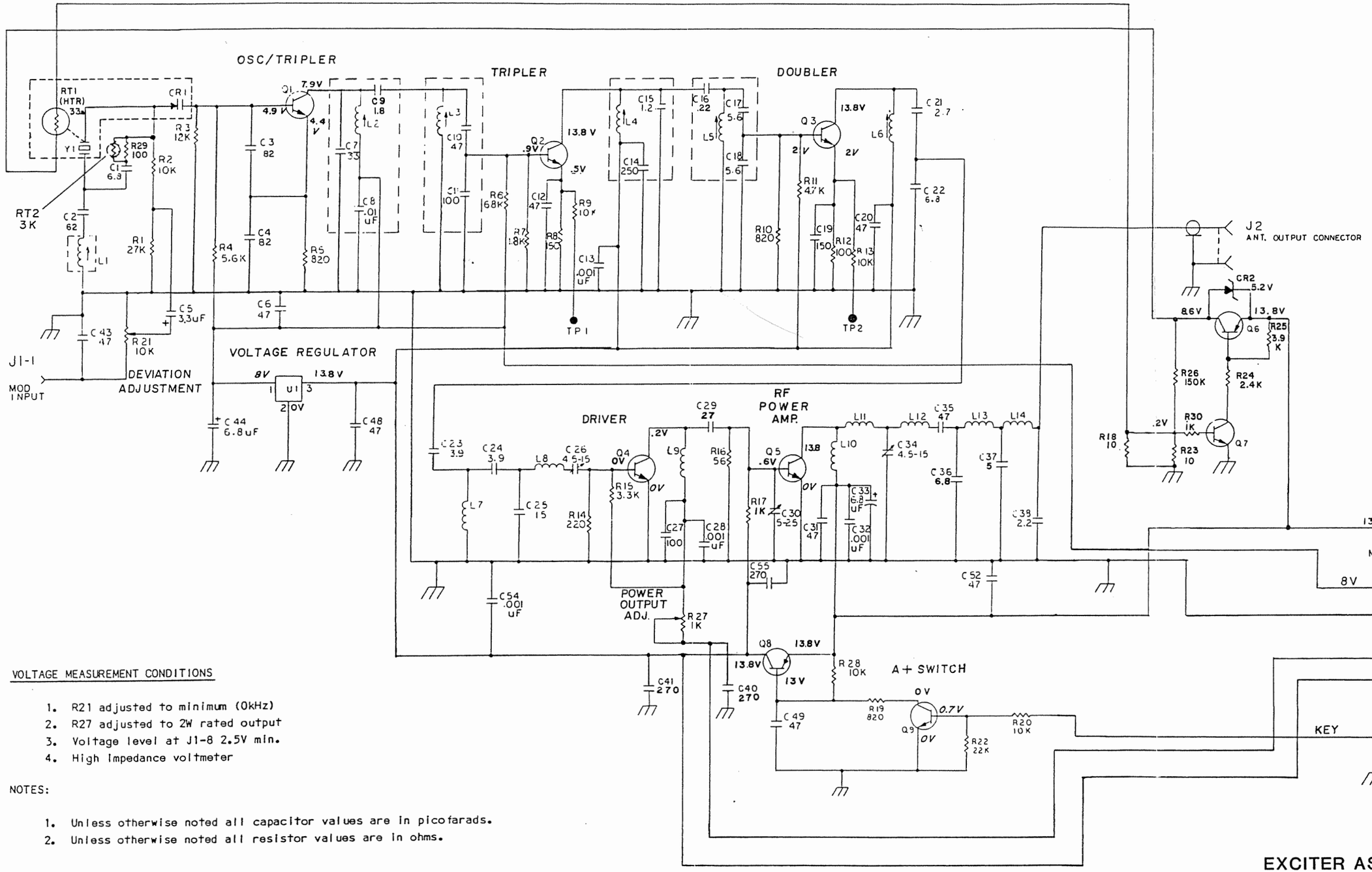
Ref. Des.	Description	Part #
	CAPACITORS	
C1	Capacitor, Cer., 6.8 pF	15-01-072
C2	Capacitor, Cer., 62pF	15-01-312
C3	Capacitor, Cer., 82pF	15-01-027
C4	Capacitor, Cer., 82pF	15-01-027
C5	Capacitor, Tant, 3.3uF 10V	15-03-009
C6	Capacitor, Cer., 47pF	15-01-197
C7	Capacitor, Cer., 33pF	15-01-067
C8	Capacitor, Cer., .01uF	15-01-131
C9	Capacitor, Cer., 1.8pF	15-01-030
C10	Capacitor, Cer., 47pF	15-01-197
C11	Capacitor, Cer., 100pF	15-01-026
C12	Capacitor, Cer., 47pF	15-01-197
C13	Capacitor, Cer., .001uF	15-01-112
C14	Capacitor, Cer., 250pF	15-01-024
C15	Capacitor, Cer., 1.2pF	15-01-115
C16	Capacitor, Cer., .22pF	15-01-047
C17	Capacitor, Cer., 5.6pF	15-01-071
C18	Capacitor, Cer., 5.6pF	15-01-071
C19	Capacitor, Cer., 150pF	15-01-105
C20	Capacitor, Cer., 47pF	15-01-197
C21	Capacitor, Cer., 2.7pF	15-01-196
C22	Capacitor, Cer., 6.8pF	15-01-072
C23	Capacitor, Cer., 3.9pF	15-01-198
C24	Capacitor, Cer., 3.9pF	15-01-198
C25	Capacitor, Cer., 15pF	15-01-276
C26	Capacitor, Var., 4.5-15pF	15-08-005
C27	Capacitor, Cer., 100pF	15-01-026
C28	Capacitor, Cer., .001uF	15-01-112
C29	Capacitor, Cer., 27pF	15-01-025
C30	Capacitor, Var., 5-25pF	15-08-021
C31	Capacitor, Cer., 47pF	15-01-197
C32	Capacitor, Cer., .001uF	15-01-112
C33	Capacitor, Tant, 6.8uF 16V	15-03-051
C34	Capacitor, Var., 4.5-15pF	15-08-005
C35	Capacitor, Cer., 47pF	15-01-165
C36	Capacitor, Cer., 6.8pF	15-01-186
C37	Capacitor, Cer., 5pF	15-01-172
C38	Capacitor, Cer., 2.2pF	15-01-174
C40	Capacitor, Cer., 270pF	15-01-166
C41	Capacitor, Cer., 270pF	15-01-166
C43	Capacitor, Cer., 47pF	15-01-197
C44	Capacitor, Tant, 6.8uF 16V	15-03-051
C48	Capacitor, Cer., 47pF	15-01-197
C49	Capacitor, Cer., 47pF	15-01-197
C52	Capacitor, Cer., 47pF	15-01-197
C54	Capacitor, Cer., .001uF	15-01-112
C55	Capacitor, Cer., 270pF	15-01-106
	CONNECTORS	
J1	10 Pin Male Connector	21-14-088
J2	Coaxial Connector (50 ohm)	21-15-037
	DIODES	
CR1	Diode, Varicap	48-13-015
CR2	Diode, Zener 5.2V	48-11-020
	INDUCTORS	
L1	Coil, 14 3/4 T	719-011-01
L2	Coil, Variable, 4 1/2 T	18-09-604
L3	Coil, Variable, 4 1/2 T	18-09-604
L4	Coil, Variable, 3 1/2 T	18-09-603
L5	Coil, Variable, 3 1/2 T	18-09-603
L6	Coil, Variable, 1 1/2 T	18-09-517
L7	Coil, 3 1/2 T	530-036-40
L8	Coil, 2 1/2 T	530-036-41
L9	Coil, 2 1/2 T	530-036-37
L10	Coil, 4 3/4 T	517-110-31
L11	Coil, 2 T	517-110-69
L12	Coil, 1 1/2 T	530-036-39
L13	Coil, 1 1/2 T	530-036-39
L14	Coil, 1 1/2 T	530-036-39
	TRANSISTORS	
Q1	Transistor, Silicon NPN	48-01-077
Q2	Transistor, Silicon NPN	48-01-081
Q3	Transistor, Silicon NPN	48-01-080
Q4	Transistor, Silicon NPN	521-047-01
Q5	Transistor, Silicon NPN	521-048-01
Q6	Transistor, Silicon PNP	48-12-007
Q7	Transistor, Silicon NPN	48-01-053
Q8	Transistor, Silicon PNP	48-12-007
Q9	Transistor, Silicon NPN	48-12-006
	RESISTORS	
R1	Resistor, 27K	47-13-273
R2	Resistor, 10K	47-13-103
R3	Resistor, 12K	47-13-123
R4	Resistor, 5.6K	47-13-562
R5	Resistor, 820 ohm	47-13-821
R6	Resistor, 6.8K	RC07GF682J
R7	Resistor, 1.8K	RC07GF182J
R8	Resistor, 150 ohm	47-13-151
R9	Resistor, 10K	47-13-103
R10	Resistor, 820 ohm	RC07GF821J
R11	Resistor, 4.7K	47-13-472
R12	Resistor, 100 ohm	RC07GF101J
R13	Resistor, 10K	47-13-103
R14	Resistor, 200 ohm	47-13-221
R15	Resistor, 3.3K	47-13-332
R16	Resistor, 56 ohm	47-13-560
R17	Resistor, 1K	RC07GF102J
R18	Resistor, 10 ohm	RC07GF100J
R19	Resistor, 820 ohm	47-13-821
R20	Resistor, 10K	47-13-103
R21	Resistor, 10K Variable	47-08-020
R22	Resistor, 22K	47-13-223
R23	Resistor, 10 ohm	RC07GF100J
R24	Resistor, 2.4K	47-13-242
R25	Resistor, 3.9K	47-13-392
R26	Resistor, 150K	47-13-154
R27	Resistor, 1K Variable	47-08-034
R28	Resistor, 10K	47-13-103
R29	Resistor, 100 ohm	47-13-101
R30	Resistor, 1K	47-13-102
	THERMISTOR	
RT1	Thermistor, HTR w/Case Lead, 33 ohm	721-090-01
RT2	Thermistor, 3K	47-04-016
	INTEGRATED CIRCUIT	
U1	Integrated Circuit Voltage Regulator 8V	31-30-042
	CRYSTAL	
Y1	Crystal, (see page 22)	23-XX-XXX
	MISCELLANEOUS	
3	Crystal Sockets	21-05-017
4	Can, Coil	25-10-006
5	Can, Coil	25-10-007
6	Heatsink Bracket	521-119-02
7	Heatsink Spacer	521-106-01
8	Nut, 8-32	90-10-004
9	Screw, 4-40 x 5/16	80-31-023
10	Nut, 4-40	90-10-007
11	Lockwasher , #4 Int. Tooth	91-13-002
12	Crystal Heater Box Cover	521-165-01
13	Screw, 2-56 x 3/8	81-16-005



Note: Components shown are Farside

1 Crystal oven housing held by two screws on bottom of p.c. board.

EXCITER P.C. BOARD ASSEMBLY



VOLTAGE MEASUREMENT CONDITIONS

1. R21 adjusted to minimum (0kHz)
2. R27 adjusted to 2W rated output
3. Voltage level at J1-8 2.5V min.
4. High Impedance voltmeter

NOTES:

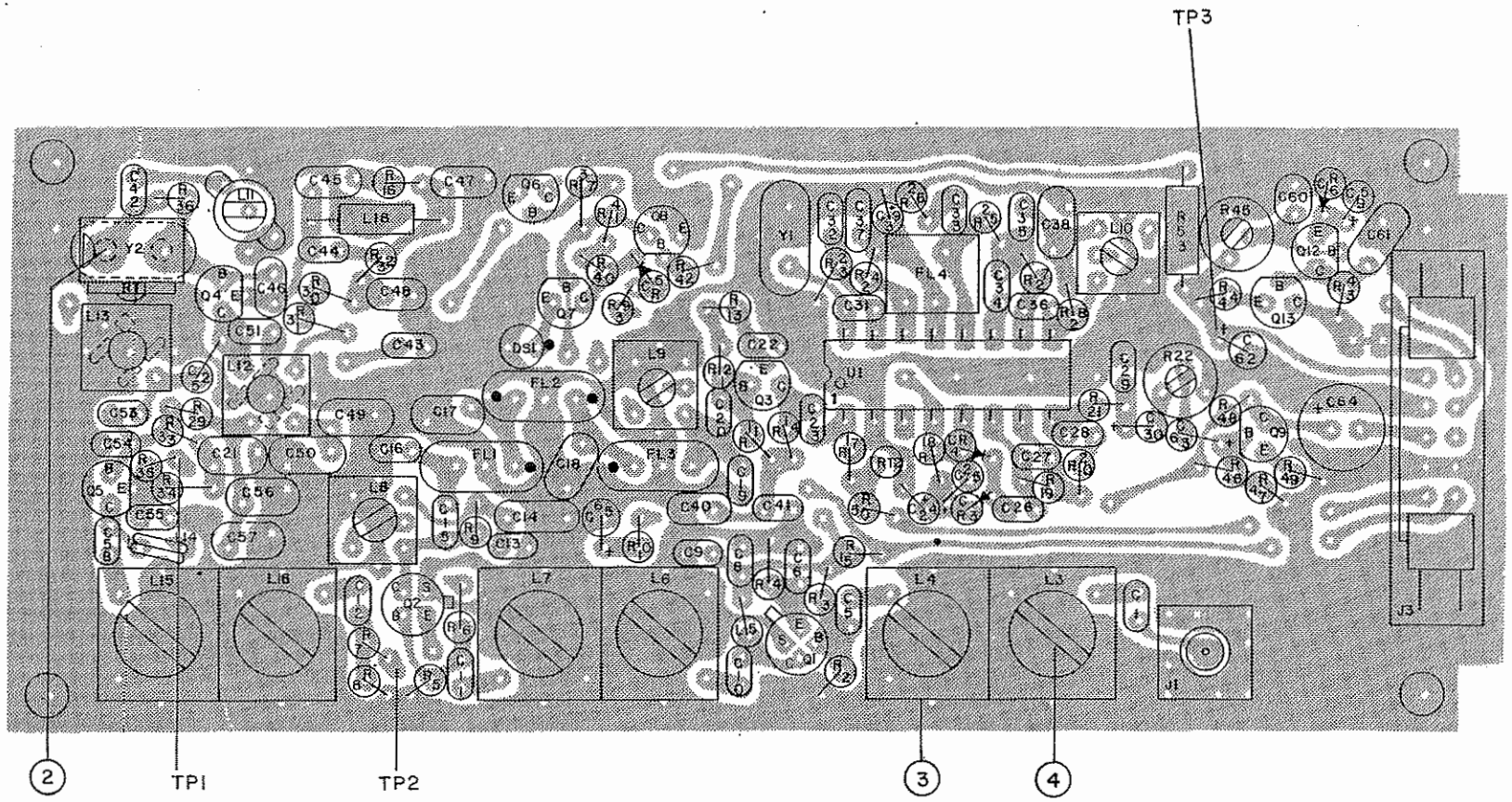
1. Unless otherwise noted all capacitor values are in picofarads.
2. Unless otherwise noted all resistor values are in ohms.

EXCITER ASSEMBLY
721-063-01

RECEIVER P.C. BOARD ASSEMBLY 721-075-01

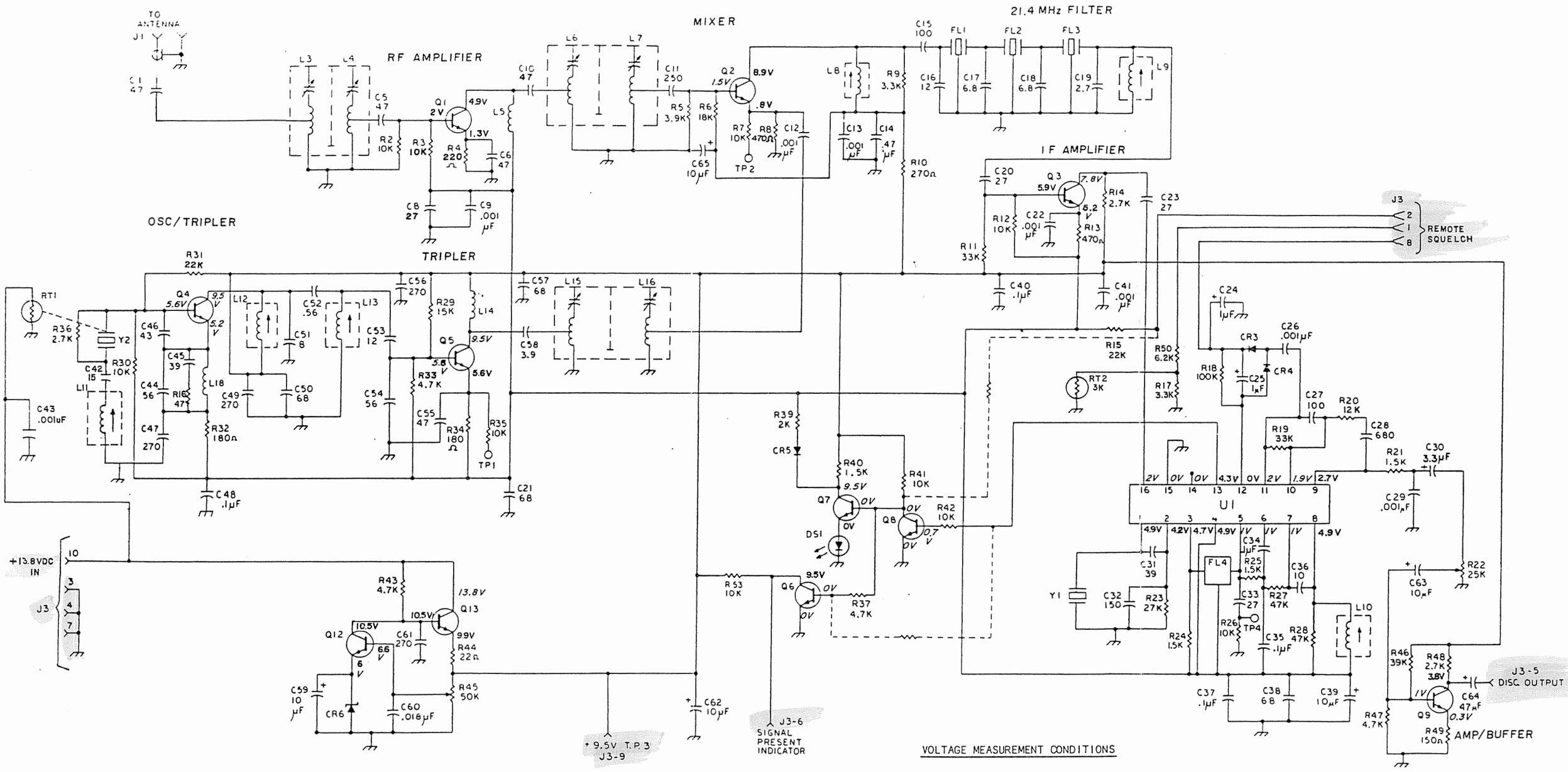
Ref. Des.	Description	Part #
	CAPACITORS	
C1	Capacitor, Cer., 47pF	15-01-197
C5	Capacitor, Cer., 47pF	15-01-197
C6	Capacitor, Cer., 47pF	15-01-197
C8	Capacitor, Cer., 27pF	15-01-148
C9	Capacitor, Cer., .001uF	15-01-112
C10	Capacitor, Cer., 47pF	15-01-197
C11	Capacitor, Cer., 250pF	15-01-024
C12	Capacitor, Cer., .001uF	15-01-112
C13	Capacitor, Cer., .001uF	15-01-112
C14	Capacitor, Cer., .47uF	15-01-076
C15	Capacitor, Cer., 100pF	15-01-026
C16	Capacitor, Cer., 12pF	15-01-240
C17	Capacitor, Cer., 6.8pF	15-01-186
C18	Capacitor, Cer., 6.8pF	15-01-186
C19	Capacitor, Cer., 2.7pF	15-01-092
C20	Capacitor, Cer., 27pF	15-01-189
C21	Capacitor, Cer., 68pF	15-01-169
C22	Capacitor, Cer., .001uF	15-01-112
C23	Capacitor, Cer., 27pF	15-01-189
C24	Capacitor, Tant, 1uF 25V	15-03-016
C25	Capacitor, Tant, 1uF 25V	15-03-016
C26	Capacitor, Cer., .001uF	15-01-112
C27	Capacitor, Cer., 100pF	15-01-026
C28	Capacitor, Cer., 680pF	15-01-181
C29	Capacitor, Cer., .001uF	15-01-112
C30	Capacitor, Tant, 3.3uF 10V	15-03-009
C31	Capacitor, Cer., 39pF	15-01-204
C32	Capacitor, Cer., 150pF	15-01-105
C33	Capacitor, Tant, 27pF	15-01-189
C34	Capacitor, Cer., .1uF	15-01-073
C35	Capacitor, Cer., .1uF	15-01-073
C36	Capacitor, Cer., 10pF	15-01-203
C37	Capacitor, Cer., .1uF	15-01-073
C38	Capacitor, Cer., 68pF	15-01-169
C39	Capacitor, Tant., 10uF 10V	15-03-008
C40	Capacitor, Cer., .1uF	15-01-073
C41	Capacitor, Cer., .001uF	15-01-112
C42	Capacitor, Cer., 15pF	15-01-019
C43	Capacitor, Cer., .001uF	15-01-112
C44	Capacitor, Cer., 56pF	15-01-064
C45	Capacitor, Cer., 39pF	15-01-185
C46	Capacitor, Cer., 43pF	15-01-062
C47	Capacitor, Cer., 270pF	15-01-166
C48	Capacitor, Cer., .1uF	15-01-073
C49	Capacitor, Cer., 270pF	15-01-166
C50	Capacitor, Cer., 68pF	15-01-169
C51	Capacitor, Cer., 8pF	15-01-194
C52	Capacitor, Cer., .56pF	15-01-082
C53	Capacitor, Cer., 12pF	15-01-240
C54	Capacitor, Cer., 56pF	15-01-209
C55	Capacitor, Cer., 47pF	15-01-197
C56	Capacitor, Cer., 270pF	15-01-166
C57	Capacitor, Cer., 68pF	15-01-169
C58	Capacitor, Cer., 3.9pF	15-01-198
C59	Capacitor, Tant., 10uF 10V	15-03-008
C60	Capacitor, Cer., .018uF	15-01-150
C61	Capacitor, Cer., 270pF	15-01-166
C62	Capacitor, Tant., 10uF 10V	15-03-008
C63	Capacitor, Tant., 10uF 10V	15-03-008
C64	Capacitor, Tant., 47uF 10V	15-03-048
C65	Capacitor, Tant., 10uF 10V	15-03-008
	DIODES	
CR3	Diode, Silicon	48-05-020
CR4	Diode, Silicon	48-05-020
CR5	Diode, Silicon	48-05-011
CR6	Diode, Zener 5.8V	48-11-013
DS1	LED	39-06-004
	FILTERS	
FL1	Filter, 21.4 MHz I.F. 6 Pole Set, Crystal Filter	27-03-022
FL2	Part of FL1	
FL3	Part of FL1	
FL4	Filter, 455 kHz I.F.	27-03-025
	CONNECTORS	
J1	Connector, Coax (50 ohm)	21-15-037
J2	Connector, 10 Pin Pwr/Control	21-14-088
	INDUCTORS	
L3	Resonator, Helical	521-089-01
L4	Resonator, Helical	521-089-01
L5	Choke, .05 uH	18-01-060
L6	Resonator, Helical	521-089-01
L7	Resonator, Helical	521-089-01
L8	Transformer, 21.4 MHz	56-06-008
L9	Transformer, 21.4 MHz	56-06-008
L10	Transformer, 455 kHz	56-06-002
L11	Coil, 18 1/2 T	18-09-018
L12	Coil, Variable, 4 1/2 T	18-09-804
L13	Coil, Variable, 4 1/2 T	18-09-804
L14	Coil, 1 1/2 T	530-036-39
L15	Resonator, Helical	521-089-01
L16	Resonator, Helical	521-089-01
L18	Choke, 0.33 uH	18-01-070
	TRANSISTORS	
Q1	Transistor, Silicon NPN	48-01-062
Q2	Transistor, Silicon NPN	48-01-062
Q3	Transistor, Silicon NPN	48-01-095
Q4	Transistor, Silicon NPN	48-01-069
Q5	Transistor, Silicon NPN	48-01-069
Q6	Transistor, Silicon NPN	48-01-053
Q7	Transistor, Silicon NPN	48-01-053
Q8	Transistor, Silicon NPN	48-01-053
Q9	Transistor, Silicon NPN	48-01-053
Q10	Not Used	
Q11	Not Used	
Q12	Transistor, Silicon NPN	48-01-053
Q13	Transistor, Silicon NPN	48-12-006
	RESISTORS	
R2	Resistor, 10K	RC07GF103J
R3	Resistor, 10K	47-13-103
R4	Resistor, 220 ohm	47-13-221
R5	Resistor, 3.9K	47-13-392
R6	Resistor, 18K	RC07GF183J
R7	Resistor, 10K	47-13-103
R8	Resistor, 470 ohm	RC07GF471J
R9	Resistor, 3.3K	47-13-332
R10	Resistor, 270 ohm	47-13-271
R11	Resistor, 33K	47-13-333
R12	Resistor, 10K	RC07GF103J
R13	Resistor, 470 ohm	47-13-471
R14	Resistor, 2.7K	47-13-272
R15	Resistor, 22K	47-13-223
R16	Resistor, 47 ohm	47-13-470
R17	Resistor, 3.3K	47-13-332
R18	Resistor, 100K	47-13-104
R19	Resistor, 33K	47-13-333
R20	Resistor, 12K	47-13-123
R21	Resistor, 1.5K	47-13-152
R22	Resistor, Variable, 25K	47-08-007
R23	Resistor, 27K	RC07GF273J

R24	Resistor, 1.5K	47-13-152
R25	Resistor, 1.5K	47-13-152
R26	Resistor, 10K	47-13-103
R27	Resistor, 47K	47-13-473
R28	Resistor, 47K	RC07GF473J
R29	Resistor, 15K	RC07GF153J
R30	Resistor, 10K	47-13-103
R31	Resistor, 22K	47-13-223
R32	Resistor, 180 ohm	47-13-181
R33	Resistor, 4.7K	47-13-472
R34	Resistor, 180 ohm	47-13-181
R35	Resistor, 10K	47-13-103
R36	Resistor, 2.7K	47-13-272
R37	Resistor, 4.7K	47-13-472
R39	Resistor, 2K	47-13-202
R40	Resistor, 1.5K	47-13-152
R41	Resistor, 10K	47-13-103
R42	Resistor, 10K	47-13-103
R43	Resistor, 4.7K	47-13-472
R44	Resistor, 22 ohm	47-13-220
R45	Resistor, Variable 50K	47-08-039
R47	Resistor, 4.7K	47-13-472
R48	Resistor, 2.7K	47-13-272
R49	Resistor, 150 ohm	47-13-151
R50	Resistor, 6.2K	47-13-622
R53	Resistor, 10K	47-13-103
	THERMISTOR	
RT1	Thermistor, HTR w/Case Lead, 33 ohm	721-090-01
RT2	Thermistor, 3K	47-04-016
	INTEGRATED CIRCUITS	
U1	Integrated Circuit Mix-Lim.-Det.	31-30-037
	CRYSTALS	
Y1	Crystal, 20.945 MHz	23-09-024
Y2	Crystal, (see page 22)	23-XX-XXX
	MISCELLANEOUS	
2	Crystal Sockets	21-05-017
3	Can Assy, Helical Resonator	721-027-01
4	Screw, Helical Resonator	521-087-01



Note: Components shown are Farside.

RECEIVER P.C. BOARD ASSEMBLY



NOTES:

1. Unless otherwise noted all capacitor values are in picofarads.

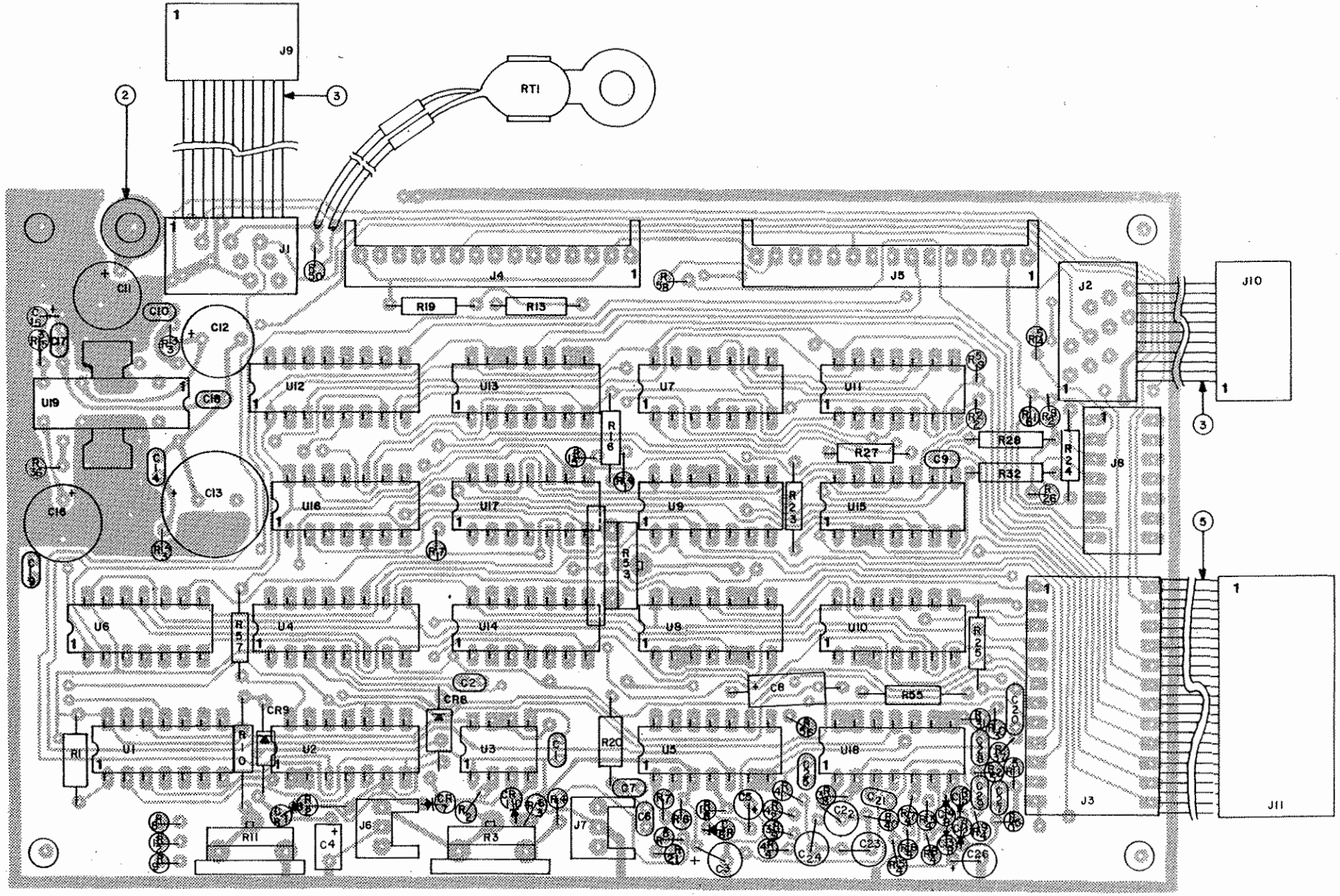
VOLTAGE MEASUREMENT CONDITIONS

1. No RF Input
2. R22 Fully CCW (Volume Minimum)
3. R45 Adjusted To 9.5V @ J3-9
4. Hi-Z Voltmeter (10M ohm - 2)

RECEIVER ASSEMBLY
721-075-01

AUDIO CONTROL P.C. BOARD ASSEMBLY		721-076-01
Ref. Des.	Description	Part #
	CAPACITORS	
C1	Capacitor, Cer., 0.1 uF	15-01-073
C2	Capacitor, Cer., 0.1uF	15-01-073
C3	Capacitor, Tant., 10 uF 20V	15-03-043
C4	Capacitor, Tant., 22uF 15V	15-03-012
C5	Capacitor, Tant, 10uF 20V	15-03-018
C6	Capacitor, Cer., 0.01uF	15-01-131
C7	Capacitor, Cer., 0.01uF	15-01-131
C8	Capacitor, Tant., 10uF 20V	15-03-018
C9	Capacitor, Cer., 0.1uF	15-01-073
C10	Capacitor, Cer., 0.1uF	15-01-073
C11	Capacitor, Elec., 100uF 25V	15-06-026
C12	Capacitor, Elec., 100uF 25V	15-06-026
C13	Capacitor, Elec., 470uF 16V	15-06-023
C14	Capacitor, Cer., 0.1uF	15-01-073
C15	Capacitor, Tant., 3.3uF 10V	15-03-009
C16	Capacitor, Elec., 100uF 25V	15-06-026
C17	Capacitor, Cer., 0.01uF	15-01-131
C18	Capacitor, Cer., 2200pF	15-01-033
C19	Capacitor, Cer., 0.1uF	15-01-073
C20	Capacitor, Cer., 1500pF	15-01-263
C21	Capacitor, Cer., 0.1uF	15-01-073
C22	Capacitor, Met. Mylar 0.047uF	15-02-002
C23	Capacitor, Met. Mylar 0.047uF	15-02-002
C24	Capacitor, Met. Mylar 0.047uF	15-02-002
C25	Capacitor, Cer., 0.1uF	15-01-073
C26	Capacitor, Tant., 10uF 20V	15-03-018
C27	Capacitor, Cer., 1800pF	15-01-059
C28	Capacitor, Cer., 4700pF	15-01-042
C29	Capacitor, Cer., 270pF	15-01-106
C30	Capacitor, Cer., 0.1uF	15-01-073
C31	Capacitor, Tant, 10uF 25V	15-03-058
	DIODES	
CR1	Diode, Signal	48-05-011
CR2	Diode, Signal	48-05-011
CR3	Diode, Signal	48-05-011
CR4	Diode, Signal	48-05-011
CR5	Diode, Signal	48-05-011
CR6	Diode, Zener 6.8V	48-11-004
CR7	Diode, Signal	48-05-011
CR8	Diode, Signal	48-05-011
CR9	Diode, Signal	48-05-011
CR10	Diode, Signal	48-05-011
	CONNECTORS	
J1	Connector, 10 Pin	21-14-073
J2	Connector, 10 Pin	21-14-073
J3	Connector, 24 Pin	21-14-076
J4	Socket, 15 Pin	21-14-078
J5	Socket, 15 Pin	21-14-078
J6	Socket, 3 Pin	21-14-077
J7	Socket, 3 Pin	21-14-077
J8	Socket, 14 Pin	31-34-001
J9	Connector, 10 Pin	21-14-071
J10	Connector, 10 Pin	21-14-071
J11	Connector, 24 Pin	21-14-076
	INTEGRATED CIRCUITS	
U1	I.C. Quad 2 Input And Gate	31-31-055
U2	I.C. Quad 2 Input Nor Gate	31-31-043
U3	I.C. Single Timer	31-30-050
U4	I.C. Hex Inverter	31-31-052
U5	I.C. Quad OP-Amp	31-30-018
U6	I.C. Quad 2 Input Or Gate	31-31-053
U7	I.C. Quad 2 Input Nor Gate	31-31-043
U8	I.C. Quad Analog Switch	31-31-041
U9	I.C. Triple 3 Input And Gate	31-31-054
U10	I.C. Quad Analog Switch	31-31-041
U11	I.C. Quad 2 Input Or Gate	31-31-053
U12	I.C. Hex Inverter	31-31-052
U13	I.C. Quad 2 Input Nor Gate	31-31-043
U14	I.C. Dual D Flip Flop	31-31-051
U15	I.C. Quad Analog Switch	31-31-041
U16	I.C. Quad 2 Input And Gate	31-31-055
U17	I.C. Quad 2 Input Or Gate	31-31-053
U18	I.C. Quad OP-Amp	31-30-018
U19	I.C. Audio Amplifier	31-30-021
	THERMISTOR	
RT1	Resistor, Positive Temp. Coefficient (Mounted on Heatsink Assembly)	47-04-023
RT2	Resistor, 311 ohm @25°C	47-04-006
	RESISTORS	
R1	Resistor, 100K	47-13-104
R2	Resistor, 100K	47-13-104
R3	Resistor, Variable 500K	47-08-065
R4	Resistor, 82K	47-13-823
R5	Resistor, 10K	47-13-103
R6	Resistor, 1M	47-13-105
R7	Resistor, 1M	47-13-105
R8	Resistor, 100K	47-13-104
R9	Resistor, 100K	47-13-104
R10	Resistor, 10K	47-13-103
R11	Resistor, Var., 500K	47-08-065
R12	Resistor, 100K	47-13-104
R13	Resistor, 1.5k	47-13-152
R14	Resistor, 10K	47-13-103
R15	Resistor, 10K	47-13-103
R16	Resistor, 100K	47-13-104
R17	Resistor, 100K	47-13-104
R18	Resistor, 620 ohms	47-13-621
R19	Resistor, 10K	47-13-103
R20	Resistor, 18K	47-13-183
R21	Resistor, 91K	47-13-913
R22	Resistor, 10K	47-13-103
R23	Resistor, 47K	47-13-473
R24	Resistor, 1K	47-13-102
R25	Resistor, 100K	47-13-753
R26	Resistor, 100K	47-13-104
R27	Resistor, 15K	47-13-153
R28	Resistor, 10K	47-13-103
R29	Resistor, 10K	47-13-103
R30	Resistor, 10K	47-13-103
R31	Resistor, 5.1K	47-13-512
R32	Resistor, 10K	47-13-103
R33	Resistor, 100 ohms	47-13-101
R34	Resistor, 2.7 ohms	47-07-2R7
R35	Resistor, 100 ohms	47-13-101
R36	Resistor, 10K	47-13-103
R37	Resistor, 20K	47-13-203
R38	Resistor, 510K	47-13-514
R39	Resistor, 100K	47-13-104
R40	Resistor, 11K	47-13-113
R41	Resistor, 4.3K	47-13-432
R42	Resistor, 75K	47-13-753
R43	Resistor, 10K	47-13-103
R44	Resistor, 6.8K	47-13-682
R45	Resistor, 6.8K	47-13-682
R46	Resistor, 100K	47-13-104
R47	Resistor, 1.8K	47-13-182
R48	Resistor, 2.7K	47-13-272
R49	Resistor, 2.7K	47-13-272
R50	Resistor, 39K	47-13-393
R51	Resistor, 39K	47-13-393

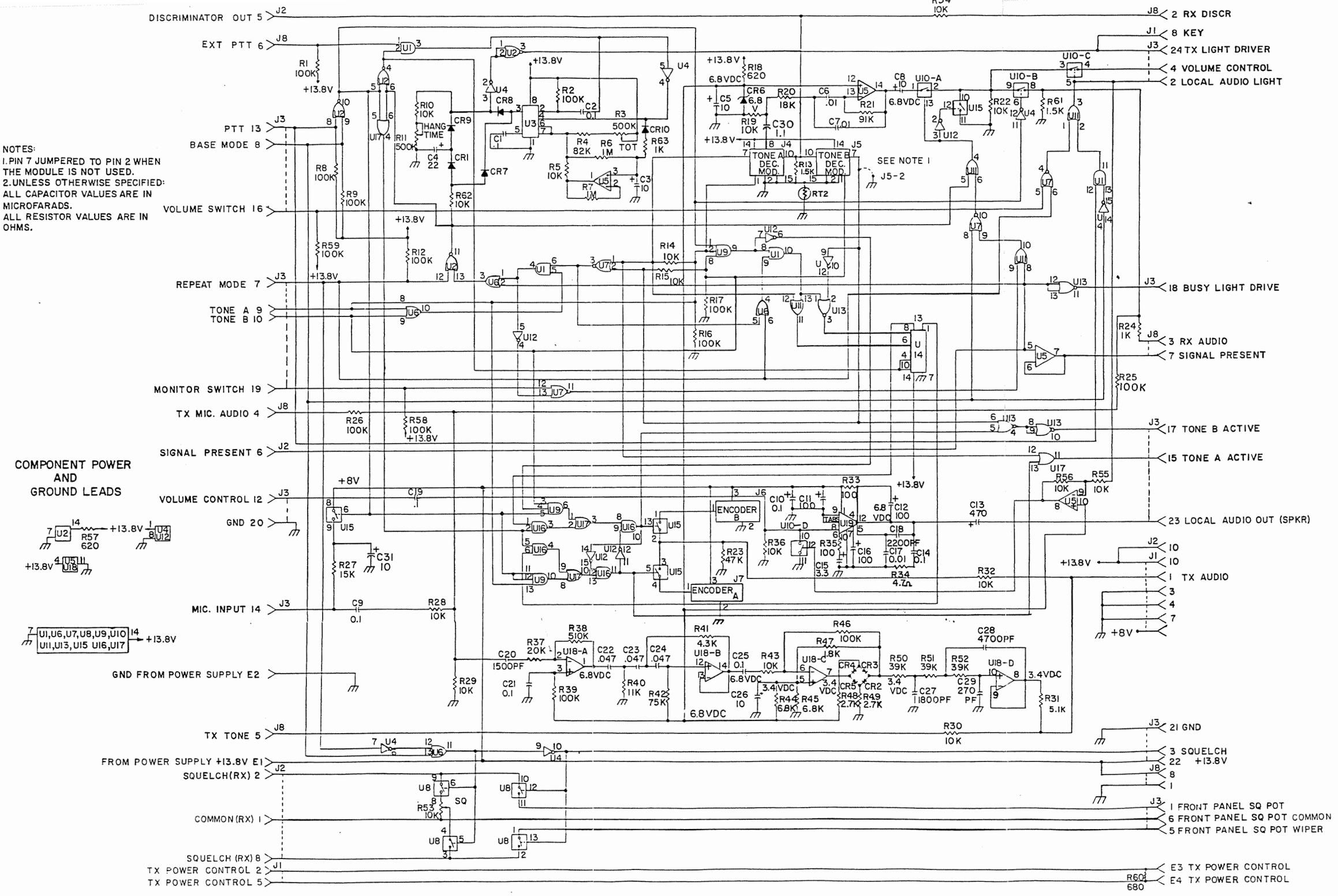
R52	Resistor, 39K	47-13-393
R53	Resistor, Var., 10K	47-08-064
R54	Resistor, 10K	47-13-103
R55	Resistor, 10K	47-13-103
R56	Resistor, 10K	47-13-103
R57	Resistor, 620 ohms	47-13-621
R58	Resistor, 100K	47-13-104
R59	Resistor, 100K	47-13-104
R60	Resistor, 680 ohms	47-13-681
R61	Resistor, 1.5K	47-13-152
R62	Resistor, 10K	47-13-103
R63	Resistor, 1K	47-13-102
	MISCELLANEOUS	
2	Swage Standoff	28-03-003
3	Cable, 10 Conductor	60-04-011
5	Cable, 24 Conductor	47-04-015



NOTE: Circuitry Shown is Foreside

AUDIO CONTROL P.C. BOARD ASSEMBLY

NOTES:
1. PIN 7 JUMPERED TO PIN 2 WHEN THE MODULE IS NOT USED.
2. UNLESS OTHERWISE SPECIFIED: ALL CAPACITOR VALUES ARE IN MICROFARADS.
ALL RESISTOR VALUES ARE IN OHMS.



END OF DOCUMENT

AUDIO / CONTROL BOARD SCHEMATIC