LBI-31846A

Lm377 New Model

3/89

GE Mobile Communications

U20

D4

Desk Mic 19C851086P8

RCN1000 REMOTE CONTROL UNIT DC AND TONE

CAUTION

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: TO PREVENT FIRE OR ELECTRIC SHOCK HAZARD. DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE.

CAUTION:
TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

Maintenance Manual

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IMPORTANT SAFETY INSTRUCTIONS

1. **SAVE THIS MANUAL** - It contains important safety and operating instructions for RCN 1000 Remote Control Units.

2. Do not use auxiliary equipment not recommended or sold by the manufacturer. To do so may result in a risk of fire, electric shock, or injury to persons.

3. To reduce risk of damage to electric plug and cord, pull by plug rather than cord when disconnecting unit.

4. Make sure the cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damge or stress.

5. An extension cord should not be used unless absolutely necessary. Use of improper extension cord could result in a risk of fire. and electric shock. If an extension cord must be used, make sure:

   a. That pins on plug of extension cord are the same number, size and shape as those of plug on unit.

   b. That extension cord is properly wired, in good condition; and

   c. That wire size is large enough for AC ampere rating of unit as specified in Table 1.

TABLE 1
RECOMMENDED MINIMUM SIZE FOR EXTENSION CORDS

LENGTH OF EXTENSION CORD (FT.)	
AWG SIZE OF EXTENSION CORD	

Do not operate unit with damaged cord or plug - replace them immediately.

Do not operate unit if it has received a sharp blow, been dropped, or otherwise damaged in any way; return to a qualified service shop.

Do not disassemble unit; return to a qualified service shop when service or repair is required. Incorrect reassembly may result in a risk of electric shock or fire.

To reduce risk of electric shock, unplug unit from outlet before attempting any maintenance or cleaning.

GROUNDING AND AC POWER CORD CONNECTION - To reduce risk of electrical shock use only a properly grounded outlet. the unit is equipped with an electric cord having an equipment-grounding conductor and a grounding plug. Be sure that the outlet is properly installed and grounded in accordance with all local codes and ordinances.

DANGER - Never alter AC cord or plug. If it will not fit outlet, have a proper outlet installed by a qualified electrician. Improper connection can result in risk of an electric shock.

This unit is for use on a 110-volt circuit, and has a grounding plug that looks like the plug illustrated in Figure 1. A temporary adapter, which looks like the adapter illustrated in sketches B and C, may be used to connect this plug to a two-pole receptacle as shown in sketch B if a properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet can be installed by a qualified electrician.

IMPORTANT SAFETY INSTRUCTIONS (CONT.)

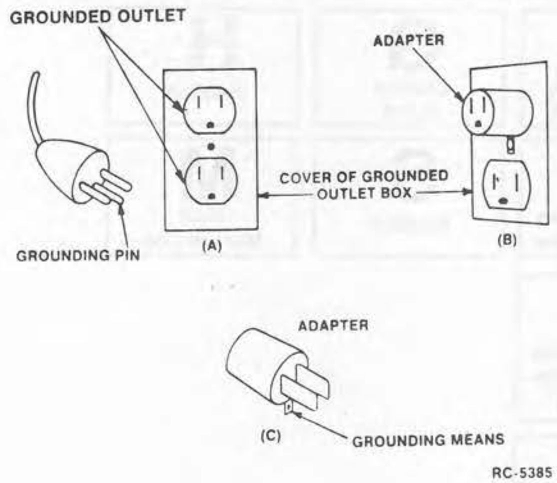

FIGURE 1

13. **DANGER** - Before using adapter as illustrated, be certain that center screw of outlet plate is gounded. The green-color rigid ear or lug extending from adapter must be connected to a properly grounded outlet--make certain it is grounded. If necessary, replace original outlet cover plate screw with a longer screw that will secure adapter ear or lug to outlet cover plate and make ground connection to grounded outlet.

SPECIFICATIONS *

AUDIO OUTPUT RECEIVE MODE (speaker)	3 watts into a 4 ohm load with less than 3 % distortion
TRANSMIT MODE (line)	+11 dBm into a 600 ohm line load
LINE LOOP RESISTANCE (DC control only)	11,000 ohms (8000 line and 3000 termination) maximum
COMPRESSION RANGE	With an audio increase of 30 dB beyond the start of compression, output level increases less than 3 dB
FREQUENCY RESPONSE	±1 dB for the frequency range from 300 to 3000 Hz
POWER REQUIREMENTS	110/220 VAC ± 20%, 50/60 Hz, 12 Watts (TX), 16 Watts (RX) and 10 Watts (STBY)
DIMENSIONS (H x W xD)	3-1/2" x 10-3/8" x 8-1/8"

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

COMBINATION NOMENCLATURE

Digits 1&2	Digit 3	Digit 4	Digit 5	Digit 6
Vendor/Product Code	Control	Number Frequency	Option	Microphone Handset
RC Remote Control	**D** DC Control	**1** 1 TX Frequency 1 RX Frequency	**G** Channel Guard	**H** Handset
	T Tone Control	**2** 2 TX Frequencies 2 RX Frequencies	**S** Standard	**M** Desk Microphones
		4 4 RX Frequencies 4 RX Frequencies (Tone Only)		
		G 2 TX Frequencies 2 TX Frequencies VG (Tone Only)		
		V 1 TX Frequency 1 RX Frequency VG (Tone Only)		

NOTES

1. RCZ006 (AUX 1) - DIGIT 3 MUST BE T, DIGIT 4 MUST BE 1, 2, OR V.
2. RCZ008 (CHANNEL GUARD ON-OFF) - DIGIT 3 MUST BE T. NOT COMPATIBLE WITH DIGIT 4 OF P.
3. RCZ010 (NOTCH FILTER) - DIGIT 3 MUST BE T, NOT COMPATIBLE WITH DIGIT 4 OF P.
4. RCZ013 (PARALLEL OPERATION) - DIGIT 3 MUST BE T, NOT COMPATIBLE WITH DIGIT 4 OF P.
5. RCZ015 (VOTER OPERATION) - DIGIT 4 MUST BE 1. NOT COMPATIBLE WITH DIGIT 4 OF P.
6. RCZ016 (SCAN) - DIGIT 4 MUST BE 2. DIGIT 5 MUST BE S.
7. RCZ019 (PARALLEL OPERATION) - DIGIT 3 MUST BE D.
8. RCZ020 (AUX REC) - DIGIT 4 MUST BE 1, ON 2 DIGIT 5 MUST BE S.
9. RCZ005 (4W AUDIO) - DIGIT 4 MUST BE 1, 2, OR 4. THIS FUNCTION IS STANDARD WITH DIGIT 4 OF V, G, OR P.
10. RCZ007 GE MARC V-APPLIES TO RCD1SM OR RCD1SM ONLY.
11. RCZ021, 022, 023-DIGIT 6 MUST BE M, 5 MUST BE S.
12. RCZ024, 025, 026-DIGIT 6 MUST BE M, 5 MUST BE G.

OPTION	DESCRIPTION
RCZ001	ALERT TONE
RCZ002	CLOCK/VU METER
RCZ003	SUPERVISORY CONTROL
RCZ004	ALTERNATE LINE
RCZ005	4 WIRE AUDIO
RCZ006	AUXILIARY 1
RCZ007	GE MARC V
RCZ008	CHANNEL GUARD ON-OFF
RCZ009	REPEATER ON-OFF
RCZ010	NOTCH FILTER
RCZ011	SPEAKER MUTE
RCZ012	INTERCOM
RCZ013	PARA TX INDICATOR/NOTCH FILTER/FUNCTION TONE MUTE
RCZ014	EXTERNAL TONE CABLE
RCZ015	TAKE OVER SWITCH
RCZ016	SCAN
RCZ017	WALL MOUNT BRACKET
RCZ018	CSIP OPTION (ON PREMISE-MARK C)
RCZ019	PARALLEL TX INDICATOR
RCZ020	AUXILIARY RECEIVER
RCZ021	FOOTSWITCH
RCZ022	FOOTSWITCH W/EARMUFF HEADSET
RCZ023	FOOTSWITCH W/EARPIECE HEADSET
RCZ024	DUAL FOOTSWITCH
RCZ025	DUAL FOOTSWITCH W/EARMUFF HEADSET
RCZ026	DUAL FOOTSWITCH W/EARPIECE HEADSET
RCZ027	CSIP OPTION (SERVICE STATION FACILITY-MARK S)

DESCRIPTION

The RCN1000 Remote Controller is used to control remote or remote/repeater base station radios. They are available in either DC control or tone control versions. The two versions of the RCN1000 remote controllers are housed in a specifically designed plastic enclosure to provide a modern clean design. These units are available with either a handset or desk microphone.

DC CONTROL

The DC Control version utilizes DC currents that are applied to a metallic pair which activates specific circuits in the adapter panel controlling the remote base station radio. Five current levels are available: -2.5 milliamps, + or - 6 milliamps and + or - 11 milliamps. In addition, on specific panels zero current is used to control the primary receiver.

TONE CONTROL

The Tone Control version utilizes audio tones in the range from 1050 Hz to 2175 Hz which are applied to the voice grade audio line that connect the remote controller to the termination panel. These tones activate specific functions on the adapter panel which then allow the remote operator to control the base station radio. Each specific function tone is proceeded by a "Secur-It" tone which is a +10 dB burst of 2175 Hz. This tone alerts the panel audio. The "Secur-It" tone at the +10 dB level must be present for 100 milliseconds before the panel will recognize it as valid. The function tone is then transmitted at a 0 dB level for 40 milliseconds and is divided up in 100 Hz steps in the frequency range from 1050 Hz to 2050 Hz.

The "Hold" tone of 2175 Hz is then transmitted at a -20 dB level which enables the transmit function on the appropriate frequency. This holds the transmitter keyed as long as the PTT button on the remote is depressed. When the PTT is released and the 2175 Hz "Hold" tone at -20 dB is removed, the panel will clear its latched functions.

OPTIONS

In addition to the handset/deskmic option there are single to four frequency controls with standard configurations or Channel Guard. The special Tone Remote Controllers for the VG (Voice Guard) and PST (Public Service Trunking) provide the necessary control and nomenclature for these particular functions.

The 18 options that can be applied to the basic units include the Clock/VU Meter which is located next to the transmit indicator in the upper crystal area. The clock can be selected by the user to have a 12 or 12/24 hour format. The other control function options are push button switches located in the keypad area.

The Take Over, Supervisory Control and Alternate Line options require an additional enclosure to be mounted exterior to the DC and Tone Remote Controller main cabinet. This assembly contains the relays and terminal connection block for the lines that need to be terminated in order to provide the required control.

The four Wire Audio and Parallel Transmit Indicator options are added to the internal PC boards within the controller cabinet.

AC POWER CONNECTION

The RCN 1000 may be operated from a 110 or 220 VAC 50/60 Hz power source. The unit is normally shipped for 110 VAC operation. To convert for 220 VAC operation, move the WHITE lead of the power cord to the 220 VAC connection on power transformer T1. The power plug must also be charged (customer supplied).

TELEPHONE LINE CHARACTERISTICS

DC CONTROL CONNECTIONS

The DC remote control unit will allow the installer to be able to select one of four types of line connection schemes that are normally used in the DC control functions. The choice of one of these should be based on the cost, availability and performance compared with the conditions that the controller is to operate within. The following Table 1 and accompanying figures contain information to assist you in selecting the best method of control and audio coupling. The modular connector on the rear of the DC remote controller contains six (6) control

METHOD	DESCRIPTION	ADVANTAGES OR DISADVANTAGES
1	One metallic pair for both audio and control voltages with control voltage simplexed on the line pair.	Economical: dependable where earth ground currents may be large or good earth grounds cannot be obtained. The keying clicks will be heard on paralleled remotes.
2	One metallic pair for both audio and control voltages with control voltages simplexed between the line and earth ground.	Economical: minimizes keying clicks in paralleled remotes but large ground currents may result in interference with control function if located near sub-stations.
3	One voice grade circuit for bi-directional audio and the other a metallic pair for control voltages.	Provides excellent performance by eliminating keying clicks and providing no path for ground loop currents, but requires two pair.
4	One metallic pair for both audio and control voltages. The other for receive audio.	Provides full duplex operation in which the remote can operate in receive and transmit simultaneously, but requires two pair.

TABLE 1 - AUDIO AND CONTROL LINE COMPARISON

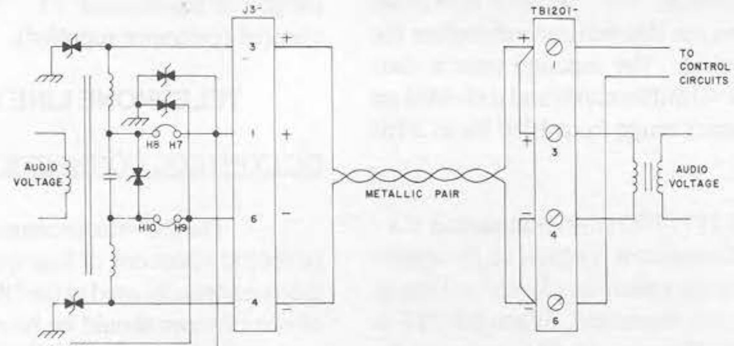

FIGURE 1 - SINGLE METALLIC PAIR WITH LINE TO LINE CONTROL

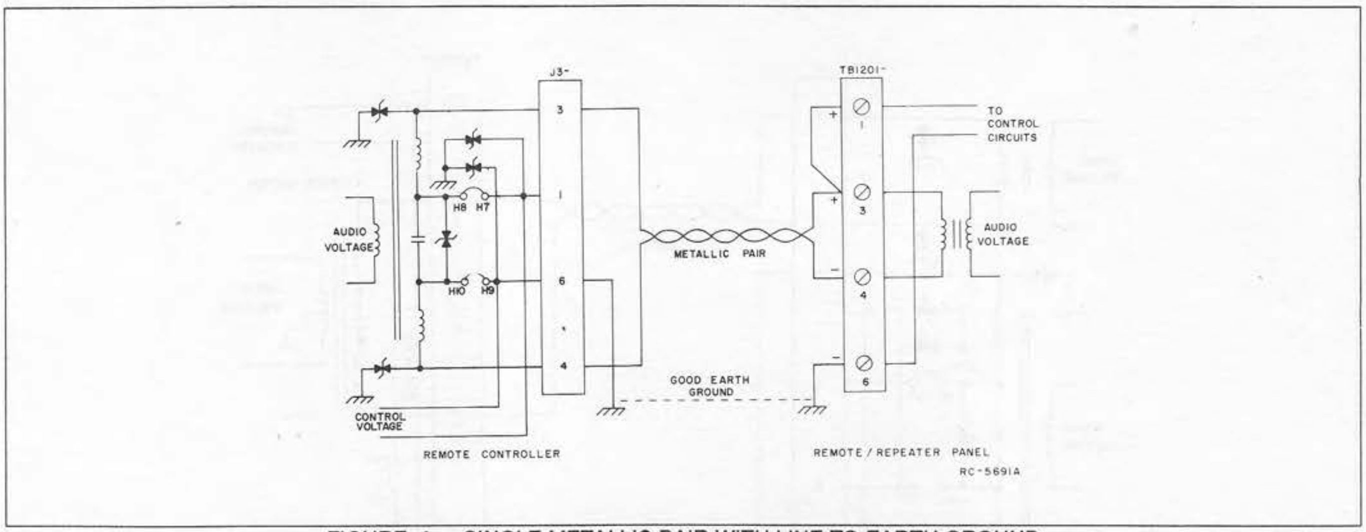

FIGURE 2 - SINGLE METALLIC PAIR WITH LINE TO EARTH GROUND

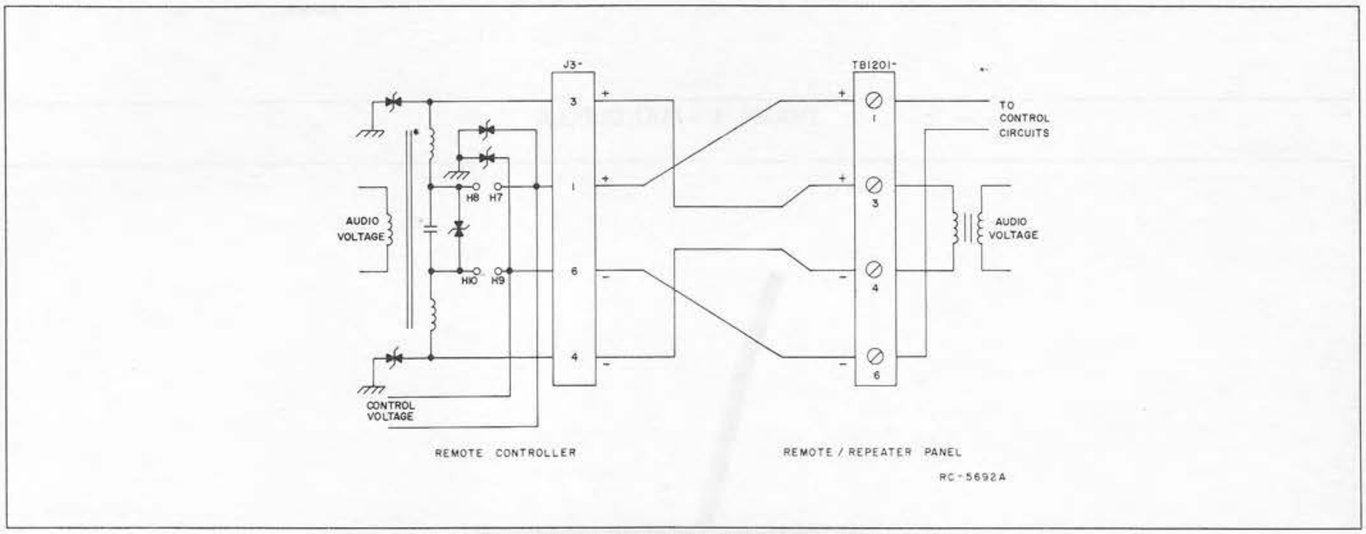

FIGURE 3 - SEPARATE CONTROL AND AUDIO PAIRS

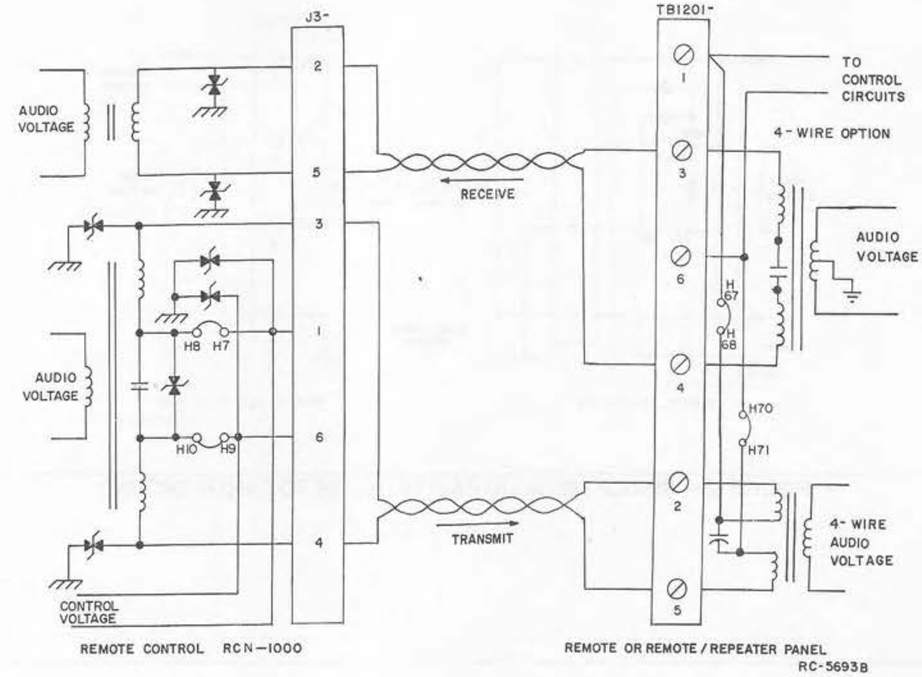

FIGURE 4 - FULL DUPLEX

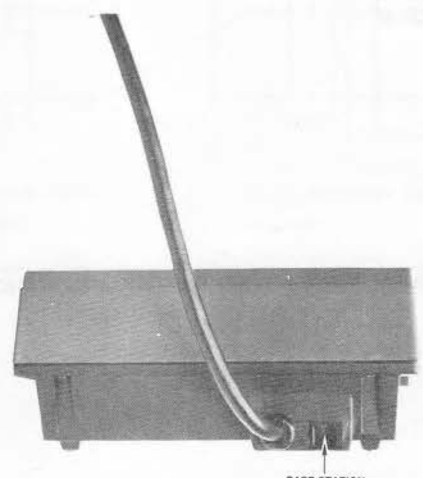

FIGURE 5 - TELEPHONE CONNECTOR VIEW

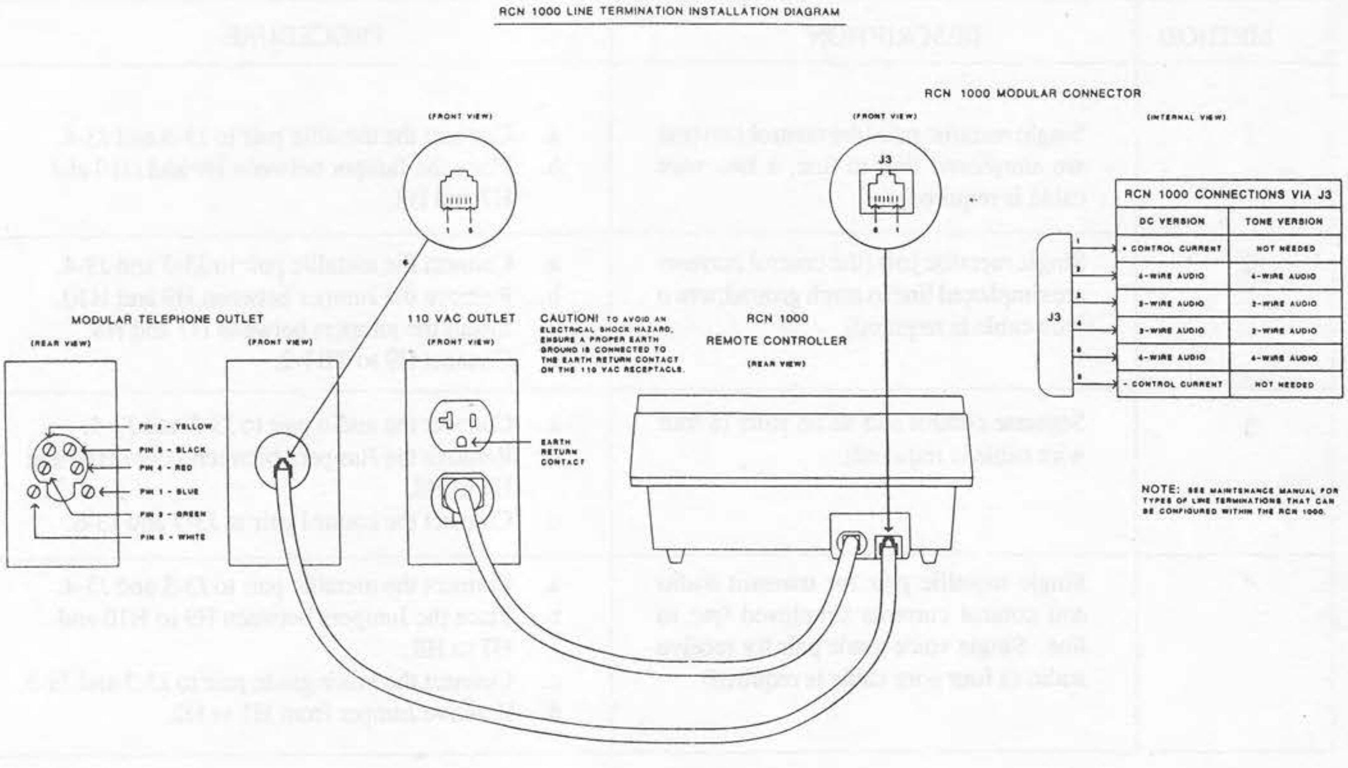

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FIGURE 6 - INSTALLATION DIAGRAM

LINE CONNECTIONS

The output connector J3 on the DC remote controller uses a standard 6 pin modular connector. The exterior cable can be a standard 2, 4 or 6 wire harness that is available at any telephone sales and service center. The center two connectors are used with method 1. The center four connectors are used with method 2 and 3. All connectors are used with method 4.

Connection to the metallic or voice grade lines should be done according to the diagrams in using one of the following methods.

NOTE

When making connections, polarity must be observed.

METHOD	DESCRIPTION	PROCEDURE
1	Single metallic pair (the control currents are simplexed line to line, a two wire cable is required).	a. Connect the metallic pair to J3-3 and J3-4. b. Place the Jumper between H9 and H10 and H7 and H8.
2	Single metallic pair (the control currents are simplexed line to earch ground, a two wire cable is required).	a. Connect the metallic pair to J3-3 and J3-4. b. Remove the Jumper between H9 and H10. Install the jumpers between H7 and H8. c. Connect H9 to TB1-2.
3	Separate control and audio pairs (a four wire cable is required).	a. Connect the audio pair to J3-3 and J3-4. b. Remove the Jumpers between H9 to H10 and H7 to H8. c. Connect the control pair to J3-7 and J3-6.
4	Single metallic pair for transmit audio and control currents simplexed line to line. Single voice grade pair for receive audio (a four wire cable is required).	a. Connect the metallic pair to J3-3 and J3-4. b. Place the Jumpers between H9 to H10 and H7 to H8. c. Connect the voice grade pair to J3-2 and J3-5. d. Remove Jumper from H1 to H2.

FOUR WIRE AUDIO

The four wire control method described in Method 4 above is used where the customer owned multiplex microwave systems are utilized, or the leased lines do not utilize hybrids in the transmission paths therefore a 4 wire operation is required. This type of system provides for the separation of the receive audio path and the transmit audio path.

PROPER GROUNDING PRACTICES

When using the DC Remote Controller in the earth return ground mode, the signal and control current ground must be made to a ground electrode such as a metallic cold water pipe.

The ground connection should be made with a single No. 14 AWG or larger copper conductor. The conductor should be short, straight and one continuous piece of wire. Attention should be given to providing the lowest possible resistance at the connection of the ground wire.

With the surge protection varistors on the 110 VAC power line, the control lines, the two wire audio lines and the four wire audio lines, it is imperative that a good earth ground be used on the ground conductor of the power cord or a SERIOUS SHOCK HAZARD could develop if lightning struck the control or power line. In order to protect the operator to the highest possible degree, obtain a good earth ground for the ground connector on the 110 VAC power cord.

If a good earth ground as described above cannot be obtained, Method 2 of connection should be used. The surge protection varistors are of little value without this earth ground and EXTREME CAUTION must be observed when servicing this assembly in the presence of a local lightning storm. In addition the internal circuits can be damaged when a good earth ground is not used and lightning strikes the control, audio or power lines.

KEYPAD PANEL ANALYSIS

VOLUME CONTROL

Volume control switches S1 and S2 control the setting of the volume control circuit on the main board. The switches are ORed together by diodes D21 and D23, which in turn is connected to inverter U7B. The output from this inverter is again ORed by diodes D24 and D25 which disables the volume function when the "CLK" function is activated. This feature accomplishes clock setting using the "VOL UP" and "VOL DWN" switches for fast and slow controls of clock module U5.

The input to inverter U7C is normally low (less than 0.8 VDC). This inverter is controlled by the ORed diodes and its output is fed to connector P1-15 which interfaces with the remote controllers main board.

Transistor Q4 is controlled by "VOL UP" switch S1 and interfaces to output connector P1-16. Normally this output is low (less than 0.3 VDC) when S1 is not depressed and goes high (greater than 4.5 VDC) when it is pressed. The function of this output is to inform the volume control circuit, on the remote controllers main board, which direction the operator has commanded the volume to proceed--either increment or decrement.

INTERCOM CONTROL

The "INTCM" switch (S3) is a push on/push off control which permits the communication between paralleled remote controllers without keying the transmitter. It also permits communications between the controller and the remote control panel when they contain the intercom feature.

The output on P1-14 is normally low (less than 0.8 VDC) when the switch is not pressed, and goes high (greater than 4.5 VDC) when the switch is pressed. In addition, INTCM LED D18 will illuminate when the function is latched by the main remote controller board.

CHANNEL GUARD CONTROL

The "MON" switch (S4) is used in DC models. The "MON" switch is a control which selects Channel Guard operation at the base station by applying no control current on the metallic pair when the operator requests Receive -F1. In applications with 2-frequency Receive, the selection of RX-F2 causes a control current (in DC models) to be applied to the line. In either case, Channel Guard operation is selected at the base station and only those transmissions coded by the proper Channel Guard tone will be heard by the remote controller.

When the switch is depressed, the output on P1-20 goes high (greater than 4.5 VDC), and the controller connects the appropriate current or tone to the control pair which disables the station Channel Guard enabling all transmissions on the receiver frequency to be heard. In addition C/G LED, D19 will illuminate informing the operator that the function is being used.

The Tone Remote uses function tones to enable or disable Channel Guard. The "CG DIS" button is used for this control. To disable CG, 1460 Hz is used. For CG enable, 1550 Hz is used.

SCAN CONTROL (OF A TWO FREQUENCY RECEIVER)

The "SCAN" switch, (S6) is a push on /push off control which selects the SCAN function of the remote control panel at the base station end. With no receive selector switch enabled, there will be no current (in the DC model) and the SCAN function tone (in the Tone model) is applied to the control pair which allows the receiving of audio on any of the receiver frequencies selected by the SCAN function. When the RX-F1 function is enabled, the proper current or tone is applied to the control pair, disabling the SCAN function and allowing the RX-F1 signal to be monitored. When the RX-2 function is enabled this also disables the SCAN function and allows the RX-F2 signal to be monitored.

When the switch is depressed and the output on P1-12 goes high (greater than 4.5 VDC) the controller outputs the control pair enabling the station SCAN so that all transmissions on either receiver frequency can be heard. In addition, SCAN LED D15 will illuminate informing the operator that the function has been latched in by the main board.

When SCAN is selected both RX1 and RX2 will be monitored simultaneously. Both RX1 and RX2 LEDs will be on when this function is selected.

CLOCK SETTING CONTROL

The "CLOCK" switch, S5 is a momentary contact control which enables the clock setting function within clock module U5.

When the switch is pressed, it grounds the cathode side of diode D24 thus disabling the volume control setting port. Transistor Q1 is also turned on illuminating CLK LED D14 and turns on transistor Q2 driving the SET terminal on pin 11 of U5 low (less than 0.3 VDC). The clock module setting procedure is now enabled and the SLOW on pin 12 and the FAST on pin 3 are also enabled to operate by depressing the " VOL UP" or "VOL DWN" switches to set the proper time. By depressing both switches at the same time the clock module will reset its internal register to 12:00 and display this in the window.

MULTI-FREQUENCY CONTROL

The"F-SEL", "F-TX" and "F-RX" switches (S7 and S8 control the circuits which operate the transmit and receive modes of the remote controller. The RX-F1 and RX-F2 are latched flip-flop functions that can only be operated in either/ or states and are controlled by S8. When the RX-F1 function is enabled, the remote controllers main board will send out the proper current (on DC models) or the control frequency (on Tone models) on the control pair. When the RX-F2 function is enabled, the controllers current or tone generation circuit will send the proper command down the control pair. The corresponding LED (D3 or D4) is illuminated to inform the operator of which function is selected.

When S8 is depressed the output of U7A on P1-5 will go high (greater than 4.5 VDC), the latched flip-flop on the main board will change states and output the function is displayed in the window area at the top of the remote controller. This also is the condition which F-TX switch S7 works but the output of U6D on P1-6 will go high (greater 4.5 VDC) and the remote controller will output the transmit function with the corresponding transmit LED (D1 or D2) illuminated.

ALTERNATE LINE CONTROL

This option allows the selection of an alternate line in the event of a failure of the primary transmission pair.

The output of U6B on P1-19 is normally low (less than 0.8 VDC) when "LINE 2" switch S9 is not pressed. The output on P1-19 interfaces to a push on/push off flip-flop on the remote controllers main board which latches the function. In addition, Alternate line LED, D10 will illuminate when the function is selected.

SUPERVISORY CONTROL (TAKE OVER SWITCH)

When a number of remote controllers are connected in parallel on the same control pair, this function allows all paralleled units to be completely disabled and the main dispatcher to assume full control over the remote system.

When "SUPV" switch S10 is pressed the output of U6E will go high (greater than 4.5 VDC) informing the remote controllers main board that the flip-flop which functions as a push on/push off control circuit to change states. In addition, SUPV LED D11 will illuminate indicating the function has been latched on.

PARTIAL SPEAKER MUTE CONTROL

The speaker muting function permits the dispatcher to temporarily reduce the volume of the incoming calls to a low level for business discussions, telephone calls and etc.

When "SPKR" switch S11 is pressed, the output of U7E will go high (greater than 4.5 VDC) causing the remote controller to set the Speaker Mute flip-flop and thus reducing the audio in the speaker by 20 dB. In addition SPKR LED D12 will illuminate indicating the function has been selected.

ALERT TONE CONTROL

The Tone Alert Oscillator is used by the dispatcher to transmit an alerting tone to call attention to messages of more than usual importance.

ALERT switch S12 is a momentary action switch that controls inverter U7F which is used to shut off timer U2 by applying a ground (less than 0.3 VDC) to pin 4. The oscillator frequency of 1000 Hz is set by timing resistors R1 and R2 and capacitor C3. Low pass filter U1B is used to remove the higher order harmonics from the square wave output from the timer U2. The filtered audio signal is then applied to the output terminal on P1-25 which feeds the main controller board.

In addition, ALERT LED D13 is illuminated when switch S12 is depressed.

CLOCK AND V/U METER

V/U meter U4 enables the operator to check the line level of the remote controller in the transmit, receive and intercom modes. This meter is a ten segment bar graph which provides a relative indication of the audio level applied to and received from the audio pair. The unit is calibrated indicating audio peaks in the 7 to 10 bar range (from -1dB to +3 dB) when the operator is talking into the microphone at a normal level.

Amplifier U1A is a preamp which amplifies the level of the applied signal such that the audio rectifier comprised of diodes D5 and D6 can produce a DC voltage level for V/U meter module U4.

Clock Module U5 is a self contained 12 or 12/24 hour digital clock mounted adjacent to the V/U meter in the crystal area of the remote controller. The unit is shipped from the factory with the clock in the 12 hour mode (jumper between H5 and H6 is installed). If the 12/24 hour mode is desired, remove the jumper between H5 and H6 and install the jumper between H6 to H7.

The brightness of the clock can be adjusted in the field by removing resistor R18 on R19 from the circuit.

DC CONTROL CIRCUIT ANALYSIS

CONTROL FUNCTIONS

As indicated in the Table 2, the DC Remote Controller can perform a maximum of six different DC control functions. This is accomplished by applying three different levels and changing the polarities of the control currents to activate the appropriate function at the remote control panel located at the base station site.

The control currents that are presented to the metallic pair on the output of the remote controller are polarity sensitive and thus require that both ends of the wire carrying the currents be connected the same. To identify the wires at each end, temporarily short one of the wires to a good earth ground at the station remote control panel and measure the resistance between each of the wires and a good earth ground at the DC Controller. The ungrounded wire will appear as an open circuit and the grounded wire will show a resistance which is dependent upon the size and length of the metallic pair used.

Label each end of the wires and remove the ground. Connect the remote controller and remote panels as per method 1-4 making sure that the control currents are connected to the corresponding terminals.

TABLE 2 - DC CONTROL CURRENTS AND FUNCTIONS

FUNCTION	CONTROL CURRENT IN MILLIAMPS					
	-11	-6	-2.5	0	+6	+11
1 FREQ TX 1 FREQ RX				RECEIVE	TRANSMIT	
2 FREQ TX 2 FREQ RX		RX-F2		RX-F1	TX-F1	TX-F2
2 FREQ TX 2 FREQ RX WITH SCAN	RX-F2	RX-F1		SCAN	TX-F1	TX-F2
1 FREQ TX 1 FREQ RX WITH CHANNEL GUARD DISABLE			CG DISABLE	RECEIVE WITH CG	TRANSMIT	
2 FREQ TX 2 FREQ RX WITH CHANNEL GUARD DISABLE	RX-F2 CG DISABLE	RX-F2 WITH CG	RX-F1 CG DISABLE	RX-F1 WITH CG	TX-F1	TX-F2
REPEATER DISABLE		REPEATER DISABLE		RECEIVE	TRANSMIT	
REPEATER DISABLE & DISABLE CHANNEL GUARD	REPEATER REPEATER & CG DISABLE	CG DISABLE	RECEIVE DISABLE	TRANSMIT WITH CG		
1 FREQ TX 2 SEPARATE RECEIVER (AUX RX)	RX-F2	RX-F1		RX-F1 & RX-F2	TRANSMIT	

NOTE: When the remote handset is placed in the cradle, the unit will not output current (-2.5, -6, or -11) unless H18-H19 or H18-H20 is removed.

DC REMOTE CONTROLLER AUDIO SYSTEM RECEIVE AUDIO

The receive audio from the audio pair is applied through the LINE AUDIO connections on J3-3 & 4. The secondary side of coupling transformer T2 is terminated with resistor R28 which matches the impedance of the incoming line to 600 ohms. When the bridging impedance of 6000 ohms is desired; simply remove resistor R28 from the circuit by clipping one of its leads. Capacitor C6 blocks the DC current from flowing through the transformer thus forming a balanced output.

When the panel is used in the standard two wire configuration, the Jumper between H1 and H2 is installed and the receive audio is applied to potentiometer R29 which is labeled "LINE IN LEVEL ADJUST" and sets the level of the audio applied to line compression amplifier U9A. When the four wire configuration is used, transformer T3 is installed and the Jumper between H1 to H2 is removed. The incoming audio is then applied to J3-5 and J3-2 and is coupled to potentiometer R29 the same as in the two wire setup which applies the audio to amplifier U9A. This amplifier can be set up to provide compensation for the high frequency roll off on long lines. This modification should be used when the roll off in the 2500 to 3000 Hz range is more than 10 dB below the response in the 400 to 600 Hz level. See the schematic diagram for specific component changes.

The compression circuit, comprised of amplifier U9B and compressor/expandor IC U8B, allows the input signal to have 30 dB dynamic range with less than 3 dB of output change. Amplifier U9B's gain is controlled by the impedance of the gain cell within U8B. The compressor/expandor has an independent rectification input on pin 13 which produces a DC (direct current) voltage level controlling the internal variable gain cell connected between pins 9 and 11. This voltage level attack time (5 milliseconds) is controlled by Capacitor C46 and the decay time (10 seconds) is controlled by capacitor C48. The voltage on pin 12 of U8B is proportional to the amount of signal that is on the input line and ranges from 0.2 VDC to 1.75 VDC. This voltage is also sensed by comparator U24A which is used to shut off analog gate U13B in the absence of a good receive signal on the incoming line. This prevents the white noise from being amplified and put on the speaker. Potentiometer R116 is used to set the cutoff level of the comparator to each users preference. That is, if the user wants to hear the incoming signal at a lower level, set the potentiometer voltage reading lower on pin 2 of U24A. (Turn potentiometer clockwise).

Analog gate U13D is normally in the on state and the control on pin 12 is high (greater than 13.5 VDC). Thus the audio output from compressor amplifier U9B is passed directly through the gate and applied to volume control circuit U14. When the SPEAKER MUTE function is enabled on the remote controllers keypad, then the voltage on pin 12 will go low (less than 0.3 VDC) and the gate will be turned off. Thus the audio must then pass through parallel resistor R50 which reduces the audio in the speaker by 20 dB permitting the dispatcher to temporarily reduce the volume to a lower level for business discussions, telephone calls or etc.

Volume control circuit U14 sets the level of the audio to low pass filter U10A and output amplifier U15 thus controlling the volume of the remote controller. This is accomplished by varying the internal resistance from pin 3 to pin 5 with respect to lower reference on pin 6. In addition, this circuit has the capability to remember the last volume setting by having this value stored in its long term memory (EEPROM) within the device. Timer, U11 provides the pulse train which steps the volume control through its 100 step range at the rate of 30 steps per second.

The audio from high pass filter U10A is split into two directions; one being applied to earpiece amplifier adjustment potentiometer R75. This potentiometer is labeled "EARPIECE LEVEL" and controls the amount of signal that is applied to amplifier U10B and thus presented to the earpiece speaker located in the handset.

The other path is to analog gate U13C which is controlled by the HUHS (hang up handset switch) located in the handset. The control on pin 6 is high (greater the 13.5 VDC) when the handset is in its cradle. The audio signal is then coupled to speaker potentiometer R92 and applied to speaker amplifier U15. The jumper between H3 and H4 is normally installed with a handset and removed for deskmic and boom mic applications. Potentiometer, R89 which is labeled "SPEAKER LEVEL" sets the maximum output from speaker audio amplifier U15 to 3 watts into a 4 ohm load (this is 3.45 Vrms measure across the 4 ohm speaker).

TRANSMIT AUDIO

The transmit audio originates from the microphone element in the handset board and is amplified by the FET amplifier located on this board. The resistor/capacitor combination comprised of R55, R56 and C34 provide the microphone element with a 600 ohm isolated power source. The signal is then fed to analog gate U13A which is controlled by the PTT function. The control on pin 13 is normally low (less 0.3 VDC) and the gate is held in the off state until the PTT button on the handset is depressed. When analog gate U13A is on, the audio signal is applied to the compressor/expandor amplifier comprised of U7A and U8A.

The compression circuit allows the input signal to have 30 dB dynamic range with less than 15 dB of output change. Amplifier, U7A's gain is controlled by the impedance of the gain cell within U8A. The compressor/expandor has an independent rectification input on pin 3 which produces a DC (direct current) voltage level controlling the internal variable gain cell connected between pins 5 and 7. This voltage level attack time (5 milliseconds) is controlled by capacitor C15 and the decay time (10 seconds) is controlled by capacitor C13. The voltage on pin 2 of U8A is proportional to the amount of signal that is on the input line and ranges from 0.2 VDC to 1.75 VDC. This voltage is also sensed by comparator U24B which is used to turn on transistor Q17 in the absence of a good receive signal on the microphone line. This prevents the white noise originating in the compression circuit from being amplified and put on the line. Potentiometer R117 is used to set the cutoff level of the comparator to each users preference.

The microphone audio is then summed with the "ALERT AUDIO" from the keypad panel board and fed to line adjust potentiometer R46. This potentiometer is labeled "LINE OUT ADJ" and is used to set the audio level to line driver amplifier U6.

DC REMOTE CONTROLLER 5VDC AND 13.8 VDC REGULATORS

The remote controller gets its input power from a 110 VAC source which is applied to power transformer T1 via 3/8 amp fuse F1.

CAUTION

The fuse is connected to the input 110 VAC lead and care must be observed when replacing it to ensure that the power cord is disconnected from the outlet prior to removing the protective cover which covers the fuse. Qualified service personnel should be contacted when the internal fuse needs replacement and all safety precautions must be observed in order to protect against a severe shock hazard.

The low voltage secondary winding provides the remote controller its internal power requirements. The full wave bridge comprised of diodes D10-D13 and capacitor C9 rectifies the input sine wave into a DC voltage level and applies it to "13.8 VDC" regulator U1. This regulator and it associated components provide the internal audio circuits with 13.9 VDC and provides pre-regulation for regulator U5. This regulator provides the digital circuitry with a 5.0 VDC source.

132 VDC CURRENT SOURCE

The high voltage secondary winding provides the remote controller its source for the control currents that are output on terminals J3-3/and J3-6 which interface to the control panels over the metallic pair. The full wave bridge comprised of diodes D6-D9 and capacitor/C5 rectify the input sine wave to produce the 132 VDC requirements of the control current generator which is comprised of the following:

CURRENT	COMPONENTS
2.5 milliamp	U2 and Q8
6 milliamp	U3 and Q9
11 milliamp	U4 and Q10

The opto-isolators U2, U3 and U4 are light coupled from the input LED between pins 1 and 2 to the output transistor between pins 4 and 5 when the particular control current is required. The output current from the NPN transistor stage on pin 4 is used to set up the base curve of pass transistor Q1. This transistors collector current is controlled by one of the PNP pass transistors; Q8, Q9 or Q10 and potentiometers; R9, R13 or R26.

NOTE

These networks set the collector current to the 2.5, 6 or 11 milliamp range and are highly stable thus will not require adjustment in the field.

DC REMOTE CONTROLLER POLARITY AND LOGIC DECODING OUTPUT POLARITY

The output polarity of the control line on J3-6 and J3-1 are controlled by transistors Q2-Q7. When the positive polarity is enabled, transistor Q2 is turned on applying the high voltage ground to J3-6. In addition, transistor Q4 is turned on which in turn causes PNP pass transistor Q6 to turn on applying the output current to terminal J3-1.

When the negative polarity is enabled transistor Q3 is turned on applying the high voltage ground to J3-1. In addition, transistor/Q5 is turned on which causes PNP pass transisitor Q7 to apply the output current to terminal J3-6.

The jumper between H5 and H6 and H13 and H14 are present when the remote controller is equipped as a single frequency transmit only control. Otherwise these jumpers are always removed.

LOGIC DECODING CIRCUITS

The input from the keypad panel are fed directly into the D- type flip-flops; U16, U21, U22 and U23. These flip-flops latch the control function from the panel and control the output decoder, U20 and LED drive circuits; U17 and U18. When the input on any of the "CLK" lines goes high (greater than 4.5 VDC) the corresponding output on the "Q" side will also go high.

Output decoder U20 is a fuse link PROM that contains the proper output coding for the combinations of input commands that correspond to a particular control function to be generated within the remote controller. The code contained within the PROM is factory installed by opening the fuse link internal to the device, thus making the IC useful for the particular application only. If a remote controller is to be upgraded in the field to incorporate additional features PROM U20 will be required for features that correspond to additional currents applied to the metallic control pair and the Alternate Line/Supervisory functions.

TONE CONTROL CIRCUIT ANALYSIS

The Controller can perform a maximum of 12 different tone control functions. This is accomplished by applying two or three tones in sequence at the prescribed level to the transmission medium for detection at the remote base station. All of the tones are generated at the Controller by one oscillator whose frequency is selected by a combination of switch selection and logic circuitry. The control tone frequencies required to select each function in Remote and Repeater Stations are listed in Table 3.

When a non-transmit function is selected, the Secur-it tone frequency of 2175 Hz is transmitted for a period of 125 milliseconds at a level equal to normal voice peaks (See Figure 7). In the case of a 0 VU level the Secur-it tone is transmitted at a level of +10 dBm. At the end of the 125 millisecond burst, the microprocessor changes the frequency of oscillation to the proper function selected. This tone is then transmitted for a period of 40 milliseconds at a level that is 10 dB below the Secur-it tone burst level. Upon completion of this sequence, the microprocessor returns to the keypad scanning routine and awaits another keypad input command.

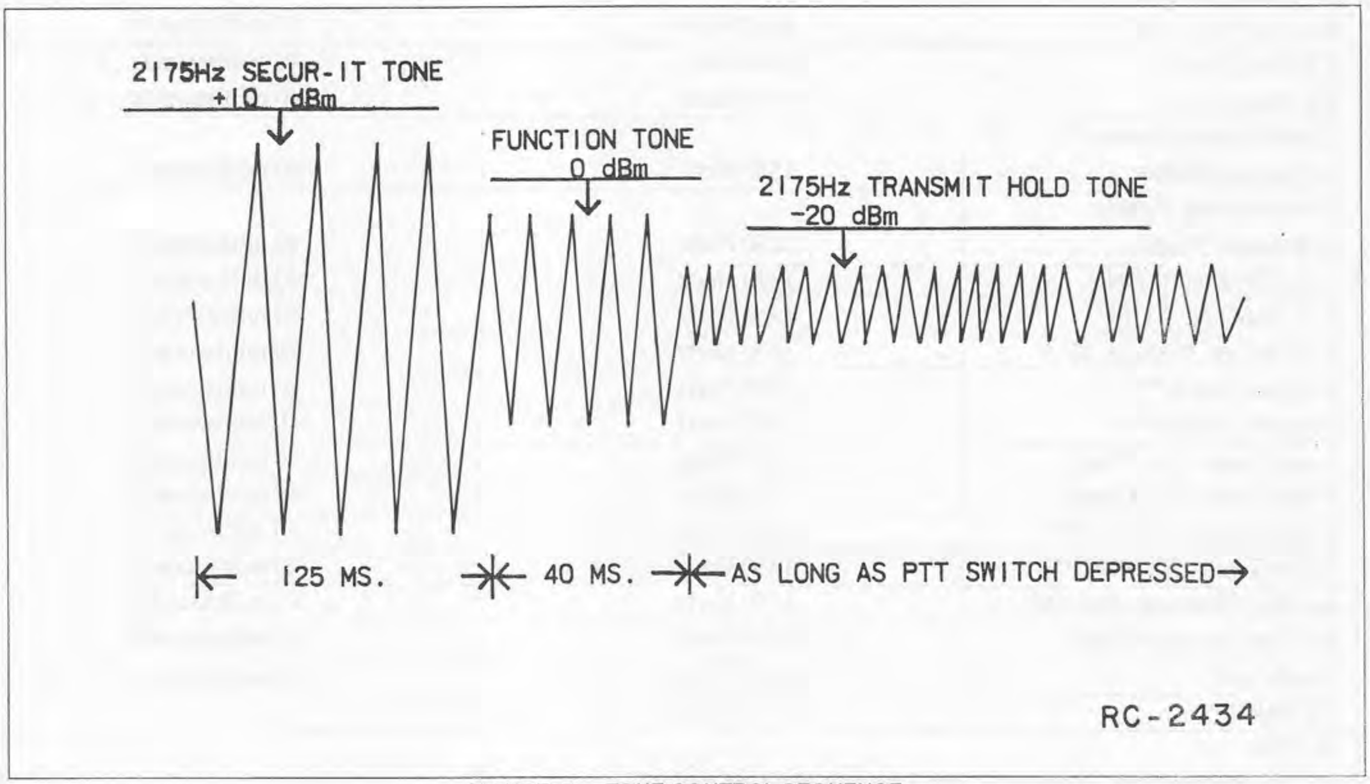

FIGURE 7 - TONE CONTROL SEQUENCE

When the transmit function is selected, the Secur-it tone is transmitted as in the above described sequence followed by a 40 millisecond burst of either the F1, F2, F3 or F4 transmit function tone. At the end of this tone period, the Secur-it tone will again be enabled by the microprocessor but this time at a level 30 dB below its initial burst level. This level remains on in the presence of voice as long as the operator has the PTT switch depressed.

LINE CONNECTIONS

The output connector on the Tone remote controller also uses a standard modular connector. The exterior cable can be a standard 2 or 4 wire harness that is available at any telephone sales and service center.

TABLE 3 - TONE CONTROL FREQUENCY AND FUNCTION

FUNCTION	TONE FREQUENCY	TONE DURATION
RX Channel Guard Disable (Reset by PTT)	2050 Hertz	40 milliseconds
TX-Freq. No. 1*, SF1	1950 Hertz	40 milliseconds
TX-Freq. No. 2, SF2	1850 Hertz	40 milliseconds
RX-Freq. No. 1 or Receiver No. 1 , SF3	1750 Hertz	40 milliseconds
RX-Freq. No. 2 or Receiver No. 2, SF4	1650 Hertz	40 milliseconds
TX-Freq. No. 3	1350 Hertz	40 milliseconds
TX-Freq. No. 4	1250 Hertz	40 milliseconds
Channel Guard Encode or Repeater Enable	1550 Hertz	40 milliseconds
Channel guard Disable or Repeater Disable	1450 Hertz	40 milliseconds
Aux. Function 1 ON	1350 Hertz	40 milliseconds
Aux. Function 1 OFF	1250 Hertz	40 milliseconds
Scan or Sim. Monitor, SF 5	1050 Hertz	40 milliseconds
Repeater Enable***	1150 Hertz	40 milliseconds
Repeater Disable***	1050 Hertz	40 milliseconds
Voice Guard - F1 (Clear)	1950 Hertz	40 milliseconds
Voice Guard - F2 (Clear)	1350 Hertz	40 milliseconds
Voice Guard - F1 (ENCPT)	1850 Hertz	40 milliseconds
Voice Guard - F2 (ENCPT)	1250 Hertz	40 milliseconds
Auxillary Receiver (Normal)	1750 Hertz	40 milliseconds
Auxillary Receiver (Aux)	1650 Hertz	40 milliseconds
Enable both	1050 Hertz	40 milliseconds
TX Hold **	2175 Hertz	

NOTES:

* All functions but Transmit F1 and Transmit Hold are optional.

** Transmit Hold is transmitted at 30 dB below the Secur-it tone level as long as PTT switch is depressed.

*** Used only when Repeater Enable/Disable is used.

Connection to the voice grade lines should be done according to either of the following methods:

METHOD	DESCRIPTION	PROCEDURE
1	Single voice grade pair (a two wire cable is required).	a. Connect the pair to J3-1 and J3-6 on a six wire cable, or J3-3 and J3-4 on a two or four wire cable. b. Place the Jumper between H1 and H2.
2	Single voice grade pair for transmit audio control Single voice grade pair for receive audio (a four wire cable is required).	a. Connect the transmit pair to J3-3 and J3-4. b. Connect the receive pair to J3-2 and J3-5. c. Remove the Jumper between H1 and H2.

FOUR WIRE AUDIO

The four wire control method described in Method 2 is used where the customer owned multiplex microwave systems are utilized or the leased lines do not utilize hybrids in the transmission paths therefore a 4 wire operation is required. This type of system provides for the separation of the receive audio path and the transmit audio path.

VOLTAGE REGULATORS

The remote controller gets its input power from a 110 VAC source which is applied to power transformer T1 via the 3/8 amp fuse, F1.

CAUTION

The fuse is connected to the input 110 VAC lead and care must be observed when placing it to ensure that the power cord is disconnected from the outlet prior to removing protector cover which covers the fuse. Qualified service personnel should be contacted when the internal fuse needs replacement and all safety precautions must be observed in

The low voltage secondary winding provides the remote controller its internal power requirements. The full wave bridge comprised of diodes, D1-D4 and capacitor, C7 rectify the input sine wave into a DC voltage level and applies it to "13.8 VDC" regulator U1. This regulator and its associated components provide the internal audio circuits with 13.8 VDC and provides pre-regulation for regulator U2. This regulator provides the digital circuitry with a 5.0 VDC source.

AUDIO CIRCUITRY

AUDIO GENERAL

The audio paths in the Tone remote controller are best described by separating the transmit audio (microphone to line) and receive audio (line to speaker).

TRANSMIT AUDIO GENERAL

The transmit audio consists of an automatic gain control, notch filter, digital to analog tone generation and line driver amplifier. Each part is described in the following paragraphs.

TRANSMIT AUDIO
AUTOMATIC GAIN CONTROL

The transmit audio originates from the microphone element in the handset board and is amplified by the FET amplifier located on this board. The resistor/capacitor combination comprised of R12, R16 and C12 provide the microphone element with a 600 ohm isolated power source. The audio signal is then applied to the compressor/expandor amplifier comprised of U7A and U8A. The AGC amplifier has a 30dB dynamic range with 15 dB change. Amplifier, U8A's gain controlled by the impedance of the gain cell within U7A. The compressor/expandor has an independent rectification input on pin 13 which produces a DC (direct current) voltage level which controls the internal variable gain cell connected between pins 9 and 11. This voltage level attack time (8 milliseconds) is controlled capacitor C16 and the decay time (10 seconds) is controlled by capacitor, C32. The voltage on pin 14 of U7A is proportional to the amount of signal that is on the input line and ranges from 0.2 VDC to 1.75 Vdc. This voltage is also sensed by comparator U8B which is used to turn off the mic audio in the absence of a good receive signal on the microphone line. This prevents the white noise originating in the compression circuit from being amplified and put on the line. Potentiometer R58 is used to set the cutoff level of the comparator to each users preference.

TRANSMIT AUDIO
NOTCH FILTER

The Secur-it tone frequency of 2175 Hz is used to alert the panel of a pending function tone generation and to hold the transmitter keyed. Therefore the voice that is being transmitted along with the Secur-it must have the 2175 Hz frequency notched out of it in order to eliminate false keying. The notch filter comprised of U1A and U1D with their associated components (located on the extension board) provides a notch with a depth of 20 dB and 3 dB points at 2000 Hz and 2350 Hz.

TRANSMIT AUDIO
DIGITAL TO ANALOG TONE GENERATION

The Secur-it and function tones are all generated by the 8031 microprocessor (U22) via digital to analog converter U16. The frequency of each complete wave-form is made up of between 16 and 20 individual steps from the microprocessor. The levels, frequency and lengths are all predetermined within the micro and will not drift with temperature. The microprocessor pro-vides extremely predictable, distortion free waveforms which are applied to lowpass filter U1B (located on the extension board). The low pass filter with its associated components removes all of the high frequencies from the wave form thus producing a clean sine wave.

In addition, the Alert Audio from the keypad panel is summed into the low pass filter circuit via resistor R10 and U1C (located on the extension board).

TRANSMIT AUDIO
LINE DRIVING AMPLIFIER

All of the audio from the microphone, digital to analog converter and alert tone meet at connector J5-5 on the extension board and are fed to "LINE OUT LEVEL ADJUST" potentiometer R64. This potenti-ometer sets the level on the input to line driver amplifier U11. When the digital to analog converter is generating the Secur-it at +10 dB or function tones, the voice audio and alert tone are disabled. When the digital to analog converter is generating the Secur-it tone at -20 dB (transmitter hold tone) the paths are enabled. When the PTT button or the Alert Tone button is pressed or a function is selected on keypad panel, the line driver is enabled by turning on transistor Q3. The audio is then passed to the line, if the control on the "COMB PTT" from U14F is ever low then the line driver on and audio is passed to the line.

RECEIVE AUDIO GENERAL

The receive audio consists of an automatic gain control, speaker mute, volume control, earpiece speaker and base speaker. Each part is described in the following paragraphs.

The receive audio from the audio pair is applied through the LINE AUDIO connections on to J3-3 and J3-4. The secondary side of coupling transformer T2 is terminated with resistor R7 which matches the impedance of the incoming line to 600 ohms. When the bridging impedance of 6000 ohms is desired; simply remove resistor R7 from the circuit by clipping one of its leads.

When the panel is used in the standard two wire configuration, the jumper between H1 and H2 is installed and the receive audio is applied to potentiometer, R43 which is labeled "LINE IN LVEL ADJUST" and sets the level of the audio applied to line compression amplifier U9B. When the four wire configuration is used transformer T3 is installed and the jumper between H1 to H2 is removed. The incoming audio is then applied to J3-2 and J3-5 and is coupled to potentiometer R43 the same as in the two wire setup which couples the audio to amplifier U9B.

RECEIVE AUDIO
AUTOMATIC GAIN CONTROL

The compression circuit comprised of amplifier U9A and compressor/expandor IC U7B, allows the input signal to have a 30 dB dynamic range with less than 3dB of output change. Amplifier U9A's gain is controlled by the impedance of the gain cell within U7B. The compressor/expandor has an independent rectification input on pin 3 which produces a DC (direct current) voltage level controlling the internal variable gain cell connected between pins 3 and 5. This voltage level attack time (5 milliseconds) is controlled by capacitor C17 and the decay time (10 seconds) is controlled by capacitor C18. The voltage on pin 2 of U7B is proportional to the amount of signal that is on the input line and ranges from 0.2 VDC to 1.75 VDC. This voltage is also sensed by comparator U9A which is used to shut off analog gate U3B in the absence of a good receive signal on the incoming line. This prevents the white noise from being amplified and put on the speaker. Potentiometer R53 is used to set the cutoff level of the comparator to each users preference. That is if the user wants to hear the incoming signal at a lower level, set the potentiometer voltage reading lower on pin 2 of U9A by turning clockwise.

RECEIVE AUDIO
SPEAKER MUTE

Analog gate (U3D) is normally in the on state and the control on pin 12 is high (greater than 13.5 VDC). Thus the audio output from compressor amplifier U9B is passed directly through the gate and applied to volume control circuit U6. When the SPEAKER MUTE function is enabled on the remote controllers keypad, then the voltage on pin 12 will go low (less than 0.3 VDC) and the gate will be turned off. Thus the audio must then pass through parallel resistor R8 which reduces the audio in the speaker by 20 dB permitting the dispatcher to temporarily reduce the volume to a lower level for business discussions, telephone calls or etc.

RECEIVE AUDIO
VOLUME CONTROL CIRCUIT

Volume control circuit U6 sets the level of the audio to low pass filter U4B and output amplifier U12 thus controlling the volume of the remote controller. This is accomplished by varying the internal resistance from pin 3 to pin 5 with respect to lower reference on pin 6. In addition this circuit has the capability to remember the last volume setting by having this value stored in its long term memory (EEPROM) within the device. Timer U10 provides the pulse train which steps the volume control through its 100 step range at the rate of 30 steps per second.

RECEIVE AUDIO
EARPIECE AMPLIFIER

The audio from high pass filter U4A is split into two directions; one being applied to earpiece amplifier adjustment potentiometer R29. This potentiometer is labeled "EARPIECE LEVEL" and controls the amount of signal that is applied to amplifier U4A and thus presented to the earpiece speaker located in the handset.

RECEIVE AUDIO
SPEAKER AMPLIFIER

The other path is to analog gate U3C which is controlled by the HUHS (hang up handset switch) located in the handset. The control on pin 6 is high (greater than 13.5 VDC) when the handset is in its cradle. The audio signal is then coupled to speaker potentiometer R52 and applied to speaker amplifier U12. The jumper between HA and HB is normally installed with a handset and R52 which is labeled "SPEAKER LEVEL" sets the maximum output from speaker audio amplifier U12 to 3 watts into a 4 ohm load (this is 3.45 Vrms measured across the 4 ohm speaker).

CONTROL CIRCUITRY

CONTROL CIRCUITRY GENERAL

The heart of the Tone remote controller is the Intel 8031 microprocessor. The basic building blocks of the control circuitry are the input buffer, output buffer, watchdog and EPROM control program. Each segment is described in the following paragraphs.

CONTROL CIRCUIT
INPUT BUFFER

The input buffer consist of two 74HC373 octal D-type latches U17 and U18. The microprocessor enables one of them at a time and reads the information from them. The PTT, Hook Switch, Ten Key Inputs and 2175 Bandpass Detect are constantly read and acted upon. The exact function of each is described under the PROM section. The Test jumper (H25-H26), Multifreq jumper Opt 1 (H23-H24) and Multifreq jumper Opt 2 (H27-H28) are read only when the unit is first powered up. If the test jumper is in place when the unit is powered up then it will begin the test mode until powered down. In a four frequency controller, the Multifreq jumpers are read to determine if less frequencies are desired and will function as listed in the Table 4 below:

TABLE 4 - MULTIFREQ JUMPERS

JUMPER POSITIONS		
H23-H24	H27-H28	NUMBER OF FREQUENCIES USED
OUT	OUT	FOUR
OUT	IN	THREE
IN	OUT	TWO
IN	IN	ONE

CONTROL CIRCUIT
OUTPUT BUFFER

The output buffer consists of one 74HC374 octal D-type flip-flop (U19) and seven external bits from the 8031 microprocessor (U22). The LED indicators are turned on and off with the open collector outputs from drivers U13 and U14. Since the microprocessor and control circuitry operate at 5 VDC and the audio circuitry operates at 13.8 VDC, open collector outputs are also used to control the analog gates. The two outputs to do this are the MUTE and COMBPTT. The MUTE is used to mute the speaker output and shut off the AGC and Alert audio while the function tones are being generated. COMBPTT enables audio to be transmitted to the line. The ALT-LN and SUP-LN are open collector outputs (Q5 and Q6) to control external relay capable of sinking 80 milliamps of current each.

CONTROL CIRCUIT
WATCH DOG

When using a microporcessor, a watch dog U23, is used to make sure the micro is always operating in a predictable manner or the watch dog will reset it. The IC used for this purpose is a 4528 dual monostable multivibrator. The micro must write to pin 6 of U23 every 100 milliseconds or pin 10 of U23 will drive the reset on pin 9 of U22 low and cause the processor to reset. The 8031 microprocessor may be reset by shorting across H29 and H30 which will cause the reset sequence to occur. This method is only used when testing the unit.

CONTROL CIRCUIT
EPROM CONTROL PROGRAM

The 27C64 EPROM (U21) has the entire control logic programmed into it. The control program has been written in a flexible fashion to allow selection of which key shall perform a specific function. It also contains one location indicating whether Channel Guard is used or not. The logic control is explained in the following paragraphs.

MICROPROCESSOR CONTROL

The tone remote controller has two modes of operation: Remote Control Mode and Test Mode. The Remote Control Mode is simply the "standard" mode of operation. The Test Mode is a self diagnostics for testing the different functions of the controller.

REMOTE CONTROL MODE

If during power up, the jumper labeled "TEST" is not in place, the Remote Mode begins.

The micro will monitor a keypad of up to 10 keys. These keys will control a tone panel and will require the micro to generate 1050, 1150, 1250, 1350, 1450, 1550, 1650, 1750, 1850, 1950, 2050, and 2175 hertz waveforms. The exact function of the keys will be stored in the EPROM. The micro also controls many LEDs on the controller to indicate the state of the unit. Lastly, the remote utilizes bilateral switches to control audio paths.

TEST MODE

If at power up or reset, the "TEST" jumper is in place, the LEDs will flash four times and the test mode begins.

The micro will monitor a keypad of up to 10 keys. These keys will produce tones which represent the function they would normally denote. This allows testing of the accuracy of the function tones. Since all keys require more than one tone, the operator will step through the tones one by one by pressing and releasing the key, testing the tone frequency and amplitude, and then pressing and releasing it again to test the next one.

For instance, to test Channel Guard Disable, press the key that corresponds to it. The LED by the key will turn on. The Secur-It tone will be generated. Other key functions are ignored and the micro will continue to generate the tone and will wait until the key is pressed again. Once the key is pressed again, the next tone (1450 Hz) is generated. One more press of the key and the LED will stay on and all keys are scanned again.

Table 5 provides the selection designator, function, and frequencies as used by the micro during the test mode.

Functions dependent on the PTT will not be tested until PTT is pressed.

TABLE 4 - FREQUENCY GENERATION BY SELECTED FUNCTION

SELECT	FUNCTION	ACTION
0	No Function	Ignore
The following are controlled by 2 keys and use 4 indicator LED's.		
2	TX-Freq NO. 1	2175-1950-2175 (Only when PTT)
	TX-Freq NO. 2	2175-1850-2175 (Only when PTT)
3	RX-Freq. NO. 1	2175-1750-none
	RX-Freq. NO. 2	2175-1650-none
4 (F-SEL)	TX/RX-Freq NO. 1	2175-1950-2175 (Only when PTT)
	TX/RX-Freq NO. 2	2175-1850-2175 (Only when PTT)
	TX/RX-Freq NO. 3	2175-1350-2175 (Only when PTT)
	TX/RX-Freq NO. 4	2175-1250-2175 (Only when PTT)
The following are controlled by one key.		
6	Channel Guard Enable	2175-1550-none
	Channel Guard Disable	2175-1450-none
7	Repeater Enable	2175-1550-none
	Repeater Disable	2175-1450-none
The following is used if SELECT 6 is being used.		
8	Repeater Enable	2175-1150-none
	Repeater Disable	2175-1050-none
The following is used if SELECT 5 is not being used.		
9	Aux. Fuction ON	2175-1350-none
	Aux. Function OFF	2175-1250-none
The following is used if SELECT 8 is not being used.		
A	Scan	2175-1050-none
The following will not cause any tones to be sent to the remote.		
C	Alt-Line, SUPR, Takeover	Provides external open collector switch.
D	Spkr Mute	Mutes the remotes speaker audio.
E	Intercom	Disallows TX tones from being sent.
F	Clock	Clock function.
10	Alert	Identical to PTT, use correct TX freq.
19	R1	2175-1750-none
	R2	2175-1650-none

TABLE 5 CONTINUED

SELECT	FUNCTION	ACTION
The following are unique to the Voice Guard Remote.		
16	CLEAR	2175-1950 (Only when PTT) - F1 2175-1350 (Only when PTT) - F2
17	ENCRYPT	2175-1850 (Only when PTT) - F1 2175-1250 (Only when PTT) - F2
18	F-TX	2175-1950 (Only when PTT) - F1 CLEAR 2175-1850 (Only when PTT) - F1 ENCRY 2175-1350 (Only when PTT) - F2 CLEAR 2175-1250 (Only when PTT) - F2 ENCRY
The following is unique to the Auxillary Receive Function		
19	AUX-RX	2175-1750 (RX normal) 2175-1650 (RX auxillary) 2175-1050 (Dual State)

TABLE 6 - KEY LOCATIONS

7	8	9	A
3	4	5	6
1	2		

The following instructions refer to how to program locations 50 to 5C of the EPROM:

Starting at 51H put key function 1 to key function A, with a 00H denoting no function. It is important to put a 00 at location 50, for the default in the program when it is waiting for a key to pressed. due to one restrictive pin, pin number 4, the alert will always be sensed at the 'A' location. So if you use alert, denote it at location 'A' regardless of where it is located.

EXAMPLE - FOR A 6 KEY REMOTE (KEYS 7-10 ARE NOT AVAILABLE)

WITH
KEY 1 - INTCM
KEY 2 - MUTE
KEY 3 - CLOCK
KEY 4 - SCAN
KEY 5 - F-TX
KEY 6 - F-RX

TABLE 7 - CODE FOR CHANNEL GUARD REQUEST FROM HANDSET IN CRADLE

50H	$00	;NO KEY ACTIVE
51H	$0F	;INTERCOM
52H	$01	;MUTE
53H	$10	;CLOCK
54H	$0A	;SCAN
55H	$02	;F-TX
56H	$03	;F-RX
57H	$00	;EMPTY
58H	$00	
59H	$00	
5AH	$00	
5BH	$00	;CG ENABLED FOR HUHS RELEASE
5CH	$FF	;PST OPTION DISABLED

ADJUSTMENT PROCEDURE AND TROUBLE-SHOOTING CHARTS

This portion of the manual contains an adjustment procedure and trouble shooting information for the Tone and DC remote controllers. The information is broken into the following sections:

1) Adjustment Procedure
   a) Tone Remote Controller
   b) DC Remote Controller
2) Troubleshooting Information
   a) Tone Remote Controller (900-0167)
   b) DC Remote Controller (900-0165)
   c) Keypad Display Board (900-0164)

ADJUSTMENT PROCEDURE

TONE REMOTE CONTROLLER

This section will contain the adjustment for the following remote controller parts:

Clock
Alert Level (R13 Keypad Display Board)
Microphone to Line Audio Level (R64)
Microphone Audio Comparator Setting (R58)
Receive Line Compensation (R43)
Receive Audio Comparator Setting (R53)
Earpiece Audio Setting (R29)

Clock

(All part numbers refer to Display Board (J19/900-0164)

To set the clock to the correct time of day, press the "CLOCK" button and the volume up ▲ button for fast, or volume down ▼ button for slow setting

To put the clock in 24 hour format, remove H5-H6 and insert H6-H7.

If the time is continually fast or slow, replace X1 with another standard colorburst crystal, 3.58 megahertz.

Alert Level

(All part numbers refer to Display Board (J19/900-0164)

To increase the Alert level to the line, decrease R14 to 1/2 its value. this may be done most easily by placing R13 with the same value as R14. Since they are in parallel and the same value, the result is a resistor with 1/2 R14's value.

Microphone to Line Audio Level

The remote was factory set up for a 0 db line. If the remote controller is to be used on a line with greater loss, use potentiometer R64 to compensate. The control tones are summed with the voice, so they should not require additional adjustment.

Microphone Audio Comparator Setting

The audio from the microphone will vary according to the environment and loudness of the users voice. If your particular environment is particularily loud, you may wish to set the comparator so that it must turn on with more audio. Or if you have a soft voice in a quiet environment, you may wish to do the opposite. Set the unit up in its working environment and adjust R58 until your voice triggers the comparator. You may observe this on the V/U meter.

Receive Line Compensation

On a line with more than 0 db loss, you may wish to readjust the line compensation potentiometer (R43). Adjustment will be a clockwise turn to allow more audio into the automatic Gain Control amplifier.

Receive Audio Comparator Setting

On an extremely noisy line, the amount of audio required to turn on the receive path speaker may be increased. This may be accomplished by adjusting R53 while the remote controller is connected to the line. At the point when the speaker audio shuts off, turn the potentiometer about 1/16 of a turn more. This ensures that the remote controller will not constantly be on the threshold of turning the speaker on. Make sure that you still receive audio.

Earpiece Audio Setting

In a noisy environment, it may be necessary to increase the audio to the earpiece speaker. This is done by adjusting potentiometer R29.

DC REMOTE CONTROLLER

This section will contain the adjustment for the following remote controller parts:

Clock
Alert Level (R14 Keypad Display Board)
Microphone to Line Audio Level (R46)
Microphone Audio Comparator Setting (R117)
Receive Line Compensation (R29)
Receive Audio Comparator Setting (R116)
Earpiece Audio Setting (R75)

Clock
(All part numbers refer to Display Board (J19/900-0164)

To set the clock to the correct time of day, press the "CLOCK" button and the volume up ▲ button for fast or volume down ▼ button for slow setting

To put the clock in 24 hour format, remove H5-H6 and insert H6-H7.

If the time is continually fast or slow, replace X1 with another standard colorburst crystal, 3.58 megahertz.

Alert Level
(All part numbers refer to Display board (J19/900-0164)

To increase the Alert level to the line, decrease R13 to 1/2 its value. This may be done most easily by placing R14 with the same value as R13. Since they are in parallel and the same value, the result is a resistor with 1/2 R14's value.

Microphone to Line Audio Level

The remote was facotry set up for a 0 db line. If the remote controller is to be used on a line with greater loss, use potentiometer R46 to compensate. The Alert tone is summed with the voice, so it will not require additional adjustment.

Microphone Audio Comparator Setting

The audio from the microphone will vary according to the environment and loudness of the users voice. If your particular environment is particularily loud, you may wish to set the comparator so that must turn on with more audio. Or if you have a soft voice in quiet environment, you may wish to do the opposite. Set the unit up in its working environment and adjust R117 until your voice triggers the comparator. You may observe this on the V/U meter.

Receive Line Compensation

On a line with more than 0 db loss, you may wish to readjust the line compensation potentiometer (R29). Adjustment will be a clockwise turn to allow more audio into the Automatic Gain Control amplifier.

Receive Audio Comparator Setting

In an extremely noisy line, the amount of audio required to turn on the receive path speaker may be desired to increase. This may be accomplished by adjusting R116 while the remote controller is connected to the line. At the point when the speaker audio shuts off, turn the potentiometer about 1/16 of a turn more. This ensures that the remote controller will not constantly be on the threshold of turning the speaker on. Make sure that you still receive audio.

Earpiece Audio Setting

In a noisy environment, it may be necessary to increase the audio to the earpiece speaker. This is done by adjusting potentiometer R75.

TROUBLESHOOTING INFORMATION

TONE REMOTE CONTROLLER

The following troubleshooting suggestions will be covered in this section:

Microphone audio (J2-1) doesn't reach the line (J3-3,4).

V/U meter doesn't function.

Alert tone does not reach the line (J3-3,4)

Control tones have no effect on the Tone Panel.

Control tone level needs adjustment.

Line audio (J3-3,4 or J3-2, 5 for four wire) doesn't reach the base speaker (J4-1, 2).

Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the earpiece speaker (J2-3, 6).

Volume control inoperative.

The volume control tone is intermittent.

Earpiece speaker is not loud enough.

A constant hum is present in the speaker.

The speaker audio turns on and off constantly.

Background tone (2175 Hz) present in receive audio.

Parallel TX indicator intermittent or stuck on.

One key stuck on or off.

Several keys stuck on or off.

Clock doesn't work.

Microprocessor functioning improperly.

Problem:	Procedure:
Microphone audio (J2-1) doesn't reach the line audio (J3-3,4)	1.) The Push-to-Talk button should be depressed fully so that the TX indicator is on. If the TX indicator does not turn on, check the cord and connector. 2.) The comparator (U8) potentiometer (R58) may be misadjusted. Check that pin 7 of U8 goes to 13.8 VDC when speaking into the microphone. Readjust the potentiometer if this is the problem. The comparator (U8) output is normally low (.7 VDC or lower) and is high (13.8 VDC) when talking at a comfortable level. 3.) The output of the automatic gain control (AGC) amplifier (Pin 1 U8) should be biased at 6 VDC with audio visible on it. The audio on connector (J5-1) should be identical. 4.) On the extension board (J19/900-0171), the 2175 notch filter output (U1 pin 1) should be biased at 6 VDC with audio riding on it. 5.) On the extension board, the transistor switch (Q1) should be allowing audio to pass. both J5-3 and J4-3 must be low (less than 0.7 VDC). 6.) On the extension board, the output of the summing amplifier (pin 8 of U1) should be biased at VDC with audio visible on it. 7.) The potentiometer (R64) may need readjustment. Adjust this potentiometer and observe the output on the line (J3-3,4). The output should be 0 dBm (.77 Vrms) for 0 dBm (.77 Vrms) of 1000 Hertz at the microphone input (J2-1). If this has no effect, the transistor switch (Q3) or U11 (on the base board) is defective.
V/U meter doesn't function.	1.) If audio isn't getting to the line (J3-3, 4), then follow the procedure for "Microphone audio (J2-1) doesn't reach the line audio (J3-3, 4)". 2.) Check the ribbon connector pin 26 for continuity. 3.) Refer to Keypad Display Board.

Problem:	Procedure:
Alert tone does not reach the line (J3-3,4).	1.) When the "Alert" button is pressed and there is no 1000 hertz tone at pin 2 of U3, check the continuity of the ribbon cable, P1-25. If there is good continuity, refer to the Keypad Display Board troubleshooting procedure. 2.) If the Alert tone is present at pin 2 of the bilateral switch (U3) and not at pin 1 of U3, pin 13 of U3 isn't being pulled high or has failed. 3.) On the extension board (J19/900-0171), the Alert tone should be detectable at pin 8 of U1.
Control tones have no effect on the Tone Panel.	1.) Observe the control tones on P5-4. The digitized tones will be present when a button is pushed that produces them (such as PTT button). If there are no tones at this point, check to see if the tones are present on the digital to analog IC (U16) pins 14, 15 and 16. If not present on these pins and the faceplate LEDs toggle on and off, there is a problem with U16. If the LEDs do not toggle, check the "Microprocessor functioning improperly" troubleshooting procedure. 2.) On the extension board (J19/900-0171), U1 pin 7 should be biased at 6 VDC and have control tones present. 3.) On the extension board (J19/900-0171), U1 pin 8 should be biased at 6 VDC and have control tones present. If they are present, the line loss between the panel and remote controller is greater than 0 dB and line out level adjust (R64), needs adjustment (review "Control tone level needs adjustment") or check the Tone Panel's trouble-shooting procedure.
Control tone level needs adjustment.	1.) Under normal conditions, the voice audio at the microphone input (J2-1) will cause 0 dBm (.77 Vrms) on the line (J3-3, 4) across a 600 ohm load. The control tones are then set up as follows. 2.) Place remote controller in test mode by shorting across H25-H26 while plugging in the unit. The faceplate LEDs will flash on and off four times to indicate test mode. 3.) Press and release any key and measure the output frequency across J3-3, 4. It should be 2175 hertz. If not, the remote is generating a function tone. If the remote is generating a function tone, continue to press a faceplate key until a 2175 hertz Secure-it tone is produced.

Problem:		Procedure:
	3.)	Place a 600 or 620 ohm load across the output of the remote controller (J3-3, 4).
	4.)	On the extension board (J19/900-0171), adjust the function tone level adjust potentiometer R22 for 10 dBm (2.45 Vrms) on the line connector (P3-3, 4).
	5.)	Unplug and plug back in the remote controller to remove unit from test mode.
Line audio (J3-3,4 or J3-2,5 for four wire) doesn't reach the base speaker (J4-1,2).	1.)	Incoming audio at P4-1 and not at P4-2 is a good indication that the parallel option is suspect. On the extension board (J19/900-0171) check the biasing on the output pins of U2. They should all be at 6 VDC.
	2.)	Pin 7 of U9 should be at 6 VDC with audio on it.
	3.)	Check U4, pin 5, 6 and 7 for 6 VDC biasing. Audio should be clearly visible at pin 7. If audio is not visible, increase the volume with the buttons on the face plate. If still a problem, refer to "Volume control inoperative" troubleshooting procedure.
	4.)	Make sure audio is on the bilateral switch (U3) on pins 3 and 4. If the switch is open, adjust the comparator (U9) potentiometer (R53). The output of the comparator is normally low. When audio -30 dBm (.024 Vrms) or more enters the remote controller (P3-3, 4), the comparator should switch high. Pin 5 of the switch (U3) will also go high and allow audio to pass from pin 4 to pin 3.
	5.)	The bilateral switch (U3) pin 8 and pin 9 are controlled by the HUHS switch J2-5.
	6.)	The potentiometer R52 that adjusts the speaker setting has been set to accept 0 dBm (.77 Vrms) at the line (J3-3, 4 or J3-2, 5 for four wire) at 1 KHz and output 3.45 Vrms on the speaker. If this potentiometer was disturbed, readjust it according to this procedure.

Problem:		Procedure:
Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the earpiece speaker (J2-3, 6).	1.)	If audio doesn't reach the base speaker (J4-1,2), refer to the section "Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the base speaker (J4-1, 2)".
	2.)	Pin 1, 2 and 3 of U4 should be biased at 6 VDC and audio should be visible on pin 1. If not try the earpiece adjustment (R29) and find a satisfying listening level.
	3.)	Check the connector J2-6 and J2-3 as well as the cord.
Volume control inoperative.	1.)	There are three elements that may effect the volume, the muting switch (U3B), the electronic potentiometer (U6), or the volume stepper (U10).
	2.)	The muting switch during normal operation should have pin 10 and 11 of U3D biased at 6 VDC and pin 12 of U3 should be high at 13.8 VDC, or low if mute is selected.
	3.)	The electronic potentiometer at pin 8 should be at 5 VDC. Pin 2 will be high (5 VDC) when volume up button is pressed and low (0.7 VDC or less) when volume down is pressed. Chip select (Pin 7) will normally be high (5 VDC) but will be low when volume up or volume down is pressed. Pin 1 of U6 will be controlled by U10 and will oscillate when either volume control is used.
	4.)	The volume stepper (U10) is controlled by pin 4. When a volume key is used the base of the transistor (Q4) goes low and pin 4 or U10 is pulled high by R56 (to 5 VDC). At that time, pin 3 of U10 will begin to produce a square wave. This is the volume step required by the electronic potentiometer (U6).
The volume control tone is intermittent.	1.)	When a volume control button is used, P1-15 goes low. At that time pin 4 of U10 goes high to allow the volume stepper to run. Volume tone oscillator (U5 pins 1 and 2) begins to oscillate. The oscillation is a result of R25 and C52 on the schmitt trigger. This output then feeds into the Volume Control IC.

Problem:		Procedure:
Earpiece speaker is not loud enough.	1.)	Use earpiece adjustment potentiometer (R29) to adjust the earpiece to a comfortable listening level.
A constant hum is present in the speaker.	1.)	The automatic gain controlled amplifier (U9) will be at maximum gain when there is no audio on the line. The voltage at pin 2 of U7 will then cause the comparator (U9) pin 1 to trigger and shut off the receive audio (U3 pin 5). If the potentiometer R53 is not set correctly (or your line is extremely noisy), your speaker audio may be irritating.
The speaker audio turns on and off constantly.	1.)	Refer to the explanation of the comparator above under "A constant hum is present in the speaker".
Background tone (2175 Hz) present in receive audio.		All adjustments described are performed on the extension board (J19/900-0171).
	1.)	The problem is that the 2175 Hertz notch filter (U2) on the extension board (J19/900-0171). To reset this filter, you must receive the 2175 Hertz hold tone from a parallel remote and adjust R31 until a minimum of 2175 hertz is heard.
	2.)	Next, adjust R32 until a minimum noise level of 2175 hertz is heard. Adjust R31 again until a minimum is reached.
	3.)	Continue procedure 2 until the tone is no longer audible.
Parallel Tx indicator intermittent or stuck on.	1.)	Parallel indication is acheived by the detection of 2175 Hertz Secure-it tone which is 125 milliseconds of a +10 dBm (2.45 Vrms) tone. This is followed by the transmit hold tone, 2175 hertz at -20 dBm (.08 Vrms), detected for the duration of the parallel transmit.
		All adjustments described are performed on the extension board (J19/900-0171).
	2.)	The input to this detector is P4-1 connector. Potentiometer R30 is used to vary the gain of the detector (U3). While detecting a parallel transmit, adjust this potentiometer until the TX indicator LED shuts off. Then readjust the potentiometer back by about 1/16 of a turn so that detection is guaranteed.
	3.)	If this doesn't cure the problem, check the DC levels of pin 1, 7, 8 and 14 or U3. They should all be at 6 VDC with audio riding on them.

Problem:		Procedure:
	4.)	Pins P4-6 and P4-7 should normally be held high (5 VDC) and will be pulled low by transistors Q2 and Q3 when 2175 hertz is detected.
One key stuck on or off.	1.)	If one single key is stuck on or off, check the continuity of the ribbon cable.
	2.)	Check both connectors.
	3.)	Monitor the input to IC U17 or U18 for a voltage transition from ground to 5 VDC.
	4.)	Clean under the keypad.
Several key stuck on or off.	1.)	If any key, other than Clock or Alert works, then the microprocessor is working, so check U17, U18 or U19 buffers.
	2.)	Check the "Microprocessor functioning improperly" troubleshooting procedure.
Clock doesn't work.	1.)	Check the Keypad Display Board troubleshooting procedure.
Microprocessor functioning improperly.	1.)	Check for 12 megahertz clock frequency between pin 18 and 19 on microprocessor (U22). Caution: Use a high impedance probe.
	2.)	Make sure pin 9 of microprocessor (U22) is low (0.7 VDC or less) at all times.
	3.)	If pin 9 of the microprocessor (U22) is constantly pulsing, the watchdog (U23) is trying to cause a reset. This means that pin 1 of the microprocessor isn't writing to the watchdog (U23 pin 6) every 100 milliseconds as it should be.
	4.)	Pin 30 of the microprocessor (U22) is used to latch the contents of the ROM (U21) to the latch (U20). This line should be constantly pulsing.
	5.)	The write line (pin 16 of U22) should be pulsing. This indicates the microprocessor is writing.
	6.)	The outputs of U15 (pin 3 and 6) should pulse constantly. This menas the microprocessor is reading key inputs.
	7.)	The output of U15 (pin 8) should pulse when a key is pushed. This indicates an LED is being written to.

DC REMOTE CONTROLLER

The following troubleshooting suggestions will be covered in this section:

Microphone audio (J2-1) doesn't reach the line (J3-3, 4).

V/U meter doesn't function.

Alert tone does not reach the line (J3-3, 4)

Control currents have no effect on the DC Panel.

Adjusting control currents.

Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the base speaker (J4-1,2).

Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the earpiece speaker (J2-3, 6).

Volume control inoperative.

The volume control tone is intermittent.

Earpiece speaker is not loud enough.

A constant hum is present in the speaker.

The speaker audio turns on and off constantly.

Parallel TX indicator intermittent or stuck on.

Key stuck on or off.

Clock doesn't work.

Problem:	Procedure:
Microphone audio (J2-1) doesn't reach the line audio (J3-3, 4)	1.) The Push-to-Talk button should be depressed fully so that the TX indicator is on. If the TX indicator does not turn on, check the cord and connector. 2.) The comparator (U24) potentiometer (R117) may be misadjusted. Check that pin 7 of U24 goes to 13.8 VDC when speaking into the microphone. Readjust the potentiometer if this is the problem. The comparator (U24) output is normally low (.7 VDC or lower) and is high (13.8 VDC) when talking at a comfortable level. 3.) The output of the automatic gain control (AGC) amplifier (pin 7 or U7) should be biased at 6 VDC with audio visible on it. 4.) The open collector output at J5-5 should not be held at ground while talking in the microphone and PTT button depressed. 5.) The potentiometer (R46) may need readjustment. Adjust this potentiometer and observe the output on the line (J3-3, 4). The output should be 0 dBm (.77 Vrms) for 0 dBm (.77 Vrms) at the microphone input (J201). If this has no effect then U6 is defective.
V/U meter doesn't function.	1.) If audio isn't getting to the line (J3-3, 4), then follow the procedure for "Microphone audio (J2-1) doesn't reach the line audio (J3-3, 4)". 2.) Check the ribbon connector pin 26 for continuity. 3.) Refer to Keypad Display Board.
Alert tone does not reach the line (J3-3, 4).	1.) Check the continuity of the ribbon cable, P1-25. If there is good continuity, refer to the Keypad Display Board troubleshooting procedure. 2.) The Alert tone should be detectable on R31 and U6 pin.

Problem:		Procedure:
Control currents have no effect on the DC Panel.	1.)	Measure the control currents by placing an ampere meter in series with the line. Try transmitting with intercom off and TXF 1. There should be 6 milliamps on the line. If there is current, check the trouble shooting procedure for the DC panel. If the current needs adjusting, check the procedure on "Adjusting control currents".
	2.)	Check the high voltage output across C5. This voltage will be approxiamately 150 volts.
	3.)	Check the output of the PROM (U20) on pins 3, 4 and 5. They will normally be at 5 volts. One will go low at a time to select the current to be generated.
	4.)	Check the output of the PROM (U20) on pins 1 and 2. Only one may be low at a time.
Adjusting control currents.		All adjustments described must be done with the handset removed from it's cradle.
	1.)	Place a current meter in series with the line.
	2.)	To adjust the 2.5 milliamp current, disable channel guard with the CG button on the faceplate. Put the remote in RX1 mode and disable intercom. Turn R8 potentiometer so that the current meter is 2.5 milliamps.
	3.)	To adjust the 6.0 milliamp current, disable intercom and select TXF1. PTT and adjust R13 potentiometer so that the current meter reads 6.0 milliamps.
	4.)	To adjust the 11.0 milliamp current, select the appropriate setting for 11.0 milliamp current generation: For a DC remote controller with: 2 frequency transmit place the unit in TX- f2 and PTT. For a DC remote controller with: Repeater Disable Channel guard Disable place the unit in Repeater disable and CG disable. For a DC remote controller with: 1 frequency transmit 2 frequency receive (Aux Rx) place the unit in RX-F2 and remove handset from base.
	5.)	Adjust potentiometer R26 until the amp meter registers 11 milliamps.

Problem:		Procedure:
Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the base speaker (J4-1,2).	1.)	Check the biasing on the output pins of U9A. They should all be at 6 VDC.
	2.)	Pin 7 of U9B should be at 6 VDC with audio on it.
	3.)	Check U10, pin 1, 2 and 3 for 6 VDC biasing. Audio should be clearly visible at pin 1. If audio is not visible, increase the volume with the buttons on the face plate. If still a problem, refer to "Volume control inoperative" troubleshooting procedure.
	4.)	Make sure audio is on the bilateral switch (U13) on pins 3 and 4. If the switch is open, adjust the comparator (U24B) potentiometer (R116). The output of the comparator is normally low. When audio -30 dBm (.024 Vrms) or more enters the remote controller (P3-3, 4 or P3-2, 5 for four wire), the comparator should switch (U13) will also go high and allow audio to pass from pin 4 to pin 13.
	5.)	The bilateral switch (U13) pin 8 and pin 9 are controlled by the HUHS switch J2-5.
	6.)	The potentiometer R92 that adjusts the speaker setting has been set to accept 0 dBm (.77 Vrms) at the line (J3-3, 4 or J3-2, 5 for four wire) at 1 KHz and output 3.45 Vrms on the speaker. If this potentiometer was disturbed, readjust it according to this procedure.
Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the earpiece speaker (J2-3, 6).	1.)	If audio doesn't reach the base speaker (J4-1, 2), refer to the section "Line audio (J3-3, 4 or J3-2, 5 for four wire) doesn't reach the base speaker (J4-1, 2) ".
	2.)	Pins 5, 6 and 7 of U10 should be biased at 6 VDC and audio should be visible on pin 7. If not try the earpiece adjustment (R75) and find a satisfying listening level.
	3.)	Check the connector J2-6 and J2-3 as well as the cord.
Volume control inoperative.	1.)	There are three elements that may efect the volume, the muting switch (U13D), the electronic potentiometer (U14), or the volume stepper (U11).
	2.)	The muting switch during normal operation should have pin 10 and 11 of U13D biased at 6 VDC and pin 12 of U13 should be high at 13.8 VDC, or low if mute is selected.

Problem:	Procedure:
	3.) The electronic potentiometer at pin 8 should be at 5 VDC. Pin 2 will be high (5 VDC) when volume up button is pressed. Chip-select (Pin 7) will normally be high (5 VDC) but will be low when volume up or volume down is pressed. Pin 1 of U14 will be controlled by U11 and will oscillate when either volume control is used. 4.) The volume stepper (U11) is controlled by pin 4. When a volume key is used the base of the transistor (Q4) goes low and pin 4 of U11 is pulled high by R85 (to 5 VDC). At that time, pin 3 of U11 will begin to produce a square wave. This is the volume step required by the electronic potentiometer (U14).
The volume control tone is intermittent.	1.) When a volume control button is used, P1-15 goes low. At that time pin 4 of U11 goes high to allow the volume stepper to run. Volume tone oscillator (U12D pins 9 and 8) begins to oscillate. The oscillation is a result of R61 and C54 on the schmitt trigger. This output then feeds into the compressor (U9) input. If this tone level isn't high enough, the compressor will not turn on.
Earpiece speaker is not loud enough.	1.) Use earpiece adjustment potentiometer (R75) to adjust the earpiece to a comfortable listening level.
A constant hum is present in the speaker.	1.) The automatic gain controlled amplifier (U9) will be at maximum gain when there is no audio on the line. The voltage at pin 14 of U8 will then cause the comparator (U24) pin 7 to trigger and shut off the receive audio (U31 pin 5). If the potentiometer R116 is not set correctly (or your line is extremely noisy), your speaker audio may be irritating.
The speaker audio turns on and off constantly.	1.) Refer to the explanation of the comparator above under "A constant hum is present in the speaker".
Parallel TX indicator intermittent or stuck on.	1.) The current is sampled on the line at J3-1, 6 from connect P2-1, 2. It is essential that the connection is made with the correct polarity. A "positive current" will cause the detector to indicate a parallel transmit.

Problem:		Procedure:
One key stuck on or off.	1.)	If one single key is stuck on or off, check the continuity of the ribbon cable.
	2.)	Check both connectors.
	3.)	Monitor the input to IC U16, U21 U22 or U23 for a voltage transition from ground to 5 VDC.
	4.)	Clean under the keypad.
Clock doesn't work.	1.)	Check the Keypad Display Board troubleshooting procedure.

KEYPAD DISPLAY BOARD

The following troubleshooting suggestions will be covered in this section:

Alert tone does not work.

V/U meter not functioning.

Clock running inproperly.

Problem:		Procedure:
Alert tone does not work.	1.)	When the "Alert" button is pressed, the TX indicator should come on. If not, the button contact may be faulty.
	2.)	When the button is pressed, the 555 timer (U2) should begin to oscillate at approxiamately 1000 hertz. If this doesn't occur, check the 5 volt supply on pin 8 of the 555. Also make sure that pin 4 goes high when the "Alert" buton is pressed.

Problem:		Procedure:
V/U meter not functioning.	1.)	There should be voice audio biased at 5 volts on U1.
	2.)	Pin 6 of the V/U meter (U4) will be a DC voltage derived from a rectified version of the voice audio.
	3.)	Check pins 4 and 10 of U4 for power.
Clock running improperly.	1.)	The clock oscillator (X1) should be running at 3.58 megahertz (pin 15 and 16).
	2.)	The pin 7 of U5 will determine the LED briteness and should be at a DC level above 1 volt.
	3.)	The set, slow and fast lines (pin 11, 12 and 3) of the clock chip will normally be held at 5 volts. When a button is pushed, these lines will be pulled low accordingly.
	4.)	Check pin 18 of U5 for 9.1 volts supply.
LEDs not lit	1.)	Check power (pin P1-3 and P1-2) lines to the keypad display board.

GE Mobile Communications

General Electric Company
Lynchburg, Virginia 24502

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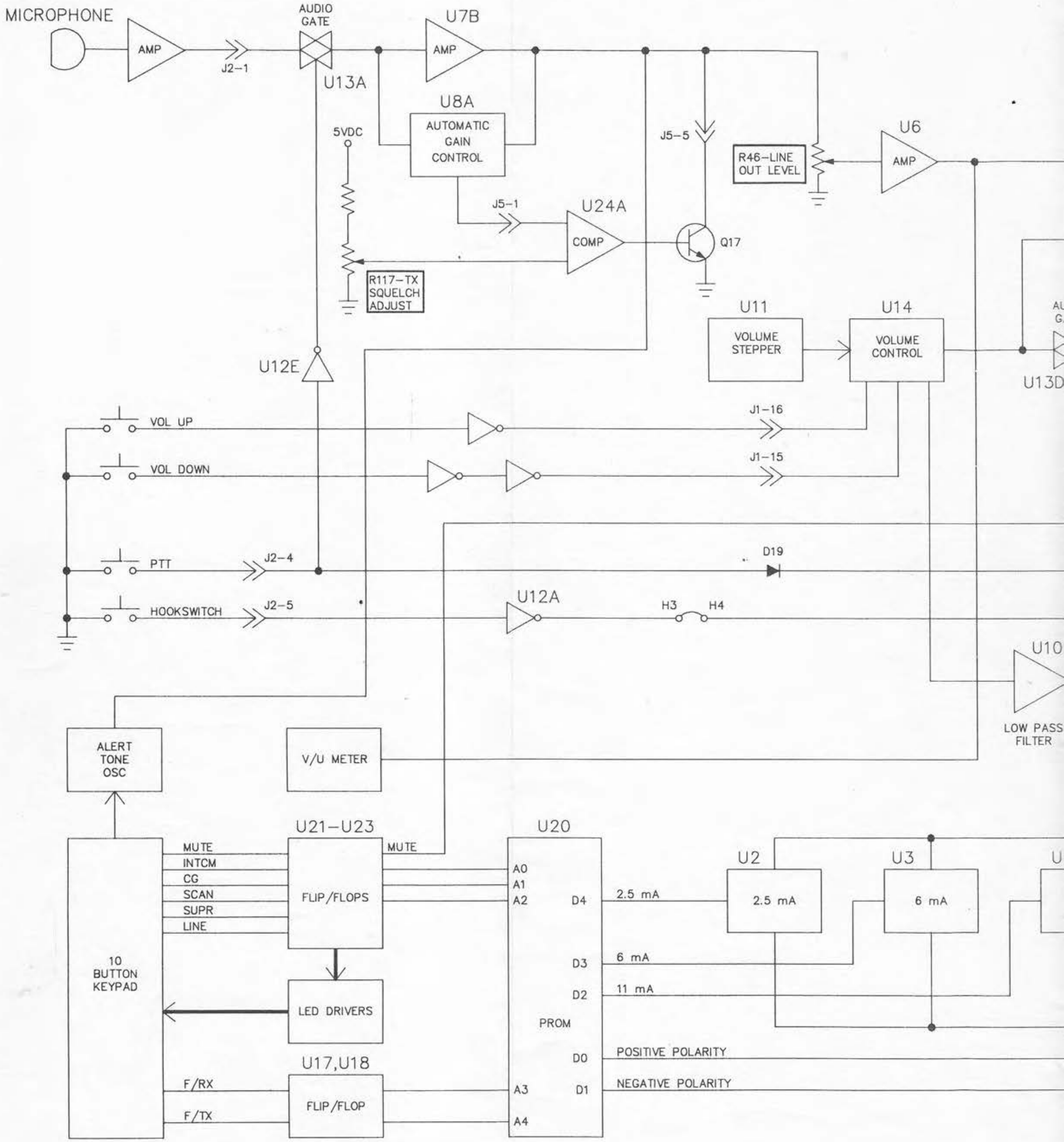
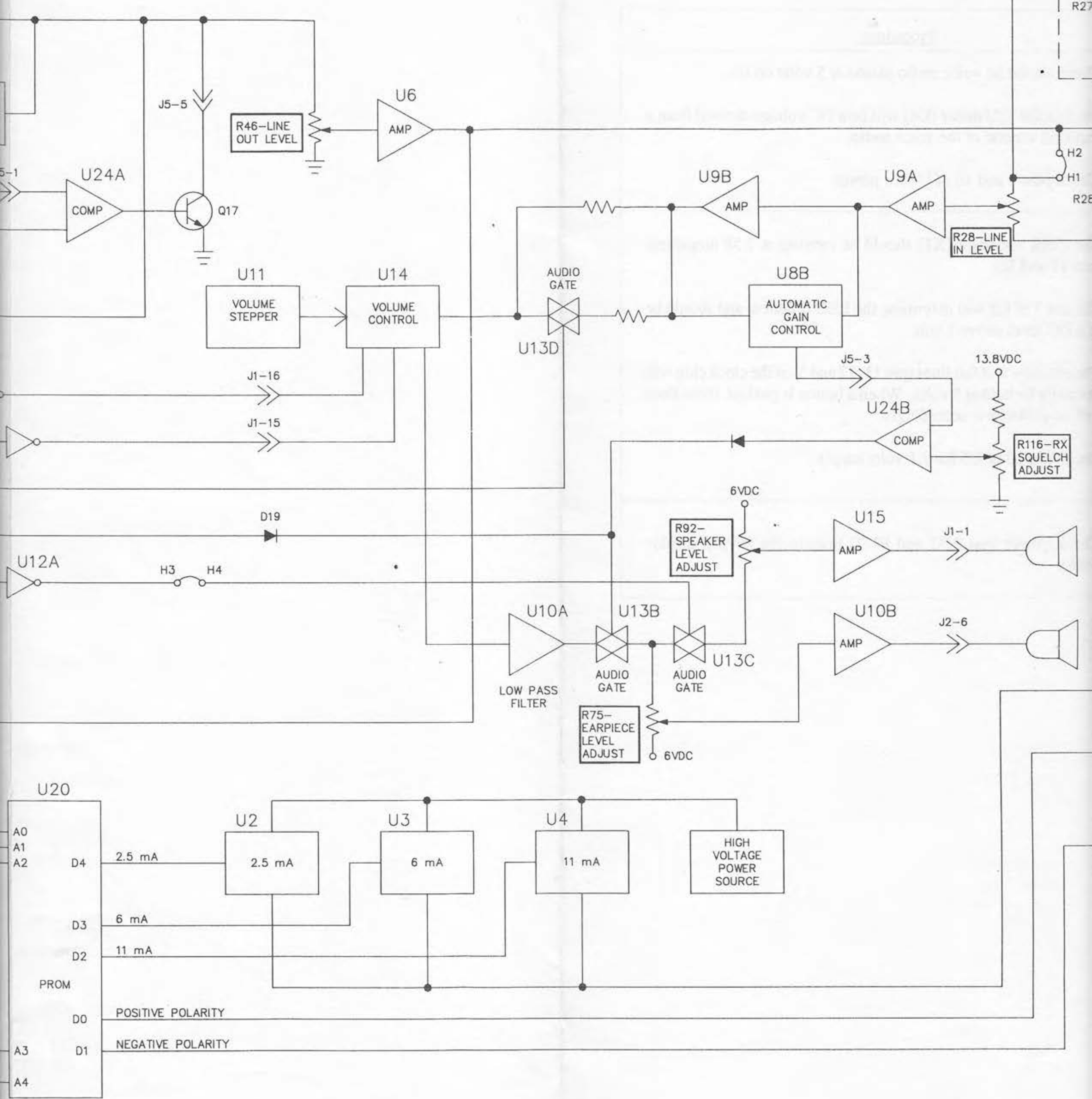


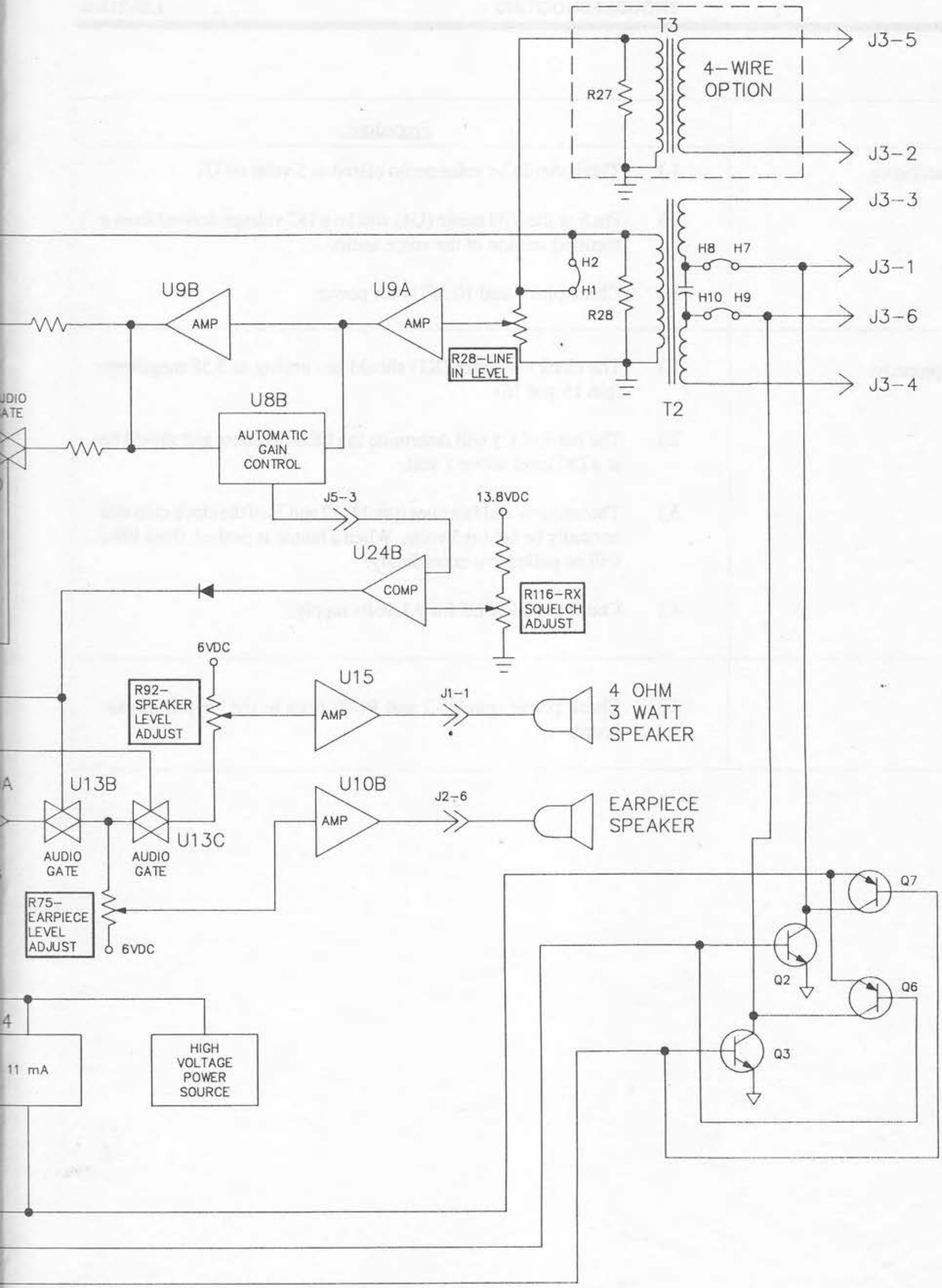
DC REMOTE CONTROLLER

(4161-S-01, Rev.A)

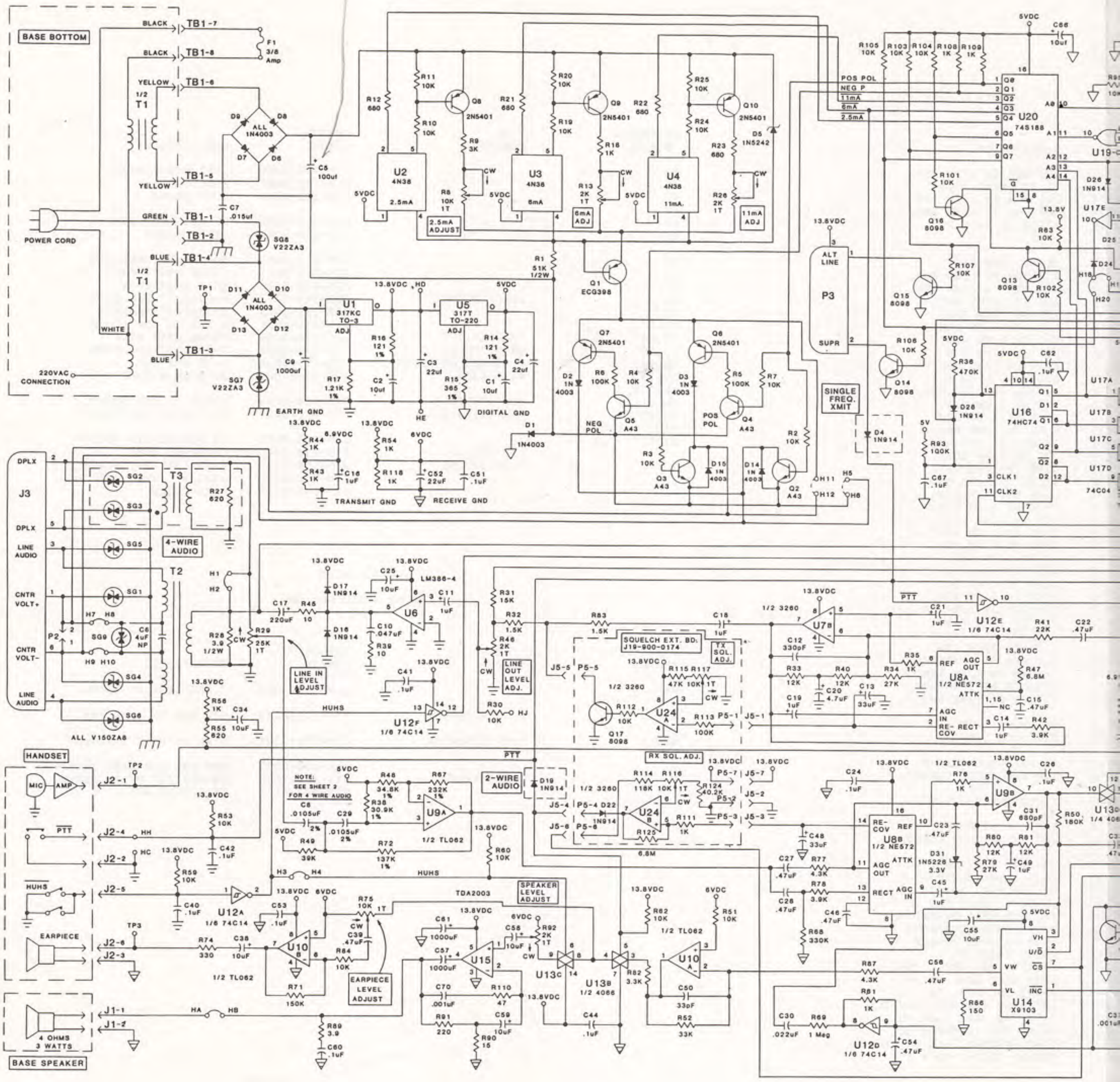
GRAM



(4161-S-01, Rev.A)

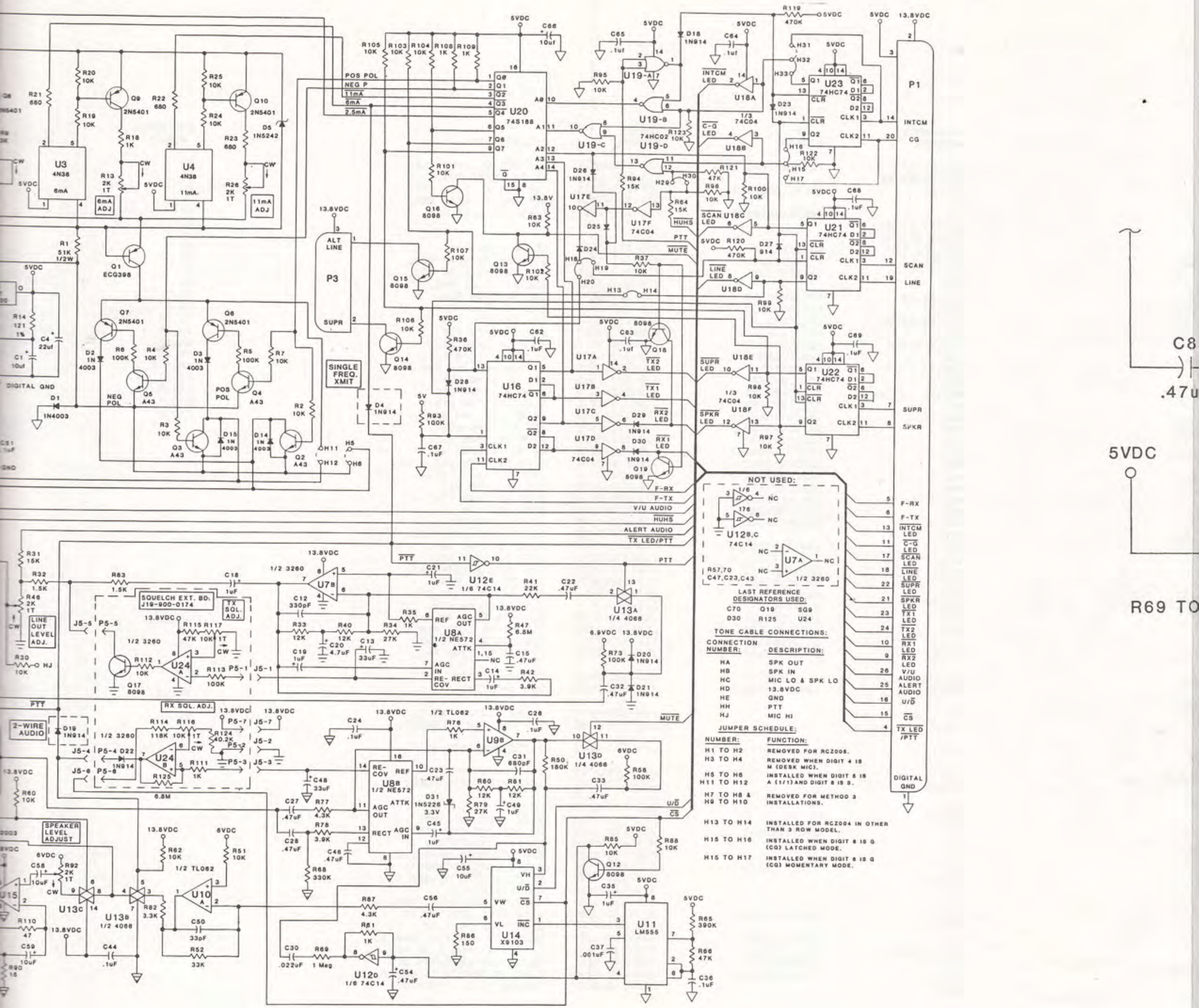

T3
4-WIRE
OPTION
R27
J3-5
J3-2
J3-3
H2
H1
H8
H7
J3-1
H10
H9
J3-6
R28
J3-4
T2
U9B
AMP
U9A
AMP
R28-LINE
IN LEVEL
U8B
AUTOMATIC
GAIN
CONTROL
J5-3
13.8VDC
U24B
COMP
R116-RX
SQUELCH
ADJUST
6VDC
R92-
SPEAKER
LEVEL
ADJUST
U15
AMP
J1-1
4 OHM
3 WATT
SPEAKER
U13B
U13C
AUDIO
GATE
AUDIO
GATE
U10B
AMP
J2-6
EARPIECE
SPEAKER
R75-
EARPIECE
LEVEL
ADJUST
6VDC
Q7
Q2
Q6
Q3
11 mA
HIGH
VOLTAGE
POWER
SOURCE

150W



(4161-S-00)

HAS SQ BOARD



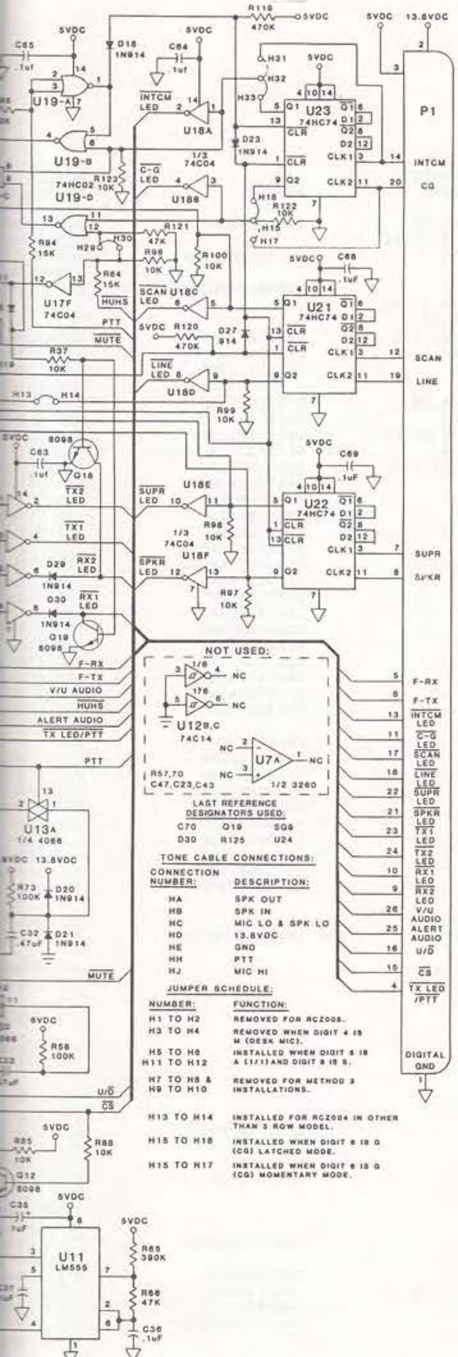
RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

RUNS ON COMPONENT SIDE

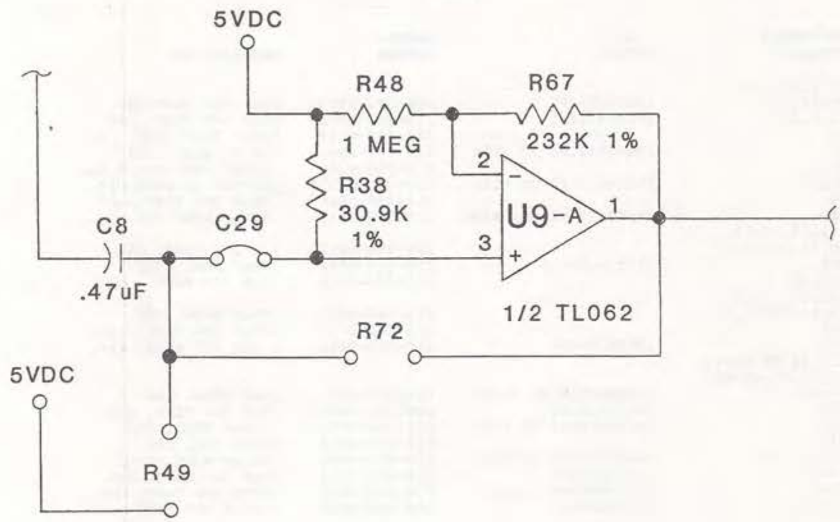
(4161-S-00)

AS SQ BOARD



EARLIER MODELS

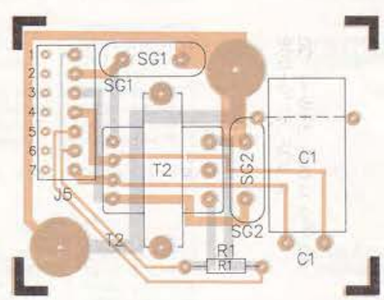
4-WIRE AUDIO OPTION

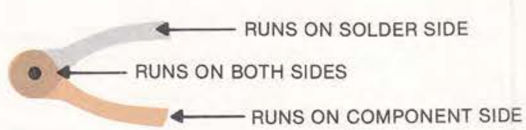


R69 TO 100K

(4161-S-02)

LATER MODELS





(4011-A-00)
(4011-A-01)

DC REMOTE CONTROLLER

PARTS LIST
DC REMOTE CONTROLLER UNIT
RCN1000
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
C1,2,34,55, 58,59,66	19A701534P7	J19-390-0010	10uF 16V TANT CAP.
C3,4,52	19A703324P1	J19-360-0002	22uF 16V ELEC. CAP.
C5		J19-360-0011	100uF 250V ELEC. CAP.
C6	19A700121P6 OR P106	J19-361-0001	4uF NP ELEC. CAP.
C7		J19-380-0001	.015uF 100V MYLAR CAP
C8,29	19A700121P2 OR P102	J19-362-0003A	.0105uF 2% MONO CAP.
C9		J19-360-0018	100uF 35V ELEC. CAP.
C10	19A700121P50 OR P105	J19-362-0009	.047uF MONO CAP.
C11,14,16,18, 19,21,35,45,49		J19-390-0012	1uF 25V TANT. CAP.
C12	19A116192P18	J19-362-0004	330pF MONO. CAP.
C13,48		J19-390-2336	33uF 16V TANT. CAP.
C15,22,27,28, 32,33,39,46,56		J19-362-0002	.47uF MONO. CAP.
C17		J19-360-0007	220uF 16V ELEC. CAP.
C20	19A701534P6	J19-390-0004	4.7uF 35V TANT. CAP.
C24,26,36,40-44, 51,53,60,62-65, 67-69	19A700121P106 OR P6	J19-362-0001	.1uF MONO. CAP.
C25	19A134202P17	J19-390-0007A	10uF 25V TANT. CAP.
C30	19A700121P3 OR P103	J19-362-0011	.022uF MONO. CAP.
C31		J19-370-0018	680pF CER. CAP.
C37,50,70	19A700121P1 OR P101	J19-362-0006	.001uF MONO. CAP.
C38	19A701534P8	J19-360-0004	10uF 16V ELEC. CAP.
C54	19A700003P3	J19-390-0002	.47uF 35V TANT. CAP.
C57,61	19A701225P7	J19-360-0012	1000uF 16V ELEC. CAP.
D1-3,6-15	T324ADP1031	J19110-0002	1N4003 DIODE
D4,16-21, 23-30	19A700028P001	J19-110-0001	1N914/1N4148 DIODE
D5		J19-111-0003	1N5242 12V ZENER
F1		J19-290-0004	3/8 AMP FUSE
H1-2,2-3,5-6, 7-8,9-10,11-12M 13-14	19A700072P1	J19-231-1002	2 POS. JUMPER POST
H15-16-17, 18-19-20	19A700041P2	J19-231-1003	3 POS. JUMPER POST
HA-B		J19-265-0006	.25" JUMPER WIRE
HH-HC	19A702104P1	J19-265-0016	.1" JUMPER WIRE
J1	19A116659P100	J19-231-1067	2 POS. .156" POST
J2,3	19J706197P1	J19-234-0066	MODULAR JACK
J5	19A700072P55	J19-231-3017	7 POS. TOP ENTRY RCPT
P1		J19-231-1071	26 POS. POST
P2	19A700072P33	J19-234-0006	7 POS. POST
P3	19A700072P84	J19-231-3107	3 POS. POST
Q1		J19-180-0020	ECG398 TRANSISTOR
Q2-5		J19-180-0008	MPSA43 TRANSISTOR
Q6-10		J19-180-0006	2N5401 TRANSISTOR
Q12-16,18,19		J19-180-0009	MPS8098 TRANSITOR
R1	C3R77P513J	J19-313-1513	51K 5% 1/2W RES.
R2-4,7,10,11, 19,20,24,25,30, 37,51,53,59,60, 62,63,84,85,88, 95-107	H212CRP310C	J19-312-0011	10K 5% 1/4W RES.
R5,6,58,73,93	H212CRP410C	J19-312-0003	100K 5% 1/4W RES.
R8,75		J19-351-1103	10K 1T. MINI POT.
R9	H212CRP230C	J19-312-0023	3K 5% 1/4W RES.

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER
R12,21-23	H212CRP168C	J19-312-00
R13,26,46,92		J19-351-12
R14,16	19A701250P109	J19-311-12
R15		J19-311-36
R17	19A701250P209	J19-311-12
R18,35,43,44 54,56,61,76, 108,109,118	H212CRP210C	J19-312-00
R27,55	H212CRP162C	J19-312-00
R28	19A700113P5	J19-313-13
R29		J19-351-12
R31,64,94	H212CRP315C	J19-312-00
R32,83	H212CRP215C	J19-312-00
R33,40,80,81	H212CRP312C	J19-312-00
R34,79	H212CRP327C	J19-312-00
R36,119,120	H212CRP447C	J19-312-00
R38	19A701250P348	J19-311-30
R39,45	H212CRP010C	J19-312-00
R41	H212CRP322C	J19-312-00
R42,78	H212CRP239C	J19-312-00
R47	H212CRP568C	J19-312-00
R48	19A701250P353	J19-311-3
R49	H212CRP339C	J19-312-00
R50	H212CRP118C	J19-312-00
R52	19A701250P363	J19-311-00
R57	H212CRP256C	J19-312-00
R65	H212CRP439C	J19-312-00
R66	H212CRP347C	J19-312-00
R67	19A701250P136	J19-311-2
R68	H212CRP433C	J19-312-1
R69	H212CRP510C	J19-312-0
R70		J19-311-3
R71	19A701250P118	J19-311-1
R72	19A701250P114	J19-311-1
R74	H212CRP133C	J19-312-0
R77	H212CRP322C	J19-312-0
R86	H212CRP115C	J19-312-0
R87	H212CRP243C	J19-312-0
R89	H212CRP939C	J19-312-0
R90	H212CRP015C	J19-312-1
R91	H212CRP122C	J19-312-0
R110	H212CRP047C	J19-312-0
SG1-6,9		J19-300-0
SG7,8	19A701250P336	J19-300-0
T2		J19-410-0
T3		J19-410-0
TB1		J19-231-0
TP1		J19-200-0
TP2,3		J19-265-0
U1		J19-130-0
U2-4		J19-130-0
U5	19A701999P1	J19-130-0
U6		J19-130-0
U7		J19-130-0
U8	19A703165P1	J19-130-0
U9,10		J19-130-0
U11		J19-130-0
U12		J19-130-0
U13	19A700029P044	J19-130-0
U14		J19-130-0
U15	19A701830P1	J19-130-0
U16,21-23	19A704380P2	J19-130-0
U17,18	19A703483P4	J19-130-0
U19	19A703483P001	J19-130-0
U20		J19-130-0

ST

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
R12,21-23	H212CRP168C	J19-312-0017	680 OHM 5% 1/4W RES.
R13,26,46,92		J19-351-1202	2K 1T. MINI POT.
R14,16	19A701250P109	J19-311-1210	121 OHM 1% 1/4W RES,
R15		J19-311-3650	365 OHM 1% 1/4W RES.
R17	19A701250P209	J19-311-1211	1.21K 1% 1/4W RES.
R18,35,43,44 54,56,61,76, 108,109,118	H212CRP210C	J19-312-0019	1K 5% 1/4W RES.
R27,55	H212CRP162C	J19-312-0045	620 OHM 5% 1/4W RES.
R28	19A700113P5	J19-313-1339	3.9 OHM 5% 1/2W RES.
R29		J19-351-1253	25K 1T. MINI POT.
R31,64,94	H212CRP315C	J19-312-0009	15K 5% 1/4W RES.
R32,83	H212CRP215C	J19-312-0078	1.5K 5% 1/4W RES.
R33,40,80,81	H212CRP312C	J19-312-0021	12K 5% 1/4W RES.
R34,79	H212CRP327C	J19-312-0005	27K 5% 1/4W RES.
R36,119,120	H212CRP447C	J19-312-0046	470K 5% 1/4W RES.
R38	19A701250P348	J19-311-3092	30.9K 1& 1/4W RES.
R39,45	H212CRP010C	J19-312-0038	10 OHM 5% 1/4W RES.
R41	H212CRP322C	J19-312-0015	22K 5% 1/4W RES.
R42,78	H212CRP239C	J19-312-0070	3.9K 5% 1/4W RES.
R47	H212CRP568C	J19-312-0016	6.8M 5% 1/4W RES.
R48	19A701250P353	J19-311-3482	34.8K 1% 1/4W RES.
R49	H212CRP339C	J19-312-0059	39K 5% 1/4W RES.
R50	H212CRP118C	J19-312-0057	180K 5% 1/4W RES.
R52	19A701250P363	J19-311-0026	44.2K 1% 1/4W RES.
R57	H212CRP256C	J19-312-0002	5.6K 5% 1/4W RES.
R65	H212CRP439C	J19-312-0001	390K 5% 1/4W RES.
R66	H212CRP347C	J19-312-0020	47K 5% 1/4W RES.
R67	19A701250P136	J19-311-2323	232K 1% 1/4W RES.
R68	H212CRP433C	J19-312-1334	330K 5% 1/4W RES.
R69	H212CRP510C	J19-312-0047	1M 5% 1/4W RES.
R70		J19-311-3650	365 OHM 1% 1/4W RES.
R71	19A701250P118	J19-311-1503	150K 5% 1/4W RES.
R72	19A701250P114	J19-311-1373	137K 1% 1/4W RES.
R74	H212CRP133C	J19-312-0079	330 OHM 5% 1/4W RES.
R77	H212CRP322C	J19-312-0015	22K 5% 1/4W RES.
R86	H212CRP115C	J19-312-0056	150 OHM 5% 1/4W RES.
R87	H212CRP243C	J19-312-0071	4.3K 5% 1/4W RES.
R89	H212CRP939C	J19-312-0060	3.9 OHM 5% 1/4W RES.
R90	H212CRP015C	J19-312-1150	15 OHM 5% 1/4W RES.
R91	H212CRP122C	J19-312-0052	220 OHM 5% 1/4W RES.
R110	H212CRP047C	J19-312-0068	47 OHM 5% 1/4W RES.
SG1-6,9		J19-300-0001	VARISTOR 150V
SG7,8	19A701250P336	J19-300-0004	VARISTOR 24V
T2		J19-410-0001A	24-10 AUDIO TRANSF.
T3		J19-410-0005	600 OHM COUP. TRANSF.
TB1		J19-231-0003	8 PIN ELECTROVERT
TP1		J19-200-0015	TEST POINT POST
TP2,3		J19-265-0011	.45" WIRE TEST POINT
U1		J19-130-0247	LM317KC REG. TO-3 IC
U2-4		J19-130-0241	4N38 OPTO ISOLATOR IC
U5	19A701999P1	J19-130-0237	LM317T REG. TO-220 IC
U6		J19-130-0223	LM386-4 AUDIO AMP IC
U7		J19-130-0229	CA3260E DUAL OP-AMP IC
U8	19A703165P1	J19-130-0240	NE572 DUAL COMPANDOR IC
U9,10		J19-130-0120	TL062CP DUAL OP-AMP IC
U11		J19-130-0010	LM555 TIMER IC
U12		J19-130-0238	CD74C14 HEX SHMT. TRG. IC
U13	19A700029P044	J19-130-0067	4066 QUAD SPST SW IC
U14		J19-130-0243	X9103 10K POT. IC
U15	19A701830P1	J19-130-0248	LM2003AT 10W AUD. AMP IC
U16,21-23	19A704380P2	J19-130-0071	MM74C74N DUAL D FF IC
U17,18	19A703483P4	J19-130-0257	74C04 HEX INVERTER IC
U19	19A703483P001	J19-130-0249	74HC02N QUAD 2-IN NOR IC
U20		J19-130-0213	74S188 32 X 8 PROM IC

REFERENCE NUMBER	GE NUMBER
WR	
F1	
F1	
Q1	
Q1	
U1	
U1	
U1	
U1	N80P1300
U1	
U2-4	
U5,15	19A70291
U5,15	N80P1300
U5,15	714225P3
U5,15	N404P13B
U6,7,9, 10,11,14	19A70015
U8,20	19A70015
U12,13,16-19, 21-23	
	19A70210
	N80P1300

REFERENCE NUMBER	GE NUMBER
J5	
R1	H212CRP1
SG1,2	19A70125
T2	
	N80P9004

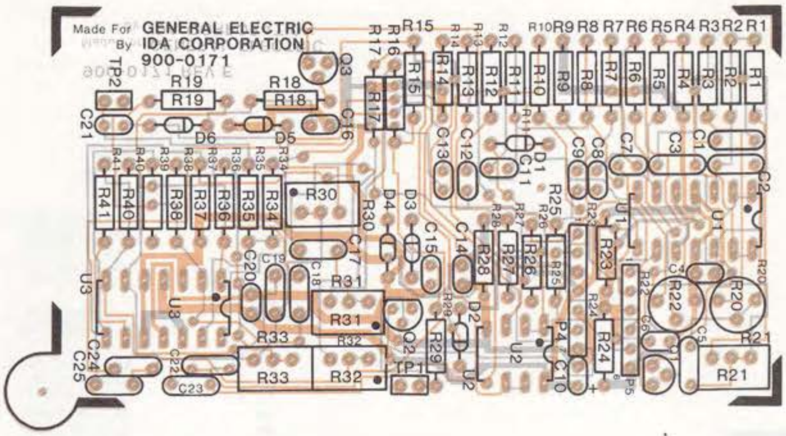
	DESCRIPTION
-0017	680 OHM 5% 1/4W RES.
-1202	2K 1T. MINI POT.
-1210	121 OHM 1% 1/4W RES,
-3650	365 OHM 1% 1/4W RES.
-1211	1.21K 1% 1/4W RES.
-0019	1K 5% 1/4W RES.
-0045	620 OHM 5% 1/4W RES.
-1339	3.9 OHM 5% 1/2W RES.
-1253	25K 1T. MINI POT.
-0009	15K 5% 1/4W RES.
-0078	1.5K 5% 1/4W RES.
-0021	12K 5% 1/4W RES.
-0005	27K 5% 1/4W RES.
-0046	470K 5% 1/4W RES.
-3092	30.9K 1& 1/4W RES.
-0038	10 OHM 5% 1/4W RES.
-0015	22K 5% 1/4W RES.
-0070	3.9K 5% 1/4W RES.
-0016	6.8M 5% 1/4W RES.
-3482	34.8K 1% 1/4W RES.
-0059	39K 5% 1/4W RES.
-0057	180K 5% 1/4W RES.
-0026	44.2K 1% 1/4W RES.
-0002	5.6K 5% 1/4W RES.
-0001	390K 5% 1/4W RES.
-0020	47K 5% 1/4W RES.
-2323	232K 1% 1/4W RES.
-1334	330K 5% 1/4W RES.
-0047	1M 5% 1/4W RES.
-3650	365 OHM 1% 1/4W RES.
-1503	150K 5% 1/4W RES.
-1373	137K 1% 1/4W RES.
-0079	330 OHM 5% 1/4W RES.
-0015	22K 5% 1/4W RES.
-0056	150 OHM 5% 1/4W RES.
-0071	4.3K 5% 1/4W RES.
-0060	3.9 OHM 5% 1/4W RES.
-1150	15 OHM 5% 1/4W RES.
-0052	220 OHM 5% 1/4W RES.
-0068	47 OHM 5% 1/4W RES.
-0001	VARISTOR 150V
-0004	VARISTOR 24V
-0001A	24-10 AUDIO TRANSF.
-0005	600 OHM COUP. TRANSF.
-0003	8 PIN ELECTROVERT
-0015	TEST POINT POST
-0011	.45" WIRE TEST POINT
-0247	LM317KC REG. TO-3 IC
-0241	4N38 OPTO ISOLATOR IC
-0237	LM317T REG. TO-220 IC
-0223	LM386-4 AUDIO AMP IC
-0229	CA3260E DUAL OP-AMP IC
-0240	NE572 DUAL COMPANDOR IC
-0120	TL062CP DUAL OP-AMP IC
-0010	LM555 TIMER IC
-0238	CD74C14 HEX SHMT. TRG. IC
-0067	4066 QUAD SPST SW IC
-0243	X9103 10K POT. IC
-0248	LM2003AT 10W AUD. AMP IC
-0071	MM74C74N DUAL D FF IC
-0257	74C04 HEX INVERTER IC
-0249	74HC02N QUAD 2-IN NOR IC
-0213	74S188 32 X 8 PROM IC

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
WR		J19-265-0006	.25" WIRE JUMPER
F1		J19-291-0001	FUSE CLIP
F1		J19-291-0005	FUSE COVER
Q1		J19-210-0002	TO-220 HEAT SINK
Q1		J19-200-0087	.187" RIVET
U1		J19-210-0001	TO-3 1/2" HEAT SINK
U1		J19-210-0012	5423B HEAT SINK
U1		J19-210-0100	TO-3 INSULATOR
U1	N80P13008B6	J19-199-3073	6-32x1/2" PH. SCREW
U1		J19-200-0068	6-32x1/8" SPACKER
U2-4		J19-220-0006	6 PIN IC DIP SOCKET
U5,15	19A702917P7	J19-210-0009	5630B HEAT SINK
U5,15	N80P13004B6	J19-199-3070	6-32z1/4" PH. SCREW
U5,15	714225P3 OR N210P13	J19-199-0020	6-32 HEX NUT
U5,15	N404P13B6	J19-199-2002	#6 STAR WASHER
U6,7,9, 10,11,14	19A700156P15	J19-220-0003	8 PIN IC DIP SOCKET
U8,20	19A700156P9	J19-220-0001	16 PIN IC DIP SOCKET
U12,13,16-19, 21-23		J19-220-0002	14 PIN IC DIP SOCKET
	19A702104P2	J19-234-0046	SHORTING PLUG
	N80P13004B6	J19-199-3070	6-32x1/4" PH. SCREW
		J19-200-0305	#4x3/8" THRD. SPACER
		J19-900-0165	P.C. BOARD

PARTS LIST

4-WIRE AUDIO OPTION
ISSUE 1

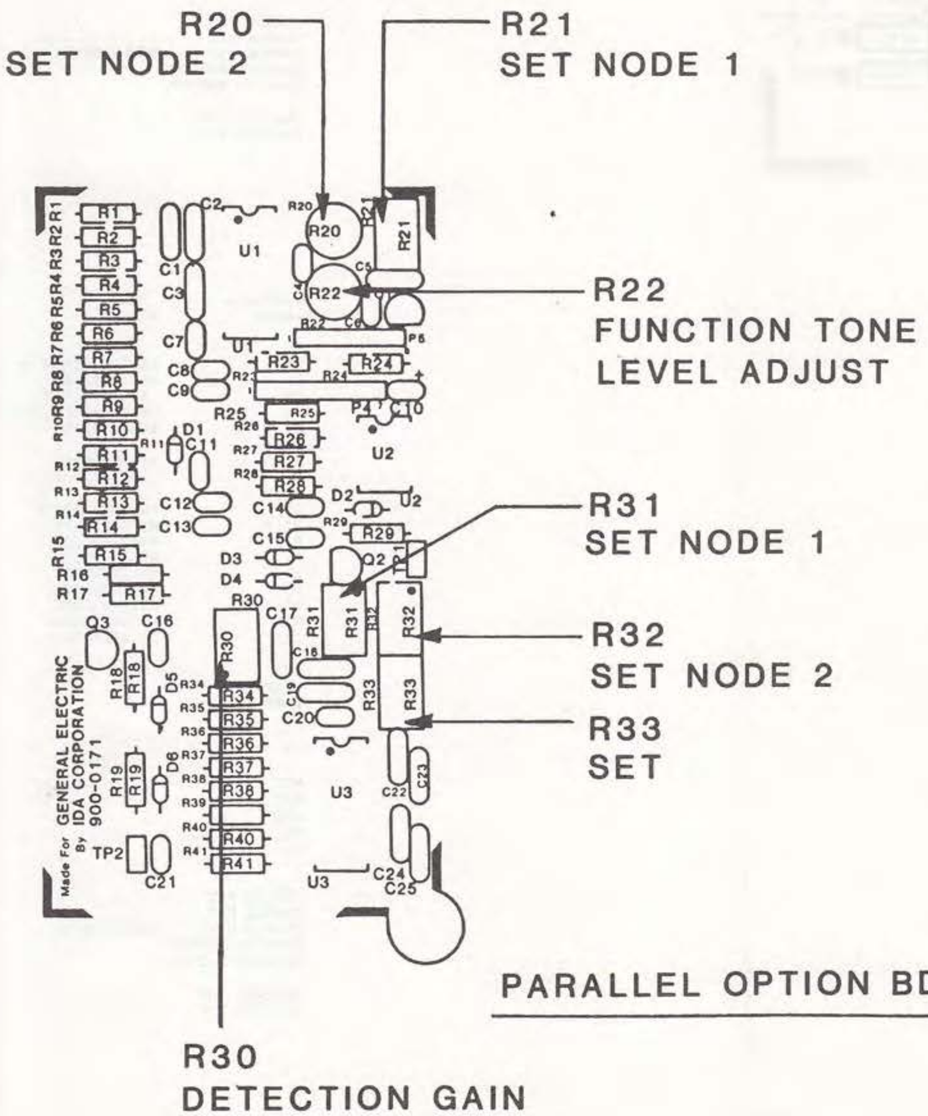
REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
J5 •		J19-231-3007	7 POS .1"x.1" RECPT.
R1	H212CRP162C	J19-312-0045	620 OHM 5% 1/4W RES.
SG1,2	19A701250P336	J19-300-0004	S14K 25 VOLT VARISTOR
T2		J19-410-0003	600 OHM COUPLING TRANSF.
	N80P9004B6	J19-199-3055	#4-40x1/4" PHLP. SCREW
		J19-900-0170	GE 4-WIRE AUDIO PC BD



(4166-A-01, Rev.E)

(4166-A-02, Rev.E)

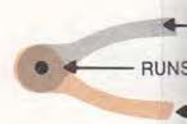
(4166-A-03, Rev.E)



PARALLEL OPTION BD.

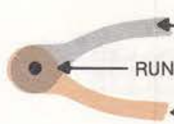
(4164-P-01, Rev.A)

Reference Number	GE Number
C1,2,3,5,18, 19,22,23,24,25	
C4,6,7,8,9,13, 14,15,16,20,21	19A700
C10	19A701
C11	
C17	
D1,2,3,4,5,6	19A700
P4	19A700
P5	19A700
Q1	
Q2,3	
R1,16,36	
R2,15	19A70
R3,17	
R4,14,37	19A701
R5,13	19A701
R6,12	H212CR
R7,18,29	H212CR
R8,25	H212CR
R9,23,24, 26,27,28,35	H212CR
R10,11,40	H212CR
R19	
R20	
R21,31,32,33	
R22	
R30	
R34	
R38,39,41	19A70
TP1,2	19A702
U1,3	
U2	
U1,3	19A700
U2	19A700
	N80P90

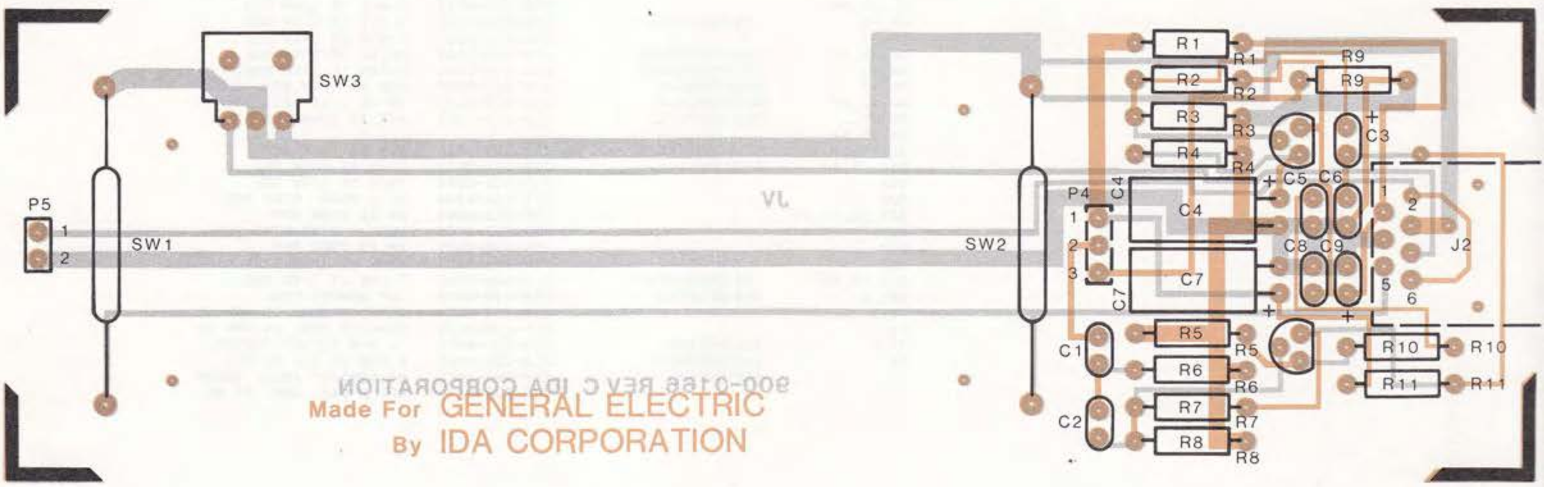


PARTS LIST
Extention/Parallel Option Board
J19/900-0171

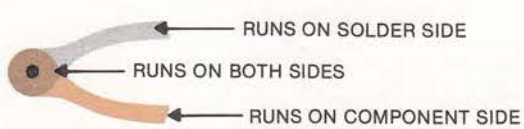
Reference Number	GE Number	VENDOR Number	Description
C1,2,3,5,18, 19,22,23,24,25		J19-362-0019	.01uF 100V ULST CAP.
C4,6,7,8,9,13, 14,15,16,20,21	19A700121P106 OR P6	J19-362-0001	.1uF 50V MONO CAP.
C10	19A701534P7	J19-390-0010	10uF 16V TANT CAP.
C11		J19-362-0014	82pF 100V MONO CAP.
C17		J19-362-0002	.47uF 50V MONO CAP.
D1,2,3,4,5,6	19A700028P001	J19-110-0001	1N914 DIODE
P4	19A700072P84	J19-231-3107	7 POS .1" POST HEADER
P5	19A700072P84	J19-231-3107	6 POS .1" POST HEADER
Q1		J19-180-0006	2N5401 PNP TRANSISTOR
Q2,3		J19-180-0009	MPS8098 NPN TRANSISTOR
R1,16,36		J19-311-6811	6.81K 1% 1/4W RES.
R2,15	19A701250P384	J19-311-7321	7.32K 1% 1/4W RES.
R3,17		J19-311-0017	2.67K 1% 1/4W RES.
R4,14,37	19A701250P365	J19-311-4642	46.4K 1% 1/4W RES.
R5,13	19A701250P225	J19-311-1781	1.78K 1% 1/4W RES.
R6,12	H212CRP343C	J19-312-0027	43K 5% 1/4W RES.
R7,18,29	H212CRP210C	J19-312-0019	1K 5% 1/4W RES.
R8,25	H212CRP347C	J19-312-0020	47K 5% 1/4W RES.
R9,23,24, 26,27,28,35	H212CRP310C	J19-312-0011	10K 5% 1/4W RES.
R10,11,40	H212CRP422C	J19-312-0012	220K 5% 1/4W RES.
R19		J19-312-0073	750K 5% 1/4W RES.
R20		J19-351-1202	2K 1 TURN MINI POT
R21,31,32,33		J19-352-0004	2K 22 TURN POT
R22		J19-352-0005	100K 1 TURN MINI POT
R30		J19-352-0003	1M 22 TURN POT
R34		J19-311-5233	523K 1% 1/4W RES.
R38,39,41	19A701250P383	J19-311-7151	7.15K 1% 1/4W RES.
TP1,2	19A702104P1	J19-265-0016	.1" JUMPER WIRE
U1,3		J19-130-0251	TL064CN QUAD OP-AMP IC
U2		J19-130-0120	TL062CP DUAL OP-AMP IC
U1,3	19A700156P7	J19-220-0002	14 PIN IC DIP SOCKET
U2	19A700156P15	J19-220-0003	8 PIN IC DIP SOCKET
	N80P9004B6	J19-199-3055	#4-40x1/4" PHLP. SCREW
		J19-900-0171	EXT / PAR. OPT. PC BD.



TONE REMOTE PARALLEL OPTION
J19/900-0171

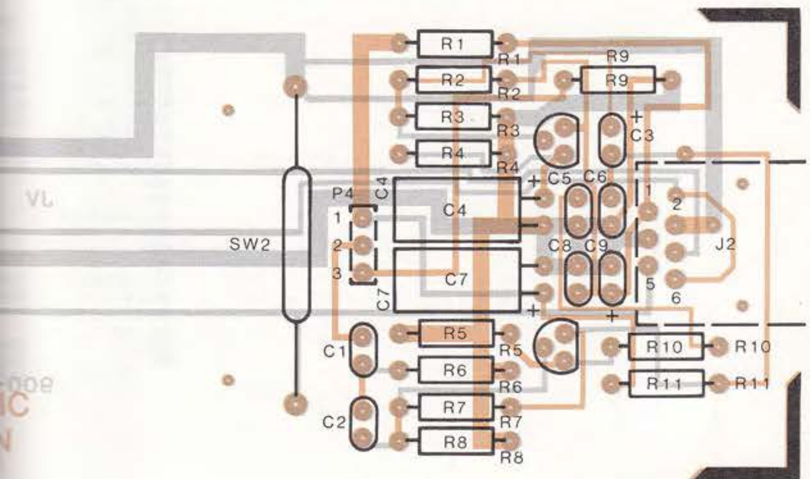


(4162-A-01)
(4162-A-02)
(4162-A-04)



REMOTE HANDSET BOARD
J19/900-0166

& PARTS LIST



-A-01)
-A-02)
-A-04)

ON SOLDER SIDE

DES

ON COMPONENT SIDE

PARTS
DC Handset
J19/9

Reference Number	GE Number
C1,2	19A700121P50 OR 105
C3	19A701225P6
C5	19A701534P6
C6	19A700121P2 OR P102
C7	19A704879P2
C8	
C9	19A700003P3
J2	19J706197P1
Q1,2	
R1	19A701250P232
R2,7	H212CRP118C
R3,8	H212CRP410C
R4	H212CRP110C
R5	H212CRP215C
R6	H212CRP210C
R9	H212CRP282C
R10	H212CRP115C
R11	H212CRP256C
SW1	
SW3	
EARPIECE	
EARPIECE	
J2	
J2	
MIC	
MIC	
MIC	
P4	
P5	
CRADLE KIT	
CRADLE KIT	
CRADLE KIT	N80P13004B4
HANDSET BOTTOM	
HANDSET BOTTOM	
HANDSET TOP	
HANDSET TOP	

PARTS
Tone Hand

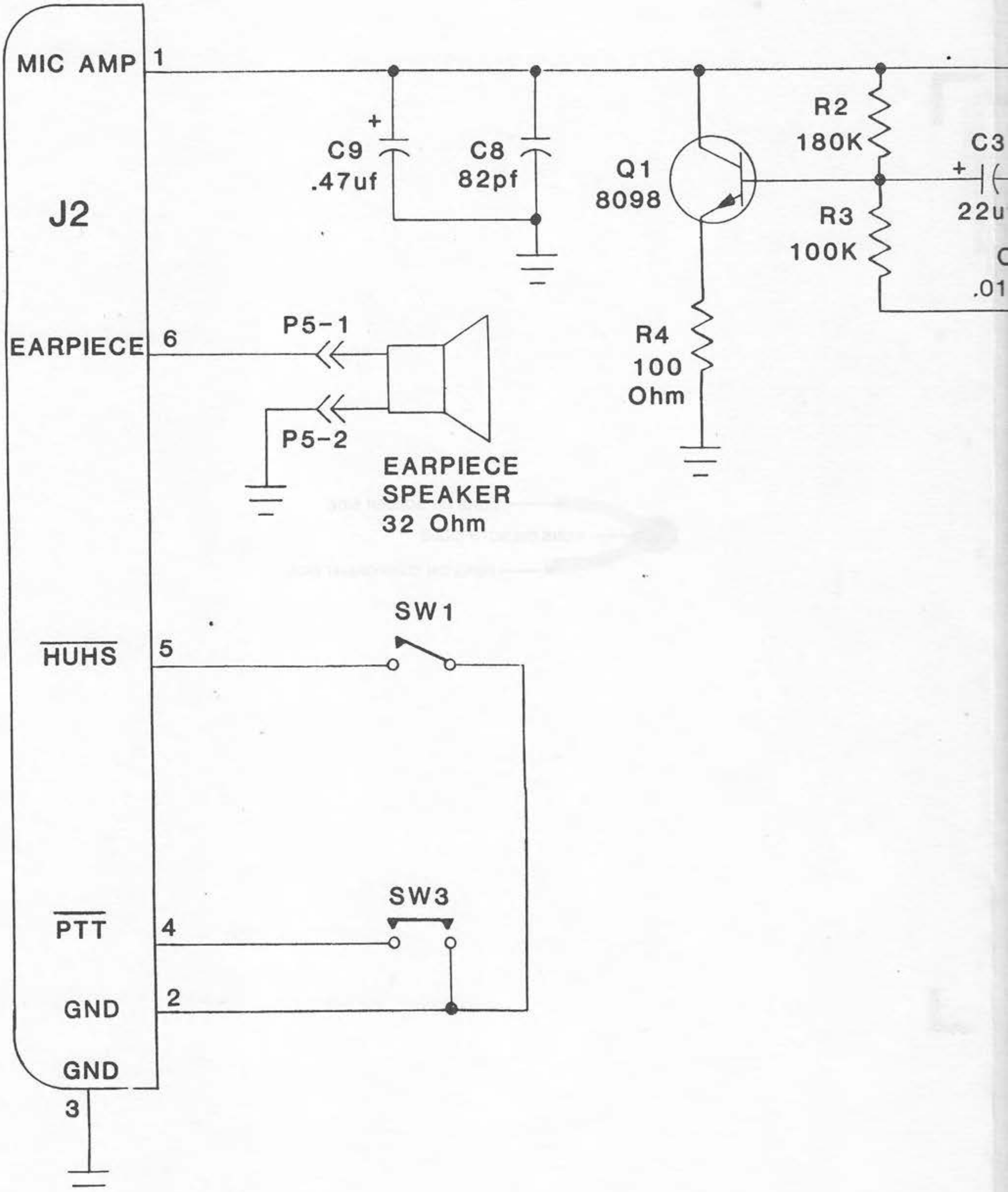
Reference Number	GE Number
C1,2	19A700121P50 OR 105
C3	19A701225P6
C5	19A701534P6
C6	19A700121P2 OR P102
C7	19A704879P2
C8	
C9	19A700003P3
J2	19J706197P1
Q1,2	
R1	19A701250P232
R2,7	H212CRP118C
R3,8	H212CRP410C
R4	H212CRP110C
R5	H212CRP215C
R6	H212CRP210C
R9	H212CRP282C
R10	H212CRP115C
R11	H212CRP256C
SW1	
SW3	
EARPIECE	
EARPIECE	
J2	
J2	
MIC	
MIC	
MIC	
P4	
P5	
CRADLE KIT	
CRADLE KIT	
CRADLE KIT	N80P13004B4
HANDSET BOTTOM	
HANDSET BOTTOM	
HANDSET TOP	
HANDSET TOP	

PARTS LIST
DC Handset Board
J19/900-0166

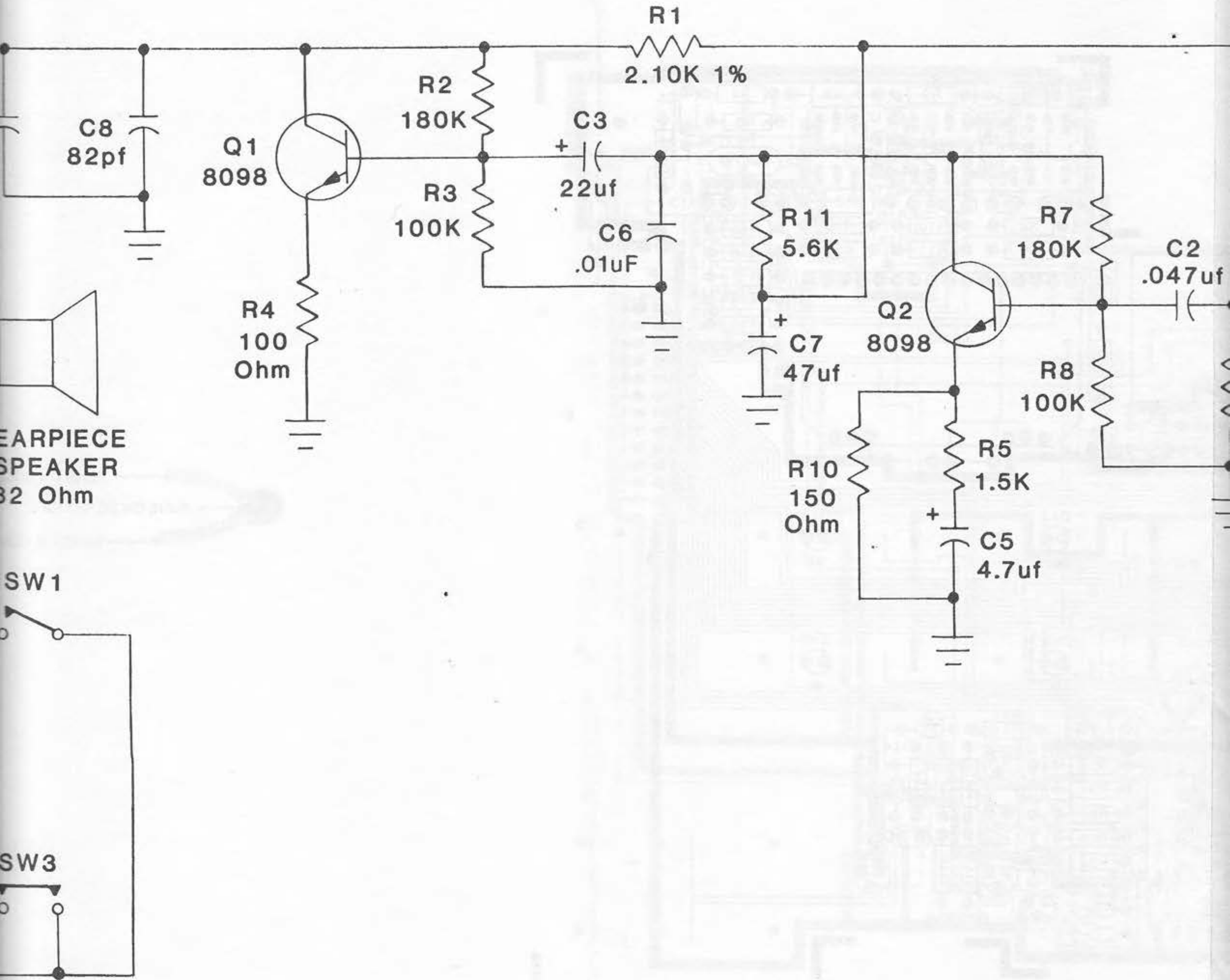
Reference Number	GE Number	VENDOR NUMBER	Description
C1,2	19A700121P50 OR 105	J19-362-0009	.047uF 50V MONO CAP.
C3	19A701225P6	J19-390-2226	22uF 16V TANT CAP.
C5	19A701534P6	J19-390-0011	4.7uF 16V TANT CAP.
C6	19A700121P2 OR P102	J19-362-0003	.01uF 50V MONO CAP.
C7	19A704879P2	J19-360-0025	47uF 16V ELEC CAP.
C8		J19-362-0014	82pF 100V MONO CAP.
C9	19A700003P3	J19-390-0002	.47uF 35V TANT CAP.
J2	19J706197P1	J19-234-0066	6 PIN MOD. PHONE JACK
Q1,2		J19-180-0009	MPS8098 NPN TRANSISTOR
R1	19A701250P232	J19-311-2101	2.10K 5% 1/4W RES.
R2,7	H212CRP118C	J19-312-0057	180K 5% 1/4W RES.
R3,8	H212CRP410C	J19-312-0003	100K 5% 1/4W RES.
R4	H212CRP110C	J19-312-0010	100 OHM 5% 1/4W RES.
R5	H212CRP215C	J19-312-0078	1.5K 5% 1/4W RES.
R6	H212CRP210C	J19-312-0019	1K 5% 1/4W RES.
R9	H212CRP282C	J19-312-0036	8.2K 5% 1/4W RES.
R10	H212CRP115C	J19-312-0056	150 OHM 5% 1/4W RES.
R11	H212CRP256C	J19-312-0002	5.6K 5% 1/4W RES.
SW1		J19-611-0030	MDRR-4 SPST REED SWITCH
SW3		J19-611-0031	SPST MOM NO PTT SWITCH
EARPIECE		J19-901-0009	32 OHM SPEAKER ELEMENT
EARPIECE		J19-901-0016	BLACK CLOTH
J2		J19-260-0023	6 COND MOD BLK COIL CORD
J2		J19-199-6099	3/8"x1" BLK HT SHRK TUBE
MIC		J19-901-0014	EM-60 MIC ELEMENT
MIC		J19-901-0011	80A RUBBER MIC MOUNT
MIC		J19-199-1002	1/4" PHLP. LATCH SCREW
P4		J19-800-0037	3" 28AWG 3 COND CABLE
P5		J19-800-0037	3" 28AWG 2 COND CABLE
		J19-199-4027	#4x1/2" MACHINE SCREW
		J19-900-0166	HANDSET PC BOARD
CRADLE KIT		J19-900-0525	BLK TXRD HANDSET CRADLE
CRADLE KIT		J19-200-0094	1/4"x1" HUHS MAGNET
CRADLE KIT	N80P13004B4	J19-199-3080	#6-32x1/4" BLK PH SCREW
HANDSET BOTTOM		J19-900-0516	BLACK PTT BUTTON
HANDSET BOTTOM		J19-900-0517	BRN SCREW COVER RETAINER
HANDSET TOP		J19-900-5006	HANDSET WEIGHT
HANDSET TOP		J19-201-0063	3/8" HANDSET FOAM
		J19-900-0515	BRN TXRD HANDSET BOTTOM
		J19-900-0514	BRN TXRD HANDSET TOP

PARTS LIST
Tone Handset Board

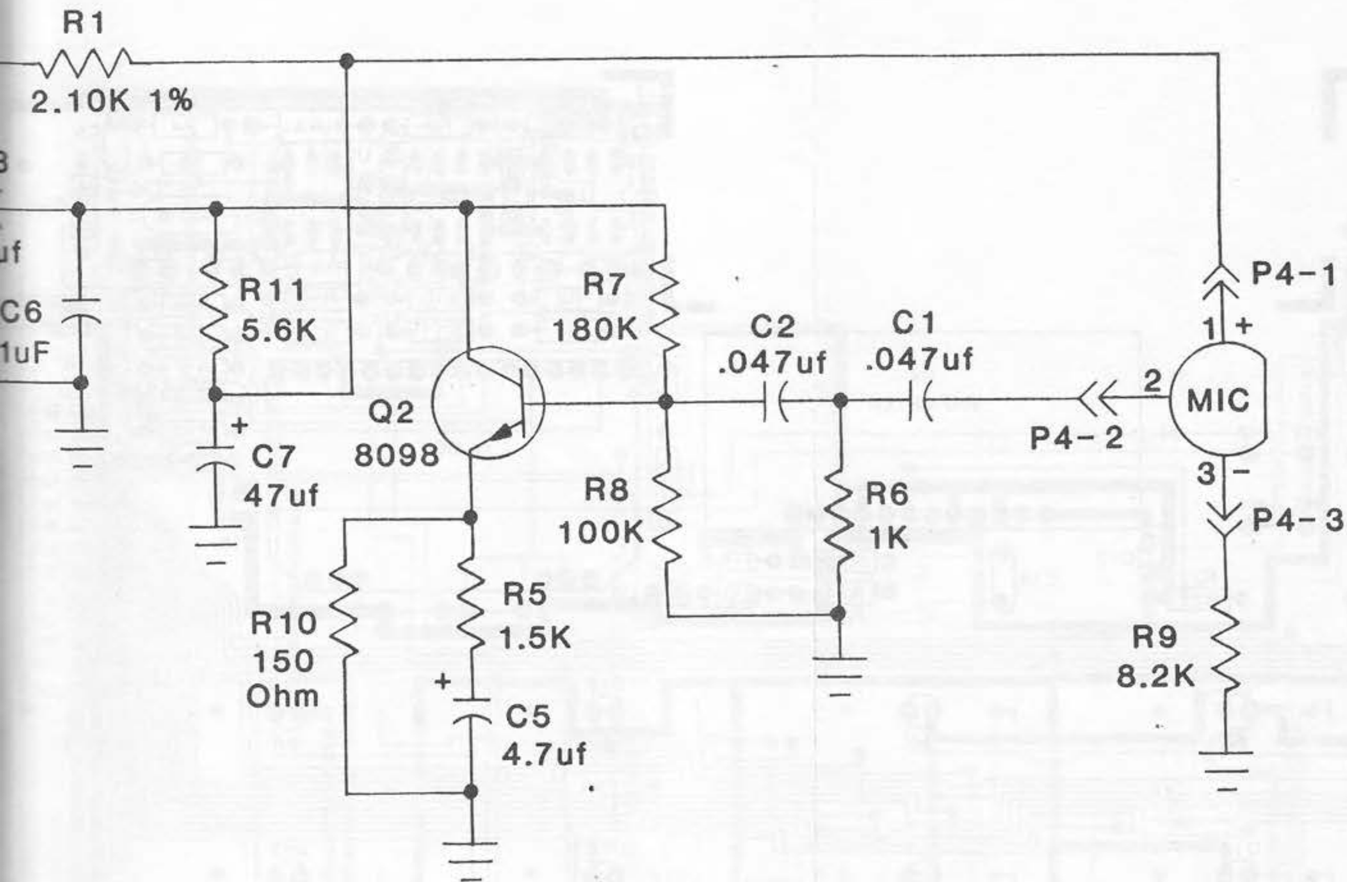
Reference Number	GE Number	VENDOR Number	Description
C1,2	19A700121P50 OR 105	J19-362-0009	.047uF 50V MONO CAP.
C3	19A701225P6	J19-390-2226	22uF 16V TANT CAP.
C5	19A701534P6	J19-390-0011	4.7uF 16V TANT CAP.
C6	19A700121P2 OR P102	J19-362-0003	.01uF 50V MONO CAP.
C7	19A704879P2	J19-360-0025	47uF 16V ELEC CAP.
C8		J19-362-0014	82pF 100V MONO CAP.
C9	19A700003P3	J19-390-0002	.47uF 35V TANT CAP.
J2	19J706197P1	J19-234-0066	6 PIN MOD. PHONE JACK
Q1,2		J19-180-0009	MPS8098 NPN TRANSISTOR
R1	19A701250P232	J19-311-2101	2.10K 5% 1/4W RES.
R2,7	H212CRP118C	J19-312-0057	180K 5% 1/4W RES.
R3,8	H212CRP410C	J19-312-0003	100K 5% 1/4W RES.
R4	H212CRP110C	J19-312-0010	100 OHM 5% 1/4W RES.
R5	H212CRP215C	J19-312-0078	1.5K 5% 1/4W RES.
R6	H212CRP210C	J19-312-0019	1K 5% 1/4W RES.
R9	H212CRP282C	J19-312-0036	8.2K 5% 1/4W RES.
R10	H212CRP115C	J19-312-0056	150 OHM 5% 1/4W RES.
R11	H212CRP256C	J19-312-0002	5.6K 5% 1/4W RES.
SW1		J19-611-0030	MDRR-4 SPST REED SWITCH
SW3		J19-611-0031	SPST MOM NO PTT SWITCH
EARPIECE		J19-901-0009	32 OHM SPEAKER ELEMENT
EARPIECE		J19-901-0016	BLACK CLOTH
J2		J19-260-0023	6 COND MOD BLK COIL CORD
J2		J19-199-6099	3/8"x1" BLK HT SHRK TUBE
MIC		J19-901-0014	EM-60 MIC ELEMENT
MIC		J19-901-0011	80A RUBBER MIC MOUNT
MIC		J19-199-1002	1/4" PHLP. LATCH SCREW
P4		J19-800-0037	3" 28AWG 3 COND CABLE
P5		J19-800-0037	3" 28AWG 2 COND CABLE
		J19-199-4027	#4x1/2" MACHINE SCREW
		J19-900-0166	HANDSET PC BOARD
CRADLE KIT		J19-900-0525	BLK TXRD HANDSET CRADLE
CRADLE KIT		J19-200-0094	1/4"x1" HUHS MAGNET
CRADLE KIT	N80P13004B4	J19-199-3080	#6-32x1/4" BLK PH SCREW
HANDSET BOTTOM		J19-900-0516	BLACK PTT BUTTON
HANDSET BOTTOM		J19-900-0517	BRN SCREW COVER RETAINER
HANDSET TOP		J19-900-5006	HANDSET WEIGHT
HANDSET TOP		J19-201-0063	3/8" HANDSET FOAM
		J19-900-0515	BRN TXRD HANDSET BOTTOM
		J19-900-0514	BRN TXRD HANDSET TOP



J2
MIC AMP
1
EARPIECE
6
HUHS
5
PTT
4
GND
2
GND
3
C9
.47uf
C8
82pf
Q1
8098
R2
180K
R3
100K
R4
100
Ohm
C3
22u
.01
P5-1
P5-2
EARPIECE
SPEAKER
32 Ohm
SW1
SW3



R1
2.10K 1%
C8
82pf
Q1
8098
R2
180K
C3
22uf
R3
100K
C6
.01uF
R11
5.6K
R7
180K
C2
.047uf
R4
100
Ohm
Q2
8098
C7
47uf
R8
100K
EARPIECE
SPEAKER
32 Ohm
R10
150
Ohm
R5
1.5K
C5
4.7uf
SW1
SW3



NOT USED:

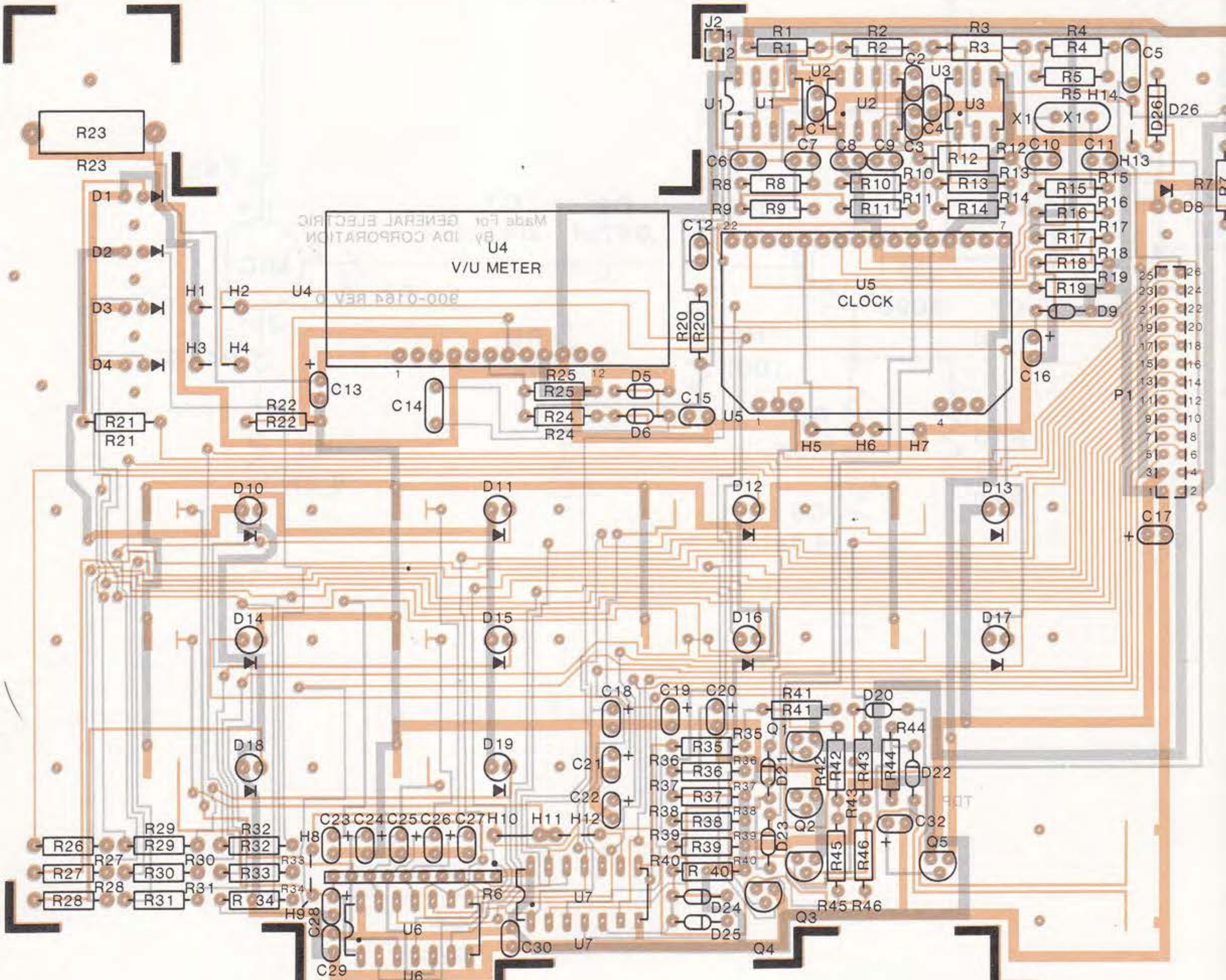
C4.

SW2

B	SL	12/3/87	SEPARATE GND.
A	JV	9/28/87	INITIAL RELEASE
REV.	BY	DATE	DESCRIPTION

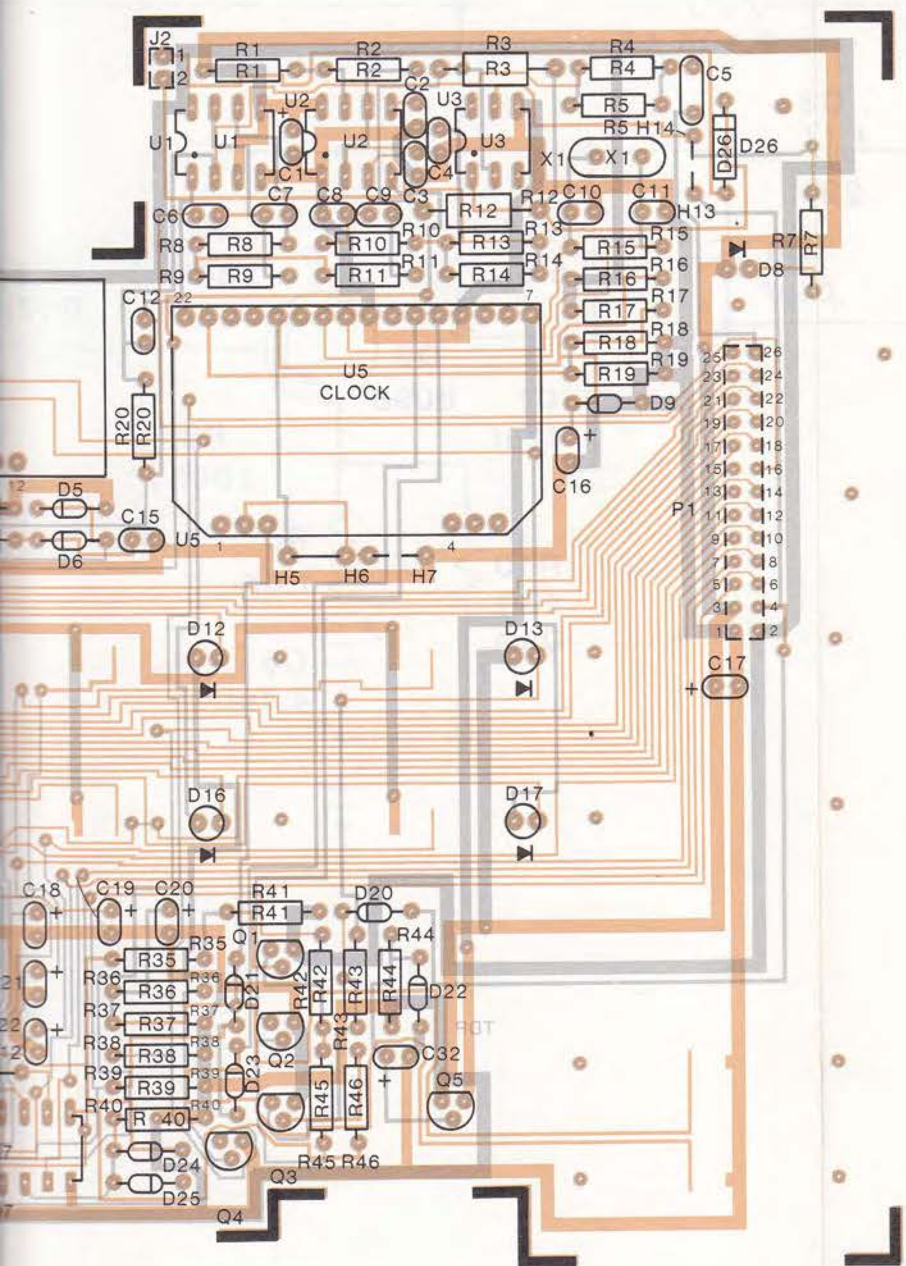
(4162-S-00)

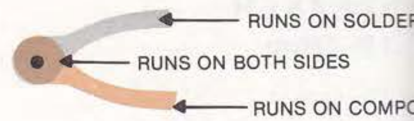
REMOTE HANDSET



KEYPAD DISPLAY BOARD
J19/900-0164

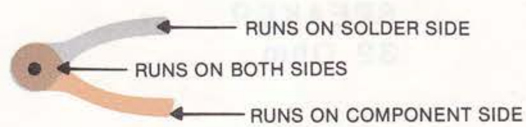
RAM

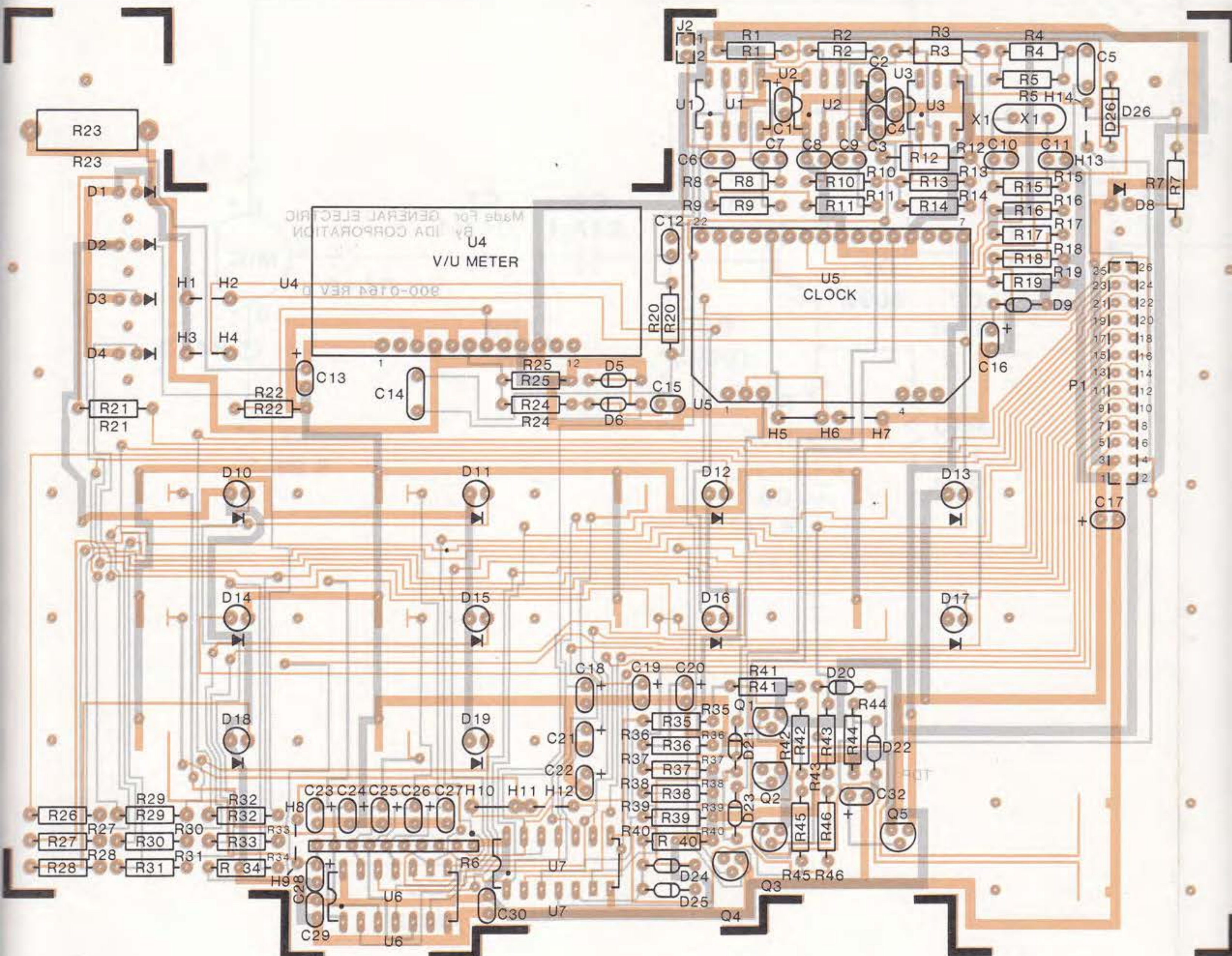




(4160-A-01)
(4160-A-02)

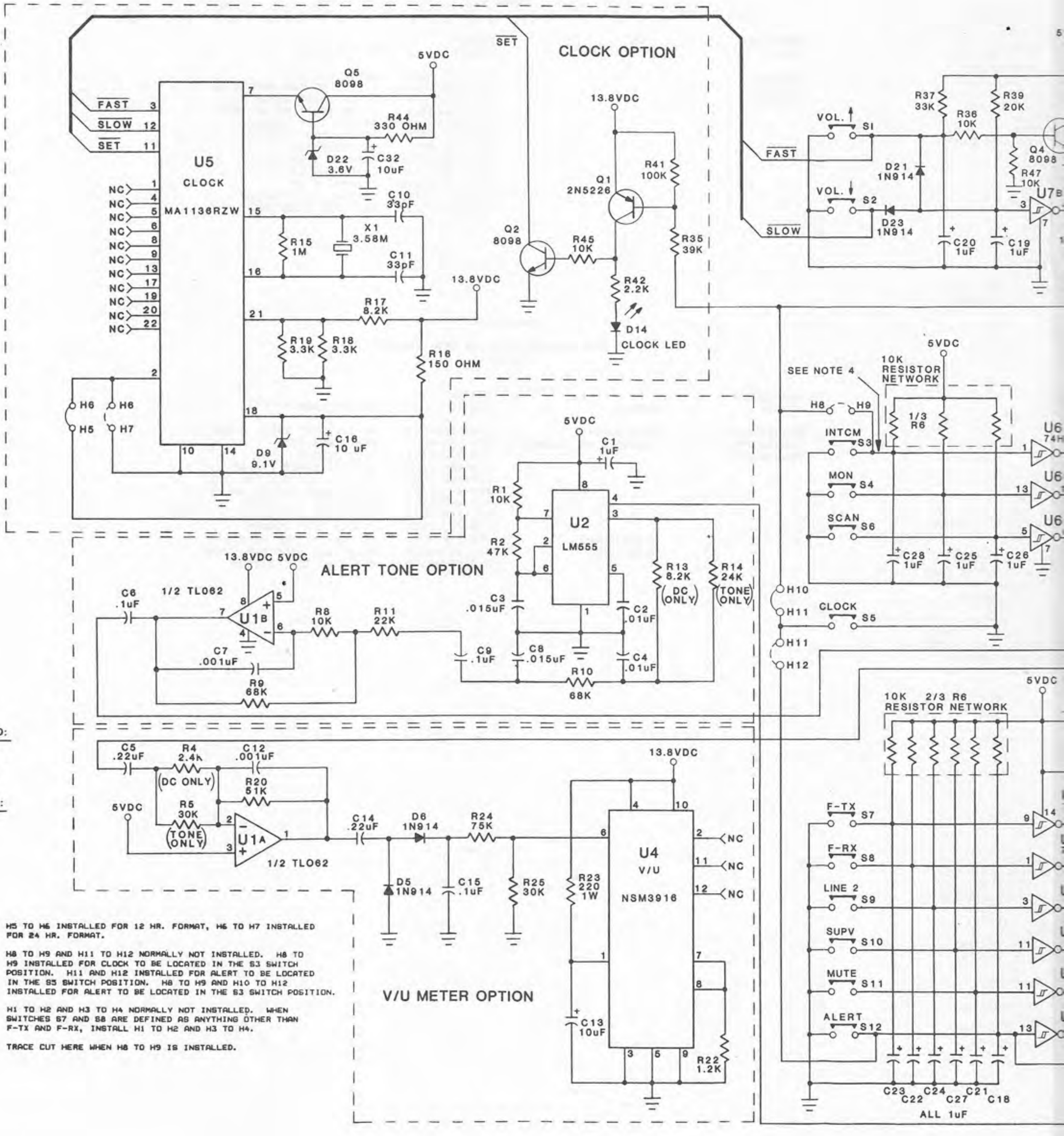

R7


RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE



(4160-A-01)
(4160-A-02)

KEYPAD DISPLAY BOARD
J19/900-0164



LAST USED:	
U7	D26
R47	H14
C32	Q5

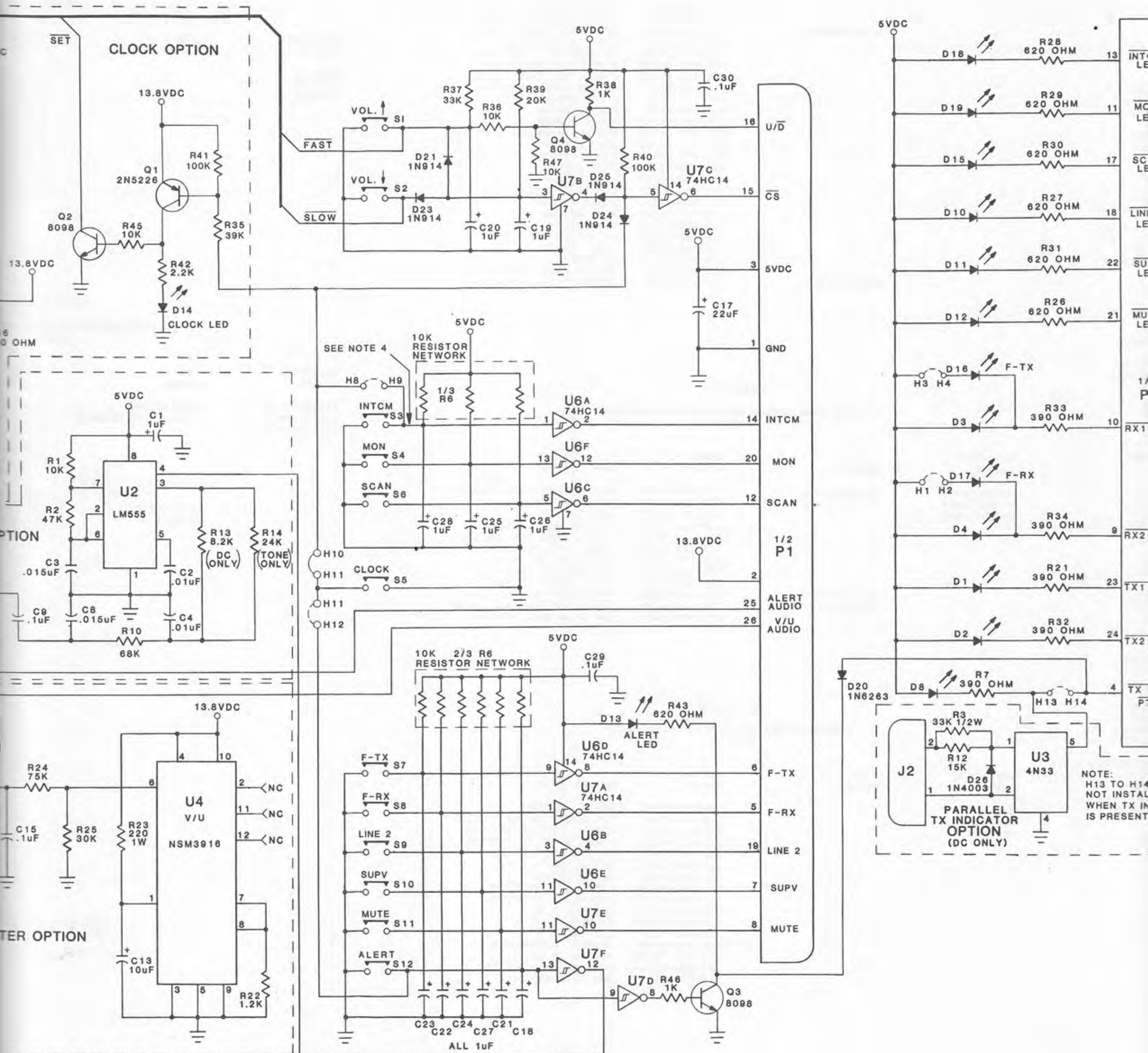
NOT USED:
D7 C31

NOTE: 1. H5 TO H6 INSTALLED FOR 12 HR. FORMAT, H6 TO H7 INSTALLED FOR 24 HR. FORMAT.

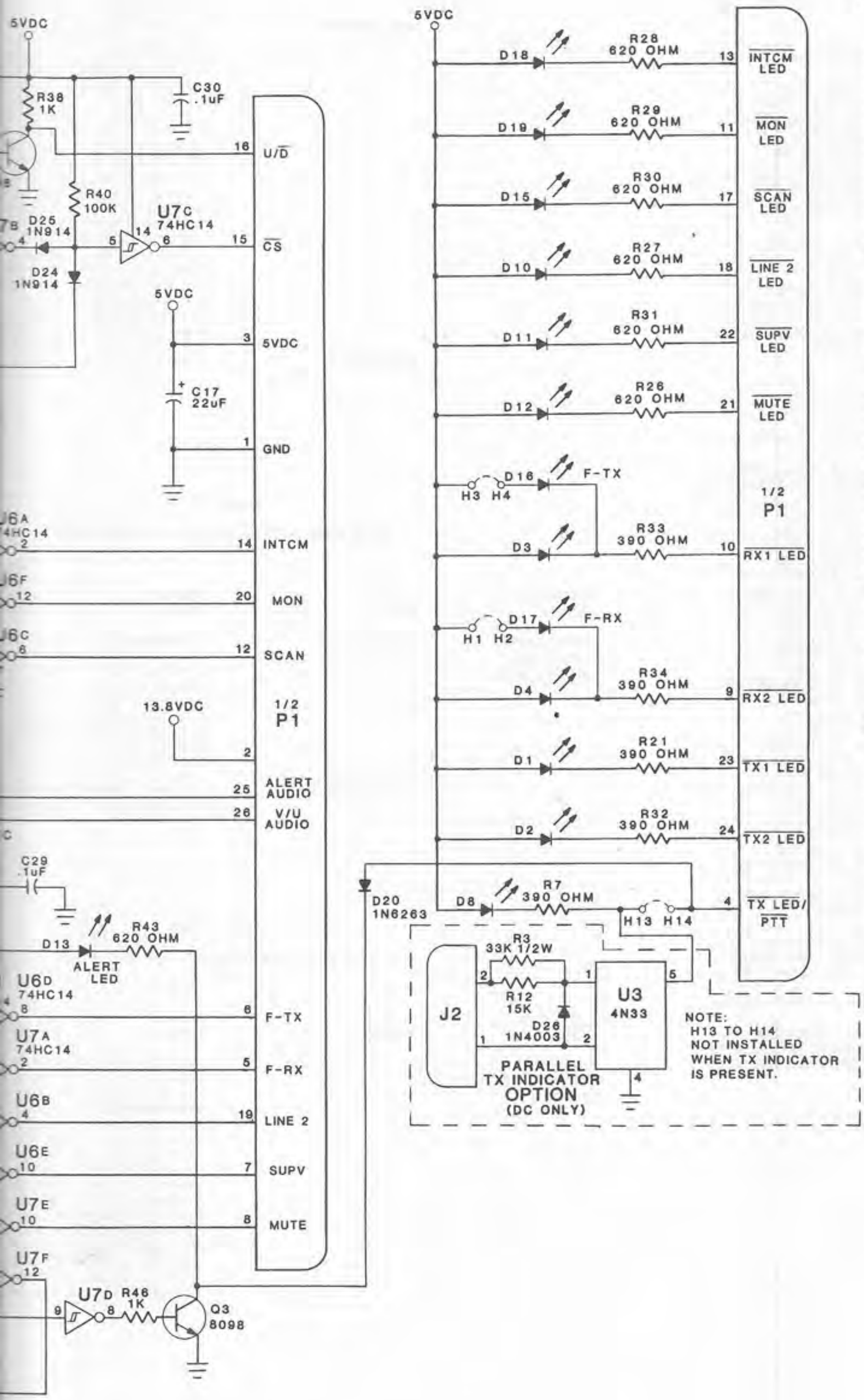
2. H8 TO H9 AND H11 TO H12 NORMALLY NOT INSTALLED. H8 TO H9 INSTALLED FOR CLOCK TO BE LOCATED IN THE S3 SWITCH POSITION. H11 AND H12 INSTALLED FOR ALERT TO BE LOCATED IN THE S5 SWITCH POSITION. H8 TO H9 AND H10 TO H12 INSTALLED FOR ALERT TO BE LOCATED IN THE S3 SWITCH POSITION.

3. H1 TO H2 AND H3 TO H4 NORMALLY NOT INSTALLED. WHEN SWITCHES S7 AND S8 ARE DEFINED AS ANYTHING OTHER THAN F-TX AND F-RX, INSTALL H1 TO H2 AND H3 TO H4.

4. TRACE CUT HERE WHEN H8 TO H9 IS INSTALLED.


CLOCK OPTION
SET
13.8VDC
Q1 2N5226
Q2 8098
R41 100K
R45 10K
R35 39K
R42 2.2K
D14 CLOCK LED
FAST
SLOW
VOL. ↑ S1
VOL. ↓ S2
5VDC
R37 33K
R36 10K
R39 20K
R38 1K
Q4 8098
R47 10K
C30 .1uF
D21 1N914
D23 1N914
D25 1N914
D24 1N914
R40 100K
U7B
U7C 74HC14
C20 1uF
C19 1uF
U/D
CS
5VDC
GND
C17 22uF
SEE NOTE 4
10K RESISTOR NETWORK
1/3 R6
H8 H9
INTCM S3
MON S4
SCAN S6
U6A 74HC14
U6F
U6C
C28 1uF
C25 1uF
C26 1uF
INTCM
MON
SCAN
1/2 P1
H10
H11
H12
CLOCK S5
ALERT AUDIO
V/U AUDIO
C1 1uF
R1 10K
R2 47K
U2 LM555
R13 8.2K (DC ONLY)
R14 24K (TONE ONLY)
C3 .015uF
C2 .01uF
C9 .1uF
C8 .015uF
C4 .01uF
R10 68K
TION
R24 75K
C15 .1uF
R25 30K
R23 220 1W
U4 V/U NSM3916
NC
C13 10uF
R22 1.2K
TER OPTION
10K 2/3 R6 RESISTOR NETWORK
C29 .1uF
D13 ALERT LED
R43 620 OHM
U6D 74HC14
U7A 74HC14
U6B
U6E
U7E
U7F
U7D
R46 1K
Q3 8098
F-TX S7
F-RX S8
LINE 2 S9
SUPV S10
MUTE S11
ALERT S12
F-TX
F-RX
LINE 2
SUPV
MUTE
C23 C22 C24 C27 C21 C18
ALL 1uF
D18 R28 620 OHM
D19 R29 620 OHM
D15 R30 620 OHM
D10 R27 620 OHM
D11 R31 620 OHM
D12 R26 620 OHM
H3 H4 D16 F-TX
D3 R33 390 OHM
H1 H2 D17 F-RX
D4 R34 390 OHM
D1 R21 390 OHM
D2 R32 390 OHM
D20 1N6263
D8 R7 390 OHM
H13 H14
J2
R3 33K 1/2W
R12 15K
D26 1N4003
U3 4N33
PARALLEL TX INDICATOR OPTION (DC ONLY)
NOTE: H13 TO H14 NOT INSTAL WHEN TX IN IS PRESENT
RX1
RX2
TX1
TX2
TX

(4160-S-00)



PARTS LIST
Keypad/Display Board
J19/900-164

Reference Number	GE Number	VENDOR Number	Description
C1,18,19,20, 21,22,23,24, 25,26,27,28	19A701534P4	J19-390-0003	1uF 35V TANT CAP.
C2,4	19A700121P2 OR P102	J19-362-0003	.01uF 50V MONO CAP.
C3,8	19A116244P4	J19-362-0012	.015uF 50V MONO CAP.
C5,14	19A116192P16	J19-362-5224	.22uF 50V MONO CAP.
C6,9,15,29,30	19A700121P106 OR P6	J19-362-0001	.1uF 50V MONO CAP.
C7,12	19A700121P1 OR P101	J19-362-0006	.001uF 50V MONO CAP.
C10,11		J19-362-5330	33pF 200V MONO CAP.
C13,16,32	19A701534P7	J19-390-0010	10uF 16V TANT CAP.
C17	19A701225P6	J19-390-2226	22uF 16V TANT CAP.
D1,2,3,4,8		J19-112-0016	3211 RECT. RED LED
D5,6,21, 23,24,25	19A700028P001	J19-110-0001	1N914 DIODE
D9		J19-111-0005	1N5239 9.1V ZENER DIODE
D10,11,12,13,14 15,16,17,18,19		J19-112-0012	HP1000 T-1 PKG. RED LED
D20	19A700047P003	J19-110-0008	1N6263 SCHOTKY DIODE
D22		J19-111-0008	1N5227 3.6V ZENER DIODE
H1-2,3-4,5-6, 6-7,8-9,10-11, 11-12,13-14		J19-265-0006	.25" JUMPER WIRE
P1		J19-231-1071	26 POS .1"x.1" POST
Q1		J19-180-0005	2N5226 PNP TRANSISTOR
Q2,3,4,5		J19-180-0009	MPS8098 NPN TRANSISTOR
R1,8,36,45,47	H212CRP310C	J19-312-0011	10K 5% 1/4W RES.
R2	H212CRP347C	J19-312-0020	47K 5% 1/4W RES.
R4	H212CRP224C	J19-311-0013	2.4K 5% 1/4W RES.
R5,25	H212CRP330C	J19-312-1303	30K 5% 1/4W RES.
R6		J19-316-1103	10K RES. NTWRK. OF 9
R7,21,32,33,34	H212CRP139C	J19-312-0044	390 OHM 5% 1/4W RES.
R9,10	H212CRP368C	J19-312-0058	68K 5% 1/4W RES.
R11	H212CRP322C	J19-312-0015	22K 5% 1/4W RES.
R14	H212CRP324C	J19-312-0064	24K 5% 1/4W RES.
R15	H212CRP510C	J19-312-0047	1M 5% 1/4W RES.
R16	H212CRP115C	J19-312-0056	150 OHM 5% 1/4W RES.
R17	H212CRP282C	J19-312-0036	8.2K 5% 1/4W RES.
R18,19	H212CRP233C	J19-312-0035	3.3K 5% 1/4W RES.
R20,39	H212CRP351C	J19-312-0032	51K 5% 1/4W RES.
R22	H212CRP212C	J19-312-0034	1.2K 5% 1/4W RES.
R23		J19-314-1224	220 OHM 5% 1W RES.
R24	H212CRP375C	J19-312-0055	75K 5% 1/4W RES.
R26,27,28, 29,30,31,43	H212CRP162C	J19-312-0045	620 OHM 5% 1/4W RES.
R35	H212CRP339C	J19-312-0059	39K 5% 1/4W RES.
R37	H212CRP333C	J19-312-0014	33K 5% 1/4W RES.
R38,46	H212CRP210C	J19-312-0019	1K 5% 1/4W RES.

Reference Number	GE Number	VENDOR NUMBER	Description
R40,41	H212CRP410C	J19-312-0003	100K 5% 1/4W RES.
R42	H212CRP222C	J19-312-0007	2.2K 5% 1/4W RES.
R44	H212CRP133C	J19-312-0079	330 OHM 5% 1/4W RES.
U1		J19-130-0120	TL062CP DUAL OP-AMP IC
U2		J19-130-0010	NE555 TIMER IC
U4		J19-130-0244	NSM3916 V/U MODULE IC
U5		J19-130-0245	MA1136RZW CLK. MODULE IC
U6,7		J19-130-0246	74HC14 HEX SCHMT.TRG. IC
X1		J19-305-0011	3.58MHz LO PROF CRYSTAL
P1		J19-233-0011	20 POS .1"x.1" RECPT.
P1		J19-800-0031	7" 20 COND RIBBON CABLE
	N80P13004B6	J19-199-3070	#6-32x1/4" PHLP. SCREW
		J19-900-0164	KEYPAD / DISPLAY PC BD
		J19-900-0522A	12 HOLE BLK TXRD PANEL
		J19-900-0522B	8 HOLE BLK TXRD PANEL
		J19-900-0522C	4 HOLE BLK TXRD PANEL
		J19-203-0020	12 POS RUBBER KEYPAD
		J19-203-0018	2 POS RUBBER KEYPAD
		J19-900-0518	BLANK BUTTON
		J19-900-0518A	CLOCK BUTTON
		JI9-900-0518B	RED ARROW VOLUME BUTTON
		J19-900-0518C	SUPV BUTTON
		J19-900-0518D	INTCM BUTTON
		J19-900-0518E	F-TX BUTTON
		J19-900-0518F	F-RX BUTTON
		J19-900-0518G	F-SEL BUTTON
		J19-900-0518H	LINE 2 BUTTON
		J19-900-0518I	ALERT BUTTON
		J19-900-0518J	MUTE BUTTON
		J19-900-0518K	SCAN BUTTON
		J19-900-0518L	RP OFF BUTTON
		J19-900-0518M	AUX-1 BUTTON
		J19-900-0518S	ENCPT BUTTON
		J19-900-0518N	CLEAR BUTTON
		J19-900-0518R	CG OFF BUTTON
		J19-900-0518T	SF 1 BUTTON
		J19-900-0518U	SF 2 BUTTON
		J19-900-0518V	SF 3 BUTTON
		J19-900-0518W	SF 4 BUTTON
		J19-900-0518X	SF 5 BUTTON
		J19-199-4029	#4x1/4" PHLP MACH SCREW
	N80P900506	J19-199-4031	#4x5/16" TRUSS SCREW

KEYPAD DISPLAY BOARD
J19/900-0164

PARTS LIST
DC KEYPAD/DISPLAY BOARD

ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
C1,18-28	19A701534P4	J19-390-0003	1uF 35V TANT CAP.
C2,4	19A700121P2 OR P102	J19-362-0003	.01uF 50V MONO CAP.
C3,8	19A116244P4	J19-362-0012	.015uF 50V MONO CAP.
C5,14	19A116192P16	J19-362-5224	.22uF 50V MONO CAP.
C6,9,15,29,30	19A700121P106 OR P6	J19-362-0001	.1uF 50V MONO CAP.
C7,12	19A700121P1 OR P101	J19-362-0006	.001uF 50V MONO CAP.
C10,11		J19-362-5330	33pF 200V MONO CAP.
C13,16,32	19A701534P7	J19-390-0010	10uF 16V TANT CAP.
C17	19A701225P6	J19-390-2226	22uF 16V TANT CAP.
D1-4,8		J19-112-0016	3211 RECT. RED LED
D5,6,21, 23-25	19A700028P001	J19-110-0001	1N914 DIODE
D9		J19-111-0005	1N5239 9.1V ZENER DIODE
D10-19		J19-112-0012	HP1000 T-1 PKG. RED LED
D20	19A700047P003	J19-110-0008	1N6263 SCHOTKY DIODE
D22		J19-111-0008	1N5227 3.6V ZENER DIODE
D26	T324ADP1031	J19-110-0002	1N4003 DIODE
H1-2,3-4,5-6, 6-7,8-9,10-11, 11-12,13-14		J19-265-0006	.25" JUMPER WIRE
P1		J19-231-1071	26 POS .1"x.1" POST
Q1		J19-180-0005	2N5226 PNP TRANSISTOR
Q2-5		J19-180-0009	MPS8098 NPN TRANSISTOR
R1,8,36,45,47	H212CRP310C	J19-312-0011	10K 5% 1/4W RES.
R2	H212CRP347C	J19-312-0020	47K 5% 1/4W RES.
R3		J19-313-0014	33K 5% 1/2W RES.
R4	H212CRP224C	J19-311-0013	2.4K 5% 1/4W RES.
R6		J19-316-1103	10K RES. NTWRK. OF 9
R7,21,32-34	H212CRP139C	J19-312-0044	390 OHM 5% 1/4W RES.
R9,10	H212CRP368C	J19-312-0058	68K 5% 1/4W RES.
R11	H212CRP322C	J19-312-0015	22K 5% 1/4W RES.
R12	H212CRP315C	J19-312-0009	15K 5% 1/4W RES.
R13,17	H212CRP282C	J19-312-0036	8.2K 5% 1/4W RES.
R15	H212CRP510C	J19-312-0047	1M 5% 1/4W RES.
R16	H212CRP115C	J19-312-0056	150 OHM 5% 1/4W RES.
R18,19	H212CRP233C	J19-312-0035	3.3K 5% 1/4W RES.
R20,39	H212CRP351C	J19-312-0032	51K 5% 1/4W RES.
R22	H212CRP212C	J19-312-0034	1.2K 5% 1/4W RES.
R23		J19-314-1224	220 OHM 5% 1W RES.
R24	H212CRP375C	J19-312-0055	75K 5% 1/4W RES.
R25	H212CRP330C	J19-312-1303	30K 5% 1/4W RES.
R26-31,43	H212CRP162C	J19-312-0045	620 OHM 5% 1/4W RES.
R35	H212CRP339C	J19-312-0059	39K 5% 1/4W RES.
R37	H212CRP333C	J19-312-0014	33K 5% 1/4W RES.
R38,46	H212CRP210C	J19-312-0019	1K 5% 1/4W RES.
R40,41	H212CRP410C	J19-312-0003	100K 5% 1/4W RES.
R42	H212CRP133C	J19-312-0079	330 OHM 5% 1/4 W RES.
U1		J19-130-0120	TL062CP DUAL OP-AMP IC
U2		J19-130-0010	NE555 TIMER IC
U3		J19-130-0256	4N33 OPTO ISOLATOR IC
U4		J19-130-0244	NSM3916 V/U MODULE IC
U5		J19-130-0245	MA1136RZW CLK. MODULE IC
U6,7		J19-130-0246	74HC14 HEX SCHMT. TRG. IC
X1		J19-305-0011	3.5 MHz LO PROF CYRSTAL
J2		J19-233-0039	2 POS .1" RECEPTACLE
J2 PIN 1		J19-222-0020	12" 22AWG BRN STRD WIRE
J2 PIN 2		J19-222-0014	12" 22AWG RED STRD WIRE

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRI
P1		J19-233-0011	20 POS
P1		J19-800-0031	7" 20
	N80P13004B6	J19-199-3070	#6-32x
		J19-900-0164	KEYPAD,
		J19-900-0522A	12 HOL
		J19-900-0522B	8 HOLE
		J19-900-0522C	4 HOLE
		J19-203-0020	12 POS
		J19-203-0018	2 POS
		J19-900-0518	BLANK
		J19-900-0518A	CLOCK
		J19-900-0518B	RED AR
		J19-900-0518C	SUPV B
		J19-900-0518D	INTCM
		J19-900-0518E	F-TX B
		J19-900-0518F	F-RX B
		J19-900-0518H	LINE 2
		J19-900-0518I	ALERT
		J19-900-0518J	MUTE B
		J19-900-0518K	SCAN B
		J19-900-0518L	RF OFF
		J19-900-0518M	AUX-1
		J19-900-0518Q	CG BUT
		J19-199-4029	#4x1/4
	N80P900506	J19-199-4031	#4x5/1

PARTS LIST

TONE BASE BOTTOM PLASTICS AND ASSEMBLY
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRI
TRANSFORMER	N80P13005B6	J19-199-4032	#6-32x
TRANSFORMER	714225P3 OR N210P13	J19-199-0020	#6-32
TRANSFORMER		J19-200-0024	BUTT S
		J19-420-0005	117/24
		J19-260-0009	6 FT
		J19-203-11087	POWER
		J19-199-6010	GE SER
		J19-203-1054	1/4"
		J19-200-0069	#6-32x
	N80P13004B4	J19-199-3080	#6-32x
	N80P5016B6	J19-199-4030	#4x1"
		J19-900-0524	BLK T

PARTS LIST

TONE BASE TOP PLASTICS AND ASSEMBLY
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRI
SPEAKER		J19-199-0040	#6-32
SPEAKER		J19-222-0016	12" 22
SPEAKER		J19-233-0024	2 POS
		J19-901-0013	4 OHM
		J19-200-0069	#6-32x
		J19-200-0091	#6-32x
		J19-199-6011	GE NA
		J19-900-0519A	CRYST
		J19-900-0519B	CRYST
		J19-900-0519C	CRYST
		J19-900-0519D	CRYST
		J19-900-0519E	CRYST
		J19-900-0519F	CRYST
		J19-900-0519I	CYRST
		J19-900-0519J	CRYST
		J19-900-0523	BRN T

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
P1		J19-233-0011	20 POS .1"x.1" RECPT.
P1		J19-800-0031	7" 20 COND RIBBON CABLE
	N80P13004B6	J19-199-3070	#6-32x1/4" PHLP. SCREW
		J19-900-0164	KEYPAD/DISPLAY PC BD
		J19-900-0522A	12 HOLE BLK TXRD PANEL
		J19-900-0522B	8 HOLE BLK TXRD PANEL
		J19-900-0522C	4 HOLE BLK TXRD PANEL
		J19-203-0020	12 POS RUBBER KEYPAD
		J19-203-0018	2 POS RUBBER KEYPAD
		J19-900-0518	BLANK BUTTON
		J19-900-0518A	CLOCK BUTTON
		J19-900-0518B	RED ARROW VOLUME BUTTON
		J19-900-0518C	SUPV BUTTON
		J19-900-0518D	INTCM BUTTON
		J19-900-0518E	F-TX BUTTON
		J19-900-0518F	F-RX BUTTON
		J19-900-0518H'	LINE 2 BUTTON
		J19-900-0518I	ALERT BUTTON
		J19-900-0518J	MUTE BUTTON
		J19-900-0518K	SCAN BUTTON
		J19-900-0518L	RF OFF BUTTON
		J19-900-0518M	AUX-1 BUTTON
		J19-900-0518Q	CG BUTTON
		J19-199-4029	#4x1/4 PHLP MACH SCREW
	N80P900506	J19-199-4031	#4x5/16" TRUSS SCREW

PARTS LIST

TONE BASE BOTTOM PLASTICS AND ASSEMBLY
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
TRANSFORMER	N80P13005B6	J19-199-4032	#6-32x5/16" PHLP. SCREW
TRANSFORMER	714225P3 OR N210P13	J19-199-0020	#6-32 HEX NUT
TRANSFORMER		J19-200-0024	BUTT SPLICE
		J19-420-0005	117/240 POWER TRANSF.
		J19-260-0009	6 FT 3 COND BLK PWR CORD
		J19-203-11087	POWER CORD STRAIN RELIEF
		J19-199-6010	GE SERIAL NO. PLATE
		J19-203-1054	1/4" RUBBER FEET
		J19-200-0069	#6-32x.250" INSERT
	N80P13004B4	J19-199-3080	#6-32x1/4" BLK PH SCREW
	N80P5016B6	J19-199-4030	#4x1" BLK PHLP MCH SCREW
		J19-900-0524	BLK TXRD BASE BOTTOM

PARTS LIST

TONE BASE TOP PLASTICS AND ASSEMBLY
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
SPEAKER		J19-199-0040	#6-32 PAL NUT
SPEAKER		J19-222-0016	12" 22AWG GRN STRD WIRE
SPEAKER		J19-233-0024	2 POS .156" RECEPTACLE
		J19-901-0013	4 OHM 3W 3" SQ SPEAKER
		J19-200-0069	#6-32x.250" INSERT
		J19-200-0091	#6-32x.180" INSERT
		J19-199-6011	GE NAMEPLATE
		J19-900-0519A	CRYSTAL 1 2F/VU/CLK
		J19-900-0519B	CRYSTAL 2 4F/VU/CLK
		J19-900-0519C	CRYSTAL 3 2F
		J19-900-0519D	CRYSTAL 4 4F
		J19-900-0519E	CRYSTAL 5 1F
		J19-900-0519F	CRYSTAL 6 1F/VU/CLK
		J19-900-0519I	CYRSTAL 9 VG
		J19-900-0519J	CRYSTAL 10 VG/VU/CLK
		J19-900-0523	BRN TXRD BASE TOP

PARTS LIST

DC BASE TOP PLASTICS AND
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER
SPEAKER		J19-19
SPEAKER		J19-222
SPEAKER		J19-233
		J19-901
		J19-200
		J19-200
		J19-19
		J19-90
		J19-90
		J19-90
		J19-90
		J19-90

PARTS LIST

DC BASE BOTTOM PLASTICS A
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER
TRANSFORMER	N80P13005B6	J19-19
TRANSFORMER	714225P3 OR N210P13	J19-19
TRANSFORMER		J19-20
		J19-42
		J19-26
		J19-20
		J19-19
		J19-20
		J19-20
	N80P13004B4	J19-19
	N80P5016B6	J19-19
		J19-90

PARTS LIST

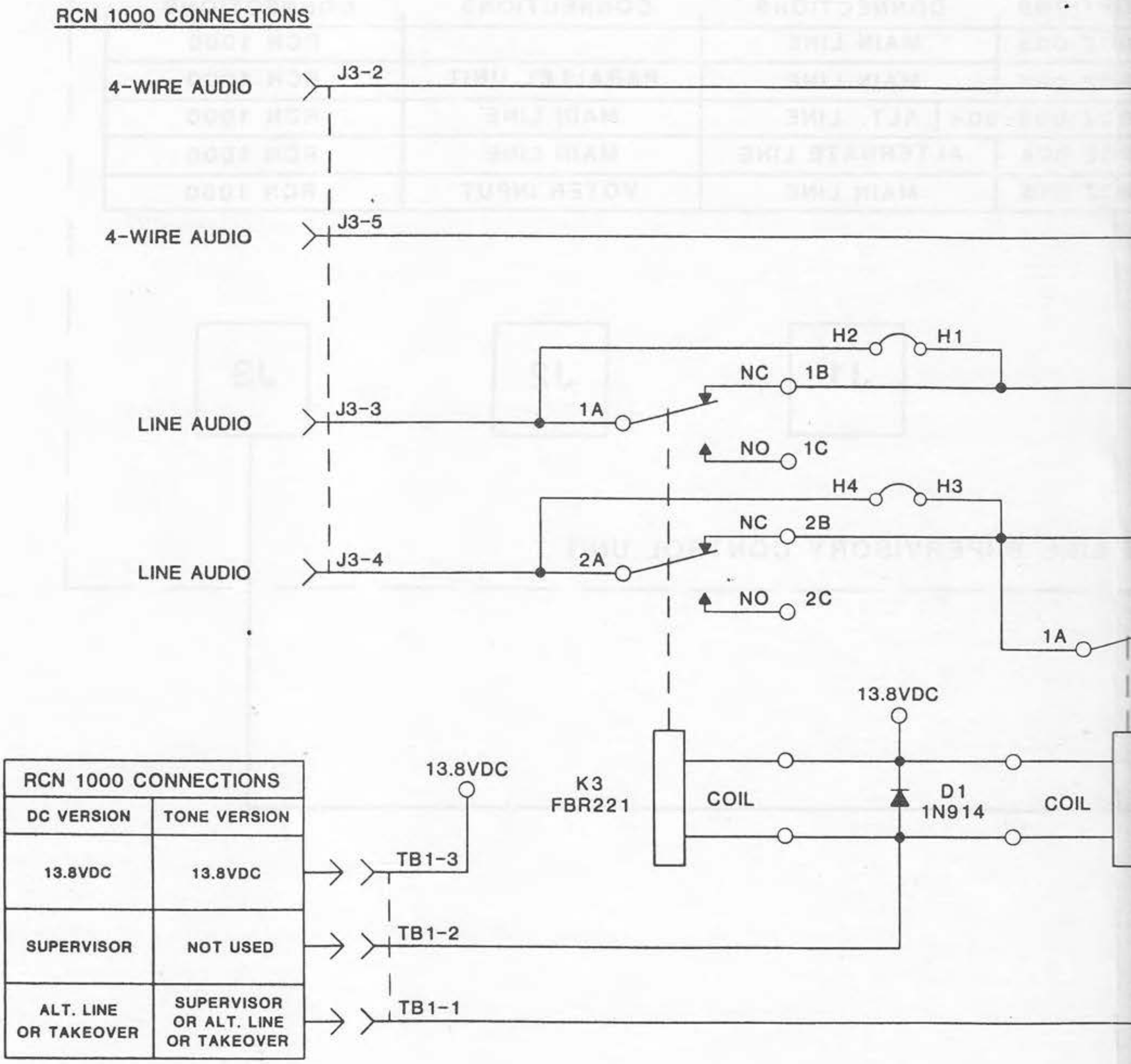
DC BASE TOP PLASTICS AND ASSEMBLY
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
SPEAKER		J19-199-0040	#6-32 PAL NUT
SPEAKER		J19-222-0016	12" 22AWG GRN STRD WIRE
SPEAKER		J19-233-0024	2 POS .156" RECEPTACLE
		J19-901-0013	4 OHM 3W 3" SQ SPEAKER
		J19-200-0069	#6-32x.250" INSERT
		J19-200-0091	#6-32x.180" INSERT
		J19-199-6011	GE NAMEPLATE
		J19-900-0519A	CRYSTAL 1 2F/VU/CLK
		J19-900-0519C	CRYSTAL 3 2F
		J19-900-0519E	CRYSTAL 5 1F
		J19-900-0519F	CRYSTAL 6 1F/VU/CLK
		J19-900-0523	BRN TXRD BASE TOP

PARTS LIST

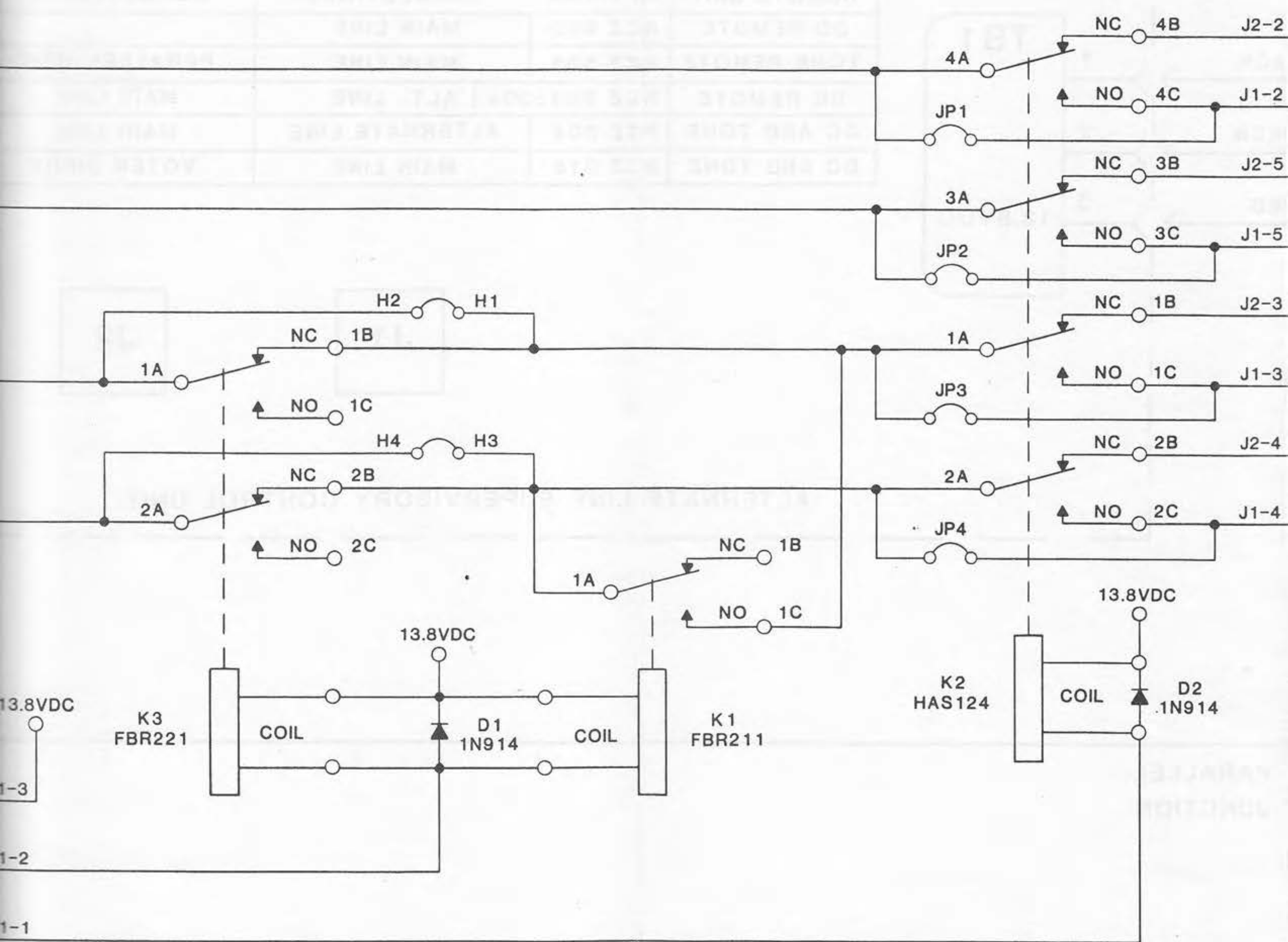
DC BASE BOTTOM PLASTICS AND ASSEMBLY
ISSUE 1

REFERENCE NUMBER	GE NUMBER	VENDOR NUMBER	DESCRIPTION
TRANSFORMER	N80P13005B6	J19-199-4032	#6-32x5/16" PHLP. SCREW
TRANSFORMER	714225P3 OR N210P13	J19-199-0020	#6-32 HEX NUT
TRANSFORMER		J19-200-0024	BUTT SPLICE
		J19-420-0005	117/240 POWER TRANSF.
		J19-260-0009	6 FT 3 COND BLK PWR CORD
		J19-203-1107	POWER CORD STRAIN RELIEF
		J19-199-6010	GE SERIAL NO. PLATE
		J19-203-1054	1/4" RUBBER FEET
		J19-200-0069	#6-32x.250" INSERT
	N80P13004B4	J19-199-3080	#6-32x1/4" BLK PH SCREW
	N80P5016B6	J19-199-4030	#4x1" BLK PHLP MCH SCREW
		J19-900-0524	BLK TXRD BASE BOTTOM

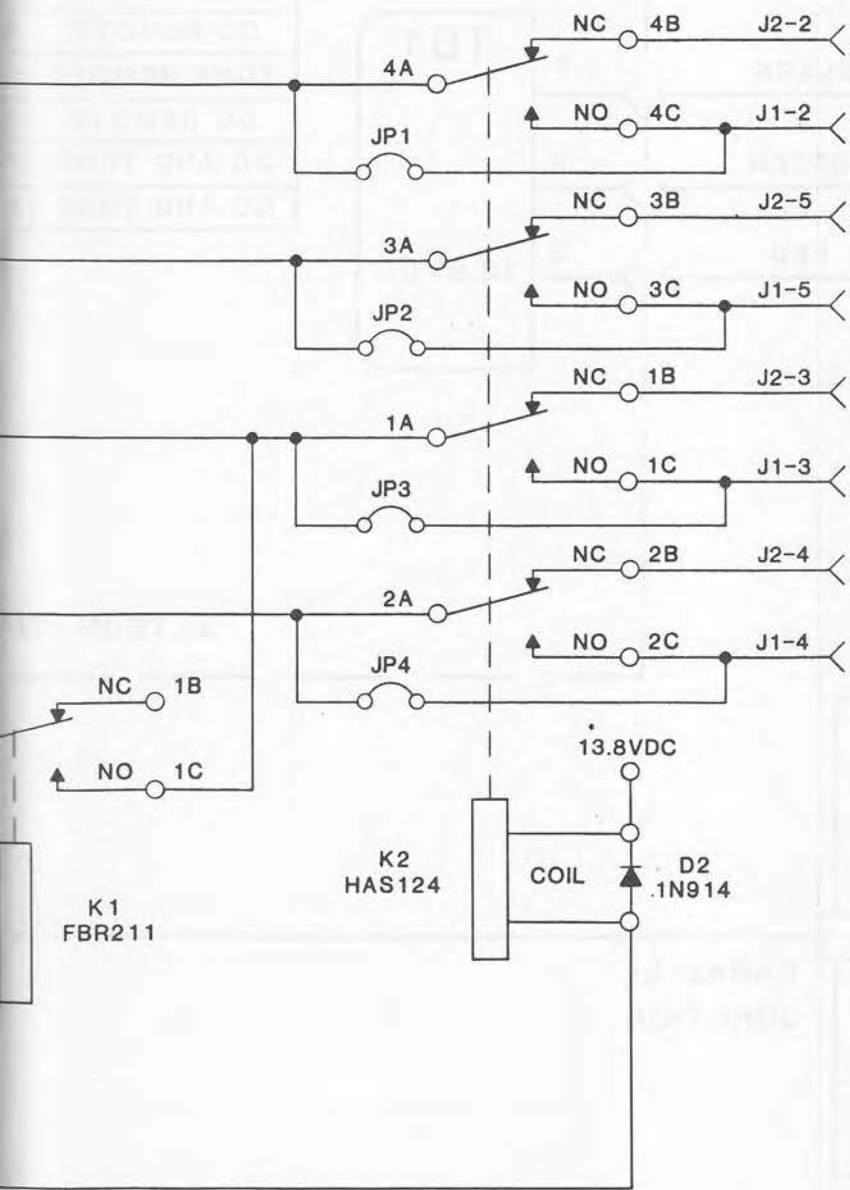


OPTION		PARTS N
NUMBER	FUNCTION	DC VERSIO
RCZ 003	SUPERVISOR	D2,K2,K3
RCZ 004	ALTERNATE LINE	D1,K1,K3,JP1 TH
RCZ 015	TAKEOVER	D1,K1,K3
RCZ 003-004	SUPERVISOR AND ALTERNATE LINE	K3,JP1 THRU

(4163-



OPTION		PARTS NOT USED PER OPTION	
NUMBER	FUNCTION	DC VERSION	TONE VERSION
RCZ 003	SUPERVISOR	D2,K2,K3	D1,K1,K3
RCZ 004	ALTERNATE LINE	D1,K1,K3,JP1 THRU JP4	D1,K1,K3,JP1 THRU JP4
RCZ 015	TAKEOVER	D1,K1,K3	D1,K1,K3
RCZ 003-004	SUPERVISOR AND ALTERNATE LINE	K3,JP1 THRU JP4	NOT AVAILABLE



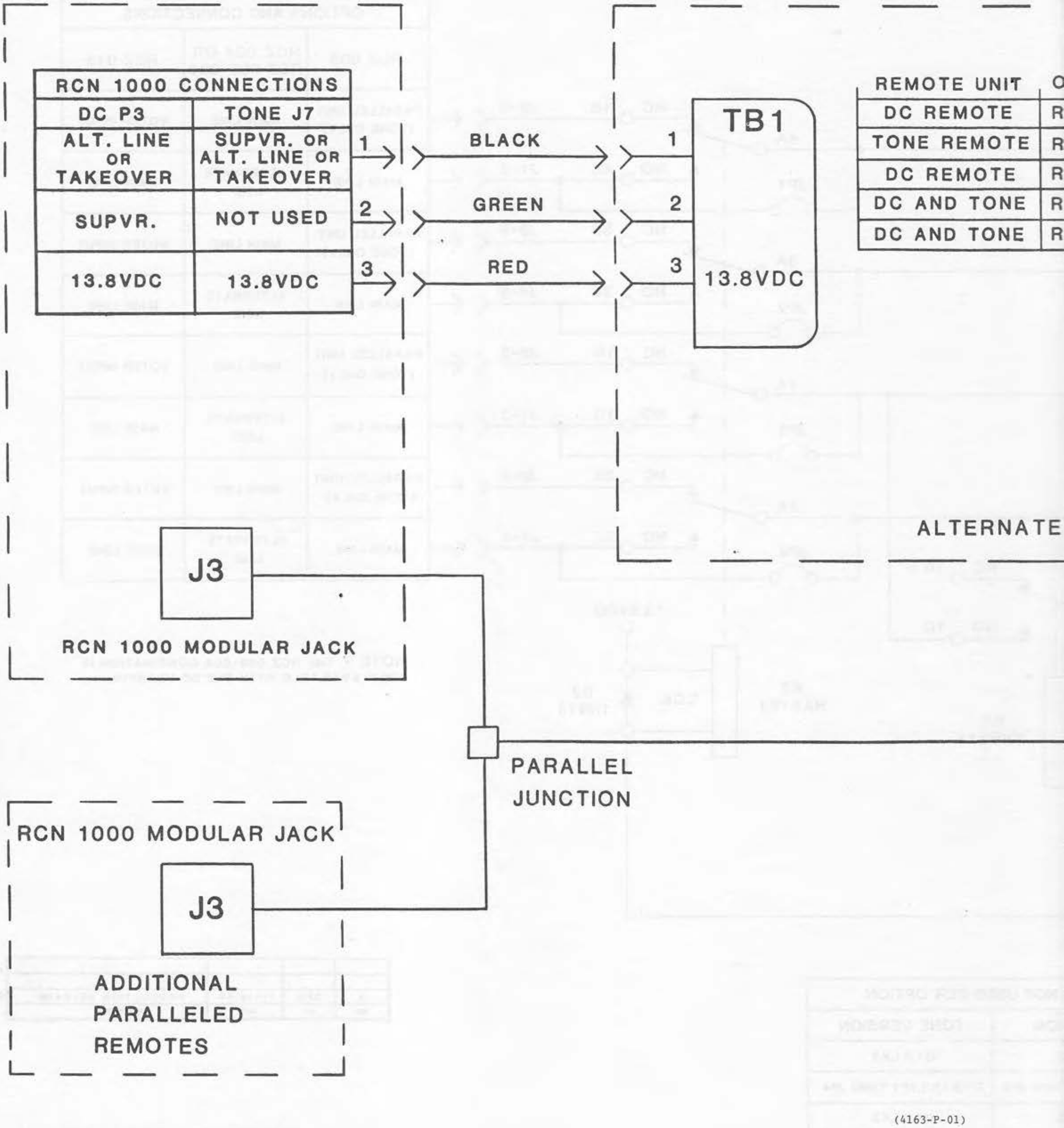
OPTIONS AND CONNECTIONS		
RCZ 003	RCZ 004 OR RCZ 003-004	RCZ 015
PARALLEL UNIT (TONE ONLY)	MAIN LINE	VOTER INPUT
MAIN LINE	ALTERNATE LINE	MAIN LINE
PARALLEL UNIT (TONE ONLY)	MAIN LINE	VOTER INPUT
MAIN LINE	ALTERNATE LINE	MAIN LINE
PARALLEL UNIT (TONE ONLY)	MAIN LINE	VOTER INPUT
MAIN LINE	ALTERNATE LINE	MAIN LINE
PARALLEL UNIT (TONE ONLY)	MAIN LINE	VOTER INPUT
MAIN LINE	ALTERNATE LINE	MAIN LINE

NOTE : THE RCZ 003-004 COMBINATION IS ONLY AVAILABLE WITH THE DC VERSION.

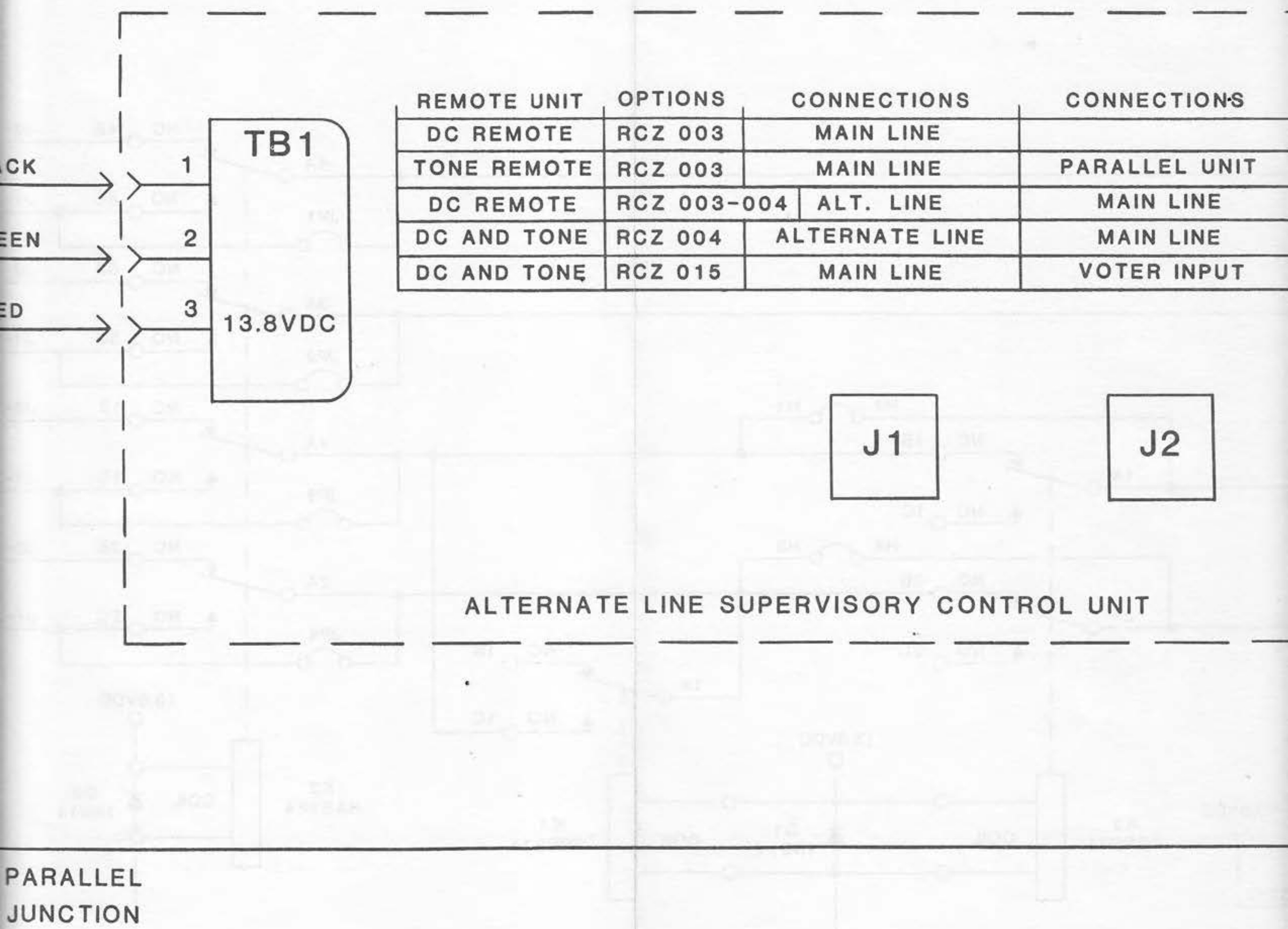
S NOT USED PER OPTION	
SION	TONE VERSION
(3	D1,K1,K3
THRU JP4	D1,K1,K3,JP1 THRU JP4
(3	D1,K1,K3
U JP4	NOT AVAILABLE

REV.	BY	DATE	DESCRIPTION
A	DPR	11/19/87	PRODUCTION RELEASE

ALTERNATE LINE/SUPERVISORY
CONTROL BOARD
J19/900-0169



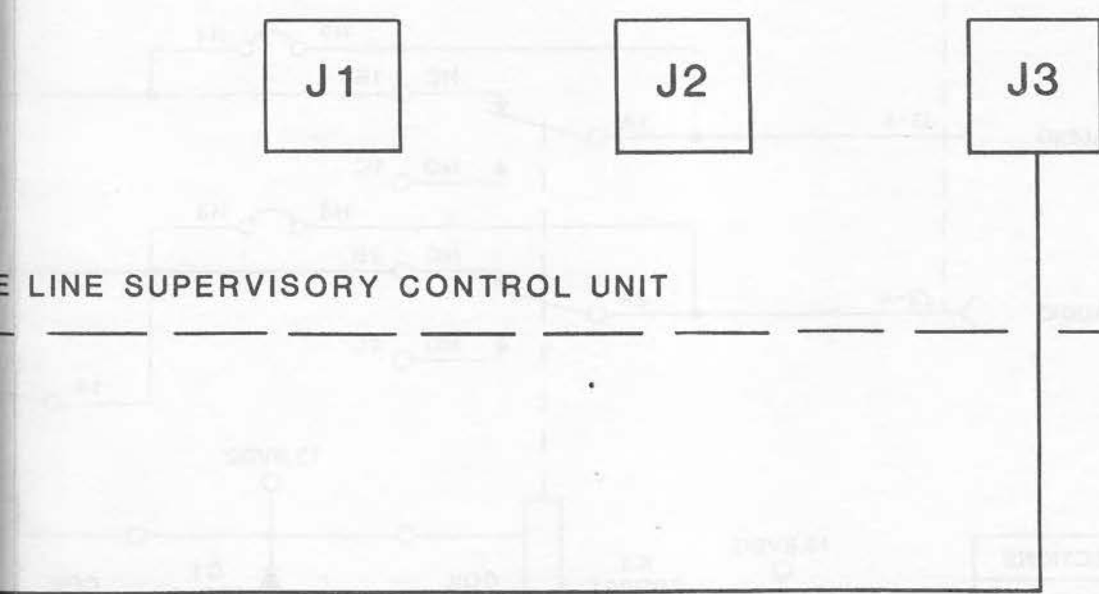
ALTERNATE LINE/SUPERVISORY
CONTROL BOARD
J19/900-0169



REMOTE UNIT	OPTIONS	CONNECTIONS	CONNECTIONS
DC REMOTE	RCZ 003	MAIN LINE	
TONE REMOTE	RCZ 003	MAIN LINE	PARALLEL UNIT
DC REMOTE	RCZ 003-004	ALT. LINE	MAIN LINE
DC AND TONE	RCZ 004	ALTERNATE LINE	MAIN LINE
DC AND TONE	RCZ 015	MAIN LINE	VOTER INPUT

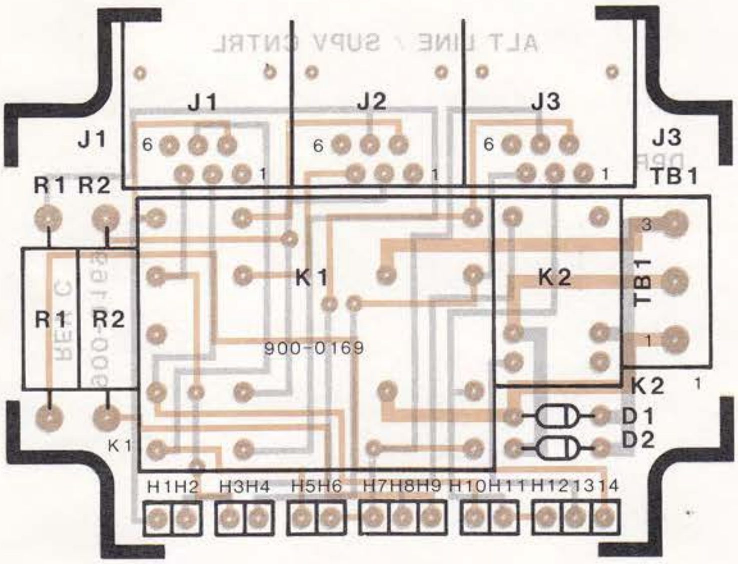
A
REV.

OPTIONS	CONNECTIONS	CONNECTIONS	CONNECTIONS
RCZ 003	MAIN LINE		RCN 1000
RCZ 003	MAIN LINE	PARALLEL UNIT	RCN 1000
RCZ 003-004	ALT. LINE	MAIN LINE	RCN 1000
RCZ 004	ALTERNATE LINE	MAIN LINE	RCN 1000
RCZ 015	MAIN LINE	VOTER INPUT	RCN 1000



E LINE SUPERVISORY CONTROL UNIT

A	JV	11/25/87	INITIAL RELEASE
REV.	BY	DATE	DESCRIPTION



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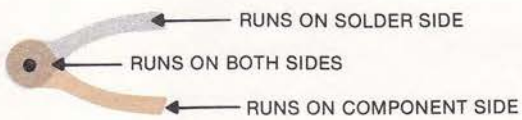
(4163-A-02)
(4163-A-03)



ALTERNATE LINE/SUPERVISORY
CONTROL BOARD
J19/900-0169

COVERAGE

This addendum replaces completely Addendum No. 1 to LBI-31846A which pertained to DC Models of the RCN1000.

INTRODUCTION

This addendum provides information on Revision D to the DC Models of the RCN1000 and on Revision D to the Tone Models of the RCN1000.

DC MODELS

Information Provided

Schematic - Main Board (4 sheets)	Revision D
Schematic - Keypad/Display Board	Revision D
Schematic - Microphone/Handset	Revision D
Schematic - Alt Line/Supv	Revision B
Discussion on Alignment	
Production Changes	

Summary of Production Changes

Initial Production is Revision A. After that several modifications were made to improve operation on some versions of the DC control RCN1000`s.

Revision D removed the squelch circuit and changed the compressor circuit to improve signal-to-noise performance. Also desk microphones were modified to add a 50K pot connected as a rheostat in series with the base of the output amplifier in the microphone. A hole is drilled in the back cover to allow adjustment. This adjustment permits reduction of pickup of room noise.

A modification kit, J19/DC-D, is available from Service Parts to bring earlier revision DC control units up to Revision D.

TONE MODELS

Information Provided

Schematic - Main Board (5 sheets)	Revision D
Schematic - Keypad/Display Board	Revision D
Schematic - Microphone/Handset	Revision D
Schematic - Alt Line/Supv	Revision B
Discussion on Alignment	
Production Changes	

Summary of Production Changes

Initial Production is Revision A. After that several modifications were made to improve operation on some versions of the tone control RCN1000`s.

Revision D removed the squelch circuit and changed the compressor circuit to improve signal-to-noise performance. Also desk microphones were modified to add a 50K pot connected as a rheostat in series with the base of the output amplifier in the microphone. A hole is drilled in the back cover to allow adjustment. This adjustment permits reduction of pickup of room noise.

A modification kit, J19/TONE-D, is available from Service Parts to bring earlier revision tone control units up to Revision D.

DISCUSSION ON ALIGNMENT OF RCN1000 AND STATION PANELS

Although audio levels should be considered on a system basis, it is appropriate to set levels on the remote controller by itself, and the station panel by itself, (both with reference to the levels required by the transmission path) and then connect the controller and station to the transmission path.

This is done because the transmission path (if it is composed of more than a simple wireline pair) is usually set up with a "test tone" and it is customary that the "average voice" level is defined as being a certain number of decibels below the test tone level. The test tone is normally the maximum level that can be sent through the path either without clipping or set by regulation. Although there is no definite agreement as to what the difference in level between test tone and average voice is, we will use 10 dB in our discussion here. Should you desire to use another number you can adjust this discussion to that number.

PROCEDURE

In order to align your RCN1000 and station panel properly, it will be necessary that you have some information about the transmission path. You should know or measure: Its loss at 1000 Hz; Its test tone or maximum level; Its average voice level if defined; and, in the event of a tone remote system, its loss at 2175 Hz.

This will enable you to determine the levels necessary to enter and leave the path at each end; and, thereby, the levels to adjust your remote controller and station panel.

Set Up RCN (microphone to line)

1. Apply 1000 Hz (600 ohm) signal to J2-1 and -2 (gnd) at 1000 millivolts. This is the test tone level. Key PTT. You will find it very convenient to prepare a short length of cable with a modular plug to insert into J2. Key PTT by connecting the lead from J2-4 to the lead from J2-2 (gnd).

2. Terminate output of RCN (J3-3 & 4) with 600 ohms. Again preparing a short length of cable with a modular plug and resistor is very convenient.

3. Set LINE OUT LEVEL (R46 in DC, R64 in tone) at (or below, if desired) the test tone level permitted on the transmission path as measured across the resistor. Note that in the case of the tone remote that the Secur-it tone will be sent at this level (adjust R22 as set out in the maintenance manual if necessary). The Secur-it tone will be 10 dB higher than the function tones. The function tones will be sent at the average voice level. Remove the test modular plug which unkeys PTT.

Set Up RCN (line to speaker)

4. Feed 1000 Hz at a 600 ohm impedance into J3-3 & 4 (J3-2 & 5 if four wire) at the test tone received level.

5. With the Volume Control and the LINE IN LEVEL (R29 in DC, R43 in tone) set to maximum, measure the level across the speaker. Reduce R29/R43 until the meter falls 1.0 dB.

Set Up RCN (Parallel transmit indication on Tone RCN's)

6. Place the most distant RCN1000 in test mode and send Secur-it tone. Reduce DETECTION GAIN (R30) until transmit light goes out. Then increase R30 until it lights and then a little more to give some margin. Remove RCN from test mode.

Set Up Panel (line to transmitter)

7. Feed 1000 Hz (600 ohms) into panel input (TB1201-3 & 4, or 2 & 5 if four wire) at the test tone received level.

8. Preset TRANSMIT LINE INPUT (R85 in DC, R91 in tone) to maximum.

9. Apply an audio voltmeter to the panel output. High to J1203-7 and low to J1203-11. Panel output connected to transmitter.

10. Place SW4 in REM PTT position.

11. Adjust REMOTE TRANSMIT LEVEL (R45 in DC, R34 in tone) for 100 millivolts.

12. Preset R85/R91 to minimum.

13. Increase R85/R91 until the meter reads 79 millivolts (a reduction of 2 dB.). In case of DC panels before Rev. G or tone panels before Rev. K use 50 millivolts (a reduction of 6 dB).

14. Adjust R45/R34 to set 3.0 kHz deviation. Note meter (J1203-7 to -11) reading.

15. Increase R45/R34 so that meter reading doubles (6 dB).

16. Return SW4 to the NORMAL position.

17. Tone units only. To set DECODER LEVEL (R122). Note that the line loss may be up to 8 dB greater at 2175 Hz than it is at 1000 Hz due to the characteristics of the phone circuit. Therefore, R122 should be adjusted to the most distant RCN1000 after connection to the actual circuit to be used. Start with R122 turned up. Then lower R122 by turning CCW until one of the tones (Secur-it, Function, or Hold) does not decode reliably. Then increase R122 slightly to operate properly and and then a little more to give some margin. If an oscilliscope is available, check TP5 to assure that the nearest RCN1000 Secur-it tone is not going into squaring. Prior to revision K, R122 was electrically after R91 so that each change in R91 required that R122 be reset. Also R149 was present before Rev. K and might need adjustment on long or noisy lines.

Set Up Panel (receiver to line)

18. Receive a RF signal from a signal generator with 3.0 kHz of 1000 Hz deviation.

19. Terminate panel output (TB1201-3 & 4) with a 600 ohm resistor.

20. Set RECEIVE LINE OUT (R30 in DC, R81 in tone) for the test tone level across the resistor.

Set Up Panel (repeater)

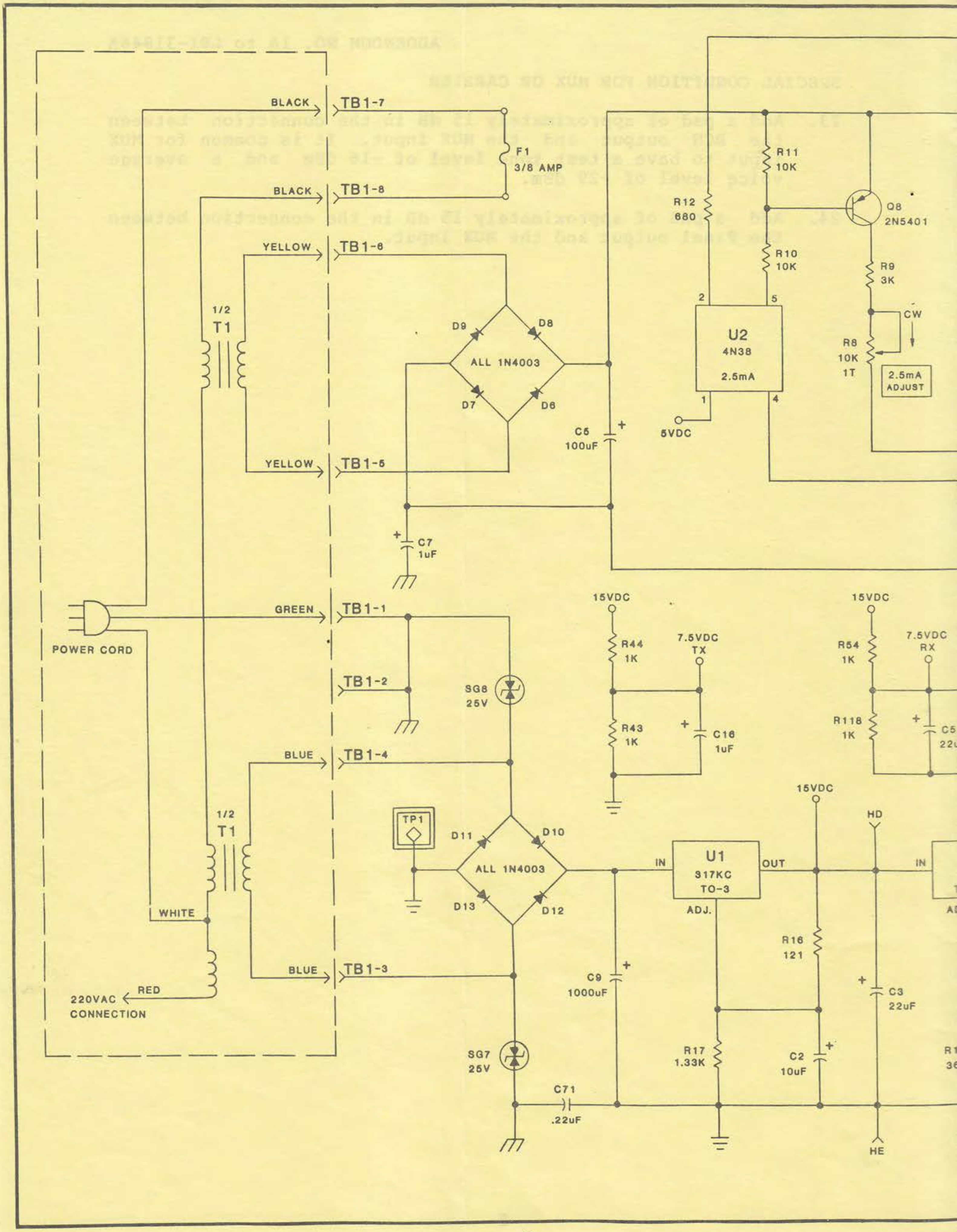
21. Receive a RF signal from a signal generator with 3.0 kHz of 1000 Hz deviation.

22. Adjust REPEATER AUDIO LEVEL (R108 in DC, R83 in tone) for a 3.0 kHz deviation on the transmitter.

SPECIAL CONDITION FOR MUX OR CARRIER

23. Add a pad of approximately 15 dB in the connection between the RCN output and the MUX input. It is common for MUX input to have a test tone level of -16 dBm and a average voice level of -29 dBm.

24. Add a pad of approximately 15 dB in the connection between the Panel output and the MUX input.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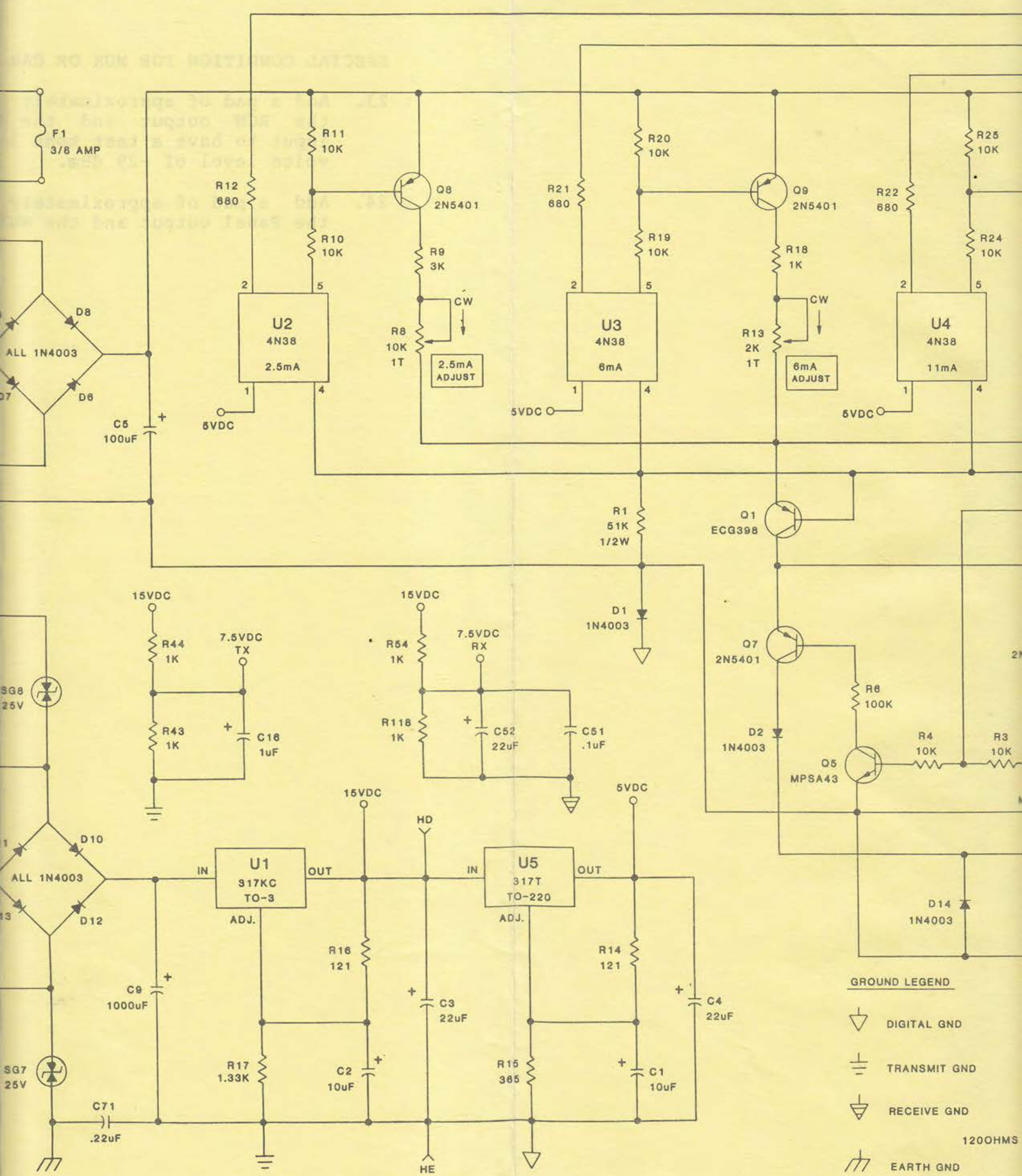
3/8 AMP
BLACK
TB1-8
YELLOW
TB1-6
1/2
T1
D9
D8
ALL 1N4003
D7
D6
YELLOW
TB1-5
C5
100uF
C7
1uF
R11
10K
R12
680
Q8
2N5401
R10
10K
R9
3K
U2
4N38
2.5mA
CW
R8
10K
1T
2.5mA
ADJUST
5VDC
POWER CORD
GREEN
TB1-1
TB1-2
SG8
25V
BLUE
TB1-4
15VDC
R44
1K
7.5VDC
TX
R43
1K
C16
1uF
15VDC
R54
1K
7.5VDC
RX
R118
1K
1/2
T1
TP1
D11
D10
ALL 1N4003
D13
D12
WHITE
BLUE
TB1-3
RED
220VAC
CONNECTION
SG7
25V
C71
.22uF
C9
1000uF
15VDC
IN
U1
317KC
TO-3
OUT
ADJ.
HD
IN
R16
121
C3
22uF
R17
1.33K
C2
10uF
HE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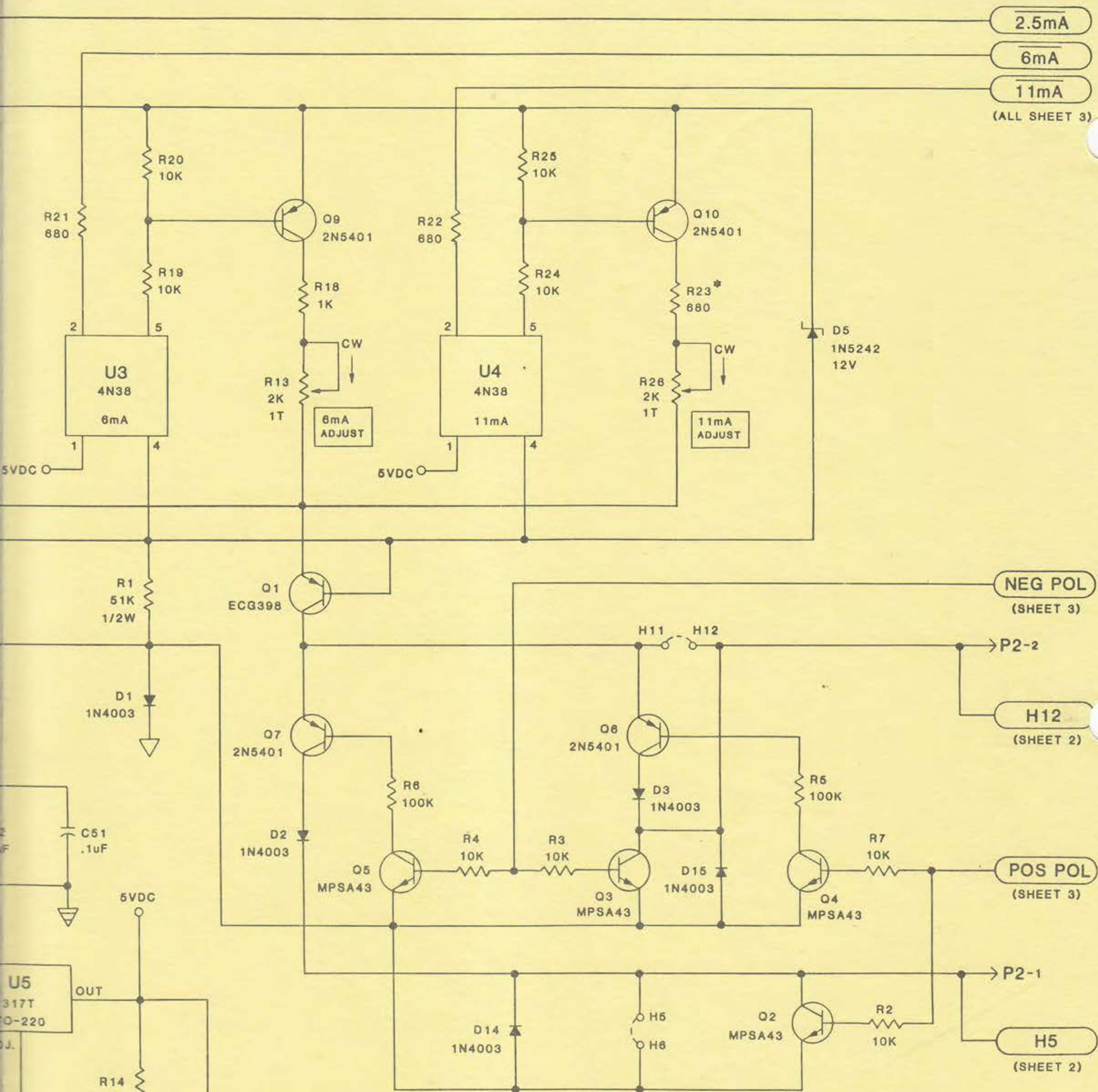
R12
680
R11
10K
R10
10K
Q8
2N5401
R9
3K
R8
10K
1T
CW
2.5mA
ADJUST
U2
4N38
2.5mA
5VDC
ALL 1N4003
D8
D6
C5
100uF
R21
680
R20
10K
R19
10K
U3
4N38
6mA
5VDC
Q9
2N5401
R18
1K
R13
2K
1T
CW
6mA
ADJUST
R22
680
R25
10K
R24
10K
U4
4N38
11mA
5VDC
R1
51K
1/2W
Q1
ECG398
D1
1N4003
Q7
2N5401
R6
100K
D2
1N4003
Q5
MPSA43
R4
10K
R3
10K
15VDC
R44
1K
7.5VDC
TX
R43
1K
C16
1uF
SG8
25V
15VDC
R54
1K
7.5VDC
RX
R118
1K
C52
22uF
C51
.1uF
15VDC
HD
5VDC
D10
ALL 1N4003
D12
IN
U1
317KC
TO-3
OUT
ADJ.
IN
U5
317T
TO-220
OUT
ADJ.
R16
121
C3
22uF
R14
121
C4
22uF
C9
1000uF
R17
1.33K
C2
10uF
R15
365
C1
10uF
SG7
25V
C71
.22uF
HE
D14
1N4003
GROUND LEGEND
DIGITAL GND
TRANSMIT GND
RECEIVE GND
EARTH GND
120OHMS



GROUND LEGEND

DIGITAL GND

TRANSMIT GND

RECEIVE GND

120OHMS

EARTH GND

*NOTE:
FOR 15mA APPLICATIONS (LIMITS TOTAL LOOP RESISTANCE TO 8000 OHMS) CHANGE R23 TO 120 OHMS .

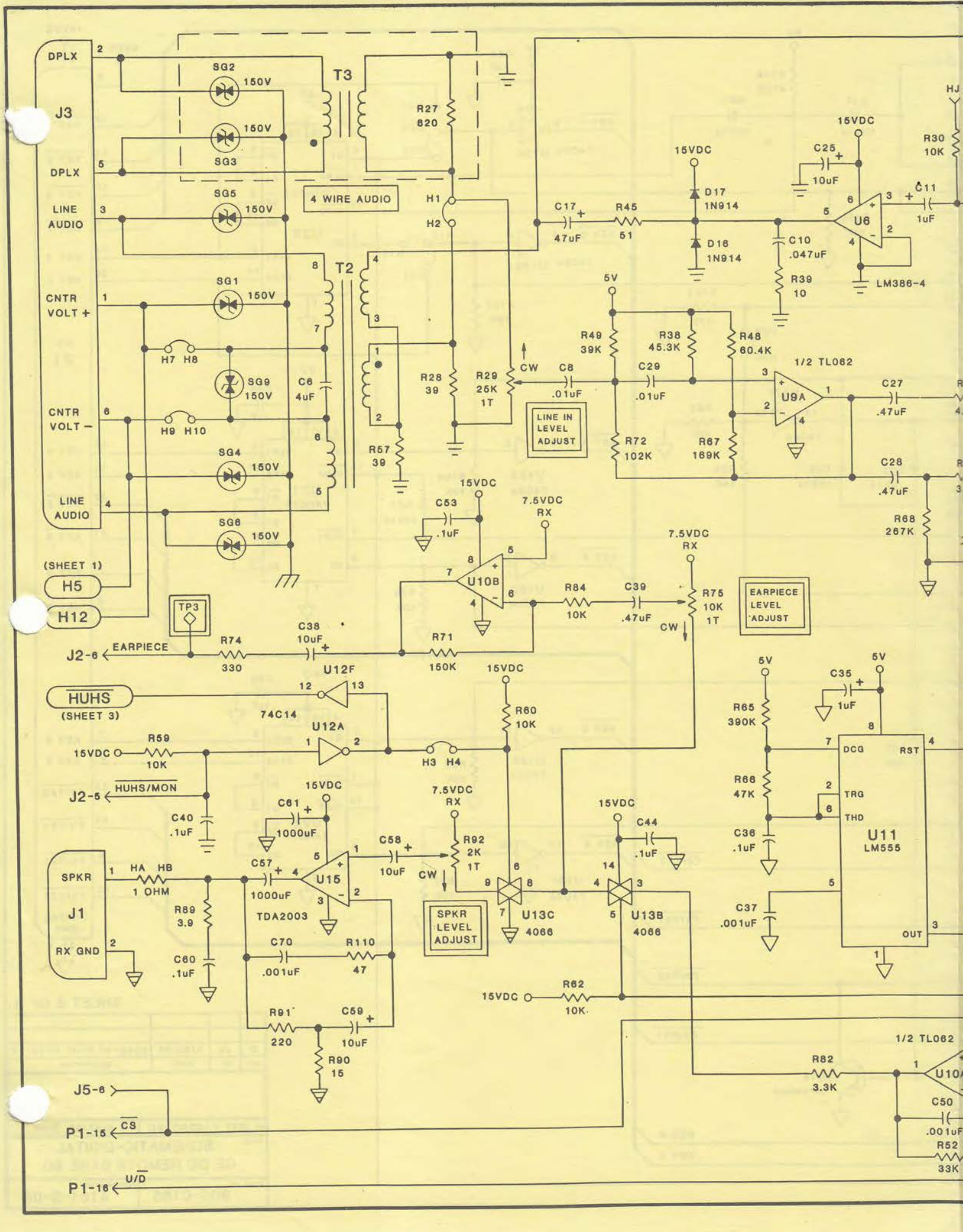
SHEET 1 OF 4

REV	BY	DATE	DESCRIPTION
D	JV	9/23/88	0048-10 PLUS 0039-16

BY JEFF VANDROVEC DATE 8/11/88

TITLE SCHEMATIC-POWER SUPPLY GE DC REMOTE BASE BD.

PART NO. 900-0165 DOCUMENT NO. 4161-S-03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DPLX
LINE AUDIO
CNTR VOLT +
CNTR VOLT −
SG2 150V
SG3 150V
SG5 150V
SG1 150V
SG9 150V
SG4 150V
SG6 150V
T3
T2
4 WIRE AUDIO
R27 820
H1
H2
H7 H8
H9 H10
C6 4uF
R28 39
R57 39
R29 25K 1T
CW
C8 .01uF
LINE IN LEVEL ADJUST
C17 47uF
R45 51
15VDC
D17 1N914
D16 1N914
C10 .047uF
R39 10
C25 10uF
U6
LM386-4
C11 1uF
R30 10K
HJ
5V
R49 39K
R38 45.3K
R48 60.4K
C29 .01uF
1/2 TL062
U9A
C27 .47uF
C28 .47uF
R72 102K
R67 169K
R68 267K
(SHEET 1)
H5
H12
TP3
C53 .1uF
7.5VDC RX
U10B
R84 10K
C39 .47uF
R75 10K 1T
EARPIECE LEVEL ADJUST
J2-6
EARPIECE
R74 330
C38 10uF
R71 150K
HUHS
(SHEET 3)
U12F
74C14
U12A
R59 10K
H3 H4
R60 10K
J2-5
HUHS/MON
C40 .1uF
C61 1000uF
C58 10uF
R92 2K 1T
SPKR LEVEL ADJUST
C44 .1uF
U13C 4066
U13B 4066
R65 390K
R66 47K
C36 .1uF
C35 1uF
C37 .001uF
U11 LM555
DCG
RST
TRG
THD
OUT
J1
SPKR
RX GND
HA HB
1 OHM
R89 3.9
C60 .1uF
C57 1000uF
U15
TDA2003
C70 .001uF
R110 47
R91 220
C59 10uF
R90 15
R62 10K
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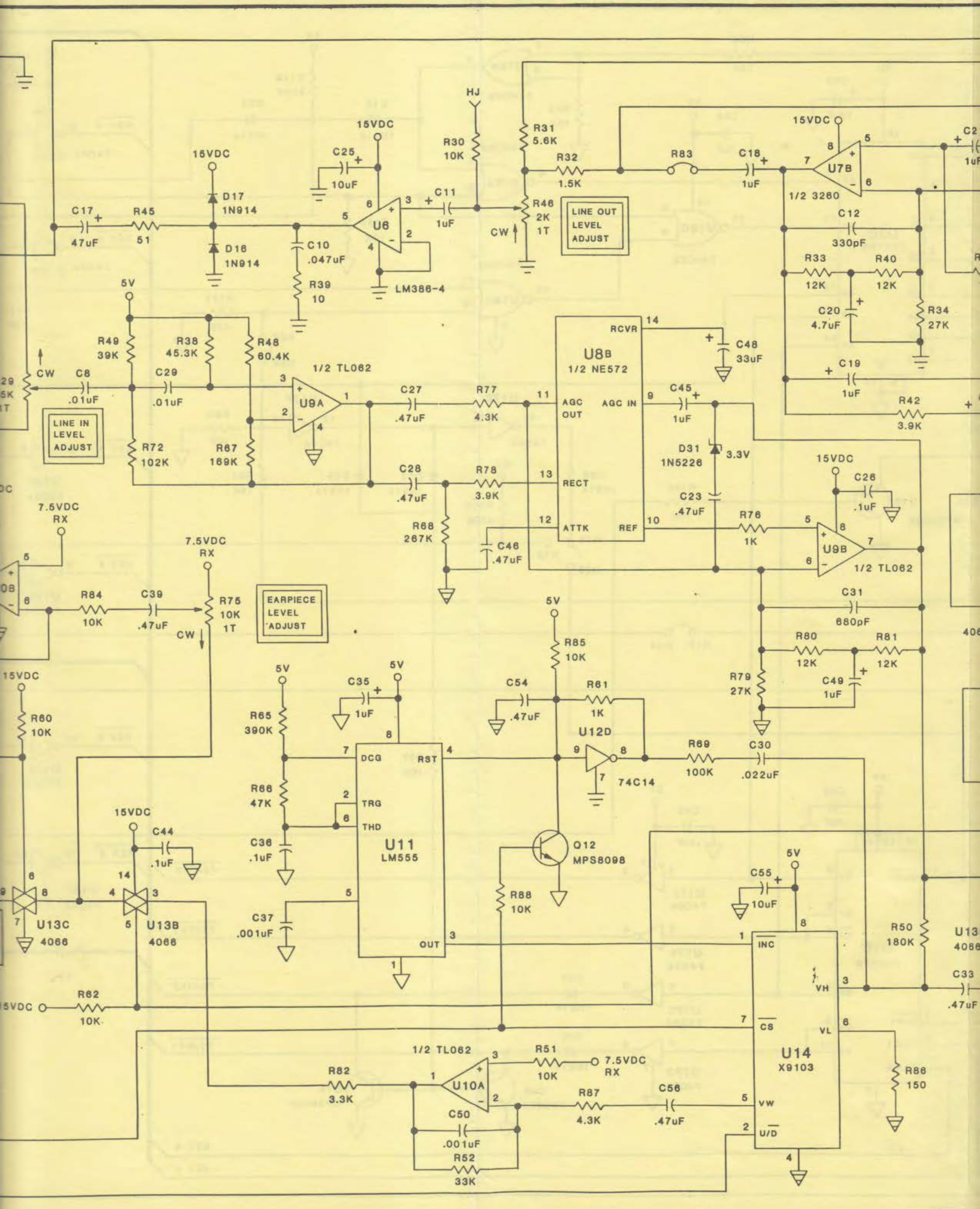
J5-6
P1-15
CS
P1-16
U/D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C25
10uF
U6
LM386-4
C11
1uF
R30
10K
R31
5.6K
R46
2K
1T
CW
LINE OUT
LEVEL
ADJUST
R32
1.5K
R83
C18
1uF
U7B
1/2 3260
C12
330pF
R33
12K
R40
12K
C20
4.7uF
R34
27K
C19
1uF
R42
3.9K
C17
47uF
R45
51
D17
1N914
D16
1N914
C10
.047uF
R39
10
5V
R49
39K
R38
45.3K
R48
60.4K
1/2 TL062
U9A
C8
.01uF
C29
.01uF
LINE IN
LEVEL
ADJUST
R72
102K
R67
169K
C27
.47uF
R77
4.3K
C28
.47uF
R78
3.9K
R68
267K
C46
.47uF
U8B
1/2 NE572
RCVR
AGC
OUT
AGC IN
RECT
ATTK
REF
C48
33uF
C45
1uF
D31
1N5226
3.3V
C23
.47uF
R76
1K
U9B
1/2 TL062
C26
.1uF
C31
680pF
R80
12K
R81
12K
R79
27K
C49
1uF
7.5VDC
RX
R84
10K
C39
.47uF
R75
10K
1T
EARPIECE
LEVEL
ADJUST
R85
10K
C54
.47uF
R61
1K
U12D
74C14
R69
100K
C30
.022uF
R60
10K
R65
390K
R66
47K
C35
1uF
DCG
RST
TRG
THD
U11
LM555
OUT
C36
.1uF
C37
.001uF
Q12
MPS8098
R88
10K
C44
.1uF
U13C
4066
U13B
4066
R62
10K
C55
10uF
INC
VH
CS
VL
VW
U/D
U14
X9103
R50
180K
C33
.47uF
R86
150
R82
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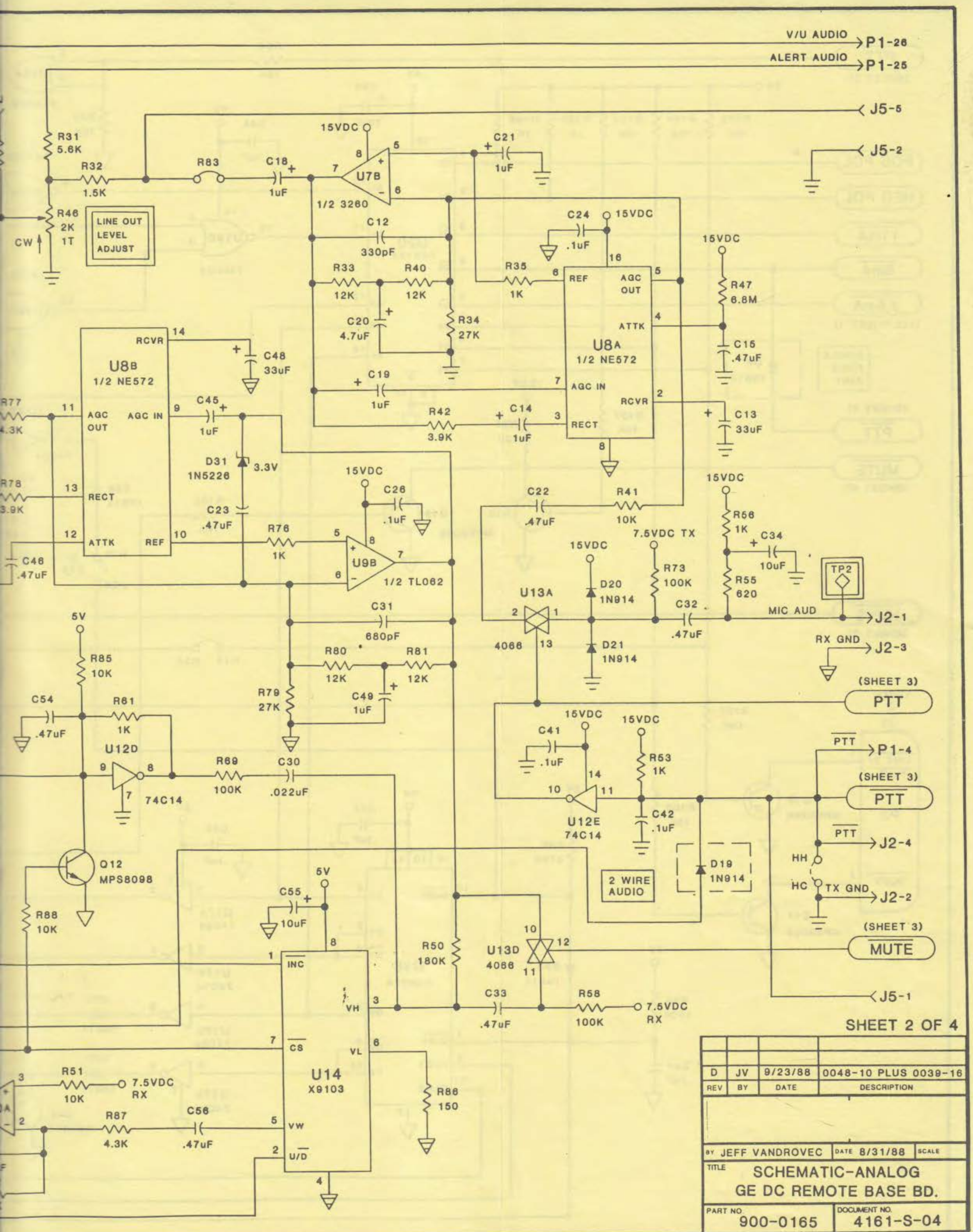
U10A
R51
10K
R87
4.3K
C56
.47uF
C50
.001uF
R52
33K


V/U AUDIO
P1-26
ALERT AUDIO
P1-25
J5-5
J5-2
R31 5.6K
R32 1.5K
R83
C18 1uF
15VDC
U7B
1/2 3260
C21 1uF
R46 2K 1T
CW
LINE OUT LEVEL ADJUST
C12 330pF
C24 .1uF
15VDC
R33 12K
R40 12K
R35 1K
C20 4.7uF
R34 27K
R47 6.8M
C15 .47uF
U8A
1/2 NE572
REF
AGC OUT
ATTK
AGC IN
RCVR
RECT
C19 1uF
R42 3.9K
C14 1uF
C13 33uF
U8B
1/2 NE572
RCVR
AGC OUT
AGC IN
RECT
ATTK
REF
C48 33uF
C45 1uF
R77 4.3K
R78 3.9K
C46 .47uF
D31 1N5226 3.3V
C23 .47uF
R76 1K
U9B
1/2 TL062
C26 .1uF
C22 .47uF
R41 10K
R56 1K
C34 10uF
R55 620
TP2
R73 100K
7.5VDC TX
D20 1N914
D21 1N914
U13A 4066
C32 .47uF
MIC AUD
J2-1
RX GND
J2-3
C31 680pF
R80 12K
R81 12K
C49 1uF
R79 27K
5V
R85 10K
C54 .47uF
R61 1K
U12D 74C14
R69 100K
C30 .022uF
(SHEET 3)
PTT
C41 .1uF
R53 1K
U12E 74C14
C42 .1uF
PTT
P1-4
(SHEET 3)
PTT
PTT
J2-4
HH
HC
TX GND
J2-2
D19 1N914
2 WIRE AUDIO
Q12 MPS8098
R88 10K
C55 10uF
5V
R50 180K
U13D 4066
(SHEET 3)
MUTE
J5-1
INC
VH
CS
VL
VW
U/D
U14 X9103
C33 .47uF
R58 100K
7.5VDC RX
R51 10K
7.5VDC RX
R87 4.3K
C56 .47uF
R86 150
SHEET 2 OF 4
D JV 9/23/88 0048-10 PLUS 0039-16
REV BY DATE DESCRIPTION
BY JEFF VANDROVEC DATE 8/31/88 SCALE
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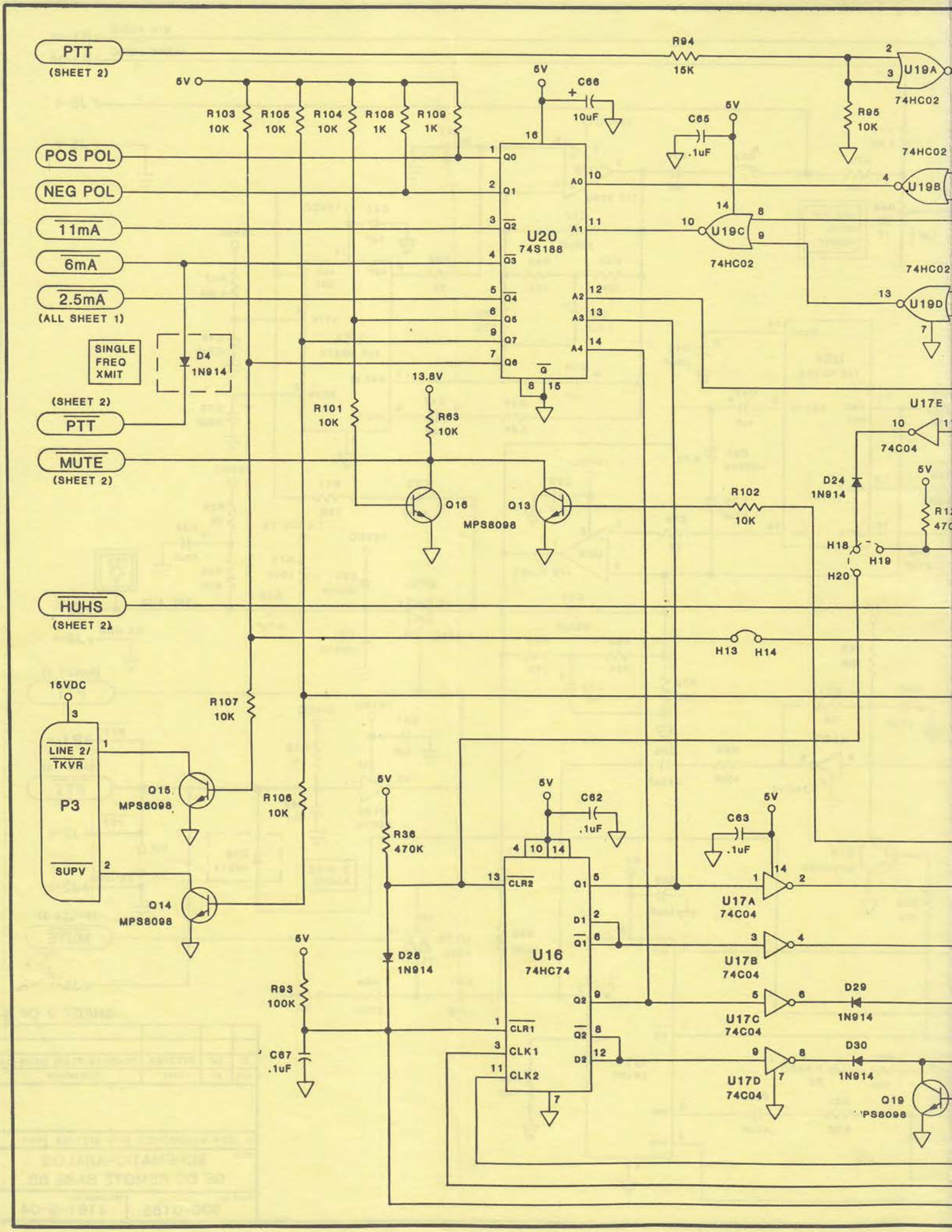
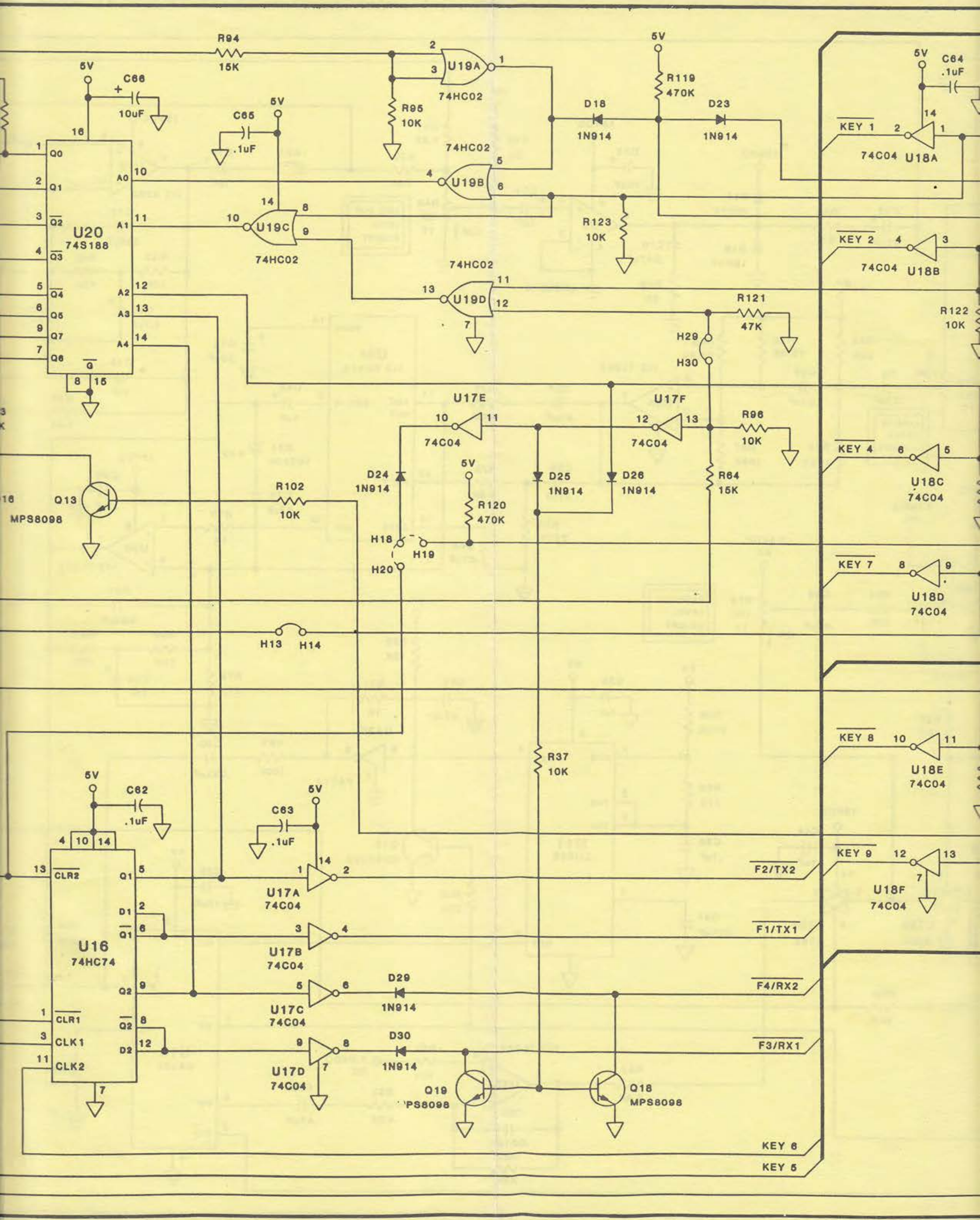
PART NO. 900-0165
DOCUMENT NO. 4161-S-04


PTT
(SHEET 2)
POS POL
NEG POL
11mA
6mA
2.5mA
(ALL SHEET 1)
SINGLE FREQ XMIT
D4 1N914
(SHEET 2)
PTT
MUTE
(SHEET 2)
HUHS
(SHEET 2)
15VDC
LINE 2/ TKVR
P3
SUPV
Q15 MPS8098
Q14 MPS8098
5V
R103 10K
R105 10K
R104 10K
R108 1K
R109 1K
R101 10K
13.8V
R63 10K
Q16
Q13
MPS8098
R107 10K
R106 10K
R36 470K
D28 1N914
R93 100K
C67 .1uF
U20
74S188
C66 10uF
R94 15K
R95 10K
U19A
74HC02
U19B
U19C
U19D
C65 .1uF
U17E
74C04
D24 1N914
R102 10K
H18
H19
H20
H13
H14
U16
74HC74
C62 .1uF
C63 .1uF
U17A 74C04
U17B 74C04
U17C 74C04
U17D 74C04
D29 1N914
D30 1N914
Q19
'PS8098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5V
C66
10uF
U20
74S188
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Q1
Q2
Q3
Q4
Q5
Q7
Q6
A0
A1
A2
A3
A4
G
U19A
74HC02
R95
10K
C65
.1uF
U19B
74HC02
U19C
74HC02
U19D
74HC02
R119
470K
D18
1N914
D23
1N914
R123
10K
R121
47K
H29
H30
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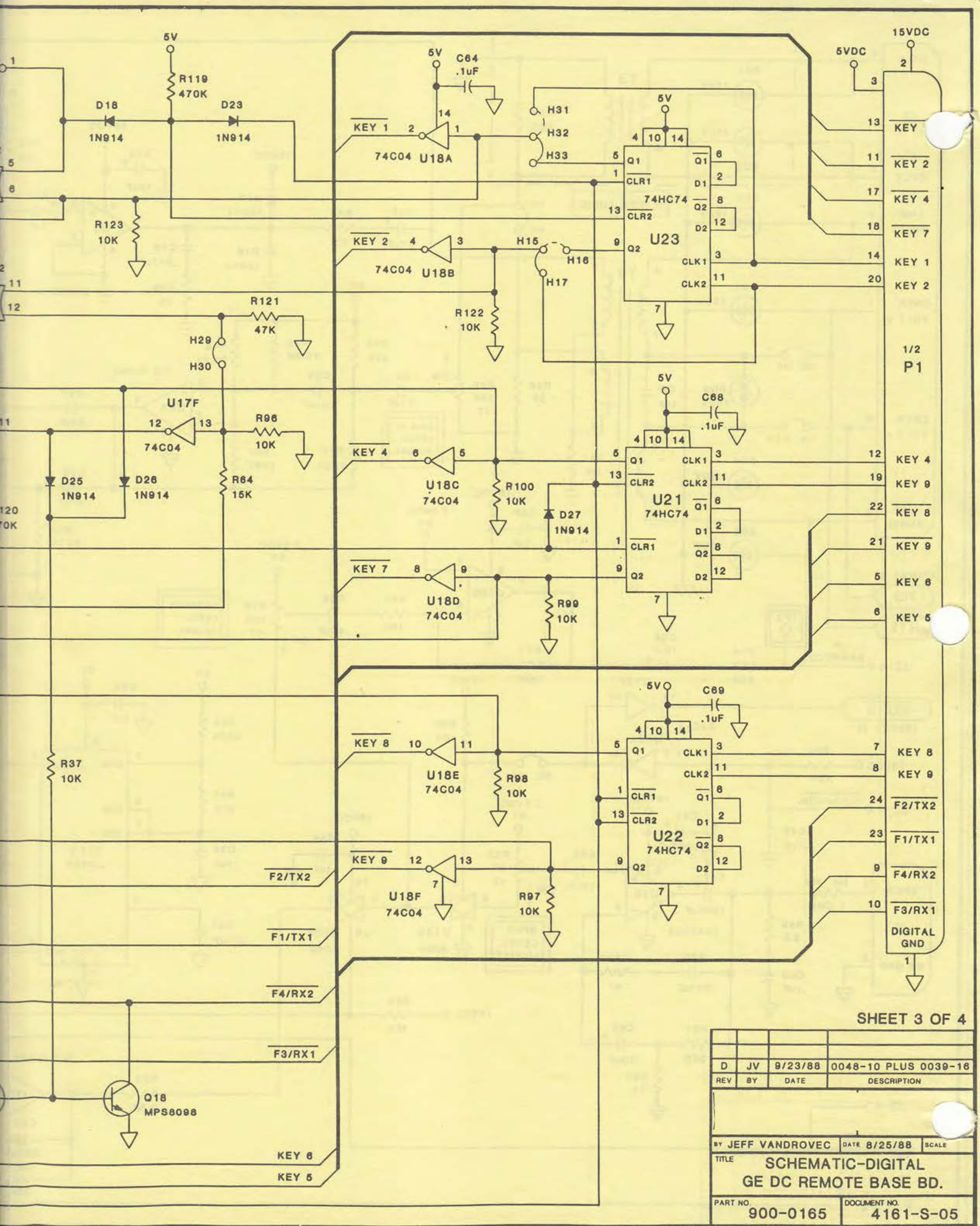
74C04
U17F
74C04
R96
10K
R64
15K
D24
1N914
D25
1N914
D26
1N914
R120
470K
R102
10K
Q13
MPS8098
H18
H19
H20
H13
H14
R37
10K
C62
.1uF
C63
.1uF
U16
74HC74
CLR2
CLR1
CLK1
CLK2
D1
D2
U17A
74C04
U17B
74C04
U17C
74C04
U17D
74C04
D29
1N914
D30
1N914
Q19
MPS8098
Q18
MPS8098
C64
.1uF
KEY 1
U18A
74C04
KEY 2
U18B
74C04
R122
10K
KEY 4
U18C
74C04
KEY 7
U18D
74C04
KEY 8
U18E
74C04
KEY 9
U18F
74C04
F2/TX2
F1/TX1
F4/RX2
F3/RX1
KEY 6
KEY 5



SHEET 3 OF 4

REV	BY	DATE	DESCRIPTION
D	JV	9/23/88	0048-10 PLUS 0039-16

BY JEFF VANDROVEC — DATE 8/25/88 — SCALE

TITLE SCHEMATIC-DIGITAL GE DC REMOTE BASE BD.

PART NO. 900-0165 — DOCUMENT NO. 4161-S-05

JUMPER SCHEDULE

NUMBER	FUNCTION
HA TO HB	REMOVED FOR RCZ014 (TONE CABLE)
HC TO HH	INSTALLED FOR TESTING AND SET-UP
H1 TO H2	REMOVED FOR RCZ005 (4-WIRE)
H3 TO H4	REMOVED WHEN DIGIT 6 IS M (DESK MIC)
H5 TO H6	NOT INSTALLED
H7 TO H8 & H9 TO H10	REMOVED FOR METHOD 3 INSTALLATIONS
H11 TO H12	INSTALLED WHEN DIGIT 4 IS A 1 AND DIGIT 5 IS AN S (NO PROM)
H13 TO 14	INSTALLED FOR RCZ004 (SUPV) IN OTHER THAN A 3 ROW MODEL
H15 TO H16	INSTALLED WHEN DIGIT 5 IS G (CG) LATCHED MODE
H15 TO H17	INSTALLED WHEN DIGIT 5 IS G (CG) MOMENTARY MODE
H18 TO H19	INSTALLED TO TURN OFF KEY 4 LED WHEN HUHS LINE BECOMES ACTIVE
H18 TO H20	INSTALLED TO RESTORE RX1 AND RX2 TO POWER UP CONDITION WHEN HUHS LINE BECOMES ACTIVE
H29 TO H30	INSTALLED WHEN DIGIT 6 IS M (DESK MIC)
H31 TO H32	INSTALLED FOR RCZ012 (INTCM) LATCHED MODE
H32 TO H33	INSTALLED FOR RCZ012 (INTCM) MOMENTARY MODE

TONE

CONNECTION N

HA
HB
HC
HD
HE
HH
HJ

LAST US

C71
D31

VALUE

C8
.47u

G

DIGITAL

TRANS

(TONE CABLE)

ING AND SET-UP

(4-WIRE)

6 IS M

3

IT 4 IS A 1
S (NO PROM)

04 (SUPV)
ROW MODEL

IT 5 IS G (CG)

IT 5 IS G (CG)

FF KEY 4 LED
MES ACTIVE

RE RX1 AND RX2
ION WHEN HUHS
E

IT 6 IS M

2 (INTCM)

2 (INTCM)

TONE CABLE CONNECTIONS

CONNECTION NUMBER	DESCRIPTION
HA	SPEAKER OUT
HB	SPEAKER IN
HC	MIC LO & SPEAKER LO
HD	15VDC
HE	GROUND
HH	PTT
HJ	MIC HI

LAST USED REFERENCE NUMBERS

C71	Q19	SG9	H33
D31	R125	U24	TP3

VALUES FOR 4 WIRE AUDIO

C8	C29	R48
.47uF	JUMPER	1M

GROUND SYMBOLS

DIGITAL　　TRANSMIT　　RECEIVE　　EARTH

CABLE CONNECTIONS

NUMBER	DESCRIPTION
	SPEAKER OUT
	SPEAKER IN
	MIC LO & SPEAKER LO
	15VDC
	GROUND
	PTT
	MIC HI

SED REFERENCE NUMBERS

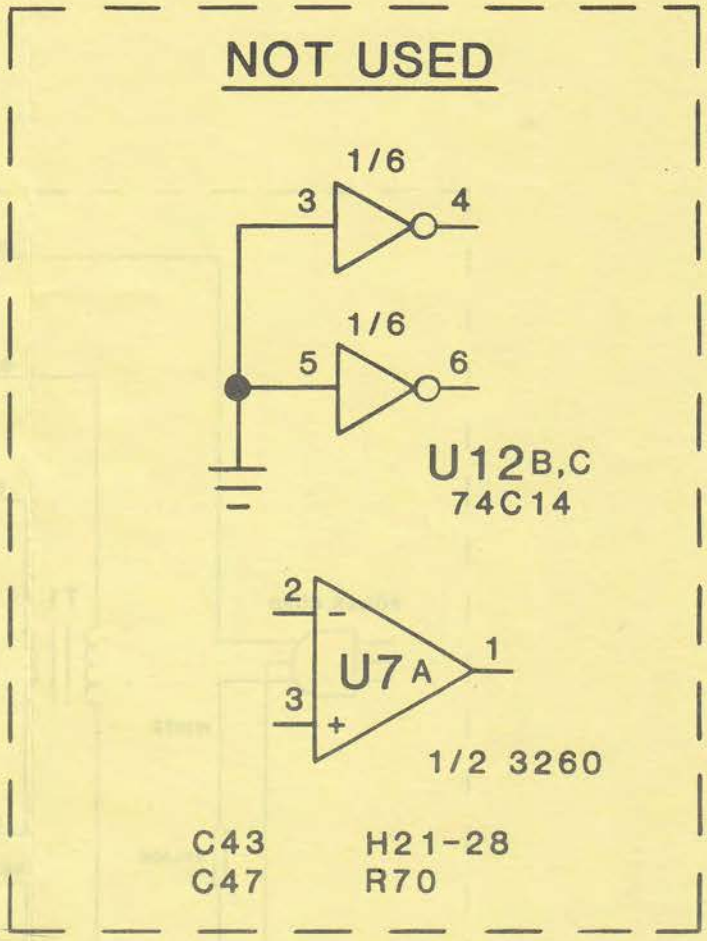
Q19	SG9	H33
R125	U24	TP3

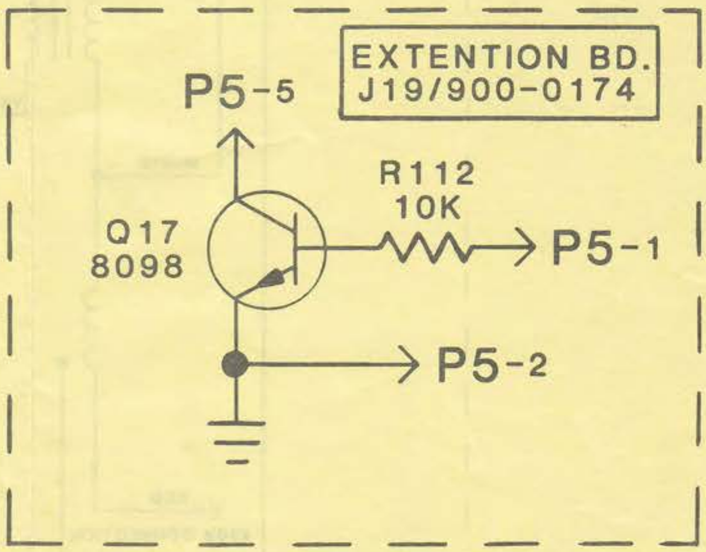
ES FOR 4 WIRE AUDIO

	C29	R48
F	JUMPER	1M

ROUND SYMBOLS

SMIT	RECEIVE	EARTH





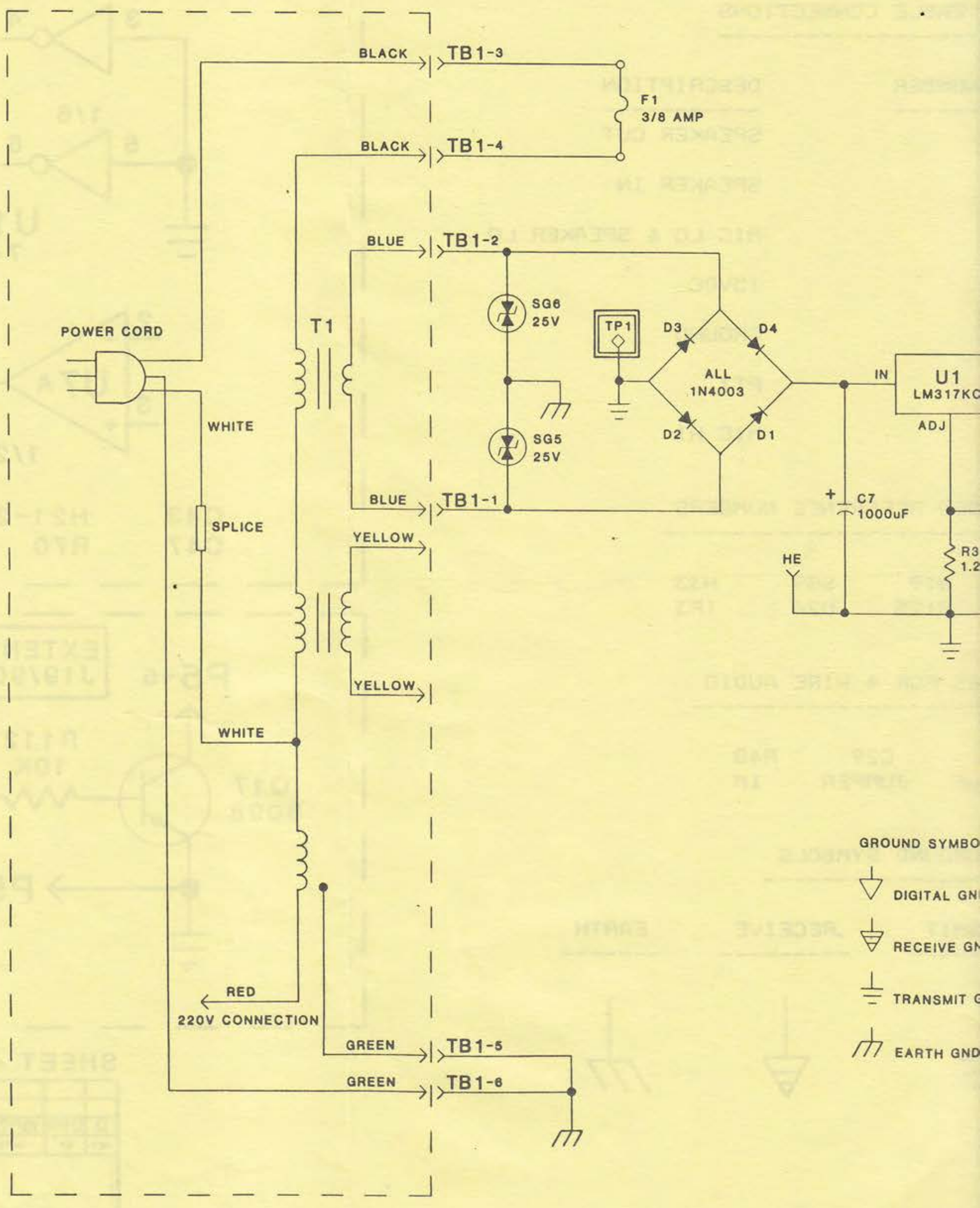
SHEET 4 OF 4

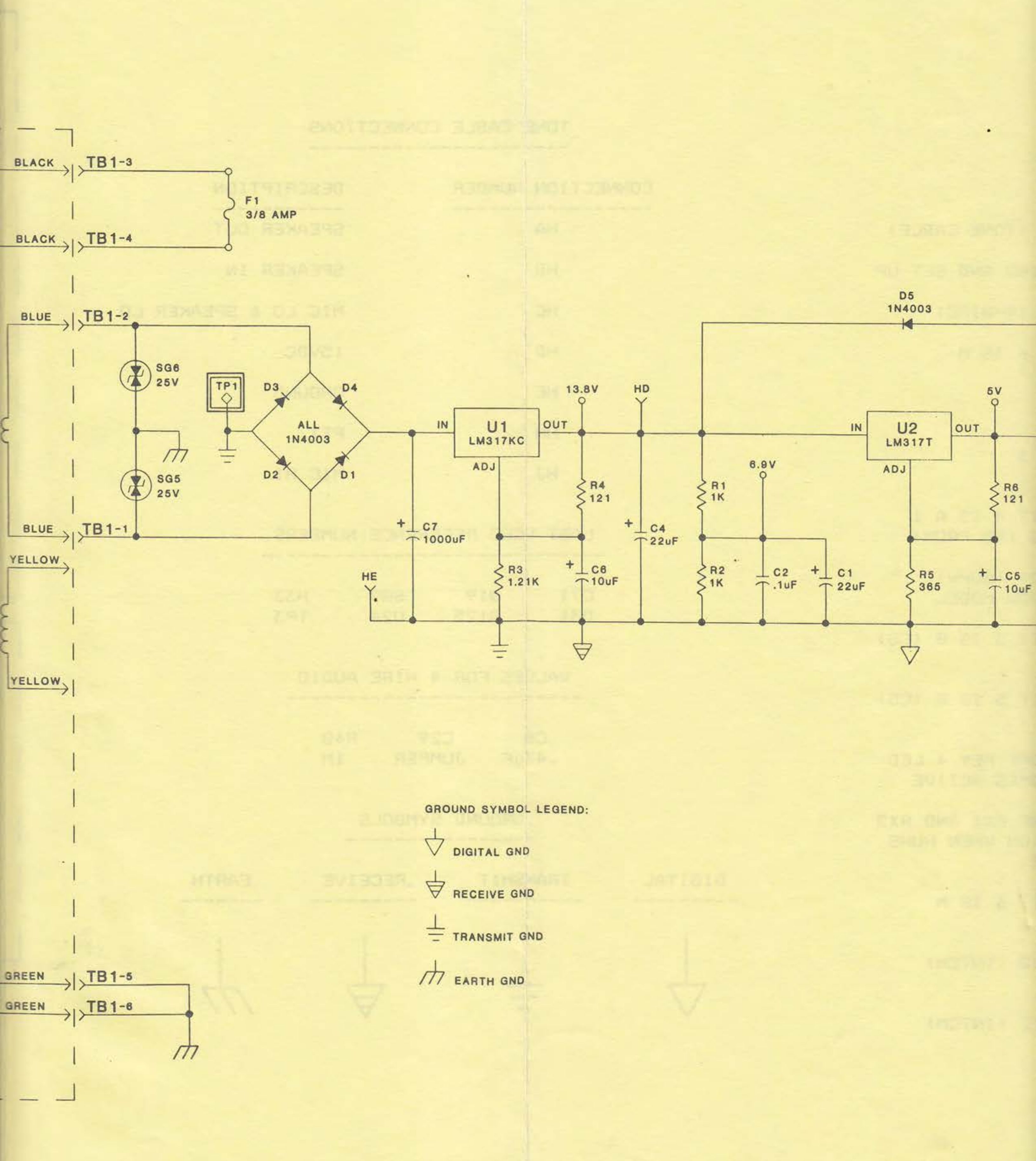
REV	BY	DATE	DESCRIPTION
D	DPR	10/17/88	0048-10,0039-16

BY DARRIN RUDE DATE 10/17/88 SCALE

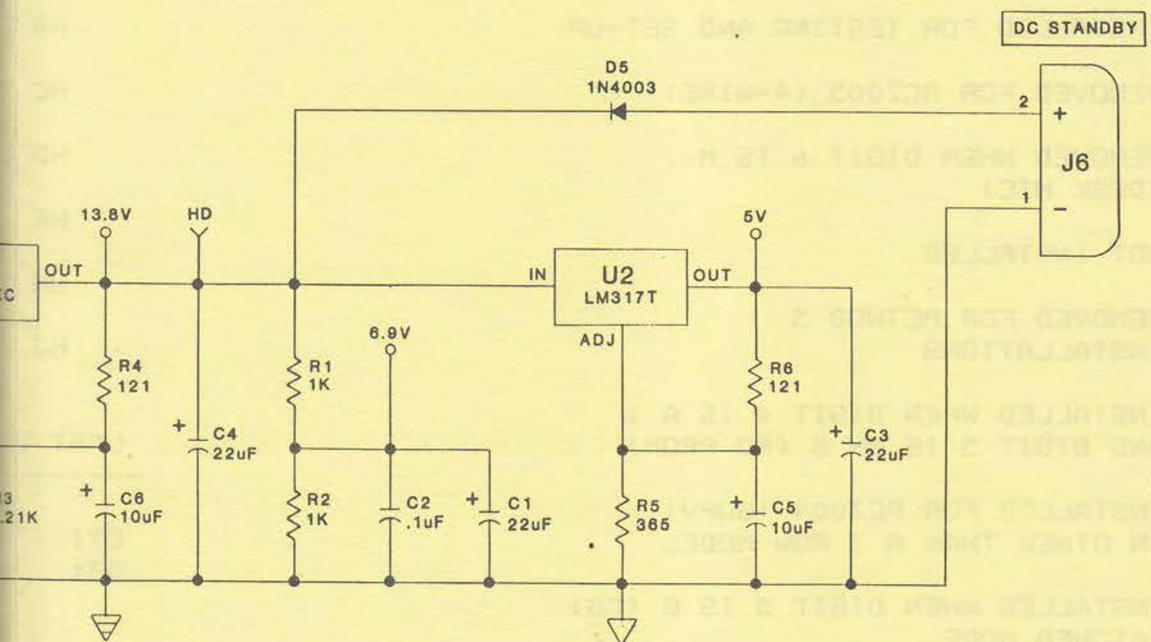
TITLE MISCELLANEOUS NOTES GE DC REMOTE

PART NO. 900-0165 DOCUMENT NO. 4161-S-06


BLACK
TB1-3
F1
3/8 AMP
BLACK
TB1-4
BLUE
TB1-2
SG6
25V
TP1
D3
D4
ALL
1N4003
D2
D1
IN
U1
LM317KC
ADJ
SG5
25V
POWER CORD
T1
WHITE
BLUE
TB1-1
C7
1000uF
R3
1.2
HE
SPLICE
YELLOW
YELLOW
WHITE
GROUND SYMBO
DIGITAL GN
RECEIVE GN
TRANSMIT G
EARTH GND
RED
220V CONNECTION
GREEN
TB1-5
GREEN
TB1-6



BLACK
TB1-3
F1
3/8 AMP
BLACK
TB1-4
BLUE
TB1-2
SG6
25V
SG5
25V
TP1
D3
D4
ALL
1N4003
D2
D1
BLUE
TB1-1
YELLOW
YELLOW
IN
U1
LM317KC
OUT
ADJ
13.8V
HD
R4
121
C7
1000uF
R3
1.21K
C6
10uF
C4
22uF
HE
D5
1N4003
R1
1K
R2
1K
6.9V
C2
.1uF
C1
22uF
U2
LM317T
IN
OUT
ADJ
5V
R6
121
R5
365
C5
10uF
GROUND SYMBOL LEGEND:
DIGITAL GND
RECEIVE GND
TRANSMIT GND
EARTH GND
GREEN
TB1-5
GREEN
TB1-6



OL LEGEND:

ND

GND

GND

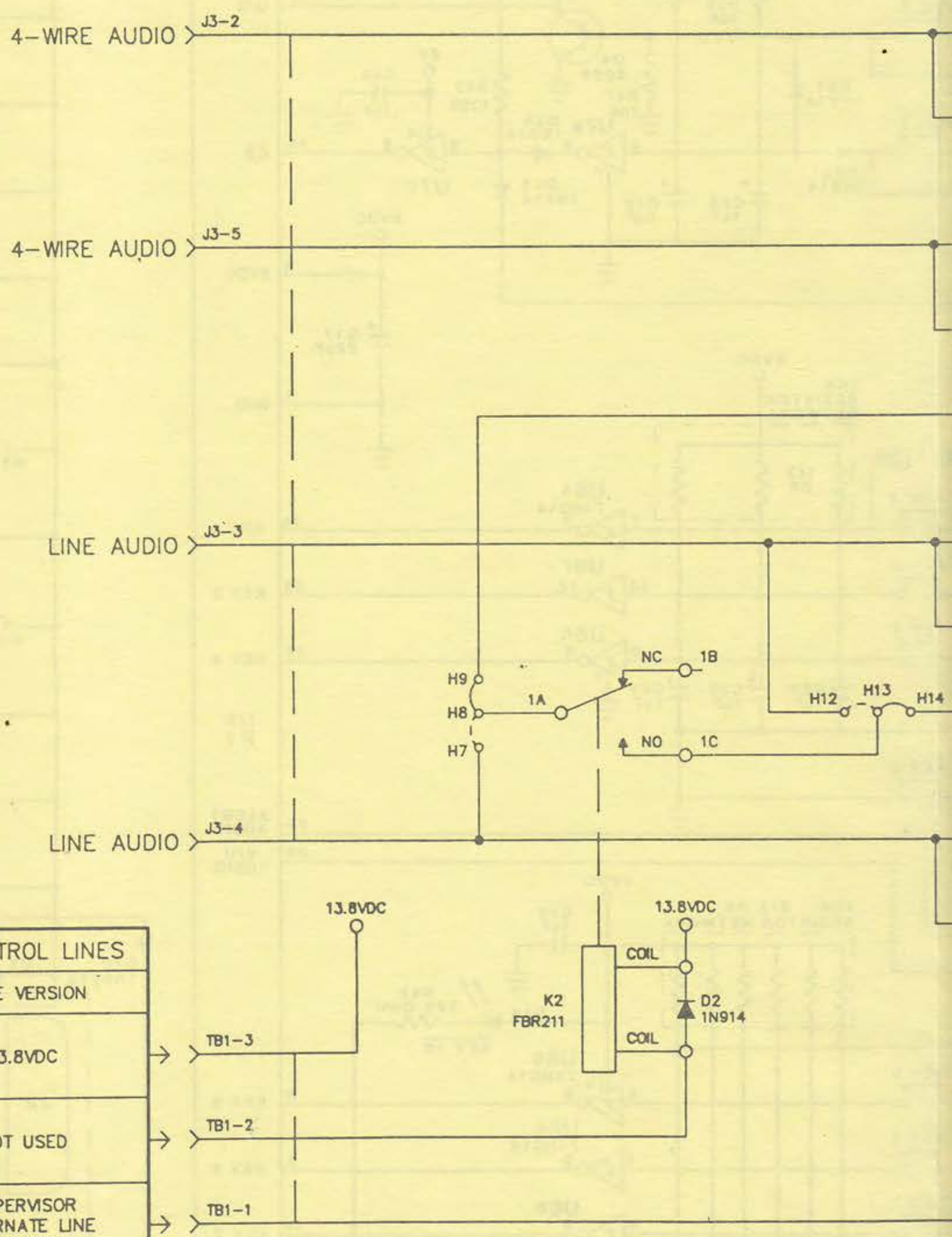
D

SHEET 1 OF 5

REV	BY	DATE	DESCRIPTION
D	SJG	10/10/88	GE-0039-19
C	JV	6/14/88	GE-0039-13

BY STEVEN LEE	DATE 8/15/88 SCALE
TITLE SCHEMATIC- TONE REMOTE POWER SUPPLY	
PART NO. 900-0167	DOCUMENT NO. 4164-S-03

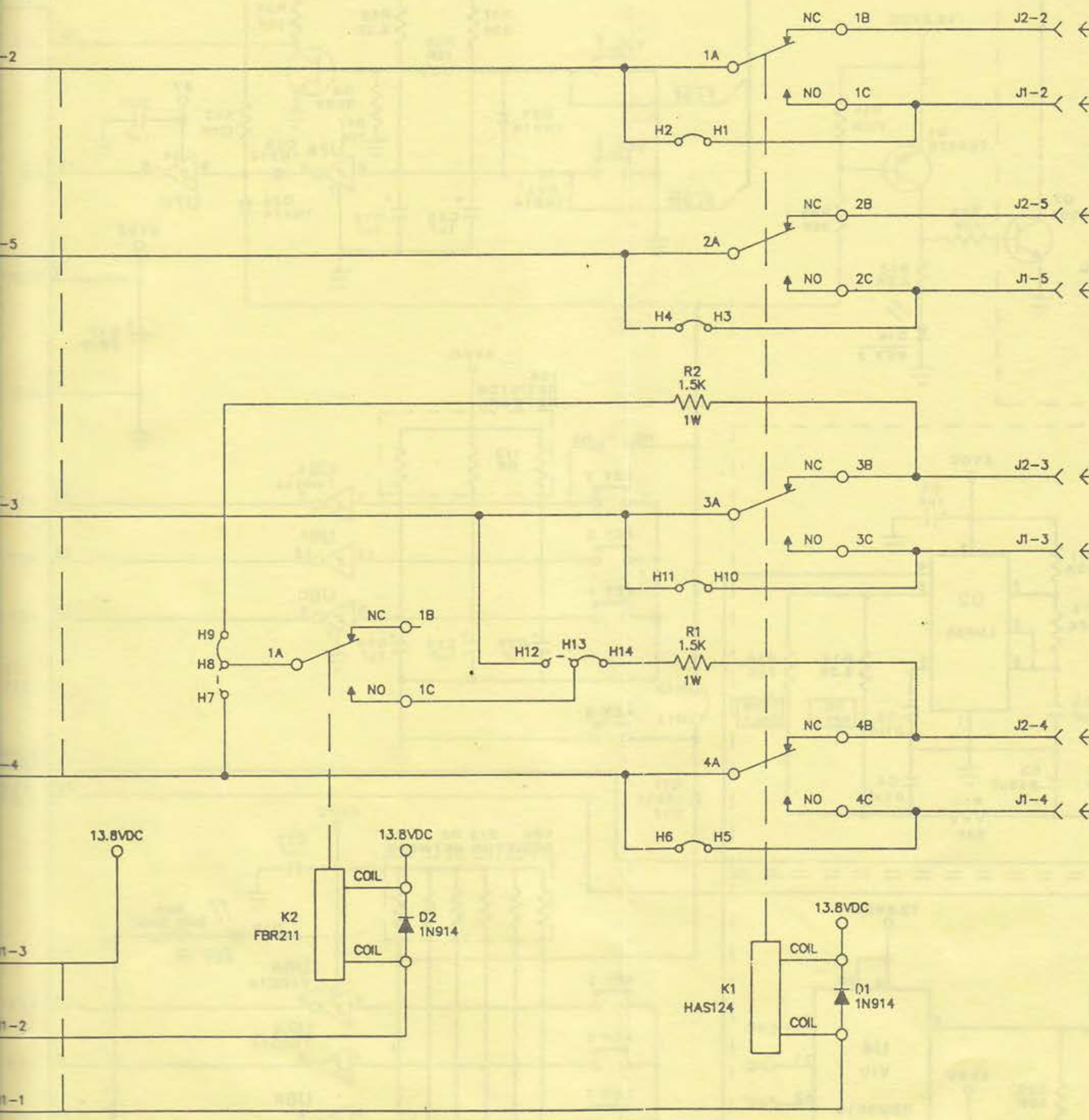
RCN 1000 CONNECTIONS



RCN 1000 POWER AND CONTROL LINES	
DG VERSION	TONE VERSION
13.8VDC	13.8VDC
SUPERVISOR	NOT USED
ALTERNATE LINE TAKEOVER	SUPERVISOR ALTERNATE LINE TAKEOVER

OPTION NUMBER	RCZ 003	RCZ 003	
FUNCTION	SUPERVISOR	SUPERVISOR	A
VERSION	DC	TONE	D
PARTS NOT INSTALLED	D1,H8-9, 13-14, K1,R1,2	D2,H7-8,8-9, 12-13,13-14, K2,R1,2	D2,H 7-8,8 13

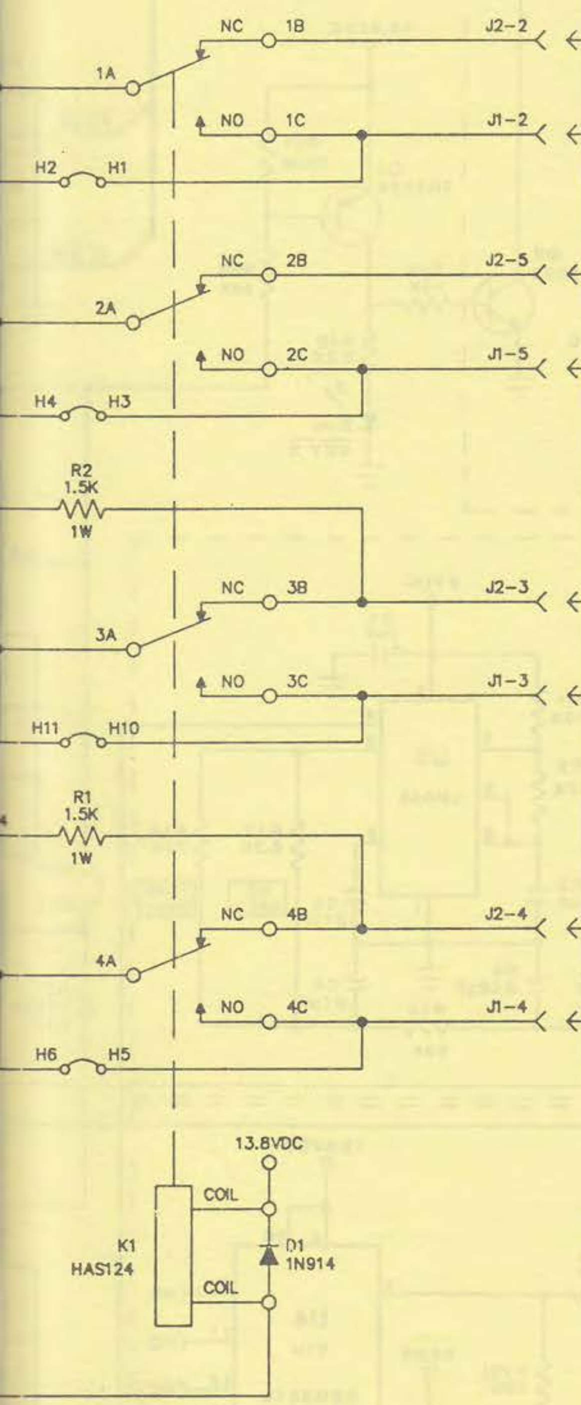
CTIONS



INPUT AND	
RCZ 003 DC	RCZ 003 TONE
NOT USED	PARALLEL UNIT
MAIN LINE	MAIN LINE
NOT USED	PARALLEL UNIT
MAIN LINE	MAIN LINE
NOT USED	PARALLEL UNIT
MAIN LINE	MAIN LINE
NOT USED	PARALLEL UNIT
MAIN LINE	MAIN LINE

NOTE: THE SCHEMATIC
THE SUPERVISO
RCZ 003 AND
WITH THE DC V

OPTION NUMBER	RCZ 003	RCZ 003	RCZ 004	RCZ 015	RCZ 003 AND RCZ 004	RCZ 003 AND RCZ 015
FUNCTION	SUPERVISOR	SUPERVISOR	ALTERNATE LINE	TAKEOVER	SUPERVISOR AND ALTERNATE LINE	SUPERVISOR AND TAKEOVER
VERSION	DC	TONE	DC OR TONE	DC OR TONE	DC	DC
PARTS NOT INSTALLED	D1,H8-9, 13-14, K1,R1,2	D2,H7-8,8-9, 12-13,13-14, K2,R1,2	D2,H1-2,3-4,5-6, 7-8,8-9,10-11,12-13, 13-14,K2,R1,2	D2,H7-8,8-9, 12-13,13-14, K2,R1,2	H1-2,3-4, 5-6,7-8, 10-11,12-13	H7-8,12-13



INPUT AND OUTPUT CONNECTIONS PER OPTION					
RCZ 003 DC	RCZ 003 TONE	RCZ 004 DC OR TONE	RCZ 015 DC OR TONE	RCZ 003, RCZ 004 DC	RCZ 003, RCZ 015 DC
NOT USED	PARALLEL UNIT	MAIN LINE	VOTER INPUT	MAIN LINE	VOTER INPUT
MAIN LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE
NOT USED	PARALLEL UNIT	MAIN LINE	VOTER INPUT	MAIN LINE	VOTER INPUT
MAIN LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE
NOT USED	PARALLEL UNIT	MAIN LINE	VOTER INPUT	MAIN LINE	VOTER INPUT
MAIN LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE
NOT USED	PARALLEL UNIT	MAIN LINE	VOTER INPUT	MAIN LINE	VOTER INPUT
MAIN LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE	ALTERNATE LINE	MAIN LINE

NOTE: THE SCHEMATIC AND JUMPER POSITIONS SHOWN REPRESENT THE SUPERVISOR AND TAKEOVER CONTROL, OPTION NUMBER RCZ 003 AND RCZ 015. THIS COMBINATION IS AVAILABLE WITH THE DC VERSION ONLY.

RCZ 004	RCZ 015	RCZ 003 AND RCZ 004	RCZ 003 AND RCZ 015
ALTERNATE LINE	TAKEOVER	SUPERVISOR AND ALTERNATE LINE	SUPERVISOR AND TAKEOVER
DC OR TONE	DC OR TONE	DC	DC
,H1-2,3-4,5-6, 8-9,10-11,12-13, 13-14,K2,R1,2	D2,H7-8,8-9, 12-13,13-14, K2,R1,2	H1-2,3-4, 5-6,7-8, 10-11,12-13	H7-8,12-13

REV.	BY	DATE	DESCRIPTION
B	DPR	01/13/88	ADD H5-14,R1-2, MINUS K3
A	DPR	11/19/87	PRODUCTION RELEASE

AUTOCAD FILENAME: 0169S.DWG

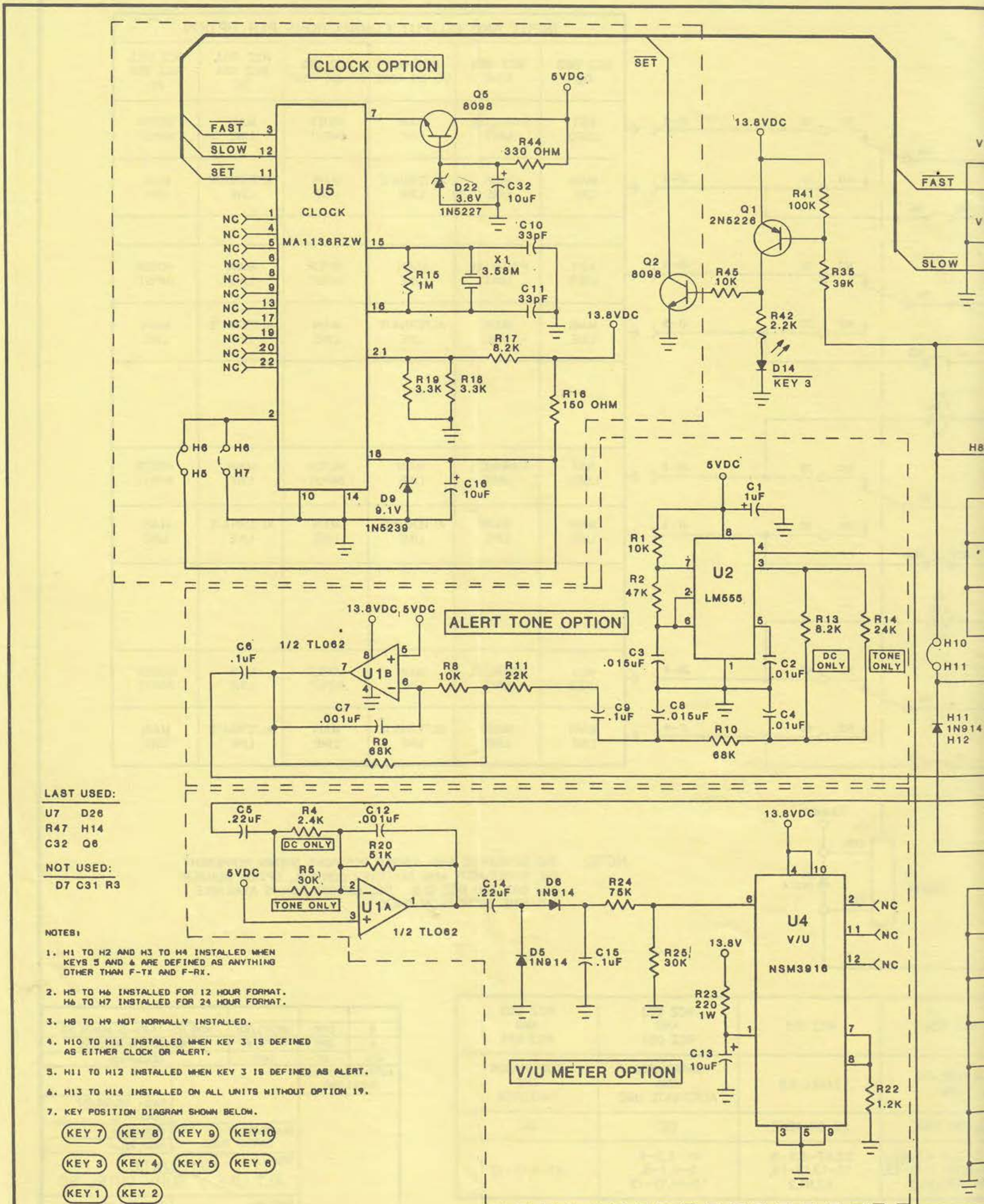
DATE- 08/28/87
SCALE- NTS
DRAWN BY DARRIN RUDE
CHECKED BY-
PROD. REL.-

TITLE SCHEMATIC ALT LINE / SUPV CNTRL BD

PART NO. 900-0169

DOCUMENT NO. 4163-S-00

DO NOT SCALE DRAWING



LAST USED:

U7	D26
R47	H14
C32	Q6

NOT USED:

D7 C31 R3

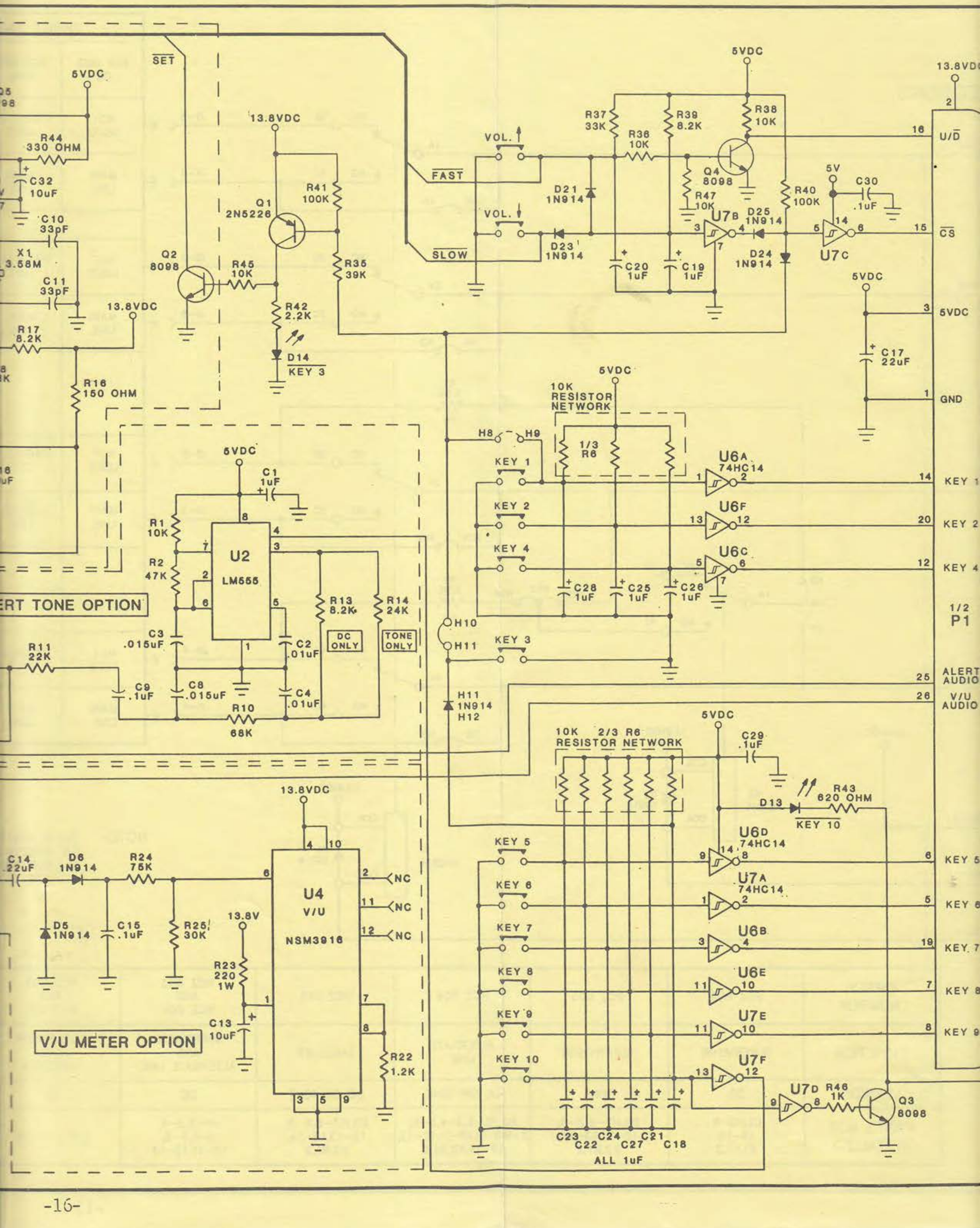
NOTES:

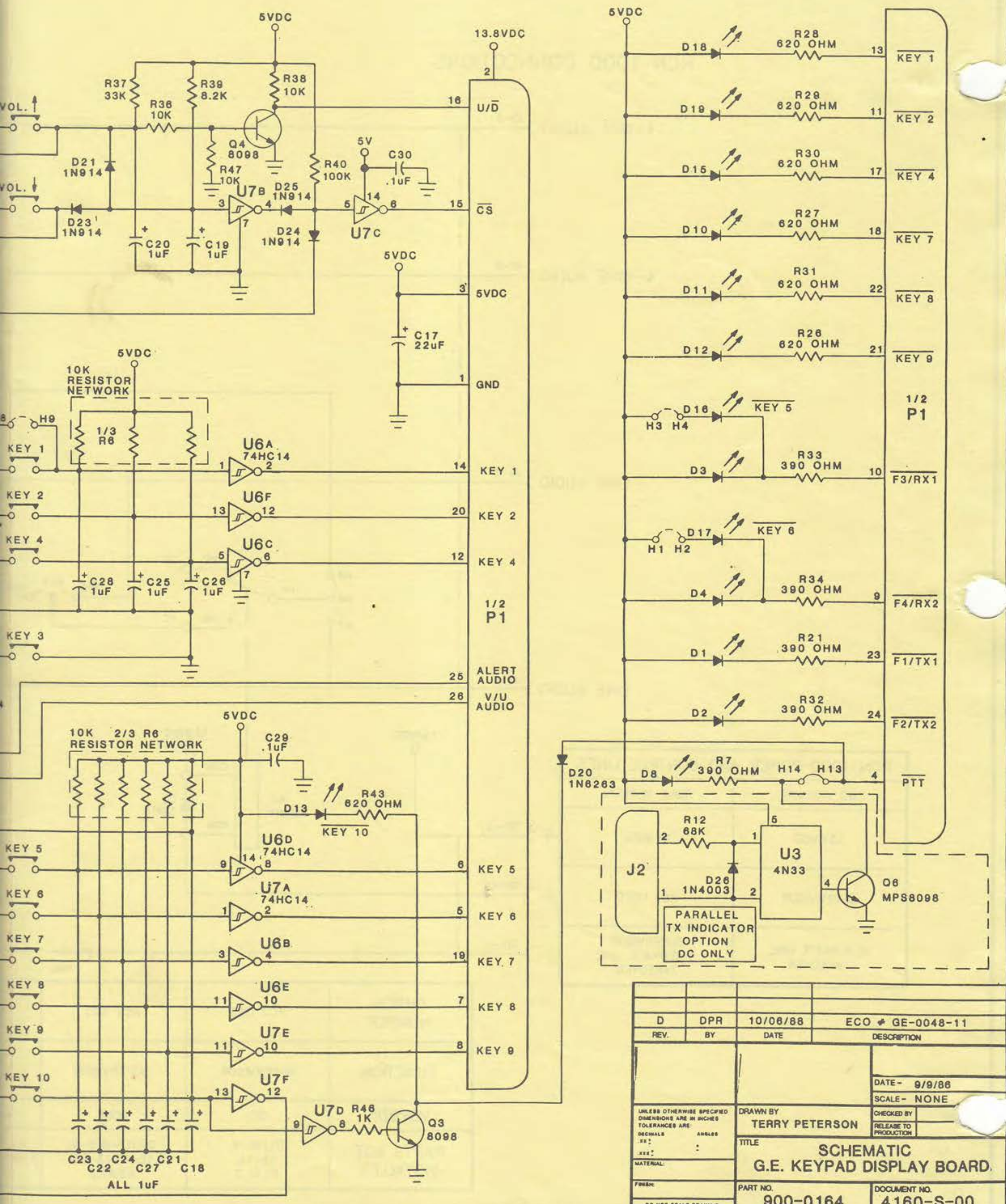
1. H1 TO H2 AND H3 TO H4 INSTALLED WHEN KEYS 5 AND 6 ARE DEFINED AS ANYTHING OTHER THAN F-TX AND F-RX.
2. H5 TO H6 INSTALLED FOR 12 HOUR FORMAT. H6 TO H7 INSTALLED FOR 24 HOUR FORMAT.
3. H8 TO H9 NOT NORMALLY INSTALLED.
4. H10 TO H11 INSTALLED WHEN KEY 3 IS DEFINED AS EITHER CLOCK OR ALERT.
5. H11 TO H12 INSTALLED WHEN KEY 3 IS DEFINED AS ALERT.
6. H13 TO H14 INSTALLED ON ALL UNITS WITHOUT OPTION 19.
7. KEY POSITION DIAGRAM SHOWN BELOW.

KEY 7 KEY 8 KEY 9 KEY10

KEY 3 KEY 4 KEY 5 KEY 6

KEY 1 KEY 2


SET
5VDC
R44
330 OHM
C32
10uF
C10
33pF
X1
3.58M
C11
33pF
R17
8.2K
13.8VDC
R16
150 OHM
Q2
8098
R45
10K
Q1
2N5226
R41
100K
R35
39K
R42
2.2K
D14
KEY 3
VOL. ↑
VOL. ↓
FAST
SLOW
D21
1N914
D23
1N914
R37
33K
R36
10K
R39
8.2K
R38
10K
Q4
8098
R47
10K
U7B
D25
1N914
D24
1N914
R40
100K
C20
1uF
C19
1uF
5V
C30
.1uF
U7C
C17
22uF
U/D
CS
GND
10K
RESISTOR
NETWORK
1/3
R6
H8
H9
KEY 1
KEY 2
KEY 4
U6A
74HC14
U6F
U6C
C28
1uF
C25
1uF
C26
1uF
H10
H11
H11
1N914
H12
1/2
P1
ALERT
AUDIO
V/U
AUDIO
C1
1uF
R1
10K
R2
47K
U2
LM555
R13
8.2K
R14
24K
DC
ONLY
TONE
ONLY
C3
.015uF
C8
.015uF
C2
.01uF
C4
.01uF
R10
68K
R11
22K
C9
.1uF
ALERT TONE OPTION
10K 2/3 R6
RESISTOR NETWORK
C29
.1uF
D13
R43
620 OHM
KEY 10
KEY 5
KEY 6
KEY 7
KEY 8
KEY 9
U6D
74HC14
U7A
74HC14
U6B
U6E
U7E
U7F
U7D
R46
1K
Q3
8098
C23
C22
C24
C27
C21
C18
ALL 1uF
U4
V/U
NSM3916
NC
C14
.22uF
D6
1N914
R24
75K
D5
1N914
C15
.1uF
R25
30K
13.8V
R23
220
1W
C13
10uF
R22
1.2K
V/U METER OPTION



D	DPR	10/06/88	ECO # GE-0048-11
REV.	BY	DATE	DESCRIPTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: DECIMALS .XX± .XXX± ANGLES ±

MATERIAL:

FINISH:

DO NOT SCALE DRAWING

DATE- 9/9/86

SCALE- NONE

CHECKED BY

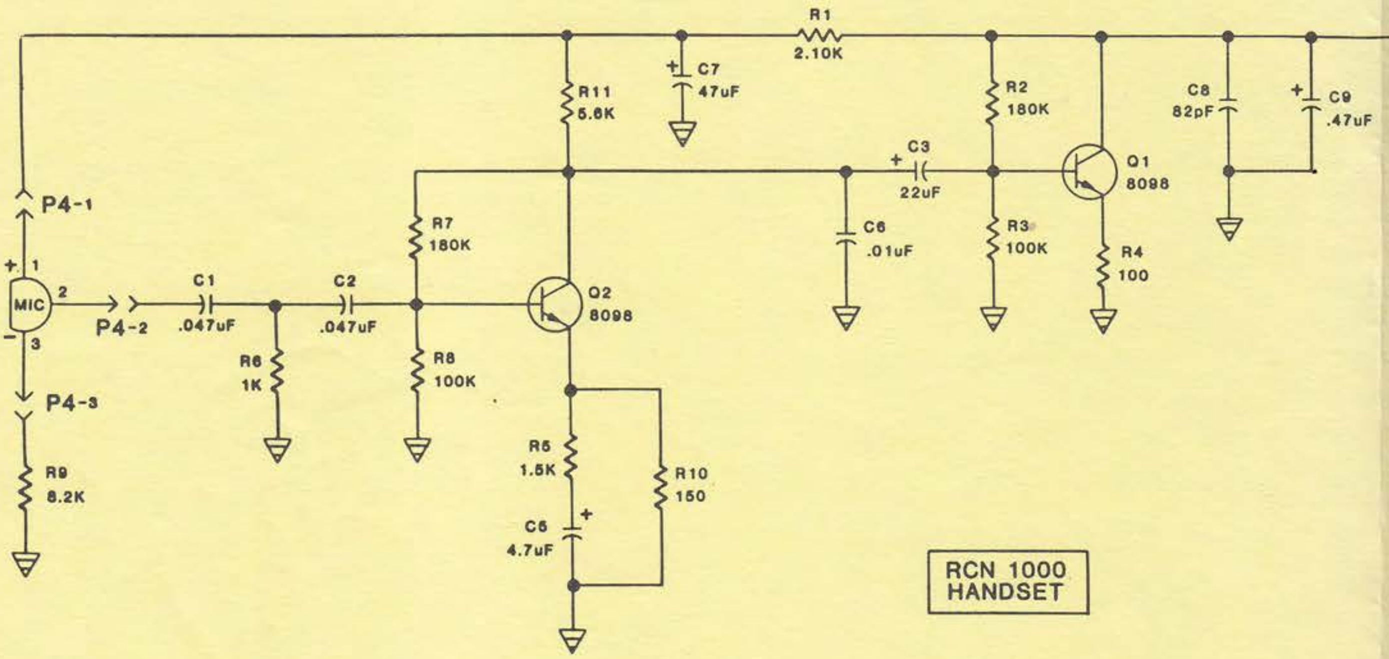
RELEASE TO PRODUCTION

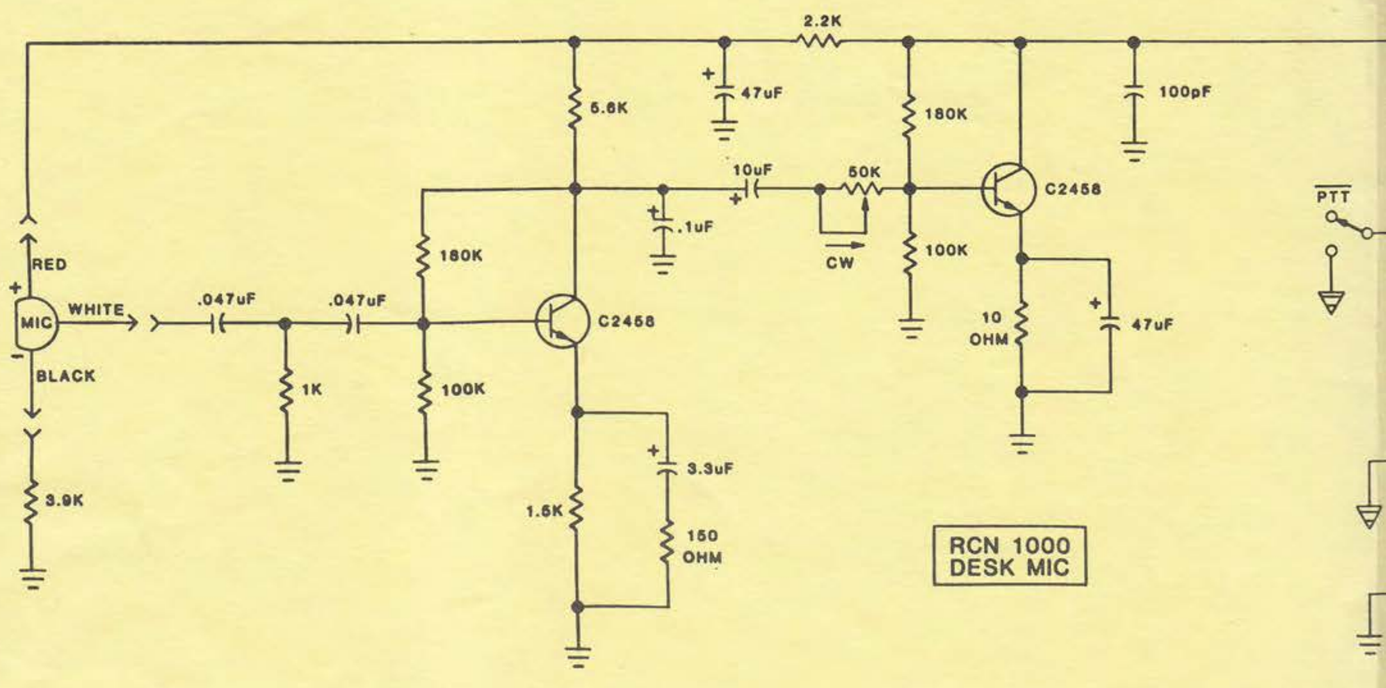
DRAWN BY TERRY PETERSON

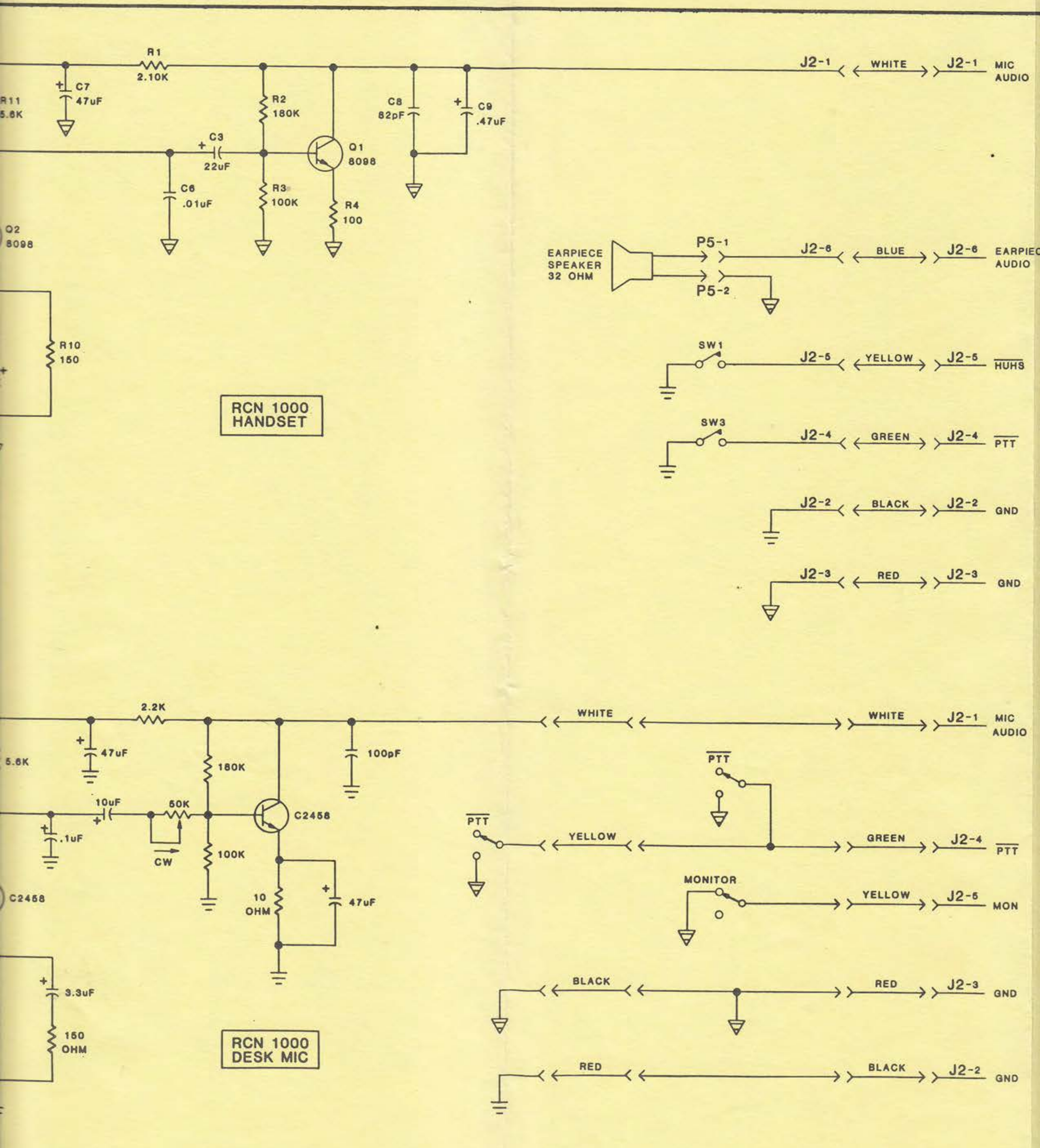
TITLE SCHEMATIC G.E. KEYPAD DISPLAY BOARD.

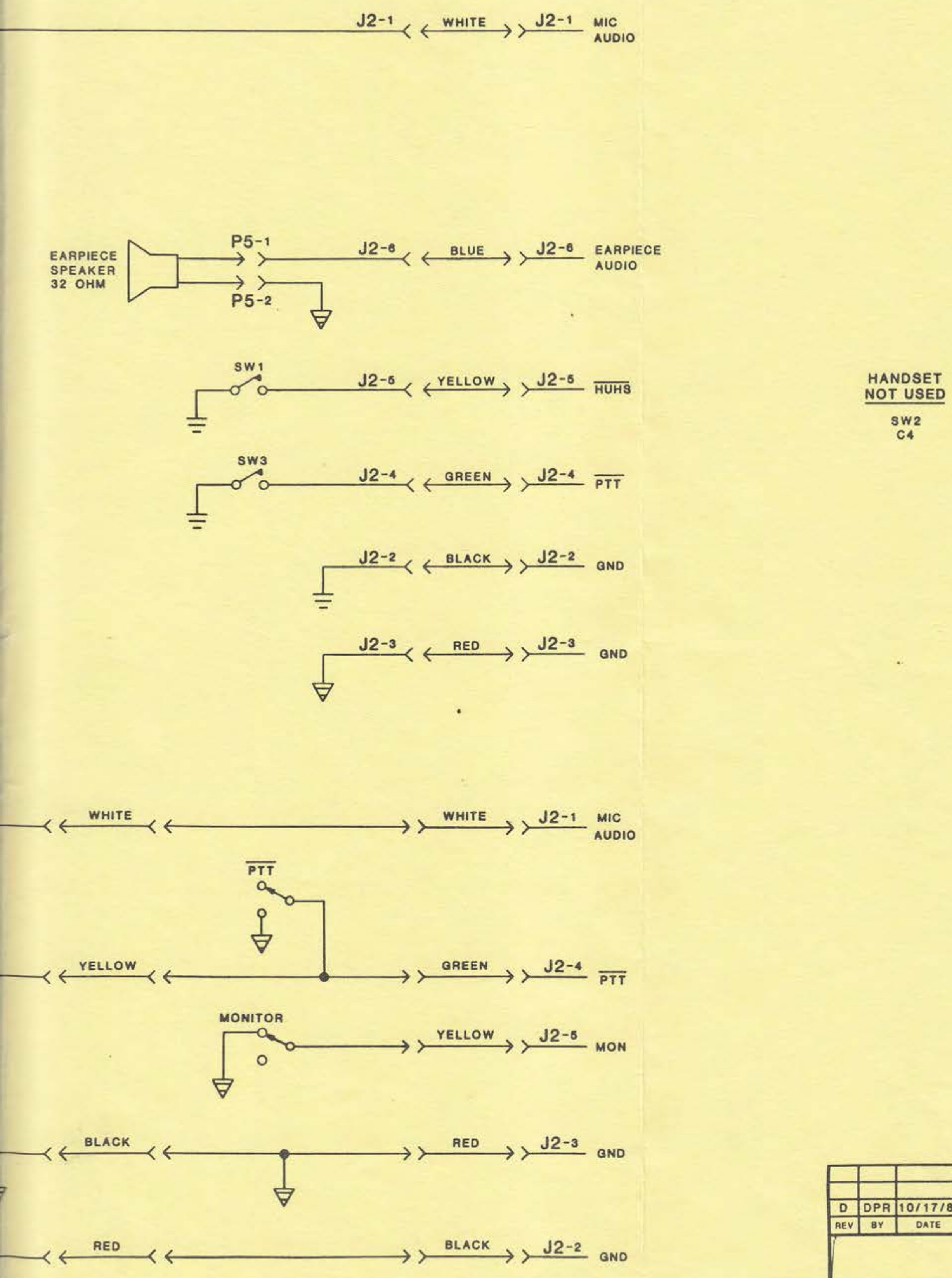
PART NO. 900-0164

DOCUMENT NO. 4160-S-00


R1
2.10K
R11
5.6K
C7
47uF
R2
180K
C8
82pF
C9
.47uF
C3
22uF
Q1
8098
P4-1
R7
180K
C6
.01uF
R3
100K
R4
100
MIC
C1
.047uF
C2
.047uF
Q2
8098
P4-2
R6
1K
R8
100K
P4-3
R5
1.5K
R10
150
R9
8.2K
C5
4.7uF
RCN 1000
HANDSET


2.2K
5.6K
47uF
180K
100pF
10uF
50K
C2458
PTT
.1uF
CW
100K
RED
180K
WHITE
.047uF
.047uF
MIC
C2458
10
OHM
47uF
BLACK
1K
100K
3.3uF
3.9K
1.5K
150
OHM
RCN 1000
DESK MIC


R1
2.10K
C7
47uF
R11
5.6K
R2
180K
C3
22uF
Q1
8098
C8
82pF
C9
.47uF
C6
.01uF
R3
100K
R4
100
Q2
8098
J2-1
WHITE
J2-1
MIC AUDIO
EARPIECE SPEAKER 32 OHM
P5-1
P5-2
J2-6
BLUE
J2-6
EARPIEC AUDIO
R10
150
SW1
J2-5
YELLOW
J2-5
HUHS
SW3
J2-4
GREEN
J2-4
PTT
RCN 1000 HANDSET
J2-2
BLACK
J2-2
GND
J2-3
RED
J2-3
GND
2.2K
47uF
5.6K
180K
100pF
WHITE
WHITE
J2-1
MIC AUDIO
PTT
10uF
50K
C2458
PTT
YELLOW
GREEN
J2-4
PTT
.1uF
CW
100K
MONITOR
YELLOW
J2-5
MON
C2458
10 OHM
47uF
3.3uF
BLACK
RED
J2-3
GND
150 OHM
RCN 1000 DESK MIC
RED
BLACK
J2-2
GND



REV	BY	DATE	DESCRIPTION
D	DPR	10/17/88	ECO # GE-0039-18

BY FRED RENNER — DATE 9-6-88 — SCALE

TITLE SCHEMATICS REMOTE HANDSET/DESK MIC

PART NO. 900-0166 — DOCUMENT NO. 4162-S-01