MAINTENANCE MANUAL
DELTA/RANGR DESK TOP STATION SYSTEM BOARD
19D901541G1

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SPECIFICATIONS

INPUT VOLTAGE	13.8 Volts DC 9 Vo1ts DC (Frequency Standby)
CURRENT DRAIN	45 milliamperes +10 mA, @13.8 VDC 5 milliamperes maximum @ 9 VDC
AUDIO LEVELS	
Input	300 millivolts from radio 100 millivolts RMS at l kHz with 3 kHz deviation
Output	80 millivolts to radio 300 millivolts to DC Remote Board
DISTORTION	Less than 3%
TEMPERATURE RANGE	-30C to 60C (-22F to +140F)

Ericsson GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Printed in U.S.A.

DESCRIPTION

System Board 19D901541G1 provides the system interface between the DELTA or RANGR two-way radio and the station controls and options. The system board provides the logic and control for the following functions:

- Receiver Muting (RX MUTE)
- Audio switching
- Local and remote keying
- Channel Guard monitor
- Volume and frequency select
- Intercom
- Supervisory control
- Scan
- Voltage regulators

The system board mounts on the station chassis under the DELTA or RANGR radio. Access to the system board for servicing by removing the station top cover, and swinging the radio up and out of the way.

The system board is equipped with jacks for the keyboard, radio interface, display board, DC remote board, scan board, desk microphone, external encoders and decoders and a programming jack for programming the Delta or RANGR radio.

NOTE

Jumper P3 must be removed when programming the radio. Always replace jumper P3 when programming is completed.

Connectors are also provided for a station speaker, a standby battery option and a 9-Volt battery for channel memory back-up. The 9-Volt battery assembly is GE Part Number 19B801331G1.

CIRCUIT ANALYSIS

Logic and control functions on the system board are provided by NAND gates, NOR gates, bilateral switches, op amps, flip-flops, one-shots, timers, regulators, transistors, etc.

When no signal is being received and no Push-To-Talk (PTT) or keyboard switches are pressed, all control inputs are high except the RX MUTE input (low). Activating any keyboard, PTT or monitor function applys a low (approximately ground potential) to the selected control line.

RX MUTE

The receiver mute input is low (<1 volt) until a carrier is received. When a carrier is received, the noise content of the input signal at VOL/SQ HI (J2-3) decreases. The decrease in noise causes the RX MUTE line to go high, turning on bilateral switch U31D. Turning on U31D applies the received audio to the volume control and then to the receiver-audio amplifier and the station speaker.

A high on the RX MUTE line also is applied to inverter U6D, NOR gates U3A and U3D which causes a low at the base of Q4, turning it off. Turning Q4 off applies the 10-Volt collector voltage to the remote line audio switch, enabling the audio path in the remote receiver.

AUDIO SWITCHING

All of the station audio paths are controlled by bilateral switches. When the control input is low, the switch is turned off. When the control input goes high, the switch is turned on to allow audio to be applied to the selected circuit. The function of each audio switch is described in the following paragraphs (See Figure 1).

U31B - passes audio from the local microphone to the transmitter when the local microphone PTT switch is pressed (LPTT).

U3IA - passes audio from the remote microphone to the transmitter except when local intercom or local microphone switch is pressed.

U31C - passes audio from the local microphhone to the remote when the local intercom or LPTT switch is pressed.

U39B - passes remote audio to the desk station speaker through the volume control, when there is no RX MUTE signal, and local intercom and LPTT are inactive.

U39A - passes received audio to the remote except when the intercom or LPTT switch is pressed.

U3ID - passes received audio to the local speaker whenever a signal is received.

U39C - enables squelch noise from V0L/SQ HI to be applied to the receiver squelch circuitry when the keyboard monitor button is not pressed.

LOCAL CONTROL

Pressing the Push-To-Talk switch on the local microphone (LPTT) applies a ground to J7-2, causing the output of NOR gate UIB-4 to go high. The high at UIB-4 disables PA KEY transistor Q8, and causes the output at U3C-10 to go low, turning off bilaterial switch U3IA. Turning off U31A prevents any remote audio from being transmitted. The high output of UIB also enables U31B in the local microphone circuit, and causes the output at UIC-10 to go high provided the local intercom is inactive. The high at UIC-10 lights the transmit indicator on the display board, and turns on transistor Q2, keying the transmitter.

Audio from the local microphone at J7-4 is coupled through TX MIC ADJUST potentiometer R66, and is applied to amplifier U30B. The output of U30B is coupled through TX MOD ADJUST R61 to amplifier U30C and then applied to the transmitter exciter.

Keying the local microphone also enables switch U31C which allows local audio from amplifier U30A to be heard at the remote.

REMOTE CONTROL

Pressing the PTT switch on a remote microphone causes the output UIC-10 to go high, lighting the transmit indicator and keying the transmitter (Q2 on).

Audio from the remote microphone is applied to the system board through J9-1. J19-1 is used for external encoder audio.

The output at U1D-11 goes low, and is gated through U3A and U3D to turn off mute control transistor Q4. When Q4 is turned off, +10 Volts is applied to the RUS lead on the DC remote board. This RUS voltage allows the remote audio to be heard in the local speaker.

INTERCOM

Pressing the INTERCOM switch on the keyboard causes the output of U4D-10 to go high, lighting the INTERCOM display and causing the output of UIC-10 to go low. The low output disables Q2 to prevent the transmitter from being keyed.

The high output of U4D also causes the output of U3C to go low. This disables switch U31A to prevent remote audio from being transmitted, and U39A which prevents received audio from going to the remote.

The low output at U3C-10 causes the output of U6A-2 to go high. This high enables U31C and disables U39B through the low output of U3B, and also disables the transmitter. U31B is controlled by LPTT only.

Audio from the local microphone at J7-4 is coupled through amplifier U30A and switch U31C to the remote VOLUME HI lead (J9-9). Disabling U39B prevents remote audio from being heard in the speaker while the local operator is intercoming.

MONITOR

Pressing the MONITOR button on either the local or remote microphone applies a low to the selected input of NAND gate U8A. This causes U8C-10 to go low, and the output of U8B and U8D to go high. The high at U8B-4 turns on Q1, and the low at the collector of Q1 disables the Channel Guard circuit. The high output at U8D-11 turns on the MONITOR indicator on the display board.

Pressing tbe MON button on the keyboard applies a ground on Jl-6, turning on the MONITOR indicator and turning off bilateral switch U39C. Turning off U39C removes the audio or noise from the Delta radio squelch control, causing the receiver to unsquelch. This allows receiver noise or signal to be heard at the local speaker to assist in selecting the desired volume level, and also acts as a channel guard disable.

SUPERVISORY CONTROL

Pressing the SUPV CONT pushbutton applies a ground to the "D" input of flip-flop U7A. The "Q" output of U7A clocks U7B, causing the "Q" and "Q" outputs to toggle oppositely from each other, as the "Q" output acts as the next

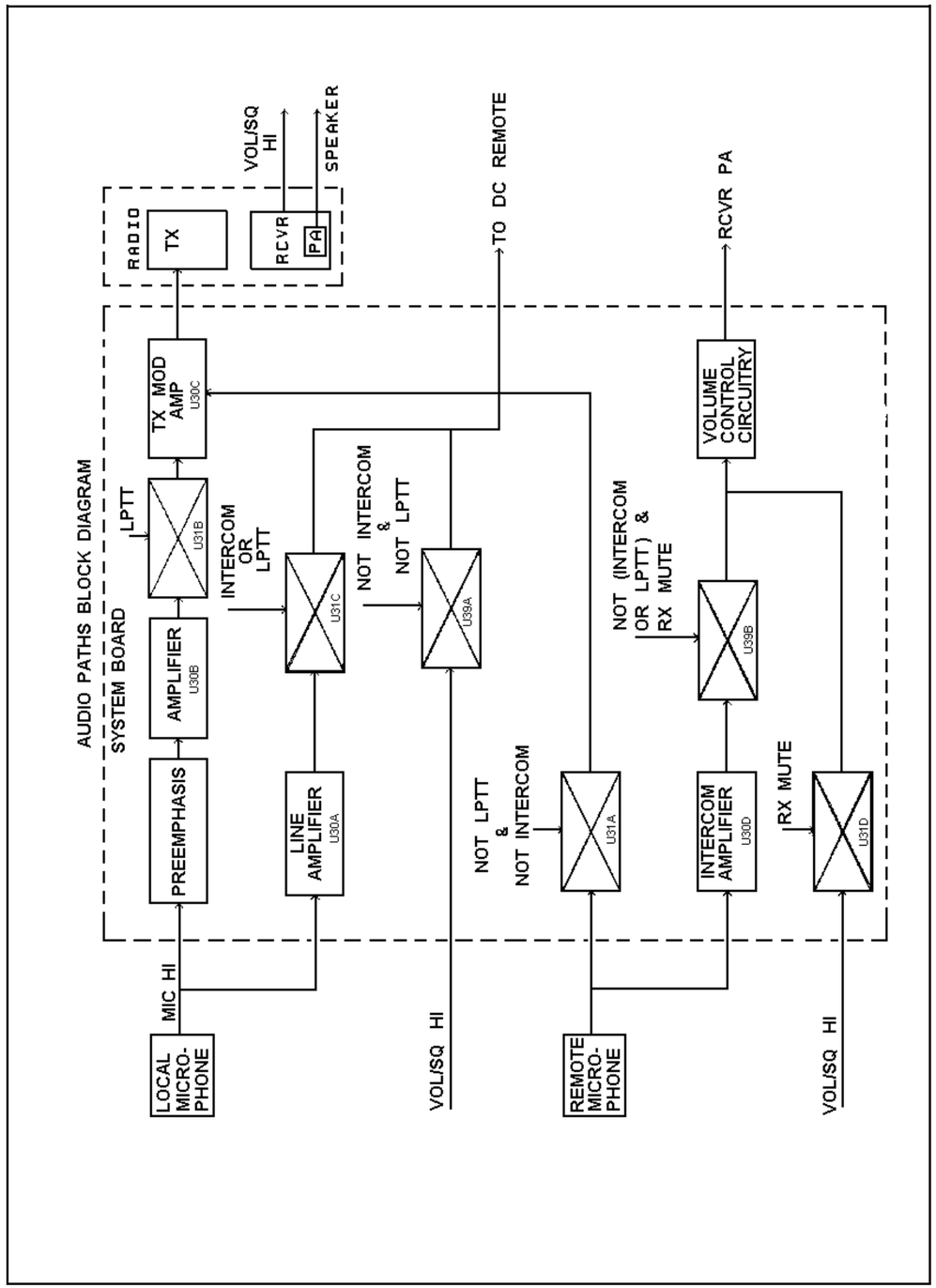


Figure 1 - Station Audio Block Diagram

input. In one state, a high "Q" output is applied to NOR gate U1D, which outputs to U1A and which outputs to UIC. The resulting low at U1C-10 turns off Q2 and disables the transmitter. The low "Q" output of U7B is applied to inverter U4B whose high output lights the SUPV CONTROL indicator on the display panel. The next push of the SUPV CONT button will toggle the "Q" and "Q" outputs of U7B, enabling the transmitter and turning off the display.

In the supervisory control mode, all audio paths may be operated as described in the LOCAL and REMOTE CONTROL section, only no audio will be transmitted.

CHANNEL SELECT

The channel select circuit consists of the following (See Figure 2):

- Timer Ul3.
- "D" flip-flops U12A and U12B.
- Up-down counter U35.
- Comparators U9 and U10.
- Timer U14 and one-shot U16.
- Quad input NAND gates U15A, U15B and U36A.
- Maximum frequency set dip switch S1.

NOTE

NAND gate U36A, timer U13, timer U14 and one-shot U16 are also used in the Volume Se1ect circuits.

Pressing the channel up/down bar on the station keyboard grounds the "D" input of the selected flip-flop U12A or U12B. The output of timer Ul3 clocks the flip-flops at a 20 millisecond rate. The "Q" outputs of the respective flip-flops activate up channel flip-flop U15A or down channel flip-flop U15B.

Each push of the channel up/down switch causes the selected NAND gate to apply a positive-going pulse to the respective inputs of up-down counter U35. The pulse is applied at the output of the 20 millisecond rate clock. Each positive edge of the NAND output steps the channel up or down, as desired.

Holding either side of the channel select switch down causes the output of U36A to start the 400 millisecond timer consisting of U14 and U16. The timer output pulses U15A or U15B, causing the counter to step up or down every 400 milliseconds as long as the channel pushbutton is held down and the up or down limits are not reached.

Each time the count is changed, the binary output of U35 is compared with the input value at comparator U9 which is set for the maximum channel number by dip switch SW1. If the two values or binary codes are equal, the output at U9-3 causes the output at inverter U5-6 to toggle U15A. The negative going output prevents the counter from stepping up any further.

At the same time, the output of U35 is being compared at U10 for a channel number equal to channel 1. If the two values are equal, the output at U5-4 pulses U15B. The output of U15B is applied to U35 to prevent the counter from stepping down any further.

The selected binary channel signal is applied to inverter U5 and then coupled through tri-state buffers U18 to the radio channel select control. A non-inverted output at J6-1, J6-2, J6-4 and J6-5 is applied directly to the display board to control the channel display.

The maximum channel limit is set at comparator U9 by SW1-5 through SW1-8. Refer to Table I for the binary codes required to set the maximum number of channels. The logic levels referenced in Table 1 are measured at DIP switch 1. The minimum channel limit at U10 is permanently set for channel 1.

TABLE 1 - MAXIMUM CHANNEL SETTING

SW1 SETTING				CORRESP0NDING CHANNEL NUMBER
SW1-8	SW1-7	SW1-6	SW1-5	
1	0	0	0	1
0	1	0	0	2
1	1	0	0	3
0	0	1	0	4
1	0	1	0	5
0	1	1	0	6
1	1	1	0	7
0	0	0	1	8
1	0	0	1	9
0	1	0	1	10
1	1	0	1	11
0	0	1	1	12
1	0	1	1	13
0	1	1	1	14
1	1	1	1	15
0	0	0	0	16

0= <1.0 VDC (CLOSED)
1= >3.5 VDC (OPEN)

VOLUME SELECT

The volume select circuit is similar to the frequency select circuit (See Figure 3). The volume select circuit consists of:

- Multiplexer U27.
- "D" flip-flops U21A and U21B.
- Comparators U19 and U20.
- Quad input NAND gates U24A and U24B.
- Up/down counter U25.
- Minimum volume set dip switch S2.
- Audio amplifier U28.
- Dual input NAND gates U22D and U22B, U22C.
- Bilateral switch U29A.

The volume select circuit also utilizes U13, U36A, U14 and U16 which are also used in the frequency select circuit.

Pressing the volume up or down switch changes the "Q" and "Q" output of U21A and U21B. The output of the selected flip-flop toggles NAND gate U24A or U24B. The positive output of the flip- flop is applied to up/down counter U25. Each time the count (volumme level) is changed, the output of U25 is compared with the input of the comparators which determine that the minimum or maximum volume level is not exceeded. Then the count is applied to multiplexer U27 and one input of U22D to select the proper combination of input resistors to set the volume level. The LSB of the count changes the gain of the audio amp stage U28 each time the count is changed. A different input resistor to U27 is selected every other count change.

Audio from the station receiver or remote is applied to the multiplexer through the selected resistor to set the audio level. The output of the multiplexer is coupled through VOLUME LEVEL ADJUST potentiometer R50 to amplifier U28. The gain of U28 is determined by the resistance in the feedback loop.

When the LSB of the count is high, U29A is off, and R52 is in the feed back path of U28. When the LSB is low, U29A is on, and R51 is parallelled with R52 to provide approximately 16K ohms resistance in the feedback path. The output of amplifier U28 at J2-8 is applied to the receiver audio PA stage, and then to the station speaker.

The volume control circuit provides up to 16 levels of audio output. The inputs to comparator U19 are permanently set at level 16 for maximum output. U20 is the minimum limit comparator, and the minimum volume level is set by dip switch S2.

Refer to Table 2 for minimum volume settings.

CHANNEL SCAN

The optional scan board connects to J10 and J11 on the station system board. The scan board is used to search any two channels of the station with either channel designated as the priority channel. Refer to the scan board Maintenance Manual for complete details on scan operation and maintenance.

Pressing the SCAN button on the station keyboard turns on/off toggle function created by flip-flops U17B and U17A. The flip-flop "Q" and "Q" outputs at U17B are clocked by the 20 millisecond clock, counter U13.

TABLE 2 - MINIMUM VOLUME SETTING

SW2 SETTING			VOLUME LEVEL	
SW2-1	SW2-2	SW2-3		
1	1	1	1	
1	1	0	2	
1	0	1	3	
1	0	0	4	
0	1	1	5	
0	1	0	6	
0	0	1	7	
0	0	0	8	←Mid Range

0= <1.0 VDC (CLOSED)
1= >3.5 VDC (OPEN)

The "Q" output of U17A turns Q3 on/off to control the common F1/F2 lines and F1/F2 select lines through bilateral switches U38A through U38D. When Q3 is turned on (collector low), switches U38A and U38D are enabled by the high output of U37-4, and U38B and U38C are disabled. The switch pairs are alternately enabled and disabled at the 125 millisecond switching rate, allowing the selected F1 and F2 frequencies to be alternately searched.

The "Q" output (low) causes U4A-2 to go high, turning the scan display on and off at a 125 millisecond rate. The "Q" output of U17A also triggers the advance change one-shot U16B.

When the scan is on, the output at J11-6 switch 4 times per second, disabling and enabling tri-state buffer U18. When J11-6 is high, the output at J10-4 is low, enabling the output of priority select switch to check the priority channel for carrier, and visa versa.

The outputs at J11-6 and J10-4 alternately switch high and low states to permit both non-priority and priority channels to be checked for carrier.

When a carrier is detected at the receiver, the CAS line at J11-4 goes high. This causes the output at J11-1 to go high, turning on Q5 and turning off Q6. Turning off Q6 applies 5 Volts to the CHANNEL BUSY indicator on the display board, turning the indicator on.

If the carrier is on the priority channel, the CHANNEL BUSY light turns on for the duration of the message and the scan board stops scanning. If a non priority channel is detected, the CAS line switches high and low as the scan board continues to scan the priority channel, causing the CHANNEL BUSY light to blink 4 times per second.

When the scan board is not present, a jumper from HL1 to HL2 is used to connect the enable line of U18 to ground, keeping the buffer stage enabled. A jumper from HL3 to HL4 is used to connect the audio in to audio out at the local speaker.

The priority channel is selected by settiag dip switch SW1-1 through SW1-4 to the desired channel as shown in Table 3.

TABLE 3 - SCAN PRIORITY SETTING

SW1 SETTING				FIXED CHANNEL SELECTED
SW1-1	SW1-2	SW1-3	SW1-4	
0	1	1	1	1
1	0	1	1	2
0	0	1	1	3
1	1	0	1	4
0	1	0	1	5
1	0	0	1	6
0	0	0	1	7
1	1	1	0	8
0	1	1	0	9
1	0	1	0	10
0	0	1	0	11
1	1	0	0	12
0	1	0	0	13
1	0	0	0	14
0	0	0	0	15
1	1	1	1	16

0= <1.0 VDC (CLOSED)
1= >3.5 VDC (OPEN)

VOLTAGE REGULATORS

The system board utilizes three regulator circuits to supply the ICs. The regulators are powered by 13 Volts from the power supply or the optional battery back-up supply. Power is applied to the system board through J27-1 (13 VDC) and J27-2 (GND).

10-Volt Regulator

The 13-Volt output of the power supply is applied to U32-3. The regulated 10 Volts is applied to the ICs on the system board, and to the DC Remote board through J9-5. An unregulated 5-Volts is taken from the junction of voltage dividers R79 and R80 to provide bias voltage for all of the op amp gain stages.

5-Volt Regulator

Supply voltage from the power supply is applied to pin 3 of 5-Volt regulator U34. The regulated 5-Volt output is applied to the system board ICs.

5-Volt Back-Up Regulator

The 5-Volt memory back-up regulator is used to maintain the channel selection in the event of power failure. The supply uses 9-Volt battery option BU01 which provides the battery with external leads for connections to the regulator circuit.

In normal 13-Volt operation, supply voltage from the power supply is applied to back-up regulator U33 through diode D34. This voltage back biases diode D35 and allows the 13-Volt supply to be applied to the regulator input at U33-3.

In the event of power failure, D35 is forward biased by the 9-Volt battery output which is applied to U33. The regulated 5-Volt output is applied to flip-flop U12A and U12B, NAND gate U15B and up-down counter U35 to retain the channel selection.

STANDBY POWER DISPLAY

When the station standby battery option is used, the standby power is connected to the emitter of Q7 through J4-2. The power supply voltage is applied to the base of PNP transistor Q7, keeping it turned off. If the AC power fails, Q7 conducts and applies power to the STANDBY POWER light, turning it on, and supplies 13 volts to the system board. When power is restored to the station, Q7 turns off, turning off the STANDBY POWER light.

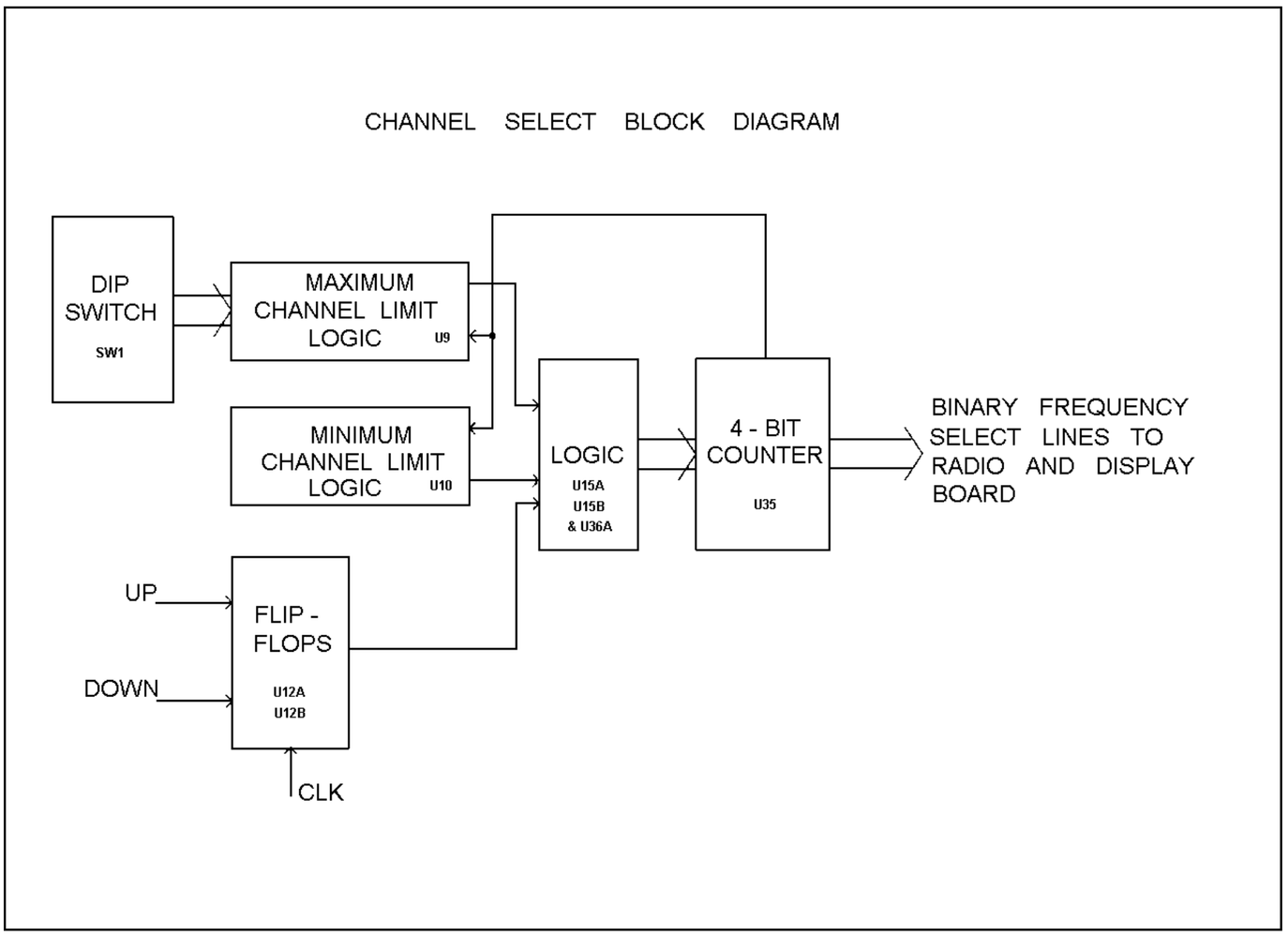


Figure 2 - Channel Select Block Diagram

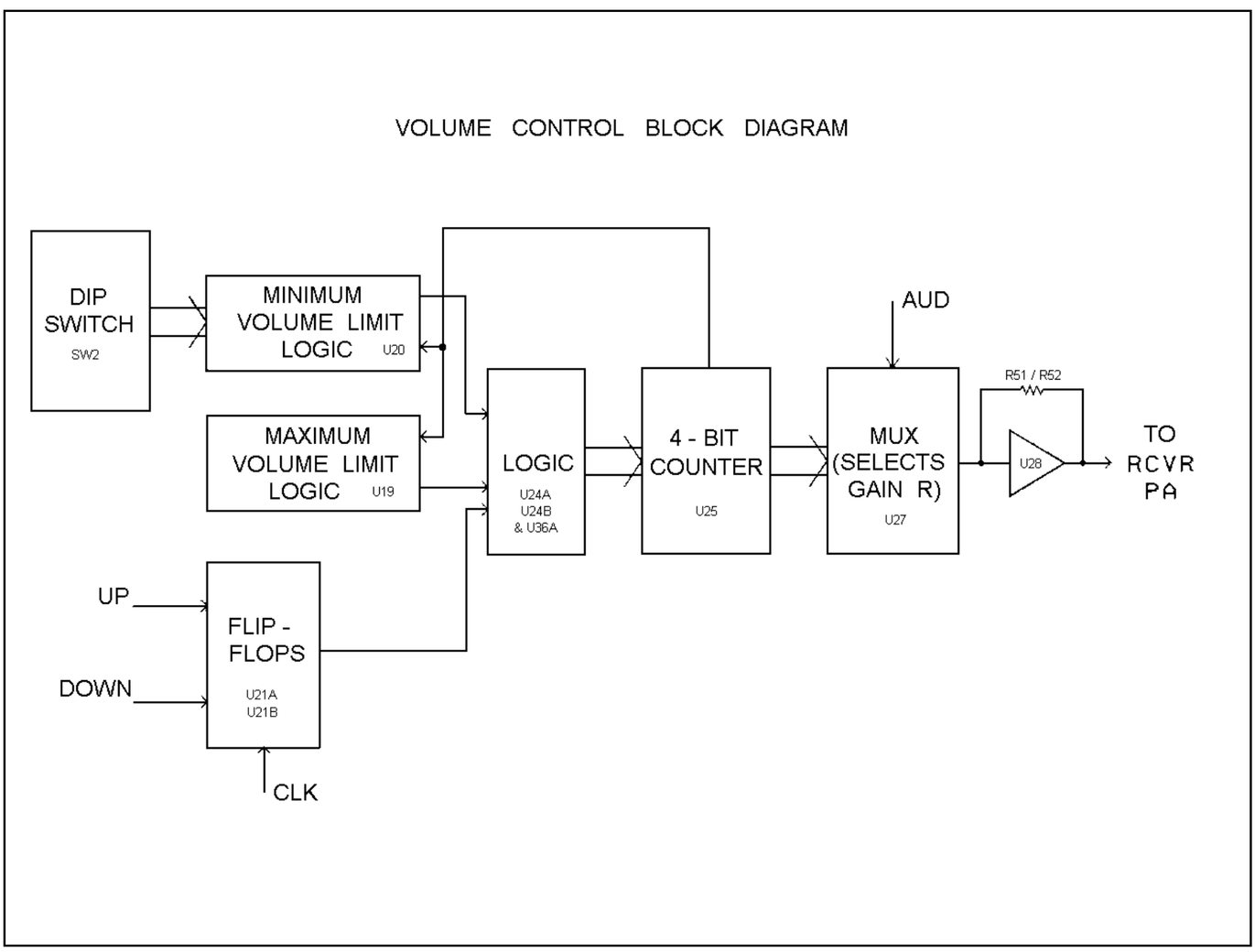
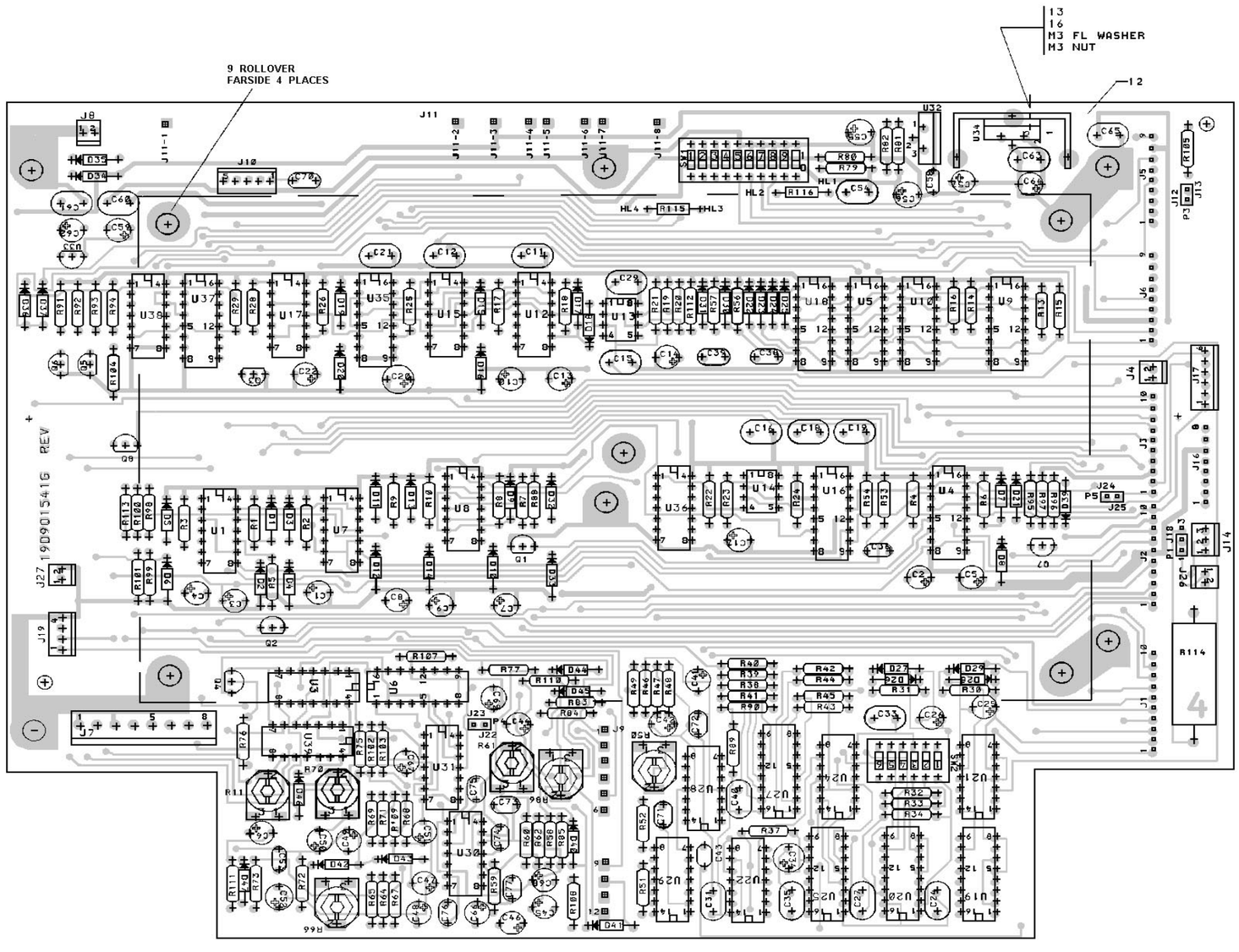


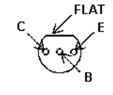
Figure 3 - Volume Select Block Diagram

COMPONENT SIDE



(19D901541, Sh. 1, Rev. 6)
(19A704408, Sh. 1, Rev. 4)

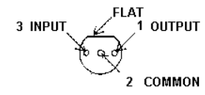
LEAD IDENTIFICATION
FOR Q1 THRU Q7



IN - LINE

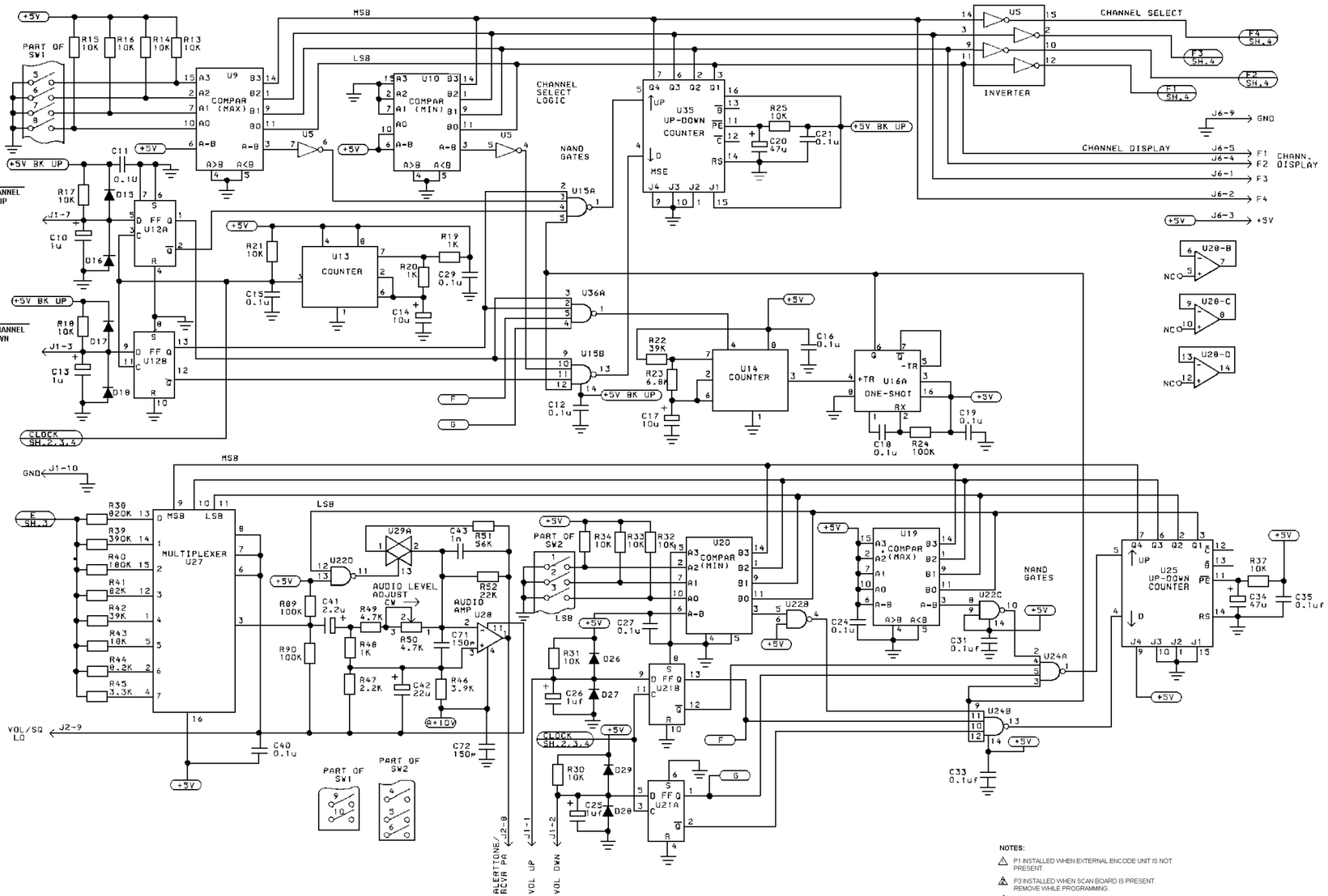
TOP VIEW

LEAD IDENTIFICATION
FOR U33



NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION

SYSTEM BOARD
19D901541G1



(19D901540, Sh. 2, Rev. 3)

NOTES:

1. P1 INSTALLED WHEN EXTERNAL ENCODE UNIT IS NOT PRESENT.
2. P3 INSTALLED WHEN SCAN BOARD IS PRESENT. REMOVE WHILE PROGRAMMING.
3. P4 INSTALLED WHEN D.C. BOARD IS PRESENT.
4. REMOVE R115 & R116 AT HL1-HL2 & HL3-HL4 WHEN SCAN BOARD IS PRESENT.
5. P5 MAY BE REMOVED TO DISABLE TRANSMITTER DURING RECEIVER TESTING.
6. R97 CONNECTED TO J4-1 WHEN BATTERY STANDBY 19D438726 RELAY ASSEMBLY IS USED OR +13V WITH 19C851129 DIODE ASSEMBLY.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER µ, n OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR µ.

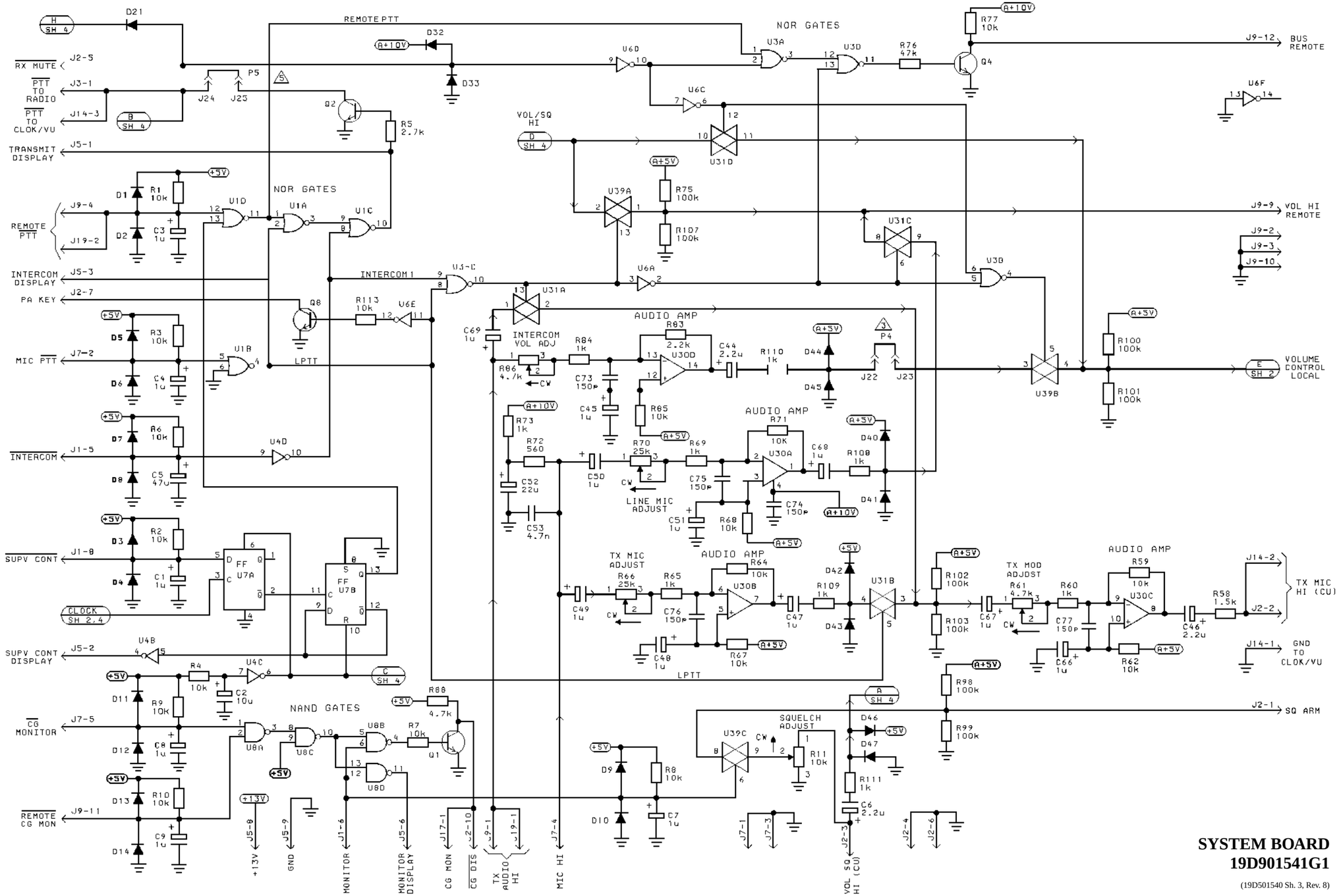
MODEL NO.	REV. LETTER
PL19D901541G1	E

DEVICE	GROUND PIN NO.	+5V PIN NO.	+5V BK UP PIN NO.	A+10V PIN NO.
U1,3,7,8 17,21,22, 24,29,31, 36,38,39	7	14		
U4,5,6,37	8	1		
U9,10,16, 19,20,25	8	16		
U12,15	7		14	
U18	8	16		
U27		16		
U30	11			4
U35	8		16	
U28				4

(19D901540, Sh. 1, Rev. 7)

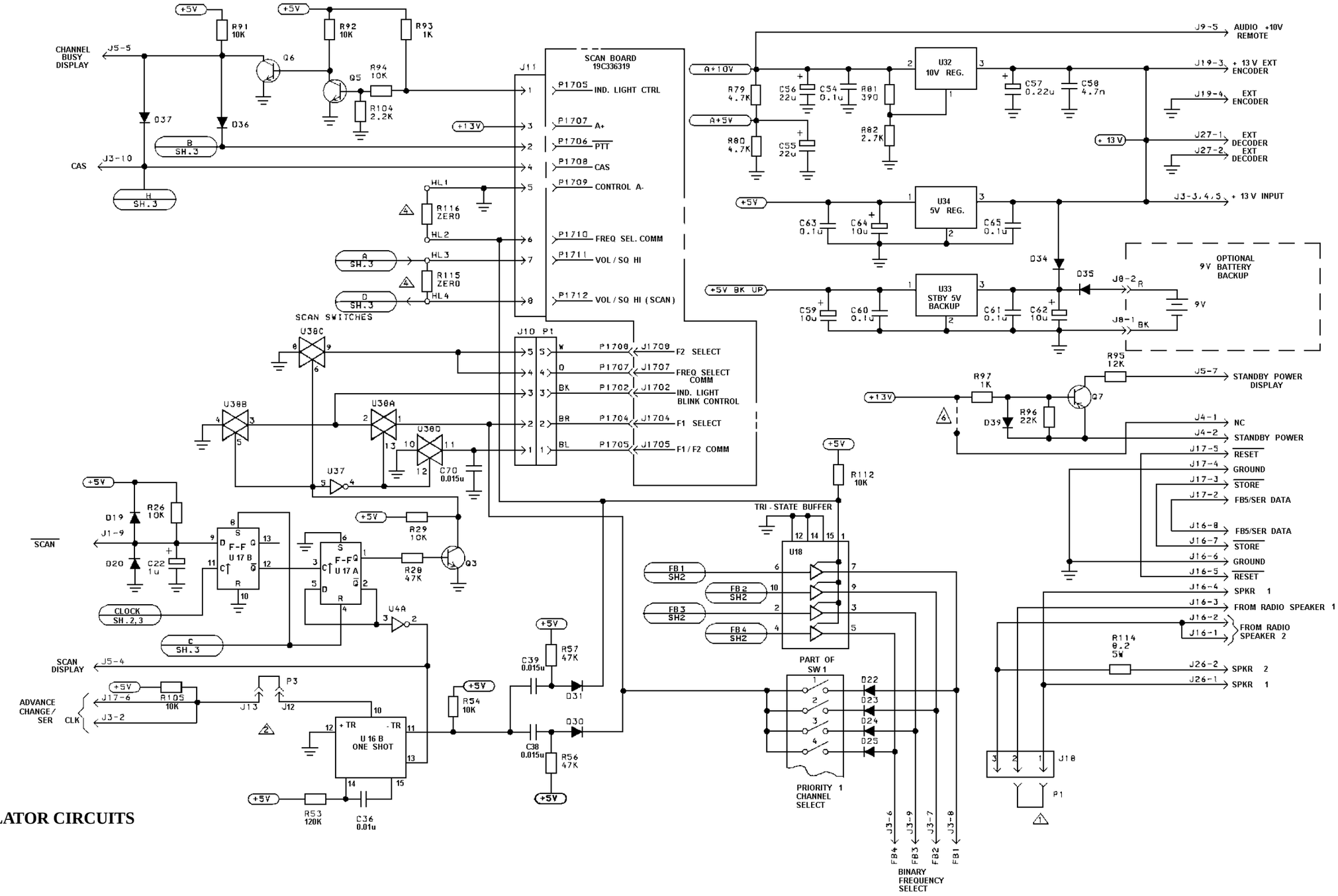
VOLUME AND CHANNEL SELECT
19D901540

(19D901540, Sh. 2, Rev. 3, and Sh. 1, Rev. 7)



SYSTEM BOARD
19D901541G1

(19D501540 Sh. 3, Rev. 8)



SCAN & REGULATOR CIRCUITS
19D901540

(19D901540, Sh. 4, Rev. 7)

TROUBLESHOOTING PROCEDURE

This Troubleshooting Procedure assumes that the Delta radio in the station is in satisfactory working condition.

SYMPTOM	PROCEDURE
l. Microphone does not key transmitter	Check mic PTT switch, U1B, U1A, U1C or Q2.
2. Remote does not key transmitter	Check remote board PTT output. Check U1D, U1A.
3. No mic audio	Check U30B, U31B, U30C. Feed 20 mv into J7-4 and check for 100 mv on J2-2.
4. No mic to line audio	Feed 20 mv into J7-4 and check for output on J9-9. Check U30A, U31C. Check Remote board telephone line.
5. No remote transmit audio	Feed audio signal into the telephone line input on the remote control board. Check remote board output at J9-1 Check U31A.
6. No receive audio	Check for 300 mv at J2-3 with an on channel RF signal of 1 kHz at 3 kHz deviation. Check U31D, U27 (output on pin 3) U28 (output on pin 1).
7. No audio from remote	Set up per step 5. Check U3OD, U39B, U3B, U6C, U6D, U6A and U3C.
8. No receive audio to line	Set up per step 6. Check U39A, check remote board. Check U3A, U3D, and Q4.
9. No squelch noise while monitoring	Check keyboard connections. Check U39C (should be open when monitoring).
10. Radio won't squelch	Check setting of Rll for critical squelch. Check U39C (should be closed).
11. No CG disable	a. From keyboard monitor: check U8B, Ql. b. From remote or local mic monitor: Check U8A and U8C.
12. No supv control	Check U7A, U7B and U1D.
13. No intercom	Check keyboard connections, U4D, U3C and U1C.
14. No volume control	Check keyboard connections, U21A, U21B, U24B,U15B, U36A, U14, U24A, U16A, U25, U19, U20, S2 setting, U27 and U13. Note: If volume changes every other step, check U22D and U29A.
15. No channel control	Check keyboard connections, U12A, U12B, Ul3, U36A, U15A, U15B, Ul4, U16A, U35, U9, U10, S1 setting and U18.
16. Improper channel control	Check U35, U9, Ul0, U5 and U18.
17. No scan	Check keyboard connections U17B, U17A, Q3, U38 A-D and U37, scan board (See Scan Board Maintenance Manual), CAS input.
18. Priority scan time too long (No advance change pulse)	Check U4A and U16B.
19. No 10 volts	Check U32.
20. No 5 volts	Check U34.
21. No 5 volt backup	Check U33.

PARTS LIST

DELTA DESK TOP STATION
SYSTEM BOARD - A4
19D901541G1
ISSUE 6

SYMBOL	PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C2	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C3 and C4	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C5	19A703314P4	Electrolytic: 47 uF -10+50%, 16 VDCW; sim to Panasonic LS Series.
C6	19A703314P7	Electrolytic: 2.2 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C7 thru C10	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C11 and C12	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C13	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C14	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C15 and C16	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C17	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C18 and C19	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C20	19A703314P4	Electrolytic: 47 uF -10+50% tol, 16 VDCW; sim to Panasonic LS Series.
C21	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C22	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C24	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C25 and C26	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C27	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C29	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C31	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C33	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C34	19A703314P4	Electrolytic: 47 uF -10+50% tol, 16 VDCW; sim to Panasonic LS Series.
C35	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C36	T644ACP310K	Polyester: .010 uF ±10%, 50 VDCW.
C38 and C39	T644ACP315K	Polyester: .015 uF ±10%, 50 VDCW.
C40	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C41	19A703314P7	Electrolytic: 2.2 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C42	19A703314P5	Electrolytic: 22 uF -10+50% tol, 25 VDCW; sim to Panasonic LS Series.
C43	T644ACP210K	Polyester: .0010 uF ±10%, 50 VDCW.
C44	19A703314P7	Electrolytic: 2.2 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C45	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C46	19A703314P7	Electrolytic: 2.2 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C47 thru C51	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C52	19A703314P5	Electrolytic: 22 uF -10+50% tol, 25 VDCW; sim to Panasonic LS Series.
C53	T644ACP247K	Polyester: .0047 uF ±10%, 50 VDCW.
C54	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C55 and C56	19A703314P5	Electrolytic: 22 uF -10+50% tol, 25 VDCW; sim to Panasonic LS Series.
C57	19A701534P2	Tantalum: 0.22 uF ±20%, 35 VDCW.
C58	T644ACP247K	Polyester: .0047 uF ±10%, 50 VDCW.
C59	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C60 and C61	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C62	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C63	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C64	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW; sim to Panasonic LS Series.
C65	19A702250P113	Polyester: 0.1 uF ±10%, 50 VDCW.
C66 thru C69	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.
C70	T644ACP315K	Polyester: .015 uF ±10%, 50 VDCW.
C71 thru C77	19A700233P2	Ceramic: 150 pF ±20%, 50 VDCW.
		- - - - - - - - - - DIODES - - - - - - - - - -
D1 thru D37	19A700028P1	Silicon: 75 mA, 75 PIV; sim to IN4148.
D39	19A700028P1	Silicon: 75 mA, 75 PIV; sim to IN4148.
D40 thru D47	19A700047P3	19A702250P113
		- - - - - - - - - - JACKS - - - - - - - - - -
J1		Connector. Includes:
	19A703248P1	Post: Tin Plated, 10 mm length.
J2 and J3		Connector. Includes:
	19A703248P2	Post: Tin Plated, 13 mm length.
J4	19A700072P28	Printed wire: 2 contacts rated @ 2.5 amps; sim to Molex 22-27-2021.
J5 and J6		Connector. Includes:
	19A703248P1	Post: Tin Plated, 10 mm length.
J7	19A116659P52	Connector, printed wiring: 8 contacts rated at 5 amps; sim to Molex 09-65-1081.
J8	19A700072P28	Printed wire: 2 contacts rated @ 2.5 amps; sim to Molex 22-27-2021.
J9	19A701785P1	Contact, electrical; sim to Molex 08-50-0404.
J10	19A700072P31	Printed wire: 5 contacts rated at 2.5 amps; sim to Molex 22-27-2051.
J11		Contact, electrical; sim to Molex 08-50-0404.
J12 and J13		Connector. Includes:
	19A703248P1	Post: Tin Plated, 10 mm length.
J14	19A700072P29	Printed wire: 3 contacts rated at 2.5 amps; sim to Molex 22-27-2031.
J16		Connector. Includes:
	19A703248P2	Post: Tin Plated, 13 mm length.
J17	19A700072P32	Printed wire: 6 contacts rated at 2.5 amps; sim to Molex 22-27-2061.
J18		Connector. Includes:
	19A703248P1	Post: Tin Plated, 10 mm length.
J19	19A700072P30	Printed wire: 4 contacts rated at 2.5 amps; sim to Molex 22-27-2041.
J22 thru J25		Connector. Includes:
	19A703248P1	Post: Tin Plated, 10 mm length.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
J26 and J27	19A700072P28	Printed wire: 2 contacts rated @ 2.5 amps; sim to Molex 22-27-2021.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	19A702104P1	Connector: Shorting Jumper, Tin Plated.
P3	19A702104P1	Connector: Shorting Jumper, Tin Plated.
P5	19A702104P1	Connector: Shorting Jumper, Tin Plated.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q6	19A700023P2	Silicon, NPN: sim to 2N3904.
Q7	19A700022P2	Silicon, PNP: sim to 2N3906.
Q8	19A700023P2	Silicon, NPN: sim to 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R4	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R5	H212CRP227C	Deposited carbon: 2.7K ohms ±5%, 1/4 w.
R6 thru R10	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R11	19B800784P108	Variable: 10K ohms ±20%, 1/2 w.
R13 thru R18	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R19 and R20	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R21	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R22	H212CRP339C	Deposited carbon: 39K ohms ±5%, 1/4 w.
R23	H212CRP268C	Deposited carbon: 6.8K ohms ±5%, 1/4 w.
R24	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R25 and R26	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R28	H212CRP347C	Deposited carbon: 47K ohms ±5%, 1/4 w.
R29 thru R34	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R37	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R38	H212CRP482C	Deposited carbon: 0.82M ohms ±5%, 1/4 w.
R39	H212CRP439C	Deposited carbon: 0.39M ±5%, 1/4 w.
R40	H212CRP418C	Deposited carbon: 0.18M ohms ±5%, 1/4 w.
R41	H212CRP382C	Deposited carbon: 82K ohms ±5%, 1/4 w.
R42	H212CRP339C	Deposited carbon: 39K ohms ±5%, 1/4 w.
R43	H212CRP318C	Deposited carbon: 18K ohms ±5%, 1/4 w.
R44	H212CRP282C	Deposited carbon: 8.2K ohms ±5%, 1/4 w.
R45	H212CRP233C	Deposited carbon: 3.3K ohms ±5%, 1/4 w.
R46	H212CRP239C	Deposited carbon: 3.9K ohms ±5%, 1/4 w.
R47	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R48	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R49	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R50	19B800784P106	Variable: 5K ohms ±20%, 1/2 w.
R51	H212CRP356C	Deposited carbon: 56K ohms ±5%, 1/4 w.
R52	H212CRP327C	Deposited carbon: 27K ohms ±5%, 1/4 w.
R53	H212CRP412C	Deposited carbon: 0.12M ohms ±5%, 1/4 w.
R54	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R56 and R57	H212CRP347C	Deposited carbon: 47K ohms ±5%, 1/4 w.
R58	H212CRP215C	Deposited carbon: 1.5K ohms ±5%, 1/4 w.
R59	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R60	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R61	19B800784P106	Variable: 5K ohms ±20%, 1/2 w.
R62	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R64	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R65	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R66	19B800784P109	Variable: 22K ohms ±20%, 1/3 w.
R67 and R68	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R69	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R70	19B800784P109	Variable: 22K ohms ±20%, 1/3 w.
R71	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R72	H212CRP156C	Deposited carbon: 560 ohms ±5%, 1/4 w.
R73	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R75	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R76	H212CRP347C	Deposited carbon: 47K ohms ±5%, 1/4 w.
R77	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R79 and R80	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R81	H212CRP139C	Deposited carbon: 390 ohms ±5%, 1/4 w.
R82	H212CRP227C	Deposited carbon: 2.7K ohms ±5%, 1/4 w.
R83	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R84	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R85	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R86	19B800784P106	Variable: 5K ohms ±20%, 1/2 w.
R88	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R89 and R90	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R91 and R92	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R93	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R94	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R95	H212CRP312C	Deposited carbon: 12K ohms ±5%, 1/4 w.
R96	H212CRP322C	Deposited carbon: 22K ohms ±5%, 1/4 w.
R97	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R98 thru R103	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R104	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R105	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R107	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R108 thru R111	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R112 and R113	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R114	5493035P52	Wirewound: 8.2 ohms ±10%, 5 w; sim to Hamilton Hall Type HR-5
R115 and R116	19A700184P1	Jumper.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
SW1	19B800010P1	Dual-Inline-Package: 10 Circuits; sim to CTS 206-10.
SW2	19B800010P4	Dual-Inline-Package: 6 Circuits; sim to CTS 206-6.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1	19A700029P2	Digital: Quad 2-Input NOR Gate; sim to 4001B.
U3	19A700029P2	Digital: Quad 2-Input NOR Gate; sim to 4001B.
U4 thru U6	19A700176P1	Digital: Hex Inverting Buffer/Converter; sim to 4049UB.
U7	19A700029P9	Digital: Dual Data Flip-Flop; sim to 4013B.
U8	19A700029P7	Digital: QUAD 2-INPUT NAND GATE.
U9 and U10	19A700029P230	Digital: BIT MAGNITUDE COMPARATOR.
U12	19A700029P9	Digital: Dual Data Flip-Flop; sim to 4013B.
U13 and U14	19A701865P1	Linear: Timer; sim to Signetics NE555N.
U15	19A700029P8	Digital: DUAL 4-INPUT NAND GATE.
U16	19A700029P219	DUAL RETRIGGERABLE RESETTABLE MONOSTABLE MULTIVIBRATOR.
U17	19A700029P9	Digital: Dual Data Flip-Flop; sim to 4013B.
U18	19A700029P229	Digital: HEX 3-STATE BUFFER.
U19 and U20	19A700029P230	Digital: BIT MAGNITUDE COMPARATOR.
U21	19A700029P9	Digital: Dual Data Flip-Flop; sim to 4013B.
U22	19A700029P7	Digital: QUAD 2-INPUT NAND GATE.
U24	19A700029P8	Digital: DUAL 4-INPUT NAND GATE.
U25	19A700029P232	UP/DOWN PRESETTABLE-COUNTER.
U27	19A700029P36	Digital: Single 8-Channel Multiplexer; sim to 4051B.
U28	19A700086P1	DUAL OP AMP; sim to Type 1458.
U29	19A700029P44	Digital: BILATERAL SWITCH.
U30	19A700086P1	DUAL OP AMP; sim to Type 1458.
U31	19A700029P44	Digital: BILATERAL SWITCH.
U32	19A701999P1	Linear: Voltage Regulator; sim to LM317T.
U33	19A704971P1	Linear: +5 Volt Regulator; sim to MC78L05ACP.
U34	19A134717P1	Linear: 5 Volt Regulator; sim to MC7805CT.
U35	19A700029P232	UP/DOWN PRESETTABLE-COUNTER.
U36	19A700029P8	Digital: DUAL 4-INPUT NAND GATE.
U37	19A700176P1	Digital: Hex Inverting Buffer/Converter; sim to 4049UB.
U38 and U39	19A700029P44	Digital: BILATERAL SWITCH.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
9	19A143578P228	Spacer, Threaded Metallic.
12	19A702917P7	Heat Sink, Transistor: Sim to Thermalloy Cat 6030B-TT.
13	19A702364P308	Machine screw, TORZ Drive: No. M3-0.5 x 8.
16	19A700032P5	Lockwasher, internal tooth: No. 3MM.
17	19A701312P4	Flatwasher: 3.2 ID.
19	19A700034P4	Nut, hex: No. M3 x 0.5MM.

PRODUCTION CHANGES

Changes in the equipment to improve or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV A - SYSTEM BOARD 19D901541G1
To provide a plug for clock/VU meter option, added J14.

REV B - SYSTEM BOARD 19D901541G1
To facilitate manufacturing, added P5, R115, and R116.

REV C - SYSTEM BOARD 19D901541G1
To make system board compatible with new desk microphone, changed R59, R64, R71, R81, and R82.

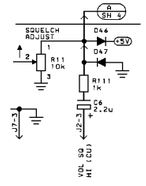
R59 was: H212CRP322C Deposited Carbon: 10k ohms ±5%, 1/4 W.
R64 was: 19A700019P37 Deposited Carbon: 27k ohms ±5%, 1/4 W.
R71 was: 19A700019P60 Deposited Carbon: 82k ohms ±5%, 1/4 W.
R81 was: 19A700019P30 Deposited Carbon: 270 ohms ±5%, 1/4 W.
R82 was: 19A700019P40 Deposited Carbon: 1.8k ohms ±5%, 1/4 W.

REV D - SYSTEM BOARD 19D901541G1
To provide better range for Line Mic adjust, changed R71.

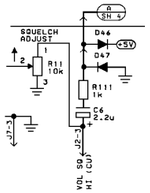
R71 was: H212CRP247C Deposited Carbon: 4.7k ohms ±5%, 1/4 W.

REV E - SYSTEM BOARD 19D901541G1
To provide lighter maximum squelch adjustment. Moved R11-1 from the cathode of D46 to the (+) side of C6.

From:



To:



REV F - SYSTEM BOARD 19D901541G1
To improve operation by increasing intercom delay to mask PTT glitch at power up. Changed the value of C5 from 1 uF to 47 uF.

C5 was: 19A703314P6 Electrolictic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS series.

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