MOBILE RADIO

MAINTENANCE MANUAL

TYPE 99 TONE
SERIES 101 DESK TOP ENCODER

Maintenance Manual LBI 4406 J
DATAFILE FOLDER - DF5042

SERIES 101

SPECIFICATIONS *

SUPPLY VOLTAGE	117 VAC ±20%, 50/60 Hz
INPUT POWER	15 Watts
STANDBY VOLTAGE	12 VDC (nominal)
TEMPERATURE RANGE	-30°C to +60°C
HUMIDITY	90% at 50°C (EIA)
FREQUENCY STABILITY	0.1%
TONE OUTPUT LEVEL	0 to 100 mV (adjustable)
FREQUENCY RANGE	288 to 1433 Hz
STANDARD TONES AVAILABLE	31 (517.5 to 967.5 Hz)
FREQUENCY RESPONSE	±1 dB (from 288 to 1433 Hz)
Tx KEYING CURRENT	500 mA maximum
DIMENSIONS	4-1/2" H x 5-7/8" W x 7-7/8" D
WEIGHT	5 lbs., 9 oz.

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

GENERAL ELECTRIC

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

The General Electric Type 99 Tone Encoder Consoles (Series 101) provide selective calling from base stations to mobiles, personal paging receivers, portable two-way units, or between base stations. The encoders utilize sequential tone signaling to permit INDIVIDUAL CALL, GROUP CALL and/or ALL CALL within a single communication system that is properly equipped with the required tone decoders.

The encoder is designed to be connected to and operated with a General Electric Transistorized Control Console or DESKON remote control console. The encoder may be used with a local or local/remote controlled MASTR base station by adding the proper adapter cables (Option 4061).

The encoder is housed in a telephonesized desk set with twelve, light-pressure switches. Status indication is provided by two light emitting diodes (LEDs), marked READY to signal the operator that the system is idle and prepared to accent a call, and TONE which flashes the moment code selection is complete and the desired call is being transmitted.

Transmitter keying is automatic. A manual transmit button is provided (marked TX) for remote transmitter keying independent of the encoding action. A switch marked R is used to reset the encoder or to cancel an incorrect or undesired code in progress.

The encoder has a self-contained power supply and voltage regulator. Plug-in interchangeable printed boards utilize integrated circuit logic packages to assure maximum flexibility. 16, 64, 100, 400 or 900 call capacity is available. A single RC feedback circuit package, along with a three-stage high gain DC amplifier provides all the required tone frequencies. Frequency selection is accomplished by changing the resistance of the oscillator feedback loop.

TONE ASSIGNMENTS

A total of thirty-one tones are available as standard. Others are available by special request. The tone assignments are made as follows:

TABLE 1 - TONE ASSIGNMENTS

Encoder Comb. Series	Number of digits used in Code	Call Capacity	Tone Assignments
101X1B	2	16	742.5 Hz plus Subgroup A
101Y1B	2	16	742.5 Hz plus Subgroup B
101Z1B	2	16	742.5 Hz plus Subgroup C
101X2B	3	64	742.5 Hz plus Subgroups A and B
101Y2B	3	64	742.5 Hz plus Subgroups B and C
101Z2B	3	64	742.5 Hz plus Subgroups A and C
101X3B	2	100	742.5 Hz plus Group A
101Y3B	2	100	742.5 Hz plus Group B
101Z3B	2	100	742.5 Hz plus Group C
101X4B	3	400	742.5 Hz plus Groups A and B
101Y4B	3	400	742.5 Hz plus Groups B and C
101Z4B	3	400	742.5 Hz plus Groups A and C
101X5B	3	900	742.5 Hz plus Groups A, B and C

TONE ASSIGNMENTS

TABLE 2 - FORMAT SELECTION

100's Digit Selected	Tone Bank (Group) Selected			
	For 1st Tone		For 2nd Tone	
	Bank	Tone Group Format: X Y Z	Bank	Tone Group Format: X Y Z
0*	1	A B A	1	A B A
1	2	B C C	1	A B A
2*	2	B C C	2	B C C
3	1	A B A	2	B C C
4*	3	C	3	C
5	3	C	1	A
6	3	C	2	B
7	1	A	3	C
8	2	B	3	C
9	Not Used			

* Diagonal Tone is substituted for 1st Tone when these digits are selected and 2nd & 3rd digits are identical.

The first digit in the paging code (hundreds digit in 64, 400 and 900 call codes) determines the tone sequence format by selecting the tone banks (tone groups) which will determine the actual tones which are selected by the tens and units digits. No format selection is required in the 16 and 100 call encoders. Table 2 indicates which tone banks are selected by each hundreds digit. If digit "3" is selected (Format X), the first tone will be selected from Bank 1 (Tone Group A) and the secondtone will be selected from Bank 2 (Tone Group B). An example will explain this more clearly:

Example 1: When paging code "175" (Format X) is to be selected, the calling party selects digit "1". From Table 2, you can see that the "1" digit selects the first tone from Bank 2 (Tone Group B) and the second tone from Bank 1 (Tone Group A). The "7" and "5" digits select tones B7 and A5, respectively. So the first tone transmitted is tone B7 (517.5 Hz) and the second tone transmitted is A5 (892.5 Hz). You can find these tone frequencies from Table 3.

In the 64, 400 and 900 call systems, it is possible to select the same tone twice. If the first digit of the code is "0", "2", or "4", both tones will be selected from the same tone group. If the second and third code digits are identical, the Diagonal Tone frequency (742.5 Hz) will be substituted for the first tone.

The 16 and 64 call encoders select from tone subgroups as indicated in Table 1.

TABLE 3

TONE SELECT GROUP FREQUENCIES

Tone Group	Tone No.	Tone Frequency
A	A0	682.5 Hz
	A1	592.5 Hz
	A2	757.5 Hz
	A3	802.5 Hz
	A4	847.5 Hz
	A5	892.5 Hz
	A6	937.5 Hz
	A7	547.5 Hz
	A8	727.5 Hz
	A9	637.5 Hz
B	B0	652.5 Hz
	B1	607.5 Hz
	B2	787.5 Hz
	B3	832.5 Hz
	B4	877.5 Hz
	B5	922.5 Hz
	B6	967.5 Hz
	B7	517.5 Hz
	B8	562.5 Hz
	B9	697.5 Hz
C	C0	667.5 Hz
	C1	712.5 Hz
	C2	772.5 Hz
	C3	817.5 Hz
	C4	862.5 Hz
	C5	907.5 Hz
	C6	952.5 Hz
	C7	532.5 Hz
	C8	577.5 Hz
	C9	622.5 Hz
Diagonal Tone:		742.5 Hz

Table 4 lists the tone frequencies making up these subgroups.

TABLE 4
TONE SELECT SUBGROUP FREQUENCIES

Tone Sub-Group	Tone No.	Tone Frequency
A	A0	682.5 Hz
	A1	592.5 Hz
	A2	757.5 Hz
	A3	802.5 Hz
B	B0	652.5 Hz
	B1	607.5 Hz
	B2	787.5 Hz
	B3	832.5 Hz
C	C0	667.5 Hz
	C1	712.5 Hz
	C2	772.5 Hz
	C3	817.5 Hz
Diagonal Tone:		742.5 Hz

COMPONENT BOARD SELECTION

Table 5 is a Component Board Selection Matrix, designed to allow the serviceman to quickly determine the specific boards used in the particular encoder he is servicing.

To use the matrix, the serviceman determines the combination number of the encoder (marked on the chassis nameplate) and, using the 4th. and 5th. digits of the combination number, finds the board combination for his particular encoder from Table 5. This is accomplished by reading down the column corresponding to the 4th. and 5th. digits of the encoder combination number (for example, X1, or Z2, etc.), finding each dot in that column and reading to the left of each dot to find the specific component boards and their number.

TABLE 5

COMPONENT BOARD SELECTION MATRIX

BOARD TITLE & NUMBER	4th & 5th Digits of Combination Number												
	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3	X4	Y4	Z4	X5
Output Sequence 19D433190G1	●	●	●	●	●	●	●	●	●	●	●	●	●
Storage 19D416314G1	●	●	●	●	●	●							
Storage 19D416320G1							●	●	●	●	●	●	●
Input Matrix 19D433495G1	●	●	●	●	●	●							
Input Matrix 19D433495G2							●	●	●	●	●	●	●
Oscillator 19C320086G1	●	●	●	●	●	●	●	●	●	●	●	●	●
Frequency Select 19D416469G1	●			●		●							
Frequency Select 19D416469G2		●		●	●								
Frequency Select 19D416469G3			●		●	●							
Frequency Select 19D416469G4							●			●		●	●
Frequency Select 19D416469G5								●		●	●		●
Frequency Select 19D416469G6									●		●	●	●
Format 19D433334G1	●	●	●				●	●	●				
Format 19D433334G2 or G3				●	●	●							
Format 19D416325G1										●	●	●	●

OPERATION

To page a receiver:

1. If the system is idle, the READY light on the encoder will be illuminated.

2. Sequentially depress the two (or three) pushbuttons on the panel corresponding to the assigned paging code of the receiver to be paged. When the tone code is being transmitted, the TONE light will flash.

CAUTION

Do not use a sharp-pointed instrument (such as a ball-point pen or pencil) to depress the pushbuttons as damage to the buttons will result.

3. The station transmitter will remain keyed for five seconds after the tone sequence is complete, allowing the operator to transmit a brief voice message. The encoder will then automatically reset and be ready for the next page at the end of this five second period.

NOTE

If it is desired to interrupt a page before completion, press the button marked R to reset the encoder.

4. To transmit a voice message without paging, use the Tx button on the panel as a normal PTT switch. Depressing the Tx button also resets the encoder if it is depressed at the end of the tone transmission but prior to automatic reset.

CIRCUIT ANALYSIS

Paging Code Selection (Figure 1)

When the operator depresses the switch on the encoder panel which corresponds to the first digit of the paging code, the closing of the switch contact connects the +4.8 VDC supply voltage to the base of the corresponding buffer transistor through a Switch-bounce suppressor RC network on the Input Matrix Board. For example, if the digit 5 switch is depressed, the supply voltage is applied to the base of Q6 on the Input Matrix Board, turning Q6 on.

When Q6 conducts, the collector goes to ground, applying a logic "0" to Pin 4 of IC1 and Pin 10 of IC1. IC1 codes the input to binary "1" at its output and IC3-B codes the input to binary "4" at its output. Binary "1" and binary "4" correspond to the decimal 5 selected at the push switch. The binary coding is connected to the Storage Board and the Format Board. In 16 and 64 call encoder modes, only digits 0 through 3 are used for selecting the paging codes, utilizing binary "1" and binary "2". In the 100, 400 and 900 call encoders, all ten digits are used, utilizing binary "1", "2", "4", and "8".

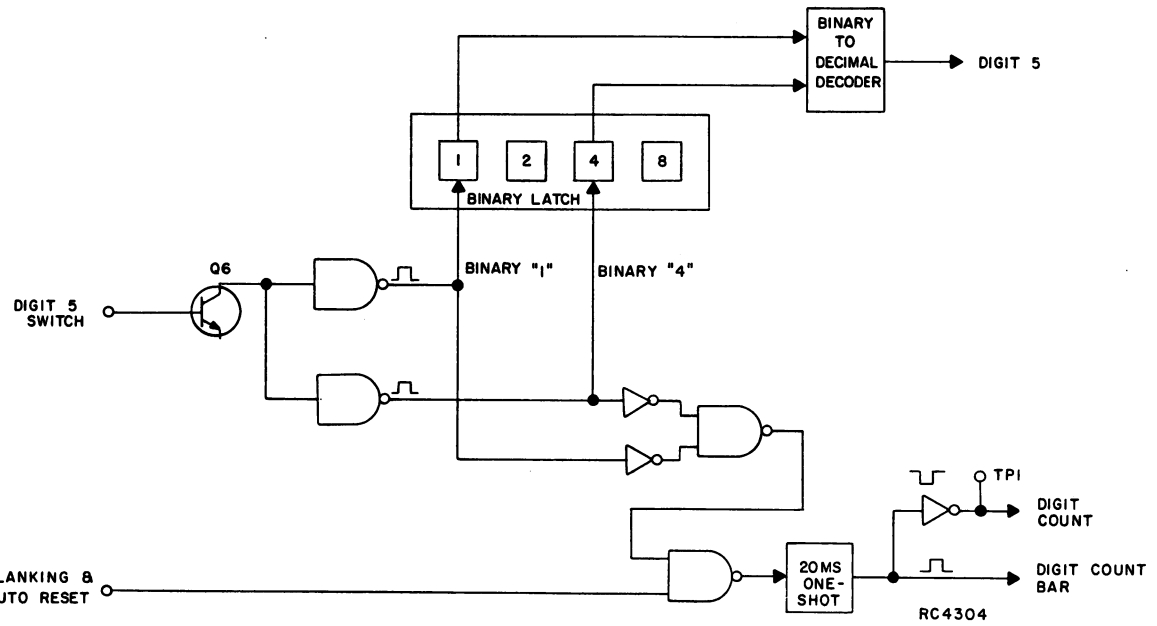

Figure 1 - Paging Code Selection

The binary coded output of the NAND gates is also applied to the 20 millisecond one-shot multivibrator which supplies pulses to the DIGIT COUNT lead P1-6. This information is also passed to the DIGIT COUNT BAR lead P1-5.

The logic "1" on the P1-5 lead is connected to the Sounder Board A1303 which reverse biases diode CR1, turning on the multivibrator (Q1-Q2). The multivibrator operates the beeper transducer LS1351 for the duration of the 20 millisecond one-shot. This gives a positive audible indication of the operation of the keyboard switch.

Digit Counting and Storage (Figure 2)

As each digit of the paging code is selected, the DIGIT COUNT output of the Input Matrix Board triggers DIGIT COUNTER FLIP FLOPS IC1A and IC1B on the Format Board. The output of the counter is ANDed with the DIGIT COUNT BAR pulses to provide triggering to the LATCH circuits.

In the 64, 400 and 900 call encoders, three paging code digits must be counted. The first digit count triggers the 1ST DIGIT LATCH on the Format Board; the second and third digit counts trigger the 2ND and 3RD DIGIT LATCH circuits on the Storage Board. In the 16 and 100 call encoders, only two paging code digits are counted. The first digit counted triggers the 2ND DIGIT LATCH on the Storage Board and the second digit count triggers the 3RD DIGIT LATCH.

Storage of the binary digits is accomplished in the LATCH circuits. The first paging code digit selected is gated to a Binary to Decimal Decoder and the decoded decimal selects the format (tone group and sequence) from the Frequency Select Board banks. The second and third digits selected determine the frequency of Tone No. 1 and Tone No. 2, respectively. For example, if the paging code digits are 1-3-5, the following tone selection takes place:

a. Paging code digit 1 is converted to binary "1" and stored in the 1ST DIGIT LATCH on the format board. The Binary to Decimal Decoder will convert the binary "1" to decimal "1" when the tone sequence is triggered, thus enabling Frequency Select Bank 2 and then Frequency Select Bank 1.

b. Paging code digit 3 is converted to binary "3" and stored in the 2ND DIGIT LATCH on the Storage Board. The Binary to Decimal Decoder will subsequently convert the binary "3" to decimal 3 which selects tone 3 from Frequency Select Bank 2. This will be the first tone transmitted in the paging sequency.

c. Paging code digit 5 is converted to binary "5" and stored in the 3RD DIGIT LATCH on the Storage Board. The Binary to Decimal Decoder will subsequently convert the binary "5" to decimal 5 which will select tone 5 from Frequency Select Board bank 1. This will be the second tone transmitted in the paging sequence.

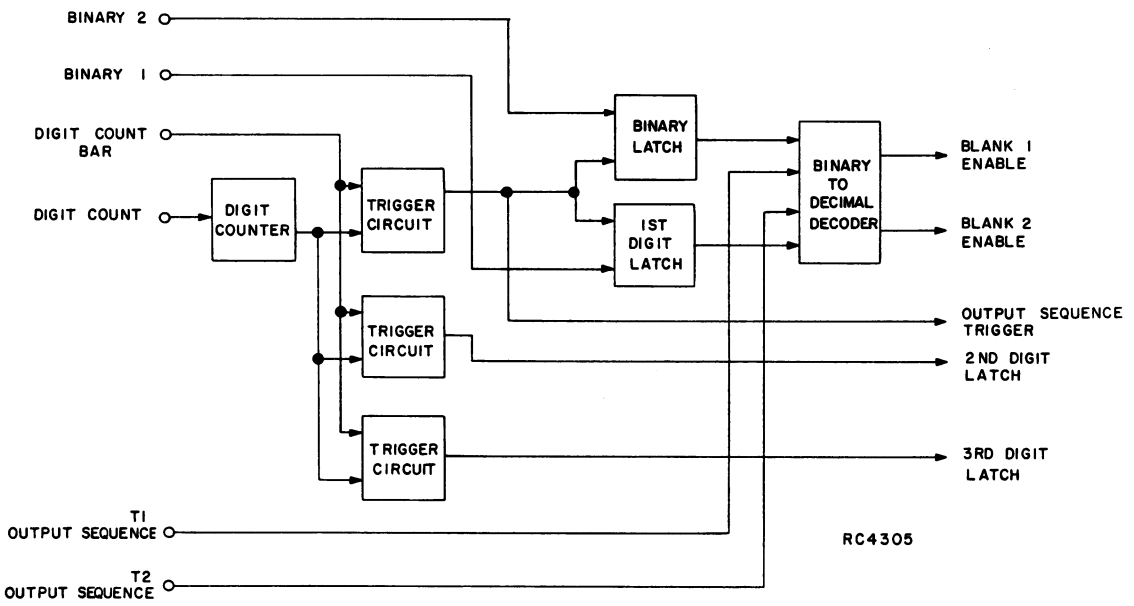

Figure 2 - Digit Counting and Storage

In the two-digit paging code systems (16 and 100 call), the first digit counted is connected via the NAND gates directly to the 2ND DIGIT LATCH on the Storage Board, the second digit counted is connected to the 3RD DIGIT LATCH.

Tone Sequence Triggering (Figure 3)

When the DIGIT COUNTER has detected the third digit (the second digit in the two-digit systems), the IC4 NAND gate on the Format Board supplies a trigger pulse to the OUTPUT SEQUENCE TRIGGER lead P2-1. This trigger is connected to P1-13 on the Output Sequence Board. The OUTPUT SEQUENCE TRIGGER operates the 5-Second Tx One Shot to key on the station transmitter. The one-shot output is also applied to the BLANKING AND AUTO RESET lead P1-10. The trigger also operates the 1-Second Tone 1 One-Shot. The BLANKING AND AUTO RESET output prevents further encoding of paging digits until after the tone sequence has been transmitted and the encoder is reset.

The 1-Second Tone 1 One Shot reads out the stored format and Tone 1 information from the Format and Storage Boards; turns on the TONE light on the encoder switch panel and opens the Audio Gate on the A1301 Mother Board.

At the completion of the first tone transmission, the 1-SECOND-ONE-SHOT returns to its normal state. This initiates the 180 MILLISECOND PAUSE ONE-SHOT. The purpose of this pause is to avoid falsing in the tone decoders in the paged receiver(s). The return of this one-shot to normal initiates the T2 ONE-SHOT to transmit the second tone T2. The T2 ONE-SHOT timing is adjustable from 0.5 to 3 seconds to provide suitable timing for different signaling systems.

At the end of the five second transmit period, the 5 Second Tx One-Shot returns to its normal state, providing a pulse to the BLANKING AND AUTO RESET circuit to trigger the 20 Millisecond One-Shot on the Input Matrix Board, applying a trigger pulse to the RESET line and an Output to the READY LIGHT GATE IC-4B which, in turn, turns on the READY light on the encoder keyboard. The encoder is now ready for encoding a new paging sequence. If the Tx button is depressed after transmission of T2 but prior to the time-out of the 5 second transmit period, Q5 on the Output Sequence is turned on, keying the transmitter and resetting the encoder.

If the operator wishes to interrupt the paging sequence prior to its completion, he depresses the switch marked R on the keyboard. This turns on Q11 on the Input Matrix Board. The logic "0" output from Q11 resets the one-shot multivibrators on the Output Sequence Boards, resets the DIGIT COUNTER on the Format Board, and resets the DIAGONAL TONE flip-flop on the Storage Board if this flip-flop has been triggered. The READY light on the encoder keyboard is also turned on.

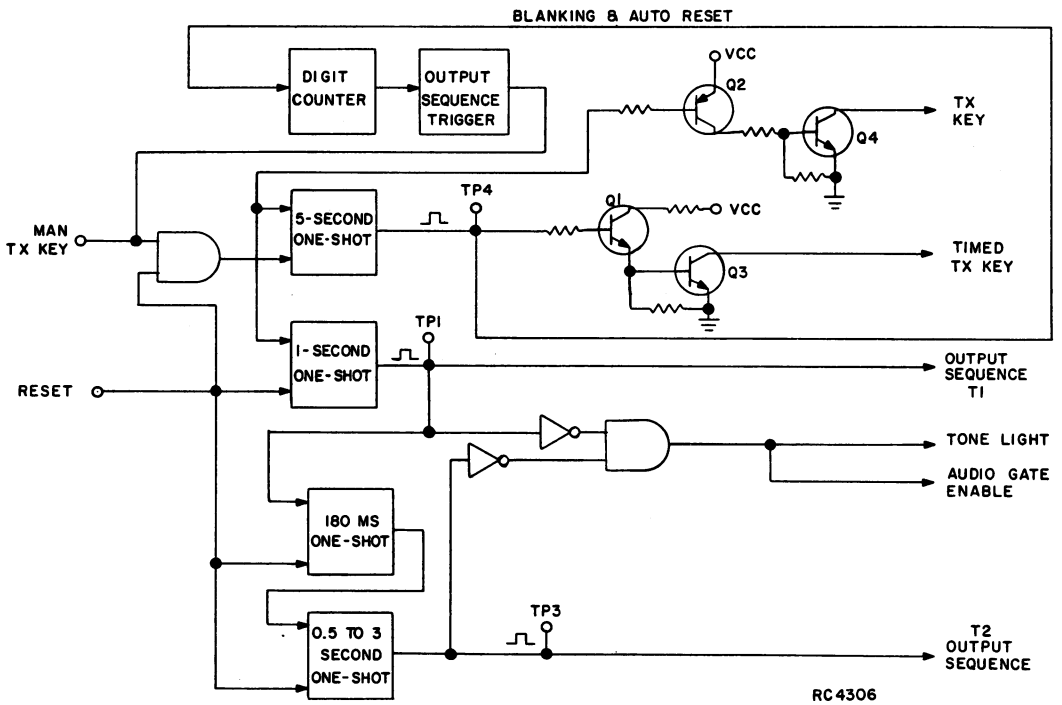

Figure 3 - Tone Sequence Triggering

If the Tx switch on the encoder panel is depressed, Q12 on the Input Matrix Board will be turned on, turning on Q2 on the Output Sequence Board. Conduction of Q2 turns on Q4 which, in turn, keys the station transmitter. The transmitter may now be keyed using the Tx pushbutton as a PTT switch.

Tone Frequency Selection (Figure 4)

The Tone Oscillator Board consists of an RC feedback circuit package and a high-gain DC amplifier and limiter. The frequency selective network consists of C1-C4, R4-R6 and the R value selected from the Frequency Select bank. The high-gain DC amplifier (IC-1) is buffered on each end by emitter followers to provide high input impedance and low output impedance. The output of the amplifier is coupled through another amplifier and limiter to provide positive feedback to the frequency determining network.

Frequency selection is determined by switching in any of the resistors (R1-R96 and the trimming resistors on IC-1) on the Frequency Select Board. Once the proper frequency select banks have been determined by decoding the first digit of the paging code, the transistor switches on the Frequency Select Board (Q3-Q12) that correspond to the second and third digits in the paging code are turned on. The corresponding resistors are thus connected through P1-1 on the Frequency Select Board and P1-6 on the Oscillator Board to the frequency-determining circuit of the oscillator. The frequency of the Oscillator is altered as these resistors are sequentially switched in by the sequence gates on the Format Board. The selected tone signal is connected from P1-4 on the Oscillator Board to the input of the AUDIO GATE on the A1301 Mother Board. The tone level is adjusted at this point by TONE LEVEL ADJUST control R1. The AUDIO GATE CR1 is enabled by turning off Q1 from the Output Sequence Board. The tone is fed to J12 and to the station transmitter.

Diagonal Tone Selection (Figure 5)

In the 64, 400 and 900 call systems, it is possible to select the same tone frequency twice during a paging sequence. If the first digit of the code is "0", "2", or "4", the TONE BANK and SEQUENCE GATES will select both tones from the same bank. If the second and third paging code digits are identical, the same tone frequency would be selected for both sequence tones.

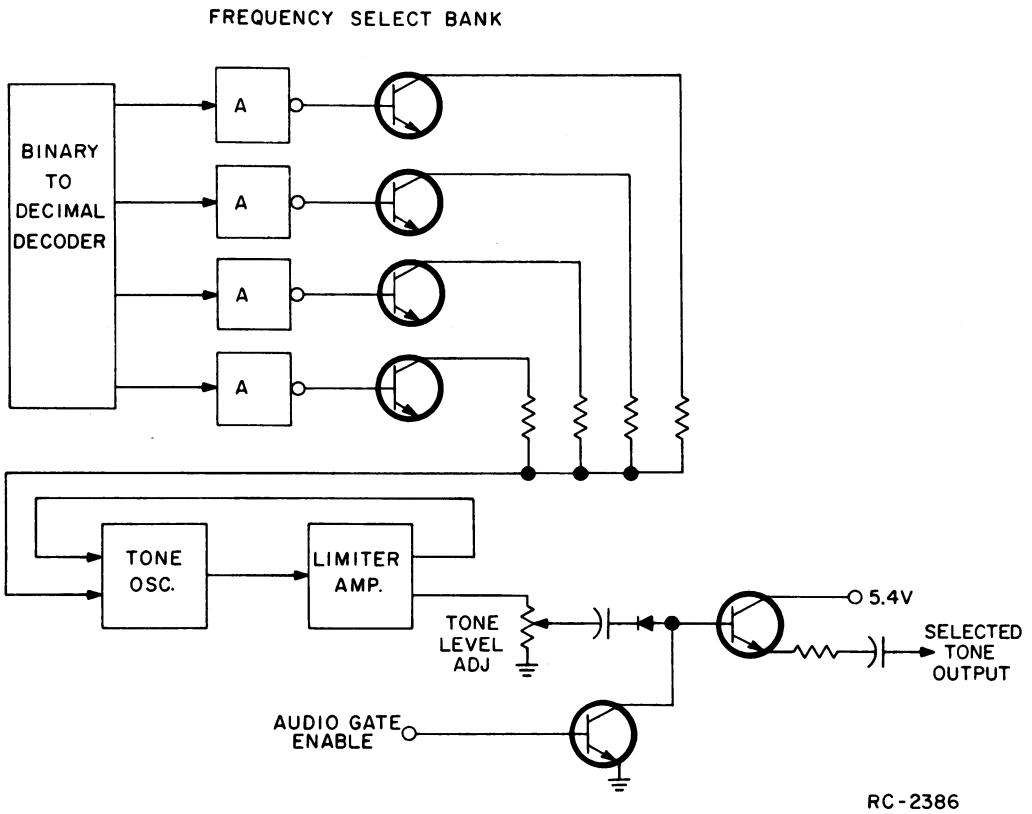

Figure 4 - Tone Frequency Selection

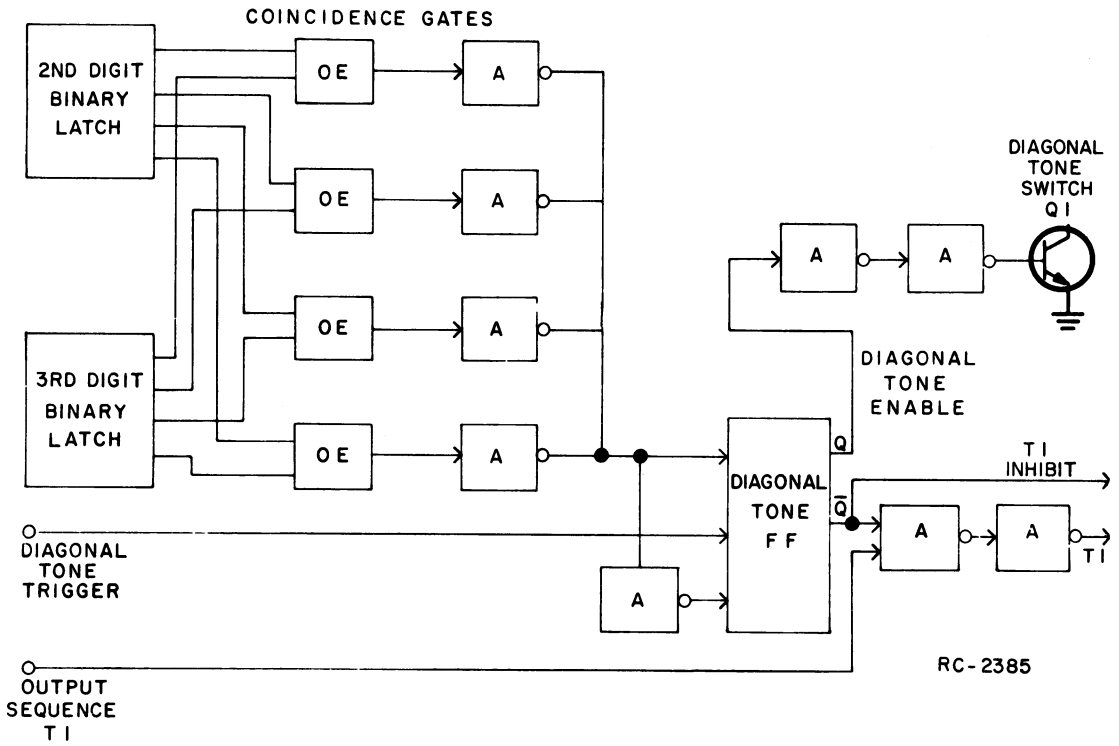

Figure 5 - Diagonal Tone Selection

To avoid this situation, the diagonal tone frequency (742.5 Hz) is substituted automatically for the first tone in the paging sequence when these conditions are present. The Binary Latches are connected to the Diagonal Tone Exclusive OR Coincidence Gates. The output of these gates enables the Diagonal Tone Flip-Flop on the Storage Board when the situation described above is present. The DIAGONAL TONE FLIP-FLOP TRIGGER pulse occurs when the OUTPUT SEQUENCE TRIGGER arrives at the Output Sequence Board. The Diagonal Tone Flip-Flop is set and the Q output (terminal 6) switches the Tone Oscillator to the diagonal tone frequency. The $\overline{Q}$ output of the Diagonal Tone Flip-Flop (terminal 5) inhibits the T1 Tone Gates to prevent Tone 1 from being selected. Upon completion of the first tone transmission period, the tone sequence proveeds in the normal manner.

Power Supply & 5.4 Volt Regulator (Figure 6)

The power supply operates from a source of 117 VAC and is fused at 1/10 ampere by slow-blow fuse F1. Slide switch S1301 connects the source to the power supply transformer T1301. The transformer connects to the bridge rectifier CR2-CR5 which provides an output to the Pi-filter composed of C16, L1301, C8 and C9. The unregulated 12 VDC output is connected to the Sounder Board (A1303) and to the output of the 5.4 Volt regulator.

The 5.4 Volt regulator is controlled by a differential amplifier composed of Q5 and Q6, zener diode VR1 and potentiometer R18. An increase in conduction of Q6 will result in a decrease in conduction of Q5. VR1 holds the base of Q5 at the proper reference voltage. The setting of R18 determines the base bias of Q6.

When current is first applied to the regulator, Q5 is turned on. Conduction of Q5 turns on Q4, providing a low resistance path for the base current of PNP power transistor Q1301.

If the output of the regulator increases Q6 conducts more, causing Q5 to conduct less. This allows less base current through Q1301 and Q4, causing the output of the regulator to remain at the proper 5.4 VDC. If the output tends to decrease Q6 conducts less, causing Q5 to conduct more. This allows more base current to flow through Q1301 and Q4, causing the regulator to remain at the proper 5.4 VDC. Diodes CR6 and CR7 limit current through the emitter-base junction of Q1301, protecting the power transistor from current surges from the power source.

Emergency Battery Operation

Provision is made for operating the encoder from a customer supplied 12 Volt battery in the event of an AC power failure. The emergency battery connects to J7 and J6 (ground) on A1301.

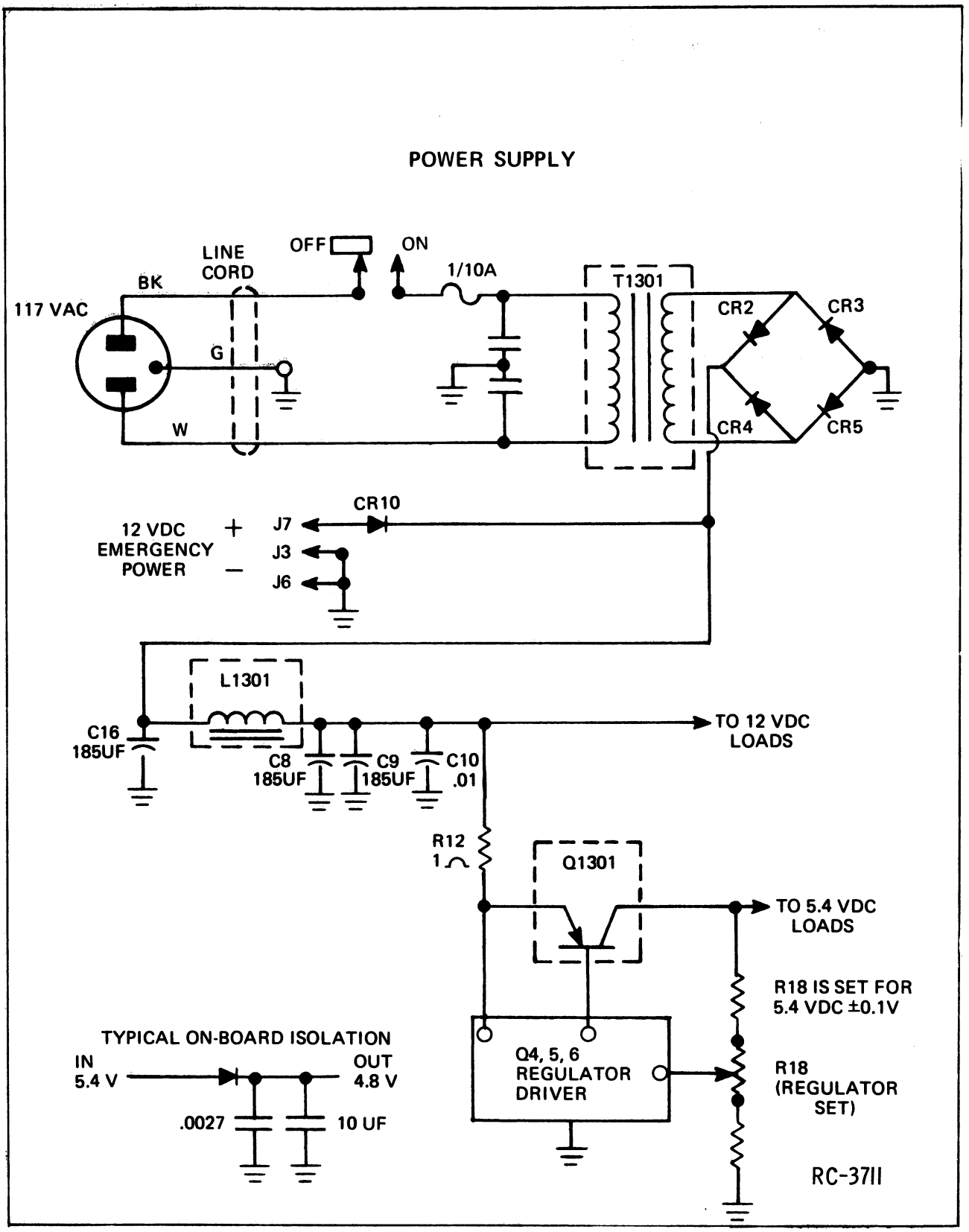

Figure 6 - Power Supply

Under normal operating conditions, CR10 is reverse biased by the encoder supply voltage, preventing any drain on the battery. An AC power failure removes the reverse bias on CR10, and the battery voltage is automatically applied to the encoder.

INSTALLATION

The encoder is located convenient to the operator and connected to the Remote Control Console by means of the 19B219512 cable. Refer to Figure 7 for connector terminations of this cable. Connect the three-conductor AC power cable to a convenient 117 VAC outlet.

Microphone Bridging (Option 4061)

The Series 101 Encoder may be used with a local or local/remote controlled MASTR base station by the addition of Option 4061. Two cables are provided to allow microphone bridging. Connect the 19B219513G2 cable to the control unit as shown in Figure 8. Connect the 19B219513G1 cable to the microphone cable connector.

Transmitter Relay Keying (Option 4062)

Transmitter keying is accomplished in the encoder by means of transistor switching up to 500 mA. This requires a positive supply voltage at the associated remote control unit relay to successfully operate the transmitter. For keying applications where polarity or voltage requirements prevent the use of the transistor switch, the customer may add Option 4062 to the encoder. Refer to Figure 9 for installation of this option.

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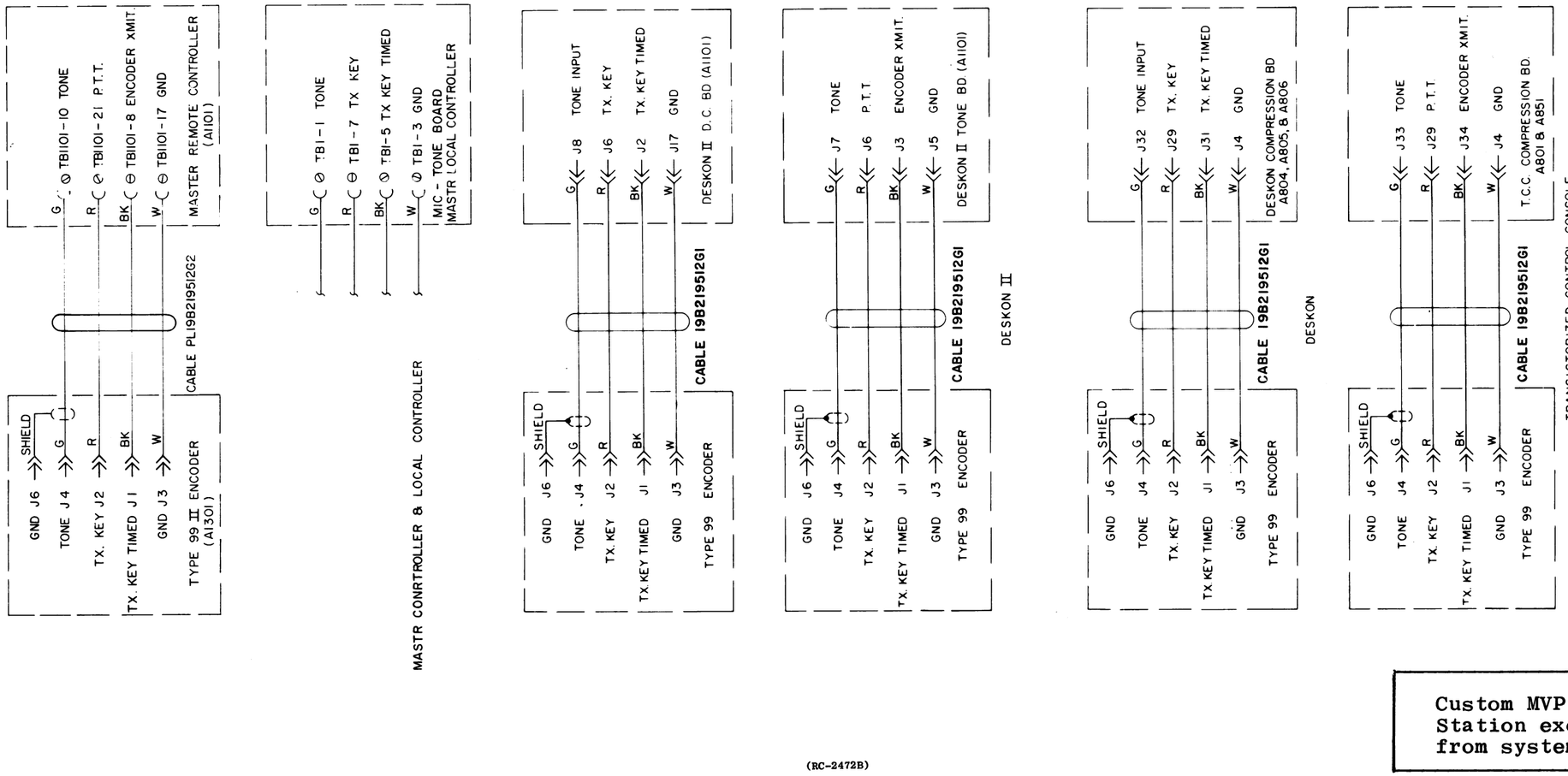


(RC-2472B)

NOTE

Custom MVP same as Executive II Station except, remove R929 from system board (19C321920).

Figure 7
Type 99 Tone Interconnections

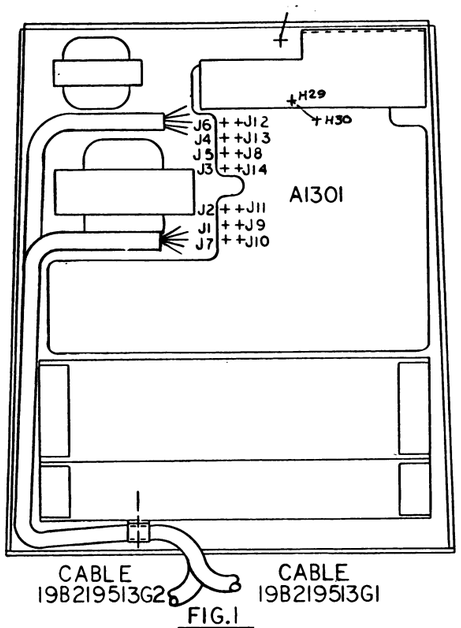
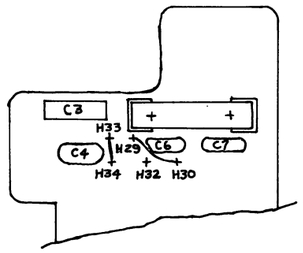


FIG.1

TYPE 99 II ENCODER

THESE INSTRUCTIONS COVER THE INTERCONNECTION OF TYPE 99 II ENCODER TO MICROPHONE BRIDGING OPTION.



PARTIAL VIEW OF A1301

VIEW "A"

INSTRUCTIONS

1. REMOVE (2) TWO SCREWS ON REAR AND ONE ON BOTTOM OF TYPE 99 II ENCODER AND REMOVE COVER. REMOVE ONE SCREW AND COVER.

1A. FOR FACTORY AND/OR FIELD INSTALLATION:
A. CUT JUMPER AT H29 TO H30 ON A1301.
B. ADD DM JUMPER BETWEEN H33 AND H34 ON A1301 (SEE VIEW A). ADD DM JUMPER BETWEEN H1 AND H2 ON OUTPUT SEQUENCE BOARD (19D416493) (SEE VIEW B).

2. CONNECT CABLES (19B219513G1 & G2) ON TYPE 99 II ENCODER PER CONNECTION CHART.

3. REASSEMBLE UNIT.

4. CONNECT 19B219513G2 CABLE TO CONTROL UNIT, CONNECT 19B219513G1 CABLE TO MICROPHONE CONNECTOR.

CONNECTION CHART		
FROM TYPE 99 ENCODER	TO	WIRE
J8	To Microphone 19B219513G1	Shield
J12		G
J2		R
J5		BK
J3		W
J14	To TX. Or Control Unit 19B219513G2	Shield
J4		G
J11		R
J13		BK
J6		W

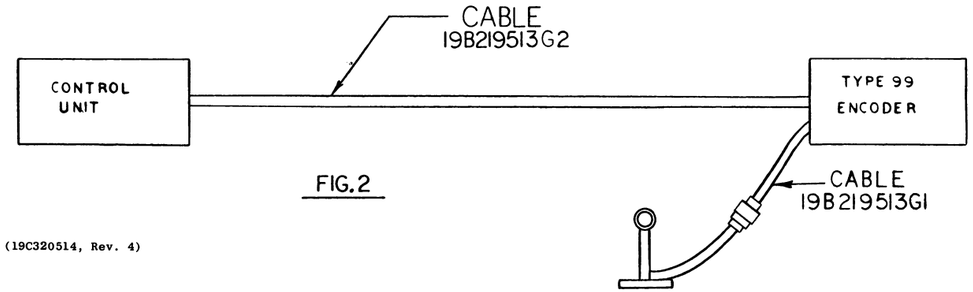
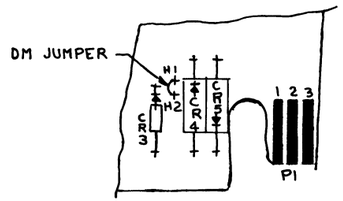


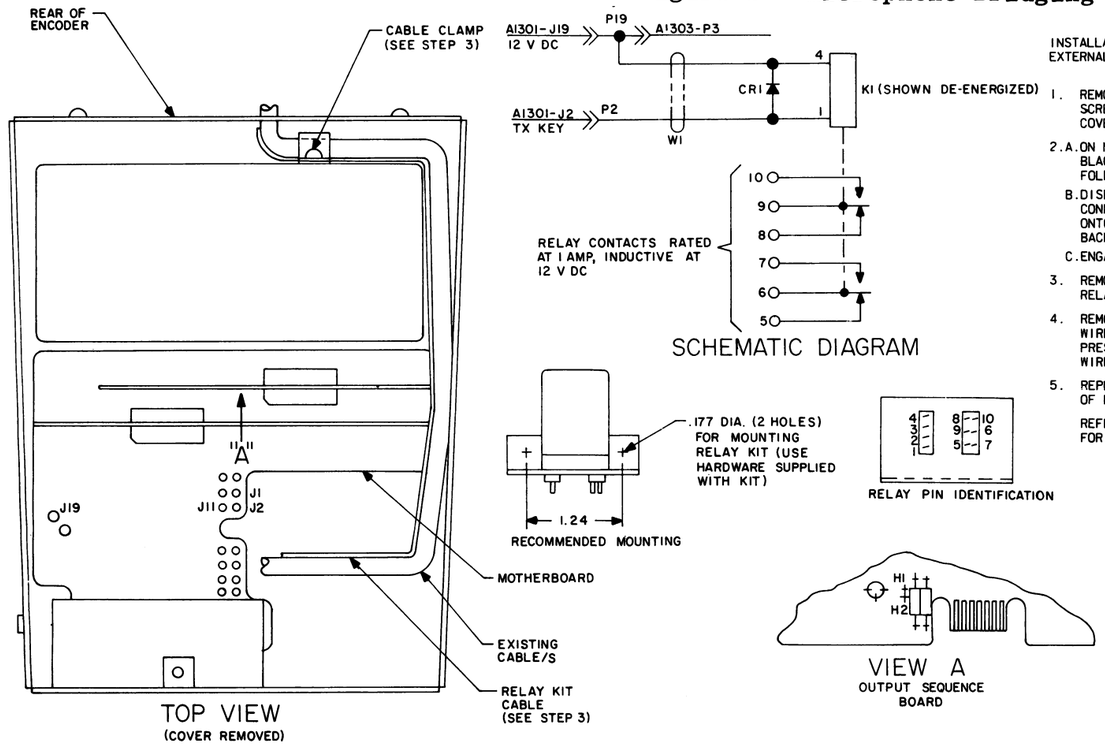
FIG.2



VIEW "B"
PARTIAL VIEW OF 19D416493

(19C320514, Rev. 4)

Figure 8 - Microphone Bridging (Option 4061) Installation



INSTALLATION INSTRUCTIONS FOR OPTIONAL EXTERNAL TRANSMIT KEYING RELAY, TYPE 99 ENCODER.

1. REMOVE TWO (2) #6 SCREWS ON REAR OF COVER AND ONE (1) #6 SCREW ON BOTTOM FRONT OF THE TYPE 99 ENCODER AND LIFT COVER OFF.

2.A. ON MOTHER BOARD (19D416477) DISENGAGE CONNECTOR WITH BLACK LEAD FROM J1; RED LEADS FROM J2 AND J11 (IF PRESENT), FOLD WIRES BACK ON CABLE & TAPE TO PREVENT SHORT CIRCUITING.

B. DISENGAGE CONNECTOR WITH RED-WHITE WIRE FROM J19. ENGAGE CONNECTOR OF RELAY KIT MARKED "19" (PIGGY-BACK BEADCHAIN) ONTO J19, & ENGAGE CONNECTOR WITH RED-WHITE WIRE IN PIGGY-BACK BEADCHAIN.

C. ENGAGE CONNECTOR OF RELAY KIT MARKED "2" TO J2.

3. REMOVE SCREW HOLDING CABLE CLAMP AT REAR OF ENCODER. DRESS RELAY KIT CABLE THRU CABLE CLAMP AS SHOWN.

4. REMOVE OUTPUT SEQUENCE BOARD FROM ENCODER. ENSURE THAT A WIRE JUMPER IS PRESENT BETWEEN H1 & H2. IF JUMPER IS NOT PRESENT OR IS CLIPPED OUT, INSTALL OR REPLACE USING BUS WIRE SUPPLIED WITH KIT. SEE VIEW "A".

5. REPLACE OUTPUT SEQUENCE BOARD AND REASSEMBLE COVER TO BASE OF ENCODER.

REFER TO SCHEMATIC DIAGRAM & RELAY PIN IDENTIFICATION FOR RELAY CONNECTIONS.

Figure 9 - Transmitter Keying Relay (Option 4062) Installation

(19C320922, Rev. 1)

PARTS LIST

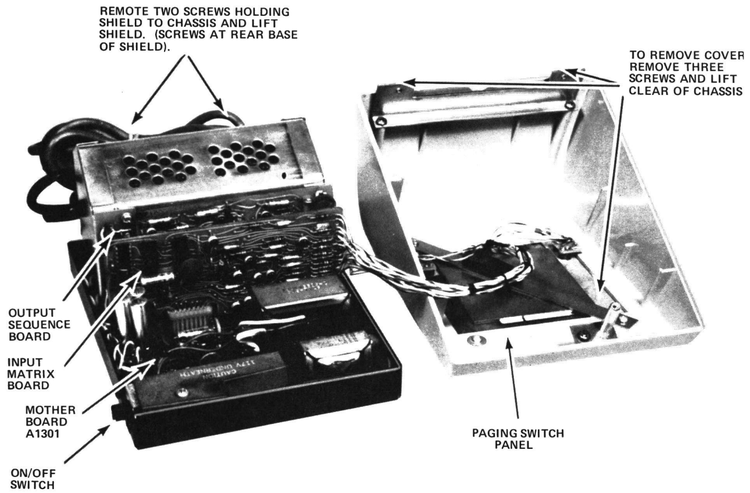
LBI-4562

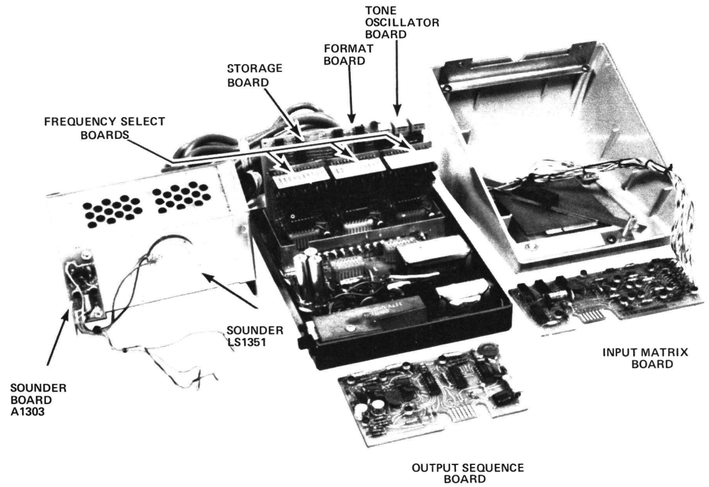
TYPE 99 TONE KEYING RELAY OPTION
19A130085G1

SYMBOL	GE PART NO.	DESCRIPTION
		RELAY CABLE ASSEMBLY 19B226228G1
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	4037822P1	Silicon.
		- - - - - - - - - - - - RELAYS - - - - - - - - - - -
K1	5491595P12	Armature: 1.5 w operating, 520 ohms ±15% coil res, 2 form C contacts; sim to Allied Control T154-X-186.
		- - - - - - - - - - - - CABLES - - - - - - - - - - -
W1	19B226222G1	2 conductor, 10 feet long.
		- - - - - - - - - - - - SOCKETS - - - - - - - - - - -
XK1	5491595P4	Relay: 10 contacts; sim to Allied Control 30054-1.
		- - - - - - - - - - - - MISCELLANEOUS - - - - - - - -
	5491595P8	Retainer: spring; sim to Allied Control 30040-1. (Used with K1).
	N80P13008C6	Screw, phillips head: No. 6-32 x 1/2.
	N210P13C6	Hex nut: No. 6-32.
	N403P13C6	Lockwasher: No. 6.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

DISASSEMBLY INSTRUCTIONS





TEST EQUIPMENT REQUIRED

1. VOM, similar to Triplett Model 631.
2. Audio Counter with a suitable gate time for counting 590 Hz at one second or less. Eldorado Model 1635, or equivalent.
3. AC VTVM, similar to Triplett Model 850.
4. Distortion Analyzer, Heath IM-12 or equivalent.

TEST PROCEDURE

A. Connect VTVM and Counter to J4 (Tone Output) and J6 (GND) on A1301 to monitor the tone frequency and level.

B. Connect the AC plug to a convenient outlet and slide switch S1301 to the ON position. The voltage at the case of Q1301 should read 5.4 Volts ±0.1 VDC, on the VOM. This is the regulator output. If the reading varies from 5.4 VDC ±0.1, adjust R18 on Mother Board. If no voltage is present at the Q1301 case, check the Slo-blo 1/10 amp. fuse located under the CAUTION cover. If fuse is okay, check regulator input voltage at L1301. This voltage should be 12 VDC as read on the VOM.

C. Tone Encode Test

1. Depress the R (RESET) switch on the encoder panel. The READY light should be illuminated. The READY LED is controlled by the Format Board and the Input Matrix Board.
2. Depress the Tx switch on the encoder panel. A reading of 0.5 VDC should be obtained at J2 on A1301 with the VOM. The keying voltage is controlled by the Output Sequence Board and the Input Matrix Board.
3. On 16 and 100 call encoders, depress digits 00 on the encoder panel. On 64, 400 and 900 call encoders, depress digits 000. An audible "beep" should be heard as each digit is encoded. This is controlled by the Input Matrix Board and Sounder Board A1303. The READY light should go out as the first digit is encoded. The last digit encoded should start the tone sequence and key the transmitter.
4. The TONE light should turn on for one second, turn off momentarily, and then turn on for another one second interval. The second tone interval may be adjusted from 0.5 to 3 seconds with R9 on the Output Sequence Board. The tone sequencing is controlled by the Output Sequence Board, the Format Board and the Input Matrix Board.
5. At the beginning of the tone 1 sequence, the reading at J1 on A1301 should drop to 0.5 VDC and remain at this level during the entire tone transmission sequence.
6. Depressing the Tx switch or another paralleled PTT switch at end of the tone sequence period will reset the encoder. Otherwise, the encoder will reset automatically approximately 5 seconds after the end of the tone sequence.

D. Tone Frequency Test

1. Connect a clip lead between TP5 and TP6 on the Output Sequence Board. This will lock the circuit on Tone 1 period.
2. Determine tone format from the combination number of the encoder, and using the appropriate tone selection chart, verify each tone frequency. Encode the digit shown on the chart and check the corresponding frequency on the counter. (Omit the 1st digit in the 16 and 100 call Units.) The tone frequency should be within ±0.1% of the frequency shown in the chart. If no tone is present, either the oscillator or the Mother Board (A1301) is at fault. The tone oscillator always runs at approximately 120 Hz if no tone is selected and, therefore, tone should always be present at J4 when TP5 and TP6 are connected together.
3. If all tone frequencies check wrong and all are on the high side of the correct frequency, check the Oscillator, Frequency Select, Format or Storage Boards. If all frequencies are wrong and are on the low side of the correct frequency, check the Oscillator Board. If all but one frequency are wrong, a Frequency Select Board is at fault. If all frequencies are correct but out of order, refer to the Format Test in E below. A close inspection of the pattern of correct and incorrect frequencies will often lead to a particular trouble location. For example; loss of binary function or incorrect frequencies only from a single Tone Select Bank.
4. Remove clip lead from TP5 and TP6.

E. Format Test

1. No format test is required for the 16 and 100 call encoders.
2. On 64, 400 and 900 call encoders, select the proper format from the chart for the format and call capacity of the unit being tested. Encode the digits indicated in the chart. As the unit sequences, verify the proper tone format.

The counter should be set for a faster gate time (0.1 second) to read the tone. The tone test performed under D verified the proper tone frequencies. The current test is for determining the proper order of tones. If the tones are out of order, check the Format or Input Matrix Boards.

F. Diagonal Tone Test

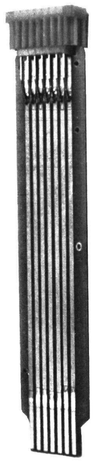
1. Connect a clip lead between TP5 and TP6 on the Output Sequence Board. Reset the encoder. Encode the 16 or 100 call encoder using digits 11. Encode the 64, 400 or 900 call encoder using digits 011. The tone output at J4 should be 742.5 Hz ±0.1%. This function is controlled by the Oscillator Board, the Format Board and the Input Matrix Board.

G. Tone Quality Test

1. The tone level should measure 100 mv rms, adjustable by R1 on A1301.
2. Tone distortion should be less than 5% (degrades from highest to lowest frequency).
3. Output level should be ±2 dB referenced from highest frequency used in unit under test.

H. Troubleshooting

1. If encoder sequences without being encoded (runs freely), check power supply regulator for spikes which could be caused by an overload, or poor connection.
2. If beeper runs continuously, check control voltage from Input Matrix Board.
3. If no response is encountered when digits are encoded, check Output Sequence Board or Input Matrix Board.
4. If two beeps are heard and two digits are encoded when only one digit has been selected, check Input Matrix Board or for faulty selector switch.



TEST FIXTURE
19B219710G1

TONE FREQUENCY TEST CHARTS

100, 400, 900, CALL ENCODERS

FORMAT X

ENCODE			ENCODE			ENCODE		
1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.
0	1	592.5	2	1	607.5	4	1	712.5
	2	757.5		2	787.5		2	772.5
	3	802.5		3	832.5		3	817.5
	4	847.5		4	877.5		4	862.5
	5	892.5		5	922.5		5	907.5
	6	937.5		6	967.5		6	952.5
	7	547.5		7	517.5		7	532.5
	8	727.5		8	562.5		8	577.5
	9	637.5		9	697.5		9	622.5
	0	682.5		0	652.5		0	667.5

100 Call

400 Call

900 Call

16, 64 CALL ENCODERS

FORMAT X

ENCODE			ENCODE		
1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.
0	1	592.5	2	1	607.5
	2	757.5		2	787.5
	3	802.5		3	832.5
	0	682.5		0	652.5

16 Call

64 Call

FORMAT Y

CALL CAPACITY 100, 400

ENCODE			ENCODE		
1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.
0	1	607.5	2	1	712.5
	2	787.5		2	772.5
	3	832.5		3	817.5
	4	877.5		4	862.5
	5	922.5		5	907.5
	6	967.5		6	952.5
	7	517.5		7	532.5
	8	562.5		8	577.5
	9	697.5		9	622.5
	0	652.5		0	667.5

100 Call

400 Call

FORMAT Y

CALL CAPACITY 16, 64

ENCODE			ENCODE		
1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.
0	1	607.5	2	1	712.5
	2	787.5		2	772.5
	3	832.5		3	817.5
	0	652.5		0	667.5

16 Call

64 Call

FORMAT Z

CALL CAPACITY 64

ENCODE			ENCODE		
1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.
0	1	592.5	0	1	712.5
	2	757.5		2	772.5
	3	802.5		3	817.5
	0	682.5		0	667.5

CALL CAPACITY 16

ENCODE		
1st Digit	2nd Digit	FREQ.
0	1	712.5
	2	772.5
	3	817.5
	0	667.5

FORMAT Z

CALL CAPACITY 400

ENCODE			ENCODE		
1st Digit	2nd Digit	FREQ.	1st Digit	2nd Digit	FREQ.
0	1	592.5	0	1	712.5
	2	757.5		2	772.5
	3	802.5		3	817.5
	4	847.5		4	862.5
	5	892.5		5	907.5
	6	937.5		6	952.5
	7	547.5		7	532.5
	8	727.5		8	577.5
	9	637.5		9	622.5
	0	682.5		0	667.5

CALL CAPACITY 100

ENCODE		
1st Digit	2nd Digit	FREQ.
0	1	712.5
	2	772.5
	3	817.5
	4	862.5
	5	907.5
	6	952.5
	7	532.5
	8	577.5
	9	622.5
	0	667.5

FORMAT TEST CHARTS

FORMAT X

CALL CAPACITY 64, 400

ENCODE	1st TONE	2nd TONE
012	592	757
112	607	757
212	607	787
312	592	787

FORMAT Y

CALL CAPACITY 64, 400

ENCODE	1st TONE	2nd TONE
012	607	787
112	712	787
212	712	772
312	607	772

FORMAT Z

CALL CAPACITY 64, 400

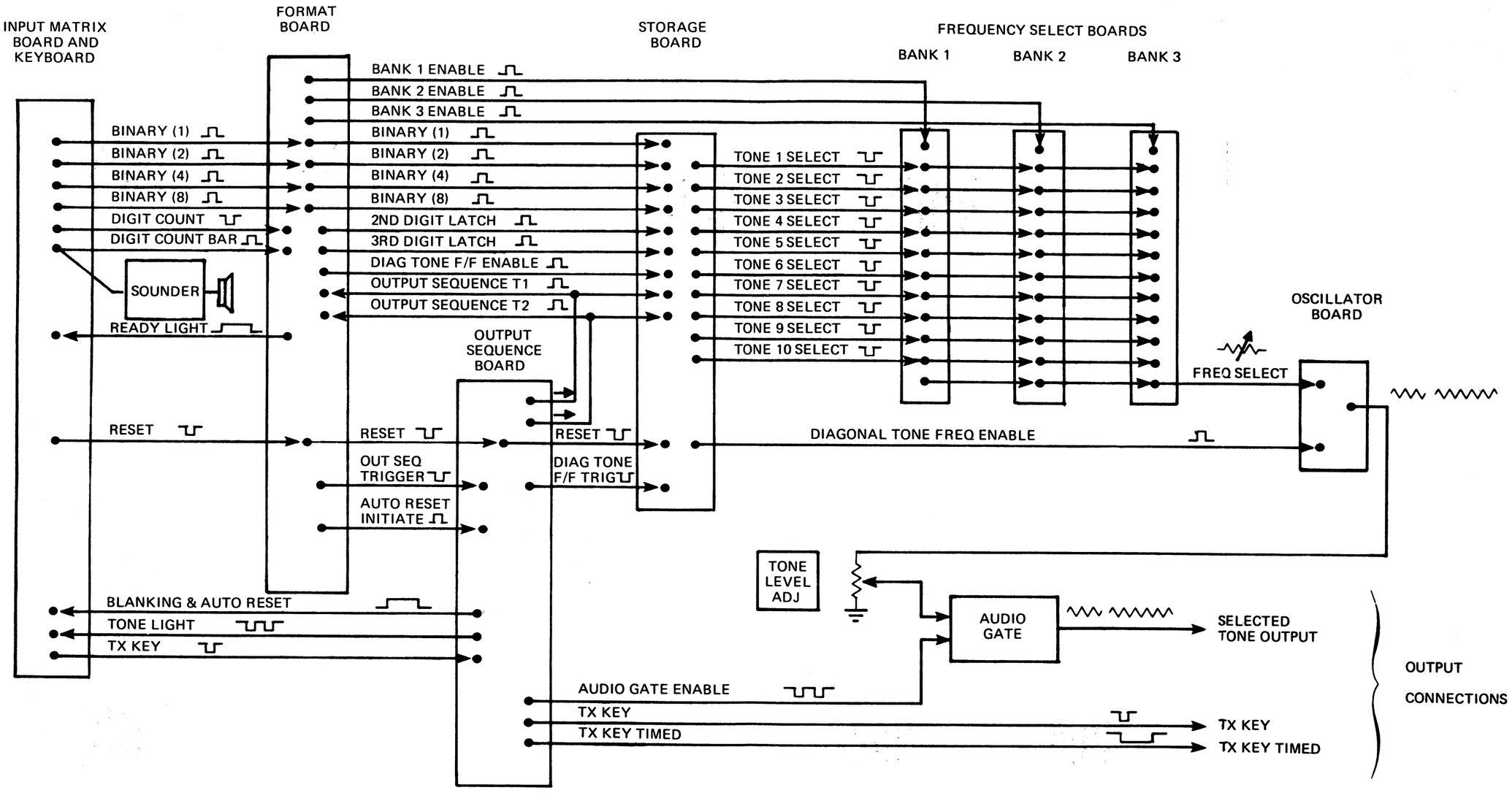
ENCODE	1st TONE	2nd TONE
012	592	757
112	712	757
212	712	772
312	592	772

FORMAT X

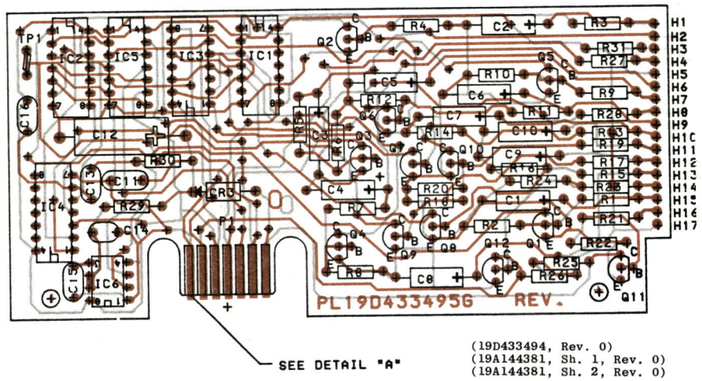
CALL CAPACITY 900

ENCODE	1st TONE	2nd TONE
012	592	757
112	607	757
212	607	787
312	592	787
412	712	772
512	712	757
612	712	787
712	592	772
812	607	772

SEQUENCE CHART SERIES 101 & 102 TYPE 99 ENCODERS

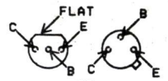


INPUT MATRIX BOARD 19D433495G1 & G2



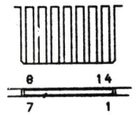
(19D433494, Rev. 0)
(19A144381, Sh. 1, Rev. 0)
(19A144381, Sh. 2, Rev. 0)

LEAD IDENTIFICATION FOR Q1 THRU Q13



TOP VIEW

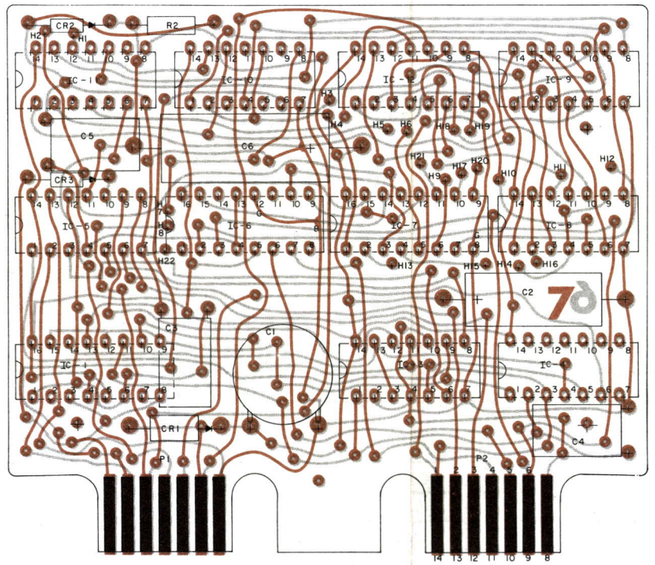
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



SOLDER SIDE TYP. NUMBERING OF CONTACT FINGERS.

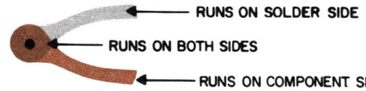
DETAIL "A"

FORMAT BOARD (400 & 900 CALL) 19D416325G1

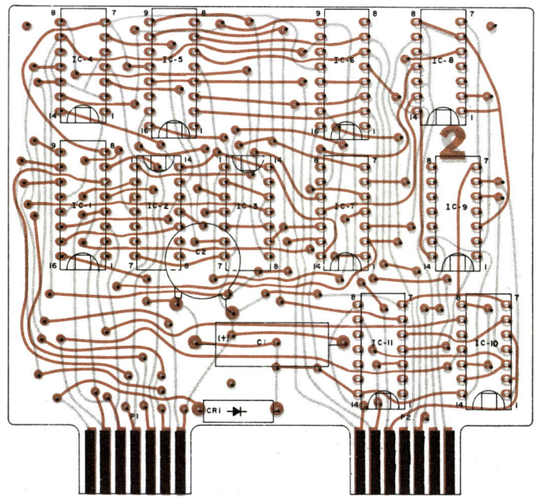


TYPICAL CONTACT FINGER NUMBERING
1 2 3 4 5 6 7
14 13 12 11 10 9 8
SOLDER SIDE

(19D416982, Rev. 5)
(19D416323, Sh. 1, Rev. 7)
(19D416323, Sh. 2, Rev. 6)



STORAGE BOARD (100-900 CALL) 19D416320G1

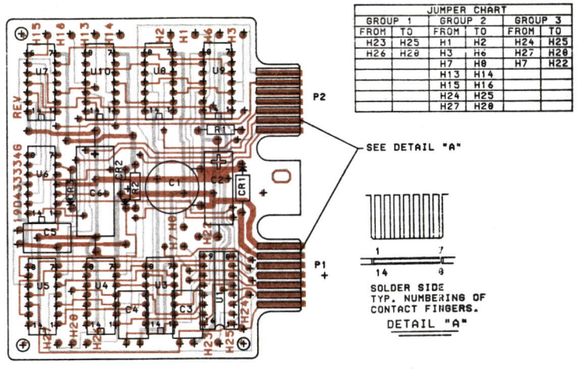


TYPICAL CONTACT FINGER NUMBERING
1 2 3 4 5 6 7
14 13 12 11 10 9 8
SOLDER SIDE

(19D416989, Rev. 1)
(19D416318, Sh. 1, Rev. 2)
(19D416318, Sh. 2, Rev. 2)

FREQUENCY SELECT BOARD
19D416469G1-G6

FORMAT BOARD (16, 64 & 100 CALL)
19D433334G1-G3



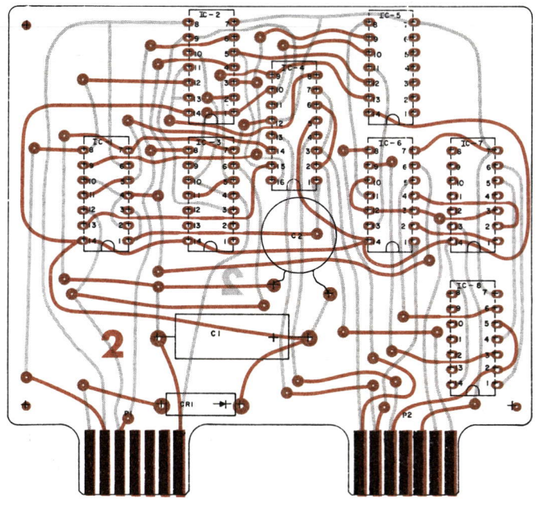
JUMPER CHART					
GROUP 1		GROUP 2		GROUP 3	
FROM	TO	FROM	TO	FROM	TO
H23	H25	H1	H2	H24	H25
H26	H28	H3	H6	H27	H28
		H7	H8	H7	H22
		H13	H14		
		H15	H16		
		H24	H25		
		H27	H28		

SOLDER SIDE TYP. NUMBERING OF CONTACT FINGERS.

DETAIL "A"

(19D433332, Rev. 0)
(19A144359, Sh. 1, Rev. 0)
(19A144359, Sh. 2, Rev. 0)

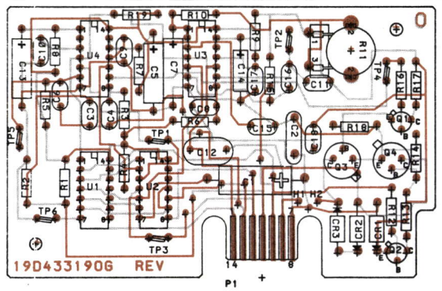
STORAGE BOARD (16 & 64 CALL) 19D416314G1



TYPICAL CONTACT FINGER NUMBERING
1 2 3 4 5 6 7
14 13 12 11 10 9 8
SOLDER SIDE

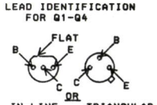
(19D416981, Rev. 1)
(19D416312, Sh. 1, Rev. 2)
(19D416312, Sh. 2, Rev. 2)

OUTPUT SEQUENCE BOARD 19D433190G1



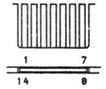
(19D433191, Rev. 0)
(19A144198, Sh. 1, Rev. 0)
(19A144198, Sh. 2, Rev. 0)

LEAD IDENTIFICATION FOR Q1-Q4



TOP VIEW

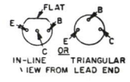
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATIL



SOLDER SIDE TYP. NUMBERING OF CONTACT FINGERS.

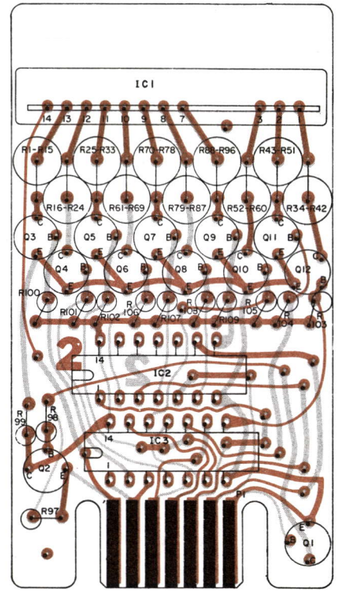
DETAIL "A"

LEAD IDENTIFICATION FOR Q1-Q13



VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



TYPICAL CONTACT FINGER NUMBERING
1 2 3 4 5 6 7
14 13 12 11 10 9 8
SOLDER SIDE

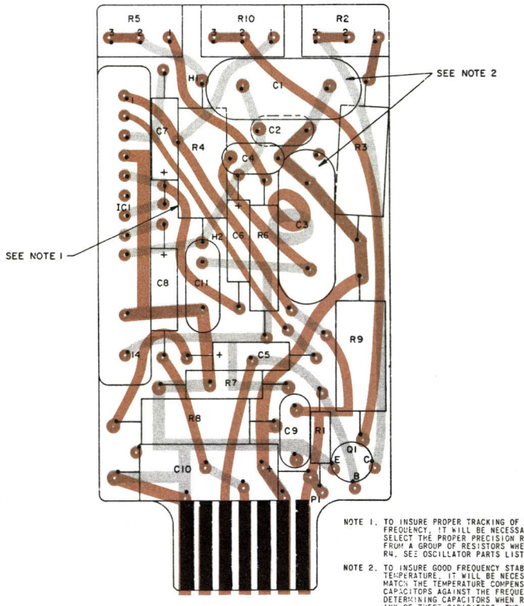
(19C320476, Rev. 2)
(19D416453, Sh. 1, Rev. 2)
(19D416453, Sh. 2, Rev. 2)

OUTLINE DIAGRAMS

TYPE 99 TONE ENCODER

16 Issue 6

OSCILLATOR BOARD 19C320086G1

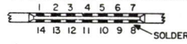


NOTE 1. TO INSURE PROPER TRACKING OF OUTPUT FREQUENCY, IT WILL BE NECESSARY TO SELECT THE PROPER PRECISION RESISTOR FROM A GROUP OF RESISTORS WHEN REPLACING R4. SEE OSCILLATOR PARTS LIST.

NOTE 2. TO INSURE GOOD FREQUENCY STABILITY WITH TEMPERATURE, IT WILL BE NECESSARY TO MATCH THE TEMPERATURE COMPENSATION CAPACITORS AGAINST THE FREQUENCY DETERMINING CAPACITORS WHEN REPLACING ANY OF THESE CAPACITORS. THE TEMPERATURE COEFFICIENT OF C2 MUST MATCH THAT OF C1. THE TEMPERATURE COEFFICIENT OF C4 MUST MATCH THAT OF C3. THE TEMPERATURE COEFFICIENT OF C1 AND C3 MUST BE THE SAME.

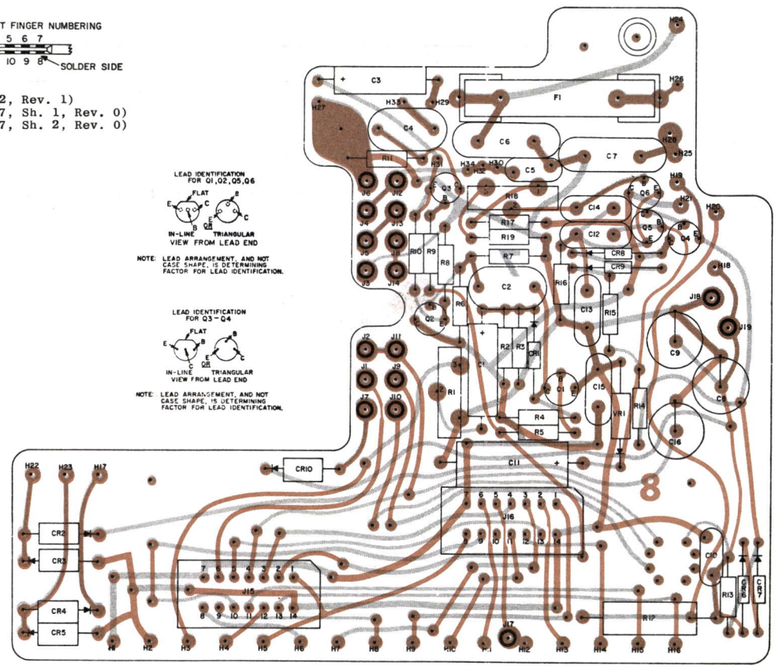
C1 AND C3 TEMPERATURE COEFFICIENT CODE	PART NO. OF C2 & C4
BAND 0	5496203P20
BAND 1	5496203P20
BAND 2	5496203P120
BAND 3	5496203P220
BAND 4	5496203P220
BAND 5	5496203P320
BAND 6	5496203P420

TYPICAL CONTACT FINGER NUMBERING



(19C320482, Rev. 1)
(19D416447, Sh. 1, Rev. 0)
(19D416447, Sh. 2, Rev. 0)

MOTHER BOARD (A1301)



LEAD IDENTIFICATION FOR Q1,Q2,Q5,Q6

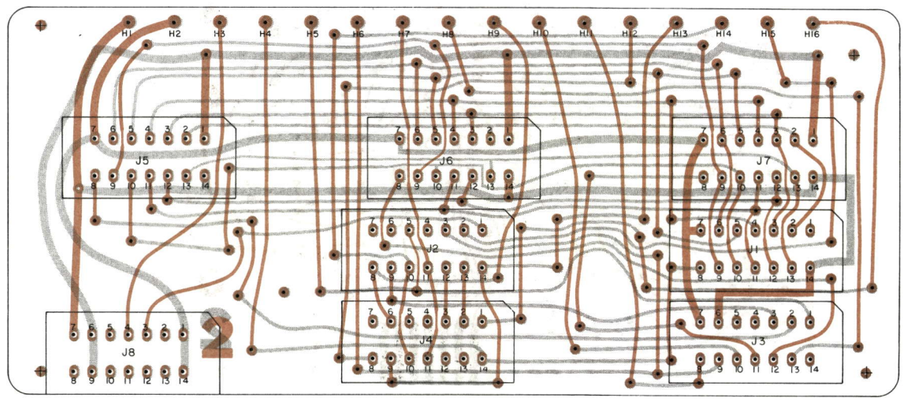
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q3-Q4

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

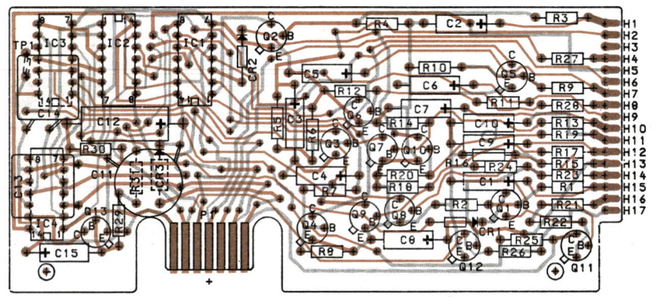
(19D416984, Rev. 4)
(19D416462, Sh. 1, Rev. 8)
(19D416462, Sh. 2, Rev. 7)

ENCODER BASE ASSEMBLY



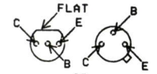
(19D417545, Rev. 0)
(19D416467, Sh. 1, Rev. 2)
(19D416467, Sh. 2, Rev. 2)

INPUT MATRIX BOARD 19C320800G1 & G2

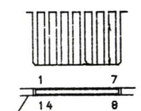


(19C320481, Rev. 4)
(19C320035, Sh. 1, Rev. 4)
(19C320035, Sh. 2, Rev. 6)

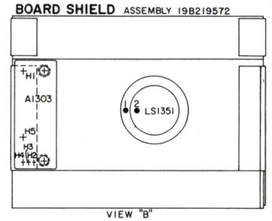
LEAD IDENTIFICATION FOR Q1 THRU Q13

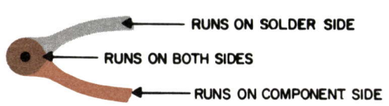


NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

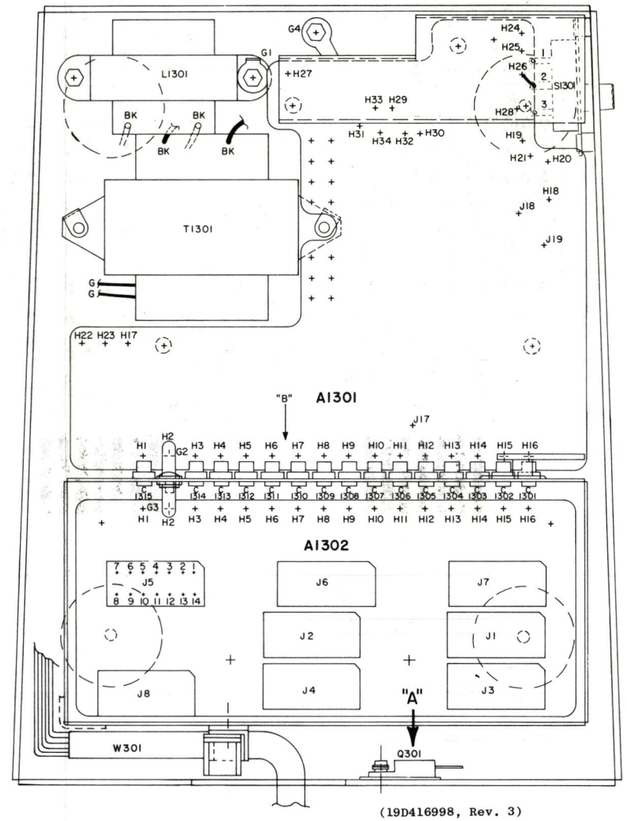


BOARD SHIELD ASSEMBLY 19B219572



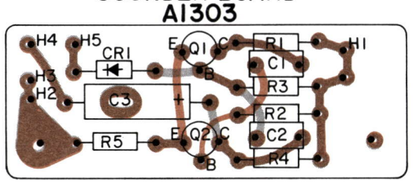


ENCODER BASE ASSEMBLY



(19D416998, Rev. 3)

SOUNDER BOARD A1303

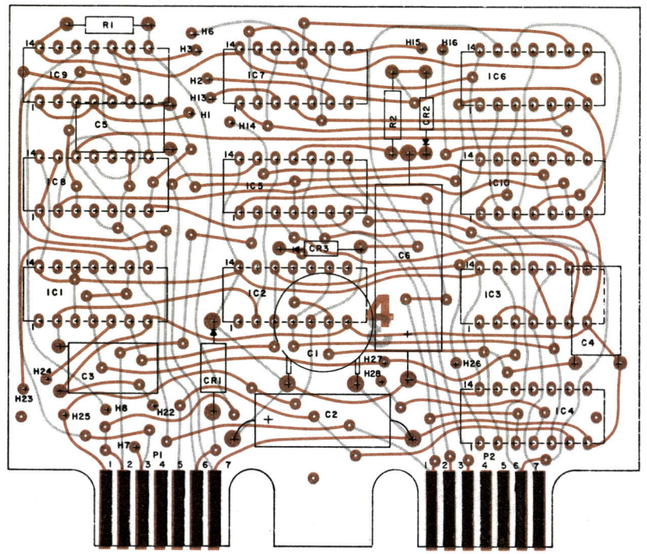


(19D416998, Rev. 3)
(19B219539, Sh. 2, Rev. 0)
(19B219539, Sh. 3, Rev. 0)

OUTLINE DIAGRAMS

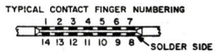
TYPE 99 TONE ENCODER

FORMAT BOARD (16, 64 & 100 CALL) 19D416327G1 & G2



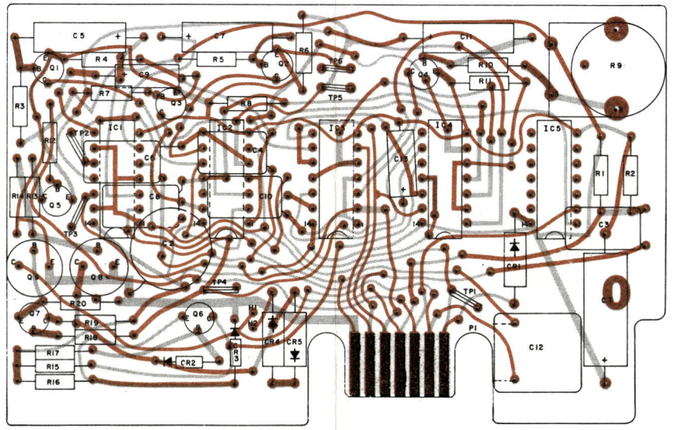
JUMPER CHART					
GROUP 1		GROUP 2		GROUP 3	
FROM	TO	FROM	TO	FROM	TO
H23	H25	H1	H2	H24	H25
H26	H28	H3	H6	H27	H28
		H7	H8	H7	H22
		H13	H14		
		H15	H16		
		H24	H25		
		H27	H28		

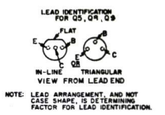
TYPICAL CONTACT FINGER NUMBERING

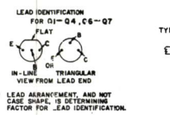


(19D416997, Rev. 2)
(19D416322, Sh. 1, Rev. 4)
(19D416322, Sh. 2, Rev. 3)

OUTPUT SEQUENCE BOARD 19D416493G1

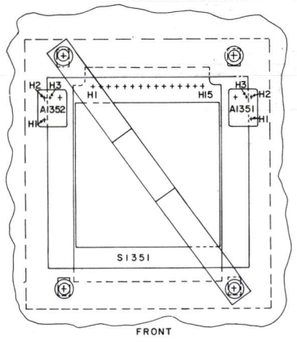




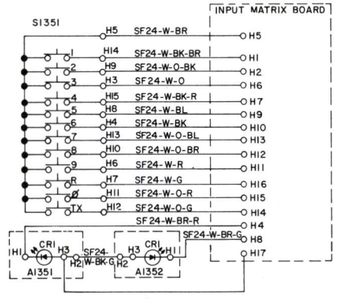


(19D416990, Rev. 2)
(19D416482, Sh. 1, Rev. 0)
(19D416482, Sh. 2, Rev. 0)

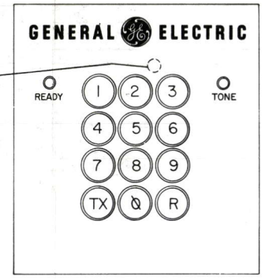
DESK TOP HOUSING ASSEMBLY



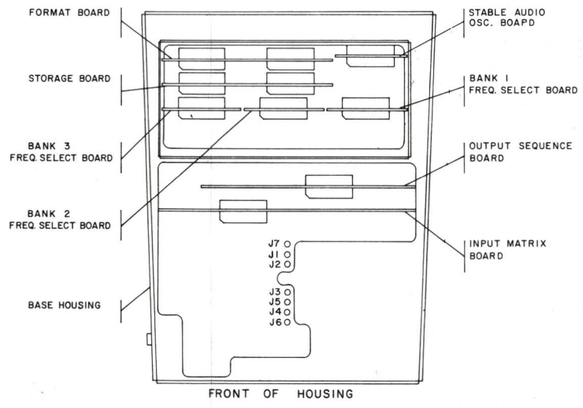
VIEW AT "B"



THE 19A116726P1 SWITCH (S1351) INCLUDES A 19A116726P2 SPRING WHICH IS LOCATED BETWEEN S1351 AND THE FRONT DRESS PLATES 19B219560G1 & G2. THE LARGER DIAMETER END OF THIS SPRING FITS IN THIS DEPRESSION ON THE DRESS PLATE WITH THE SMALLER DIAMETER END MATING WITH S1351.



VIEW "A"



(RC-2352A)

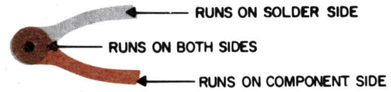
PARTS LIST

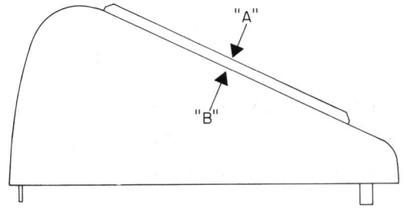
LBI4422B

TYPE 99 II TONE ENCODER
HOUSING ASSEMBLY
19D416522G1 (BEIGE)
19D416522G2 (GRAY)

SYMBOL	GE PART NO.	DESCRIPTION
A1351		COMPONENT BOARD 19B219499G2
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A116678P1	Diode, light emitting: red; sim to HP5082-4403.
A1352		COMPONENT BOARD 19B219499G1
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A116678P1	Diode, light emitting: red; sim to HP5082-4403.
		- - - - - - - - - - SWITCHES - - - - - - - - -
S1351	19A116726P1	Push: 12 poles, normally opening; sim to Datanetics Corp. DC-404.
	19A116726P2	Spring. (Part of S1351- 19A116726P1).
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19C307145P1	Housing, telephone. (BEIGE).
	19C307145P2	Housing, telephone. (GRAY).
	19B219560G1	Front dress plate. (BEIGE).
	19B219560G2	Front dress plate. (GRAY).
	19A129220G1	Front support. (Connects Housing to Base plate).
	19B219450P1	Rear support. (Connects Housing to Base plate).
	19A129463P7	Harness.
	19B219519G1	Support. (Secures S1351 to Housing).
	N402P37C13	Flatwasher: No. 6. (Used with switch support).
	N143P1305C13	Tap screw: No. 6-20 x 5/16. (Used with switch support).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures front and rear supports to Base plate).
	19B201074P306	Tap screw, Phillips POZIDRIV®: No. 6-32 x 3/8. (Secures front and rear supports to Housing).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures A1351 and A1352 to Housing).
	NP270665	Nameplate (1, 2, 3, 4, 5, 6, 7, 8, 9, Tx, Ø, R).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.





OUTLINE DIAGRAMS

TYPE 99 TONE ENCODER

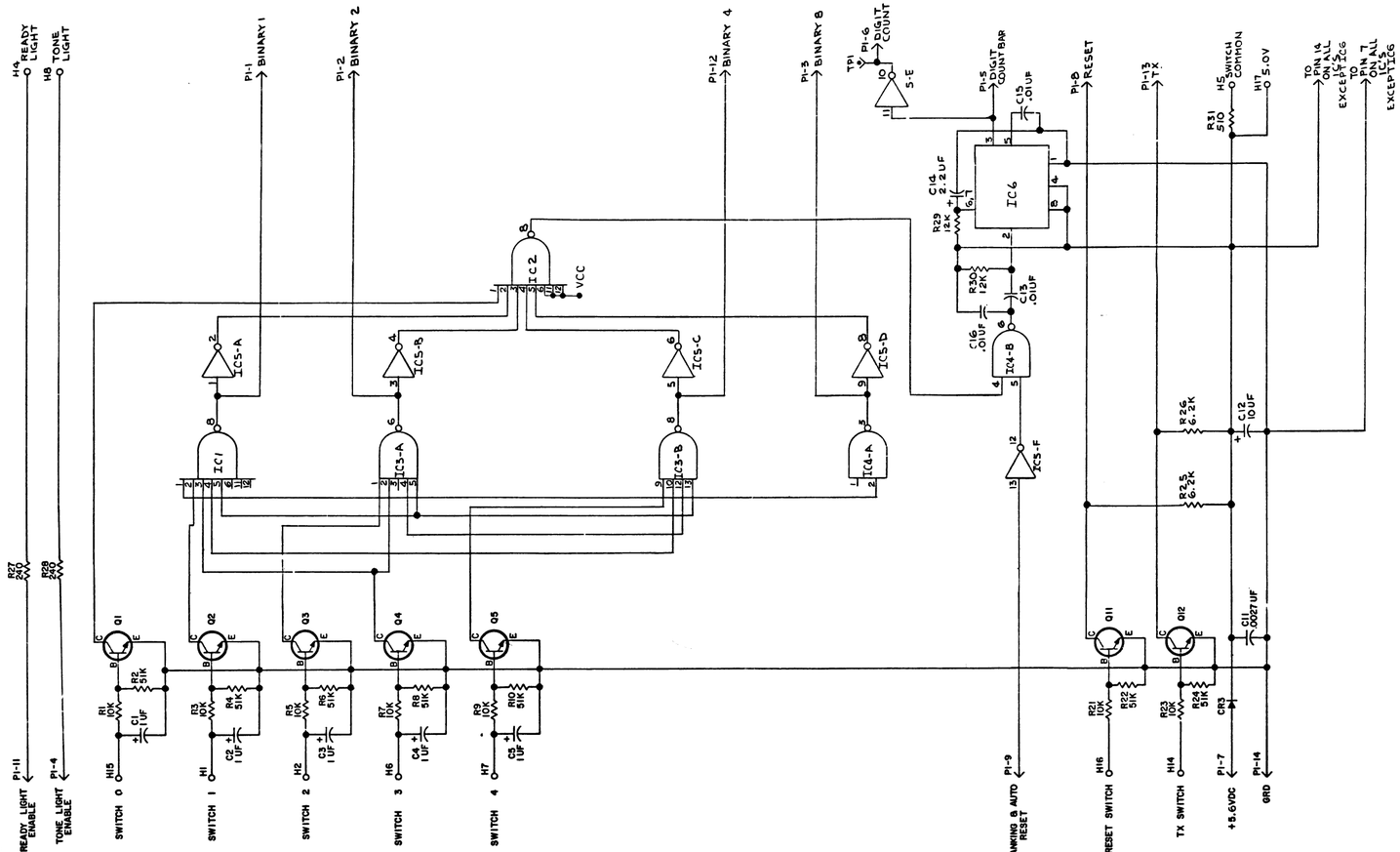
PARTS LIST

INPUT MATRIX BOARD
19D433495G1

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - - CAPACITORS - - - - - - - - - - - -
C1 thru C5	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDC#; sim to Sprague Type 150D.
C11	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	19A115686P8	Electrolytic: 10 µf +150-10%, 25 VDCW; sim to Mallory Type TTX.
C13	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C14	19J706079P5	Ceramic: 2.2 pf ±0.25 pf, 500 VDCW, 0 ±120 PPM temp coef.
C15 and C16	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - - - - - DIODES - - - - - - - - - - - -
CR3	4037822P1	Silicon, 1000 mA, 600 PIV.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
IC1 and IC2	19A134305P21	Digital: 8-INPUT POSITIVE - NAND GATES.
IC3	19A134305P15	Digital: DUAL 4-INPUT POSITIVE - NAND GATE.
IC4	19A134305P1	Digital: QUAD 2-INPUT POSITIVE - NAND GATE.
IC5	19A134305P5	Digital: HEX INVERTERS.
IC6	19A116968P1	Linear: 555 TIMER, sim to Signetics SA555N.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q5	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R2	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R3	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R4	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R5	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R6	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R7	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R8	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R9	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R10	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R21	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R22	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R23	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R24	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R25 and R26	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R27 and R28	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R29	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R30	19A700106P89	Composition: 12K ohms ±5%, 1/4 w.
R31	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
		- - - - - - - - TEST POINTS - - - - - - - -
TP1	19B211379P1	Spring.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B227689P1	Insulator. (Located under printed board).
	4035306P26	Fiber washer. (Located between printed board and insulator).
	N80P9005C6	Machine screw. (Secures insulator to printed board).
	N404P11C6	Lockwasher, internal tooth. No. 4. (Secures insulator to printed board).
	7141225P2	Hex nut. No. 4-40. (Secures insulator to printed board).

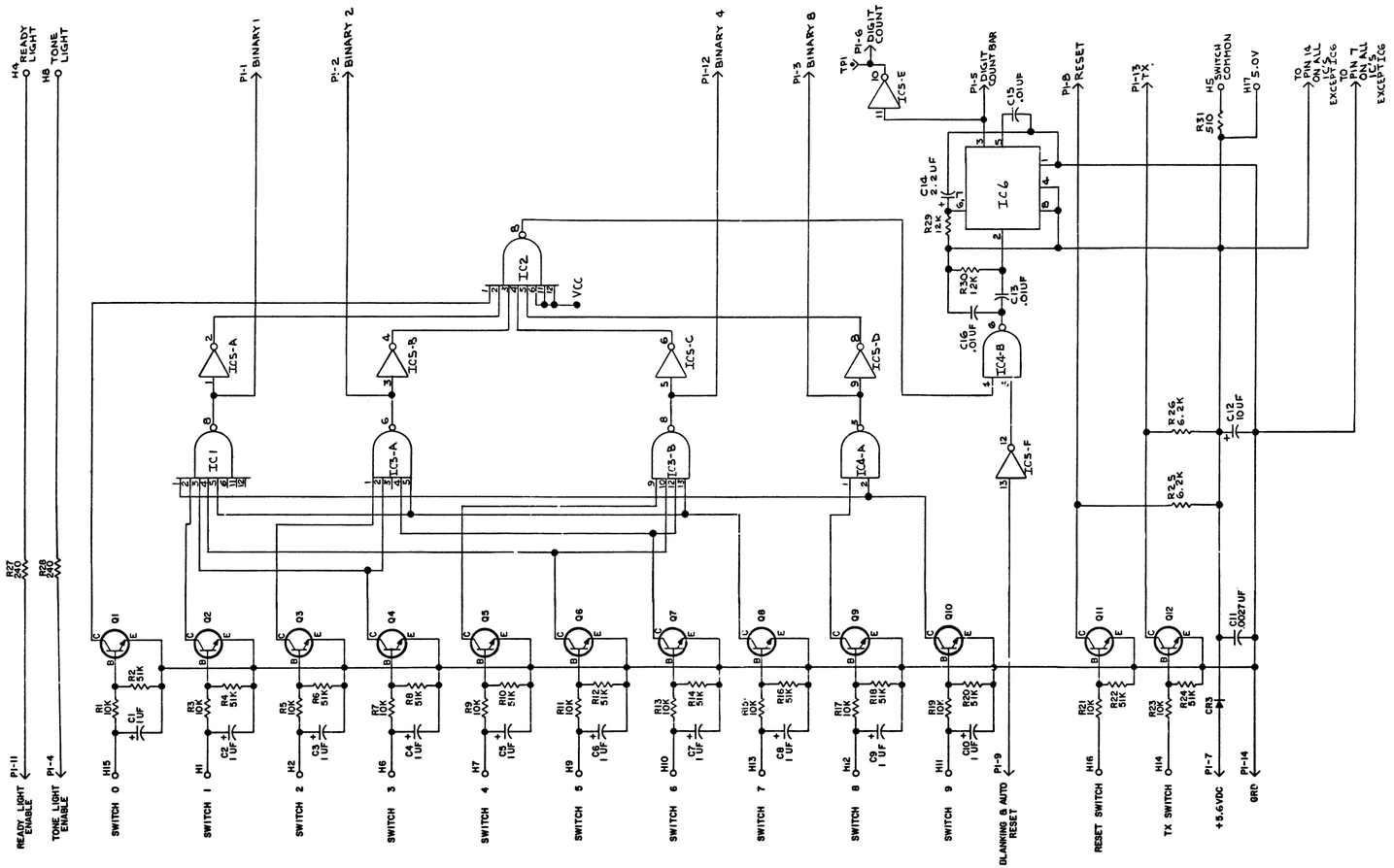
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



(19D433505, Rev. 2)

SCHEMATIC DIAGRAM

INPUT MATRIX BOARD
(16-64 CALL) 19D433495G1



(19D433506, Rev. 2)

SCHEMATIC DIAGRAM

INPUT MATRIX BOARD
(100-900 CALL) 19D433495G2

PARTS LIST

INPUT MATRIX BOARD
19D433495G2

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C1 thru C10	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C11	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	19A115680P8	Electrolytic: 10 µf +150-10%, 25 VDCW; sim to Mallory Type TTX.
C13	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C14	19J706079P5	Ceramic: 2.2 pf ±0.25 pf, 500 VDCW, 0 ±120 PPM temp coef.
C15 and C16	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		---------- DIODES ----------
CR3	4037822P1	Silicon, 1000 mA, 600 PIV.
		------- INTEGRATED CIRCUITS -------
IC1 and IC2	19A134305P21	Digital: 8-INPUT POSITIVE - NAND GATES.
IC3	19A134305P15	Digital: DUAL 4-INPUT POSITIVE - NAND GATE.
IC4	19A134305P1	Digital: QUAD 2-INPUT POSITIVE - NAND GATE.
IC5	19A134305P5	Digital: HEX INVERTERS.
IC6	19A116968P1	Linear: 555 TIMER, sim to Signetics SA555N.
		---------- TRANSISTORS ----------
Q1 thru Q12	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		---------- RESISTORS ----------
R1	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R2	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R3	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R4	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R5	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R6	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R7	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R8	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R9	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R10	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R11	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R12	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R13	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R14	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R15	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R16	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R17	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R18	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R19	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R20	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R21	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R22	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R23	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R24	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R25 and R26	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R27 and R28	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R29	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R30	19A700106P89	Composition: 12K ohms ±5%, 1/4 w.
R31	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
		---------- TEST POINTS ----------
TP1	19B211379P1	Spring.
		---------- MISCELLANEOUS ----------
	19B227689P1	Insulator. (Located under printed board).
	4035306P26	Fiber washer. (Located between printed board and insulator).
	N80P9005C6	Machine screw. (Secures insulator to printed board).
	N404P11C6	Lockwasher, internal tooth. No. 4. (Secures insulator to printed board).
	7141225P2	Hex nut. No. 4-40. (Secures insulator to printed board).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

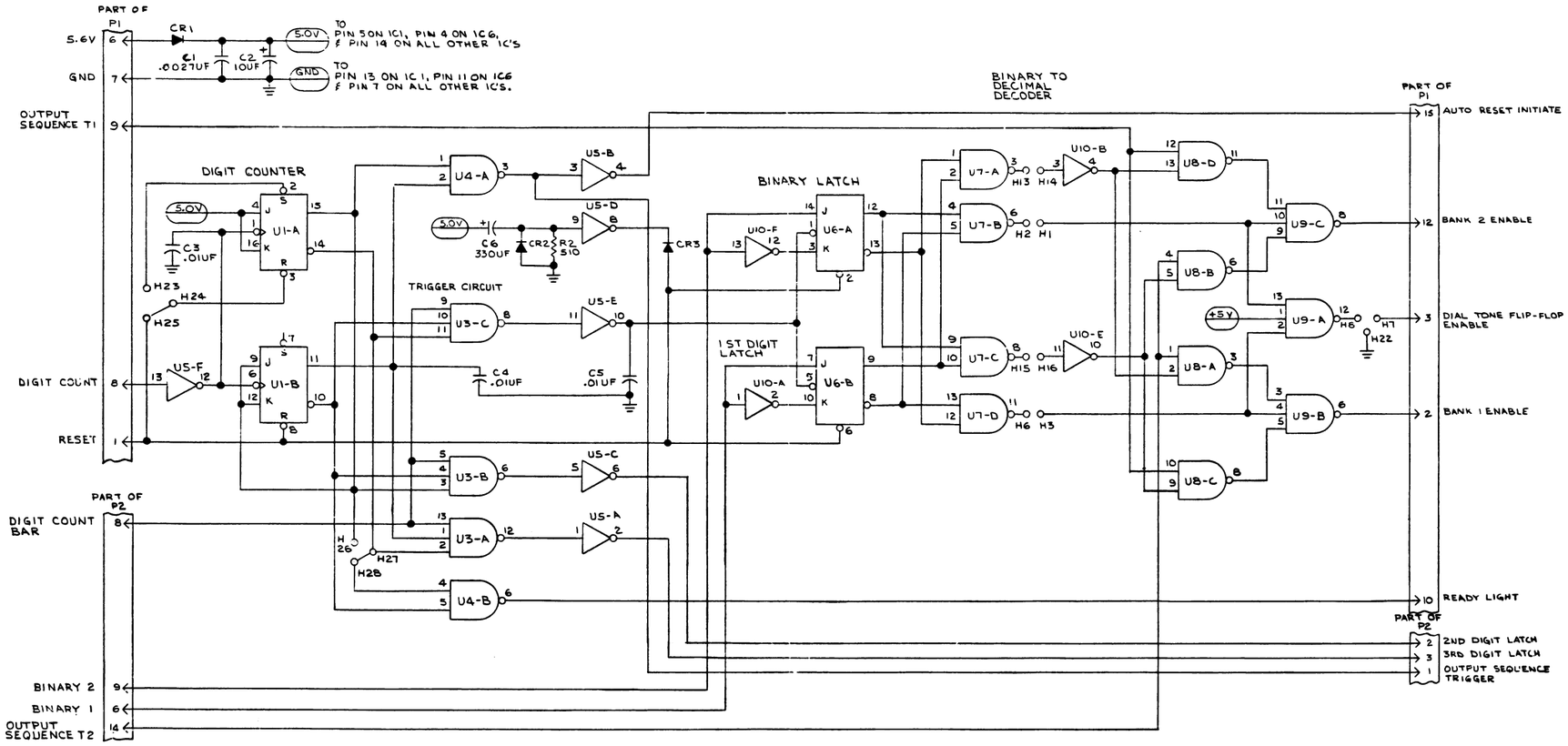
PARTS LIST

FORMAT BOARD
19D433334G1 16 CALL ENCODER

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116655P21	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A700064P1	Electrolytic: 10 µf, -10+150%, 25 VDCW.
C3 and C4	19A700005P7	Polyester: 0.010 µf ±10%, 50 VDCW.
C6	5496267P4	Tantalum: 330 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1	4037822P1	Silicon; 1000 mA, 400 PIV.
CR2 and CR3	19A700028P1	Silicon, fast recovery: fwd current 75 mA.
		- - - - - - - - - RESISTORS - - - - - - - - - -
R1	19A143400P46	Deposited carbon: 6.2K ohms ±5%, 1/4 w.
R2	19A143400P33	Deposited carbon: 510 ohms ±5%, 1/4 w.
		- - - - - - - INTEGRATED CIRCUITS - - - - - -
U1	19A700037P37	Digital: DUAL J-K FLIP-FLOP WITH PRESET CLEAR.
U3	19A700037P9	Digital: TRIPLE 3 INPUT POSITIVE-NAND GATE.
U4	19A700037P1	Digital: QUAD 2-INPUT POSITIVE-NAND GATE.
U5	19A700037P5	Digital: HEX INVERTERS.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



CONNECTIONS CHART			
GROUP 2		*GROUP 3	
FROM	TO	FROM	TO
H13	H14	H7	H22
H2	H1	H24	H25
H15	H16	H27	H28
H6	H3		
H24	H25		
H27	H26		
H5	H1		

* REFER TO MOD INSTRUCTION 19C320128 FOR JUMPER CONNECTIONS. ALL CONNECTIONS ARE DM WIRE.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN MICROFARADS (EQUIV. TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

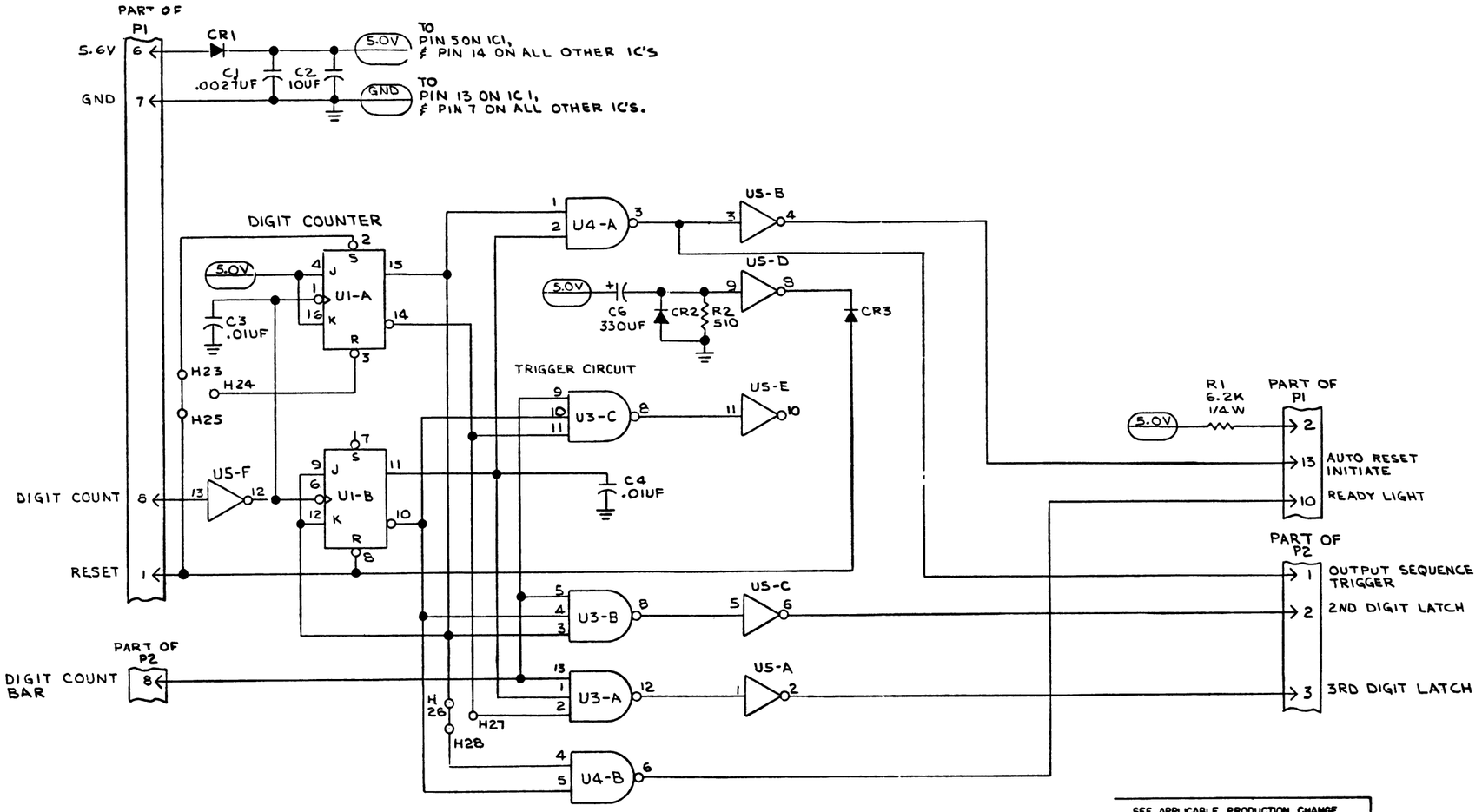
THIS ELEM DIAG APPLIES TO

MODEL NO REV LETTER

(19D433330, Rev. 0)

SCHEMATIC DIAGRAM

FORMAT BOARD (16 & 100 CALL)
19D433334G1



CONNECTION CHART		
FROM	TO	WIRE
H23	H25	DM
H26	H28	DM

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER

SCHEMATIC DIAGRAM

(19D433331, Rev. 0)

FORMAT BOARD (64 CALL)
19D433334G2 & G3

PARTS LIST

FORMAT BOARD
19D433334G2 64 CALL ENCODER
19D433334G3 64 CALL ENCODER (NON JUMPERED)

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116655P21	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A700064P1	Electrolytic: 10 µf, -10+150%, 25 VDCW.
C3 thru C5	19A700005P7	Polyester: 0.010 µf ±10%, 50 VDCW.
C6	5496267P4	Tantalum: 330 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1	4037822P1	Silicon; 1000 mA, 400 PIV.
CR2 and CR3	19A700028P1	Silicon, fast recovery: fwd current 75 mA.
		- - - - - - - - - RESISTORS - - - - - - - - - -
R2	19A143400P33	Deposited carbon: 510 ohms ±5%, 1/4 w.
		- - - - - - - INTEGRATED CIRCUITS - - - - - -
U1	19A700037P37	Digital: DUAL J-K FLIP-FLOP WITH PRESET CLEAR.
U3	19A700037P9	Digital: TRIPLE 3 INPUT POSITIVE-NAND GATE.
U4	19A700037P1	Digital: QUAD 2-INPUT POSITIVE-NAND GATE.
U5	19A700037P5	Digital: HEX INVERTERS
U6	19A700037P34	Digital: DUAL J-K FLIP-FLOP WITH CLEAR.
U7 and U8	19A700037P1	Digital: QUAD 2-INPUT POSITIVE-NAND GATE.
U9	19A700037P9	Digital: TRIPLE 3 INPUT POSITIVE-NAND GATE.
U10	19A700037P5	Digital: HEX INVERTERS.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI4425C

FORMAT BOARD
TYPE 99 II TONE
19D416325G1 & G2 - REV C

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C3 thru C5	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C6*	5496267P4	Tantalum: 330 µf ±20%, 6 VDCW; sim to Sprague Type 150D. Added by REV A.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1	4037822P1	Silicon, 1000 mA, 400 PIV.
CR2* and CR3*	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV. Added by REV A.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1	19A134305P37	Digital, J-K FLIP-FLOP WITH PRESET & CLEAR.
IC3	19A134305P9	Digital, TRIPLE 3-INPUT POSITIVE-NAND GATE.
IC4	19A134305P1	Digital, QUAD 2-INPUT POSITIVE-NAND GATE.
IC5	19A134305P5	Digital, HEX INVERTERS.
IC6	19A134305P36	Digital, 4-BIT BISTABLE LATCHES.
IC7	19A134305P27	Digital, BCD-TO-DECIMAL DECODER.
IC8 and IC9	19A134305P1	Digital, QUAD 2-INPUT POSITIVE-NAND GATE.
IC10 and IC11	19A134305P15	Digital, EXPANDABLE DUAL 4-INPUT POSITIVE-NAND GATE.
IC12	19A134305P1	Digital, QUAD 2-INPUT POSITIVE-NAND GATE.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed wiring board 19D416324P1).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2*	3R152P511J	Composition: 510 ohms ±5%, 1/4 w. Added by REV B.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

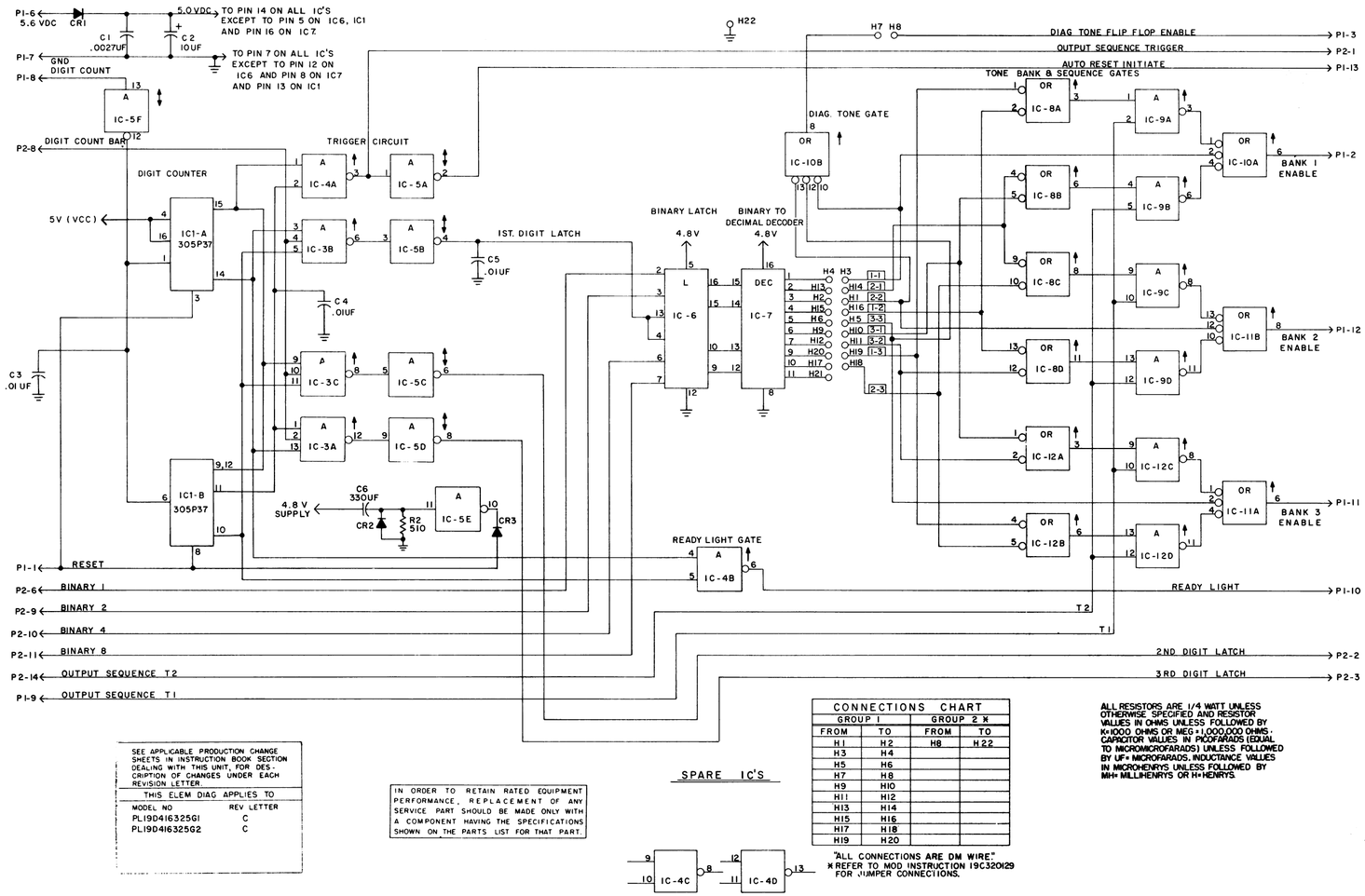
PRODUCTION CHANGES

Changes in the equipment to improve performance 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 - To provide the same tone bank for selecting both tones. Changed connections to U10B.

REV. B - To detect power line fluctuation and generate a reset pulse. Added C6, CR2, CR3, R2 and spare IC section (IC5-E).

REV. C - To eliminate DTL Integrated Circuits changed IC1-IC12 to TTL.



CONNECTIONS CHART			
GROUP 1		GROUP 2 *	
FROM	TO	FROM	TO
H1	H2	H8	H22
H3	H4		
H5	H6		
H7	H8		
H9	H10		
H11	H12		
H13	H14		
H15	H16		
H17	H18		
H19	H20		

"ALL CONNECTIONS ARE DM WIRE."
* REFER TO MOD INSTRUCTION 19C320129 FOR JUMPER CONNECTIONS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D416325G1	C
PL19D416325G2	C

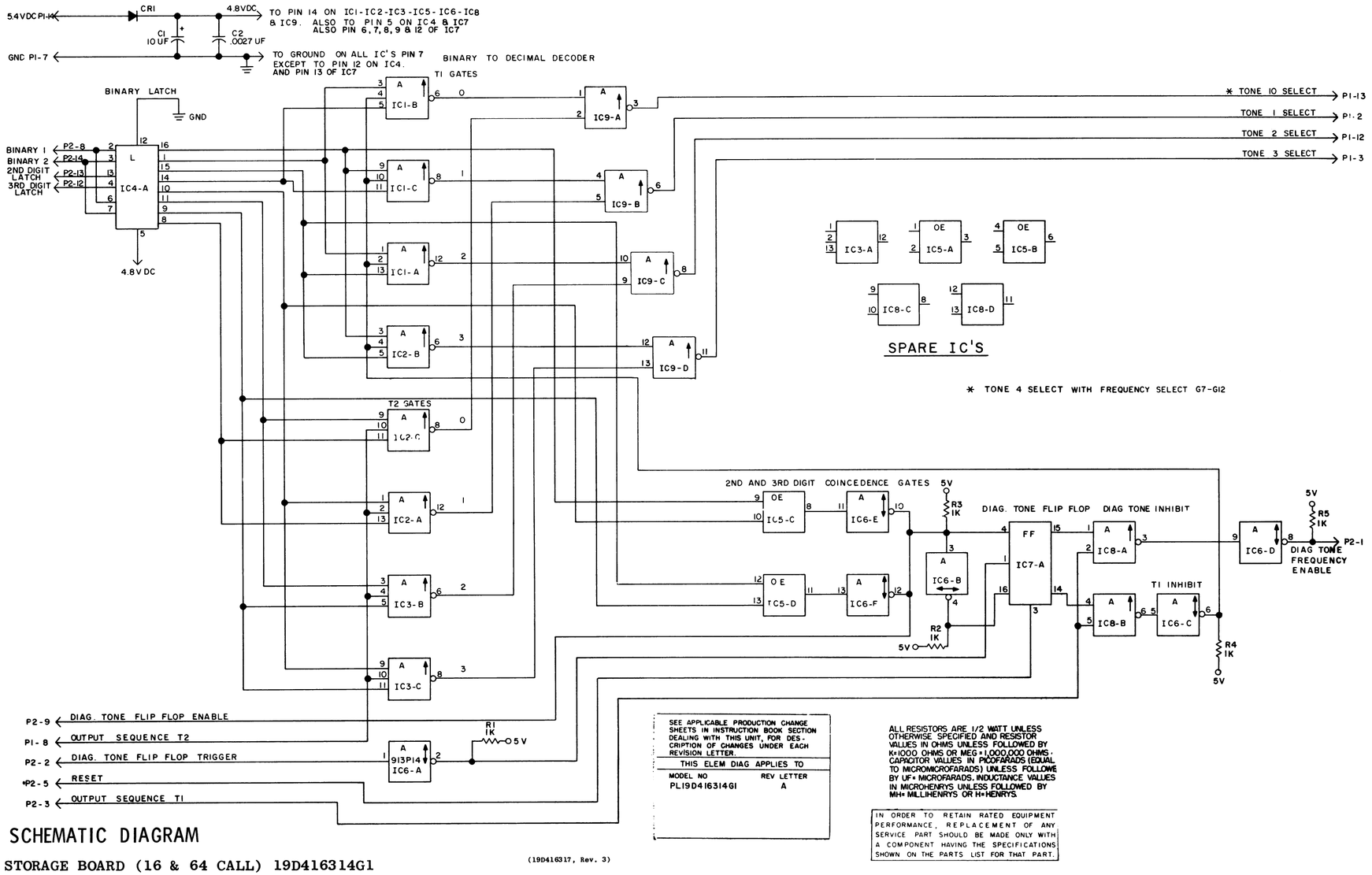
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

(19D416326, Rev. 10)

SCHEMATIC DIAGRAM

FORMAT BOARD (400 & 900 CALL)
19D416325G1 & G2



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D416314G1	A

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19D416317, Rev. 3)

SCHEMATIC DIAGRAM

STORAGE BOARD (16 & 64 CALL) 19D416314G1

PARTS LIST

LBI4418A
STORAGE BOARD
TYPE 99 II TONE
19D416314G1
REV A

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - -
C1	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C2	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - -
CR1	4037822P1	Silicon.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - - -
IC1 thru IC3	19A700037P9	Digital, TRIPLE 3-INPUT POSITIVE-NAND GATE.
IC4	19A116180P21	Monolithic, 4-BIT BISTABLE LATCH; sim to Texas Instrument Tpe SN7475N.
IC5	19A116180P18	Monolithic, QUAD 2-INPUT EXCLUSIVE-OR GATE; sim to Texas Instrument Type SN7486N.
IC6	19A700037P6	Digital, HEX INVERTERS. (OPEN COLLECTOR OUTPUT).
IC7	19A700037P37	Digital, DUAL J-K FLIP-FLOP WITH PRESET & CLEAR.
IC8	19A700037P1	Digital, QUAD 2-INPUT POSITIVE-NAND GATE.
IC9	19A700037P7	Digital, QUAD 2-INPUT POSITIVE-AND GATE.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed wiring board 19C331420P1).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R5	19A700019P37	Deposited carbon: 1K ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 - Changed DTL Integrated circuits IC1-IC8 to TTL.

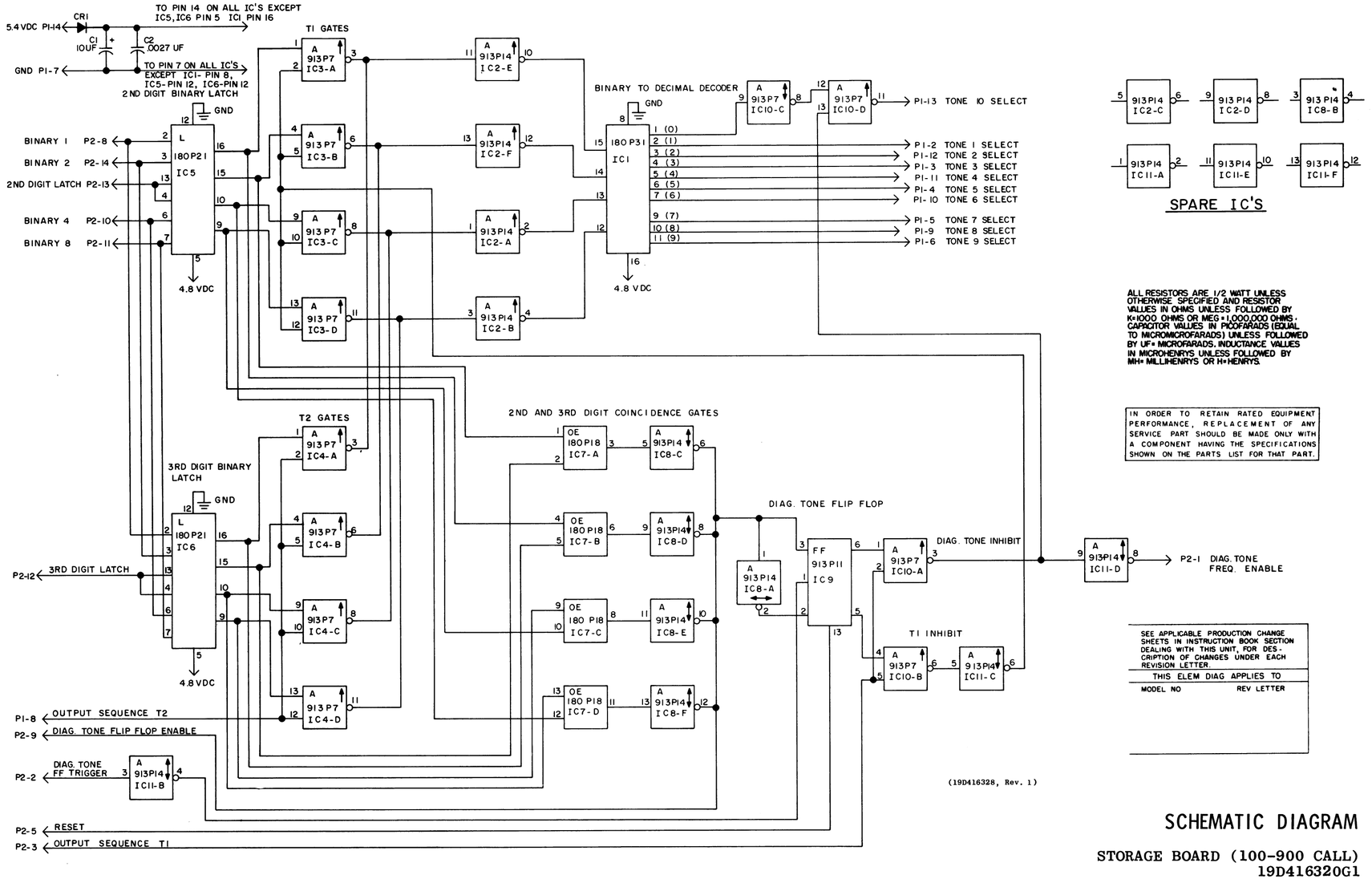
PARTS LIST

LBI-4419

STORAGE BOARD
TYPE 99 II TONE
19D416320G1

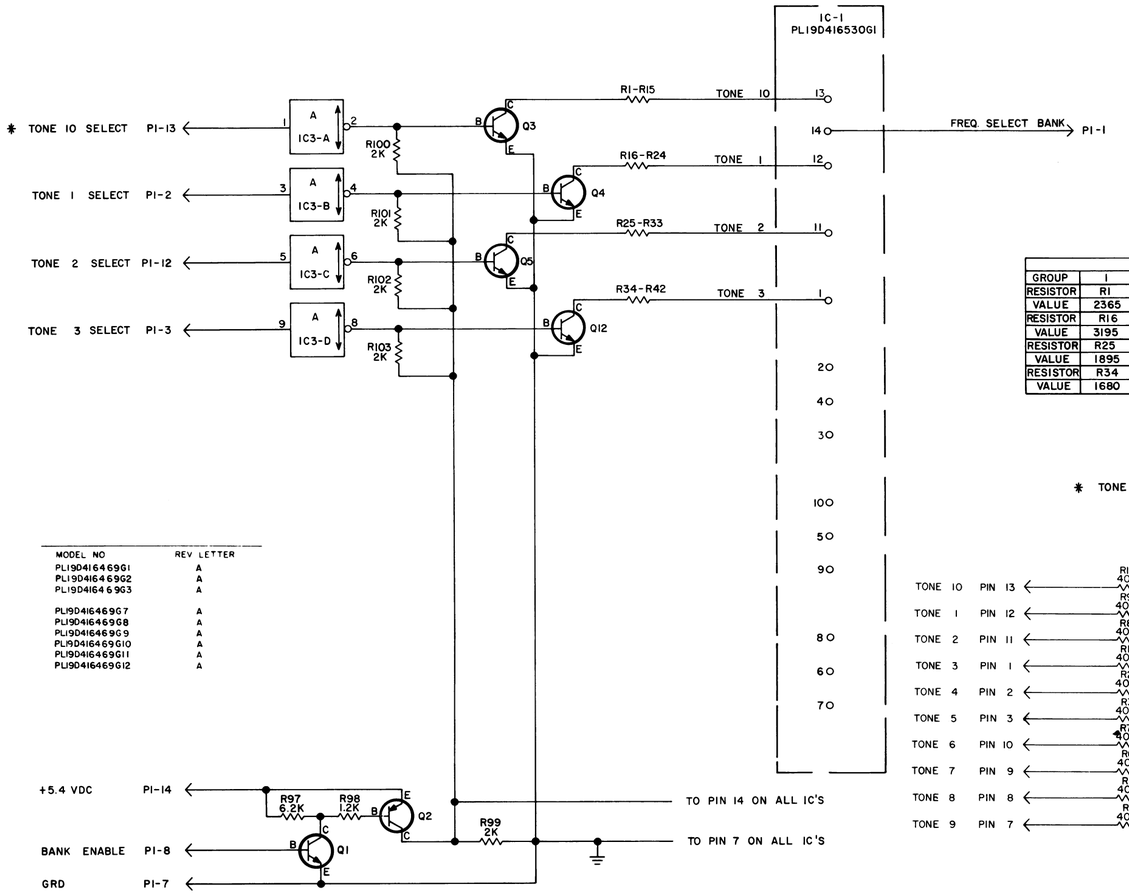
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C2	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1	4037822P1	Silicon.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
IC1	19A116180P31	Monolithic, BCD-TO-Decimal Decoder/Driver; sim to Texas Instrument Type SN74145N.
IC2	19A115913P14	Monolithic, Hex Inverter; sim to Fairchild DTL 936.
IC3 and IC4	19A115913P7	Monolithic, Quad 2-Input Gate; sim to Fairchild DTL 946.
IC5 and IC6	19A116180P21	Monolithic, 4-Bit Bistable Latch; sim to Texas Instrument Type SN7475N.
IC7	19A116180P18	Monolithic, Quad 2-Input Exclusive-or Gate; sim to Texas Instrument Type SN7486N.
IC8	19A115913P14	Monolithic, Hex Inverter; sim to Fairchild DTL 936.
IC9	19A115913P11	Monolithic, Dual 945 Flip-Flop; sim to Fairchild DTL 097.
IC10	19A115913P7	Monolithic, Quad 2-Input Gate; sim to Fairchild DTL 946.
IC11	19A115913P14	Monolithic, Hex Inverter; sim to Fairchild DTL 936.
		- - - - - - - - - - PLUGS - - - - - - - - -
P1 and P2		(Part of printed wiring board 19D416319P1).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SCHEMATIC DIAGRAM

STORAGE BOARD (100-900 CALL)
19D416320G1

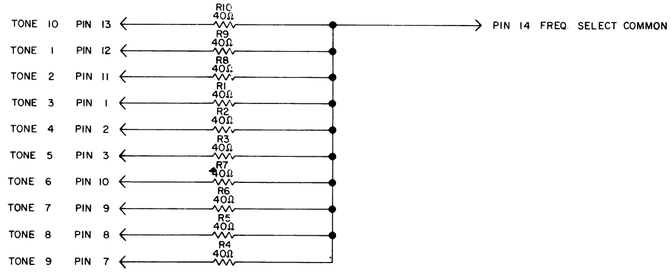


FREQ. SELECT BD.
GP. 1-3
GP. 7-12

RESISTOR CHART									
GROUP	1	2	3	7	8	9	10	11	12
RESISTOR	R1	R2	R3	R10	R11	R12	R13	R14	R15
VALUE	2365	2600	2480	7005	2195	12930	7440	2325	650
RESISTOR	R16	R17	R18	R19	R20	R21	R22	R23	R24
VALUE	3195	3030	2160	10045	3100	15715	10695	3285	775
RESISTOR	R25	R26	R27	R28	R29	R30	R31	R32	R33
VALUE	1895	1745	1820	8915	2755	14710	9490	2920	730
RESISTOR	R34	R35	R36	R37	R38	R39	R40	R41	R42
VALUE	1680	1555	1615	7900	2460	13785	8390	2600	690

* TONE 4 SELECT IN GROUP 7-12.

MODEL NO	REV LETTER
PL19D416469G1	A
PL19D416469G2	A
PL19D416469G3	A
PL19D416469G7	A
PL19D416469G8	A
PL19D416469G9	A
PL19D416469G10	A
PL19D416469G11	A
PL19D416469G12	A



(19E219517, Rev. 1)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SCHEMATIC DIAGRAM

FREQUENCY SELECT (4 FREQUENCY)
19D416469G1-G3

(19D416550, Rev. 4)

PARTS LIST

LBI-4414

FREQUENCY SELECT BOARD
TYPE 99 II TONE
19D416469G1-G3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1	19D416530G1	Frequency Select I.C.
IC3	19A115913P14	Monolithic, Hex Inverter; sim to Fairchild DTL 936.
		- - - - - - - - - - - - PLUGS - - - - - - - - -
P1		(Part of printed wiring board 19D416454P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q2	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q3 thru Q5	19A129207P1	Silicon, NPN.
Q12	19A129207P1	Silicon, NPN.
		- - - - - - - - - - - - RESISTORS - - - - - - - - -
R1	19A116690P2365	Wirewound: 2365 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R2	19A116690P2600	Wirewound: 2600 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R3	19A116690P2480	Wirewound: 2480 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R16	19A116690P3195	Wirewound: 3195 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R17	19A116690P3030	Wirewound: 3030 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R18	19A116690P2160	Wirewound: 2160 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R25	19A116690P1895	Wirewound: 1895 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R26	19A116690P1745	Wirewound: 1745 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R27	19A116690P1820	Wirewound: 1820 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R34	19A116690P1680	Wirewound: 1680 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R35	19A116690P1555	Wirewound: 1555 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R36	19A116690P1615	Wirewound: 1615 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R97	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R98	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R99 thru R103	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 - To eliminate DTL Integrated circuits changed IC2 and IC3 from 19A115913P14 to 19A700037P5.

PARTS LIST

LBI-4416

FREQUENCY SELECT BOARD
TYPE 99 II TONE
19D416469G4-G6

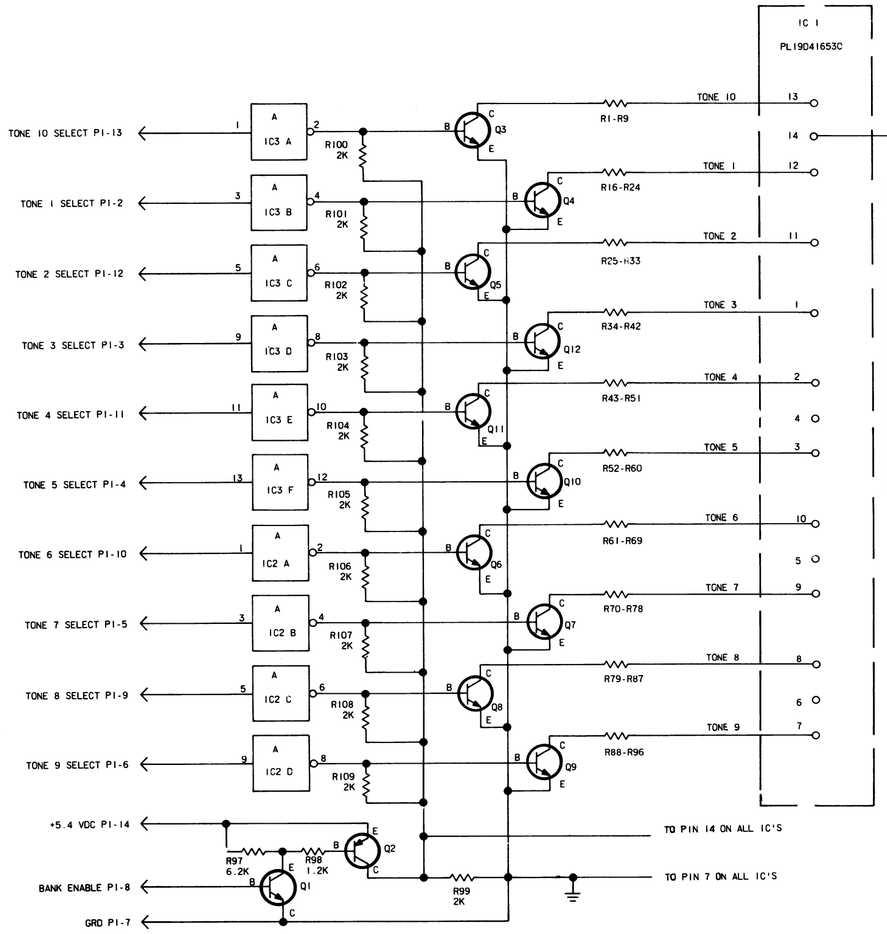
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1	19D416530G1	Frequency Select I.C.
IC2 and IC3	19A115913P14	Monolithic, Hex Inverter; sim to Fairchild DTL 936.
		- - - - - - - - - - - PLUGS - - - - - - - - -
P1		(Part of printed wiring board 19D416454P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A115889P1	Silicon, NPN; sim to Type 2N2712.
Q2	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q3 thru Q12	19A129207P1	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R1	19A116690P2365	Wirewound: 2365 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R2	19A116690P2600	Wirewound: 2600 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R3	19A116690P2480	Wirewound: 2480 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R16	19A116690P3195	Wirewound: 3195 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R17	19A116690P3030	Wirewound: 3030 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R18	19A116690P2160	Wirewound: 2160 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R34	19A116690P1680	Wirewound: 1680 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R35	19A116690P1555	Wirewound: 1555 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R36	19A116690P1615	Wirewound: 1615 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R43	19A116690P1495	Wirewound: 1495 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R44	19A116690P1390	Wirewound: 1390 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R45	19A116690P1440	Wirewound: 1440 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R52	19A116690P1340	Wirewound: 1340 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R53	19A116690P1250	Wirewound: 1250 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R54	19A116690P1295	Wirewound: 1295 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R61	19A116690P1210	Wirewound: 1210 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R62	19A116690P1130	Wirewound: 1130 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R63	19A116690P1170	Wirewound: 1170 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R70	19A116690P3775	Wirewound: 3775 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R71	19A116690P4260	Wirewound: 4260 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R72	19A116690P4005	Wirewound: 4005 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R79	19A116690P2070	Wirewound: 2070 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R80	19A116690P3565	Wirewound: 3565 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R81	19A116690P3375	Wirewound: 3375 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R88	19A116690P2730	Wirewound: 2730 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R89	19A116690P2260	Wirewound: 2260 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R90	19A116690P2870	Wirewound: 2870 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R97	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R98	3R152P122J	Composition: 1200 ohms ±5%, 1/4 w.
R99 thru R109	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 - To eliminate DTL integrated circuits, changed IC2 and IC3 from 19A115913P14 to 19A700037P5.



(19D416541, Rev. 5)

RESISTOR CHART

GROUP	4	5	6	13	14	15	16	17	18
RESISTOR	R1	R2	R3	R4	R5	R6	R7	R8	R9
VALUE	2365	2600	2480	11390	3480	876	12130	3685	825
RESISTOR	R16	R17	R18	R19	R20	R21	R22	R23	R24
VALUE	3195	3030	2160	10045	3100	15715	10695	3285	775
RESISTOR	R25	R26	R27	R28	R29	R30	R31	R32	R33
VALUE	1895	1745	1820	8915	2755	14710	9490	2920	730
RESISTOR	R34	R35	R36	R37	R38	R39	R40	R41	R42
VALUE	1680	1555	1615	7900	2460	13785	8390	2600	690
RESISTOR	R43	R44	R45	R46	R47	R48	R49	R50	R51
VALUE	1495	1390	1440	7005	2195	12930	7440	2325	650
RESISTOR	R52	R53	R54	R55	R56	R57	R58	R59	R60
VALUE	1340	1250	1295	6220	1955	1165	6600	2070	615
RESISTOR	R61	R62	R63	R64	R65	R66	R67	R68	R69
VALUE	1210	1130	1170	5535	1745	1100	5865	1845	580
RESISTOR	R70	R71	R72	R73	R74	R75	R76	R77	R78
VALUE	3775	4260	4005	4920	1555	1040	5220	1645	545
RESISTOR	R79	R80	R81	R82	R83	R84	R85	R86	R87
VALUE	2070	3565	3375	4380	1385	980	4640	1465	515
RESISTOR	R88	R89	R90	R91	R92	R93	R94	R95	R96
VALUE	2730	2260	2870	3920	1235	925	4135	1310	487

RESISTOR'S SHOWN IN CHART ARE 0.15 WATT, VALUES SHOWN ARE IN OHMS

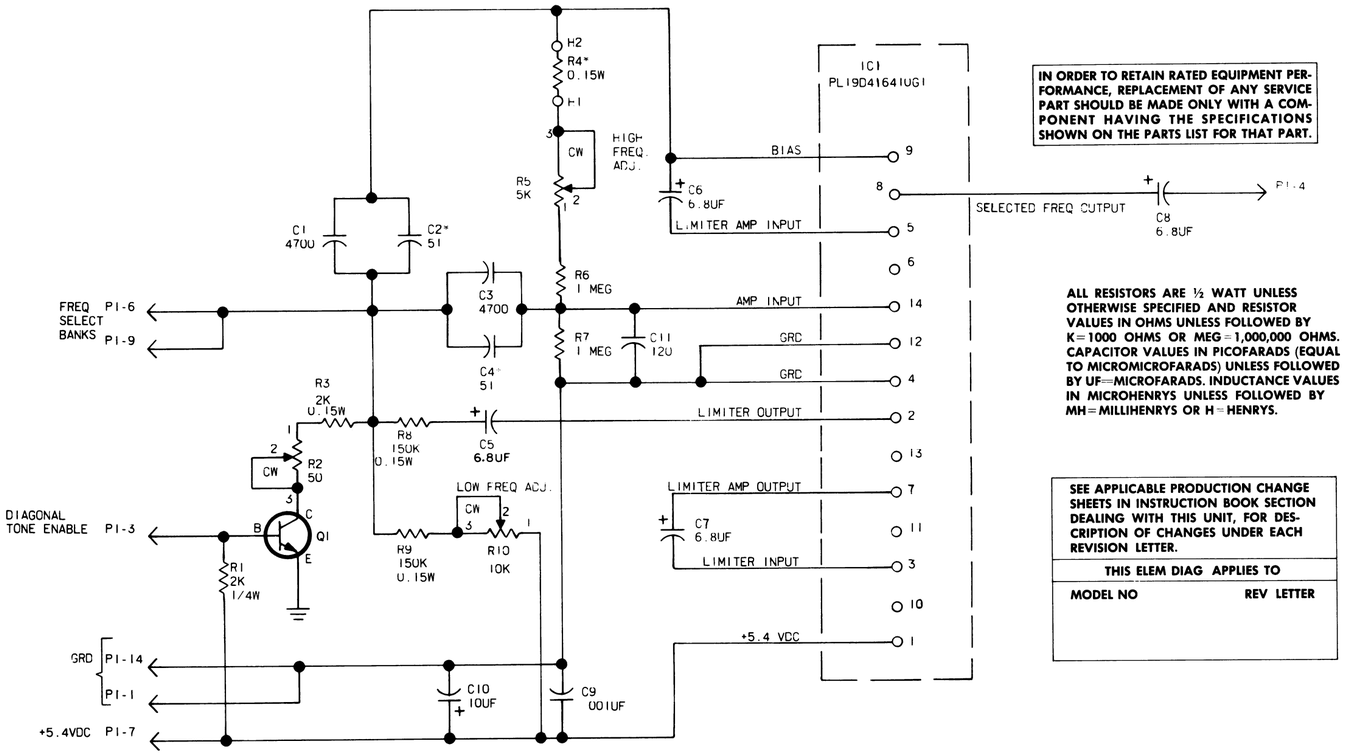
MODEL NO	REV LETTER
PL19D416469G4	A
PL19D416469G5	A
PL19D416469G6	A
PL19D416469G13	B
PL19D416469G14	A
PL19D416469G15	A
PL19D416469G16	A
PL19D416469G17	A
PL19D416469G18	A

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

SCHEMATIC DIAGRAM

FREQUENCY SELECT BOARD
10-FREQUENCY 19D416469G4-G6



(19C320123, Rev. 2)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE ½ WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER

SCHEMATIC DIAGRAM

OSCILLATOR BOARD 19C320086G1

PARTS LIST

LBI-4413B

OSCILLATOR BOARD
TYPE 99 II TONE
19C320086G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116058P4	Silver, mica: 4700 pf ±.5%, 100 VDCW; sim to Electro Motive Type DM20.
C2A	5496203P20	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -2200 PPM.
C2B	5496203P120	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -3300 PPM.
C2C	5496203P220	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -4200 PPM.
C2D	5496203P320	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -4700 PPM.
C2E	5496203P420	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -5600 PPM.
C3	19A116058P4	Silver, mica: 4700 pf ±.5%, 100 VDCW; sim to Electro Motive Type DM20.
C4A	5496203P20	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -2200 PPM.
C4B	5496203P120	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -3300 PPM.
C4C	5496203P220	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -4200 PPM.
C4D	5496203P320	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -4700 PPM.
C4E	5496203P420	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -5600 PPM.
C5 thru C8	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C10	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C11	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
UC1	19D416410G1	Stable Audio Oscillator.
		- - - - - - - - - - PLUGS - - - - - - - - -
P1		(Part of printed wiring board 19D416448P1).
		- - - - - - - - - - TRANSISTORS - - - - - - -
Q1	19A129207P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R2	19A116559P110	Variable, cermet: 50 ohms ±20%, .5 w; sim to CTS Series 360.
R3	19A116690P2000	Wirewound: 2000 ohms ±0.1%, 0.15 w; sim to Mills Type MR-100-2A.
R4A	19A116094P4020	Wirewound: 4020 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4B	19A116094P8060	Wirewound: 8060 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4C	19A116094P12000	Wirewound: 12,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4D	19A116094P16000	Wirewound: 16,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4E	19A116094P20000	Wirewound: 20,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4F	19A116094P24000	Wirewound: 24,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4G	19A116094P28000	Wirewound: 28,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4H	19A116094P32000	Wirewound: 32,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4J	19A116094P36100	Wirewound: 36,100 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R4K	19A116094P40200	Wirewound: 40,200 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R5	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R6	19A116624P1	Metal film: 1 megohm ±0.1%, 1/2 w; sim to IRC Type CCA-T9.
R7	19A116278P501	Metal film: 1 megohm ±2%, 1/2 w.
R8 and R9	19A116094P 150000	Wirewound: 150,000 ohms ±1%, 0.15 w; sim to RCL Type 7010.
R10	19A116559P106	Variable, cermet: 10,000 ohms ±20%, .5 w; sim to CTS Series 360.

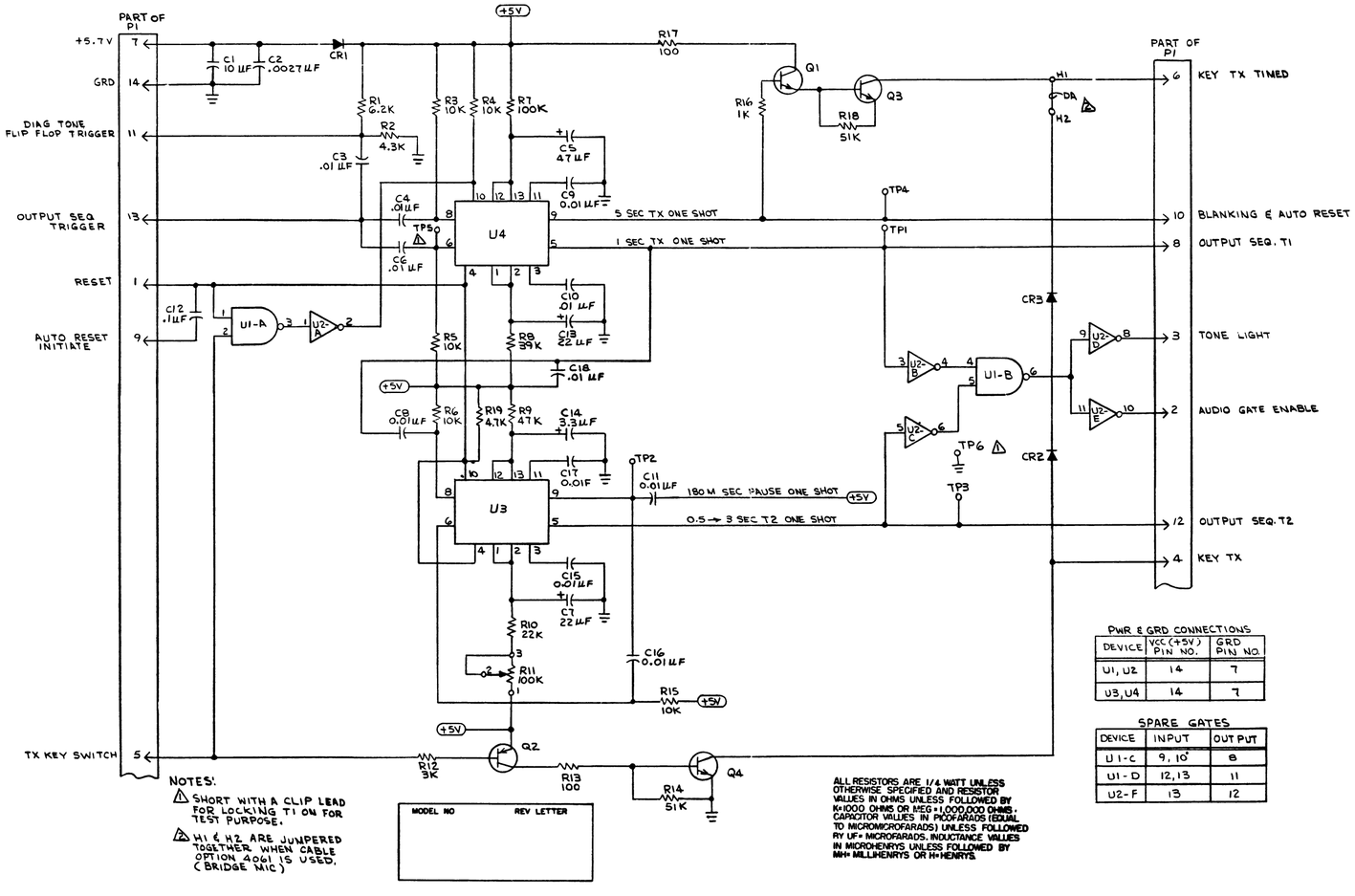
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

OUTPUT SEQUENCE BOARD
19D433190G1
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C1	19A115680P8	Electrolytic: 10 µf +150-10%, 25 VDCW; sim to Mallory Type TTX.
C2	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3 and C4	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C5	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C6	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C7	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C8 thru C11	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C14	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C15 thru C18	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		---------- DIODES ----------
CR1 thru CR3	4037822P1	Silicon, 1000 mA, 60 PIV.
		---------- PLUGS ----------
P1		Part of printed board 19D433189P1.
		---------- TRANSISTORS ----------
Q1	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q2	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q3 and Q4	19A134437P1	Silicon, NPN; sim to Type 2N5786
		---------- RESISTORS ----------
R1	3R152P622J	Composition: 62K ohms ±5%, 1/4 w.
R2	3R152P432J	Composition: 4.3K ohms ±5%, 1/4 w.
R3 thru R6	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R7	19A700106P111	Composition: 100K ohms ±5%, 1/4 w.
R8	19A700106P101	Composition: 39K ohms ±5%, 1/4 w.
R9	19A700106P103	Composition: 47K ohms ±5%, 1/4 w.
R10	19A700106P95	Composition: 22K ohms ±5%, 1/4 w.
R11	19B209358P9	Variable, carbon film: approx 800 to 25,000 ohms ±20%, 1/4 w.; sim to CTS Type U-201.
R12	3R152P302J	Composition: 3K ohms ±5%, 1/4 w.
R13	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R14	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R15	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R16	19A700106P63	Composition: 1K ohms ±5%, 1/4 w.
R17	19A700106P39	Composition: 100 ohms ±5%, 1/4 w.
R18	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R19	19A700106P79	Composition: 4.7K ohms ±5%, 1/4 w.
		---------- TEST POINTS ----------
TP1 thru TP6	19B211379P1	Spring.
		---------- INTEGRATED CIRCUITS ----------
U1	19A134305P1	Digital: QUAD 2-INPUT POSITIVE - NAND GATE.
U2	19A134305P5	Digital: HEX INVERTERS.
U3 and U4	19A116968P3	Linear: 555 TIMER; sim to Signetics SA556W.
		---------- MISCELLANEOUS ----------
	19A701332P4	Insulator, disk. (Used with Q3 and Q4).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



NOTES:

1. SHORT WITH A CLIP LEAD FOR LOCKING T1 ON FOR TEST PURPOSE.
2. H1 & H2 ARE JUMPERED TOGETHER WHEN CABLE OPTION A061 IS USED. (BRIDGE MIC)

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

PWR & GRD CONNECTIONS

DEVICE	VCC (+5V) PIN NO.	GRD PIN NO.
U1, U2	14	7
U3, U4	14	7

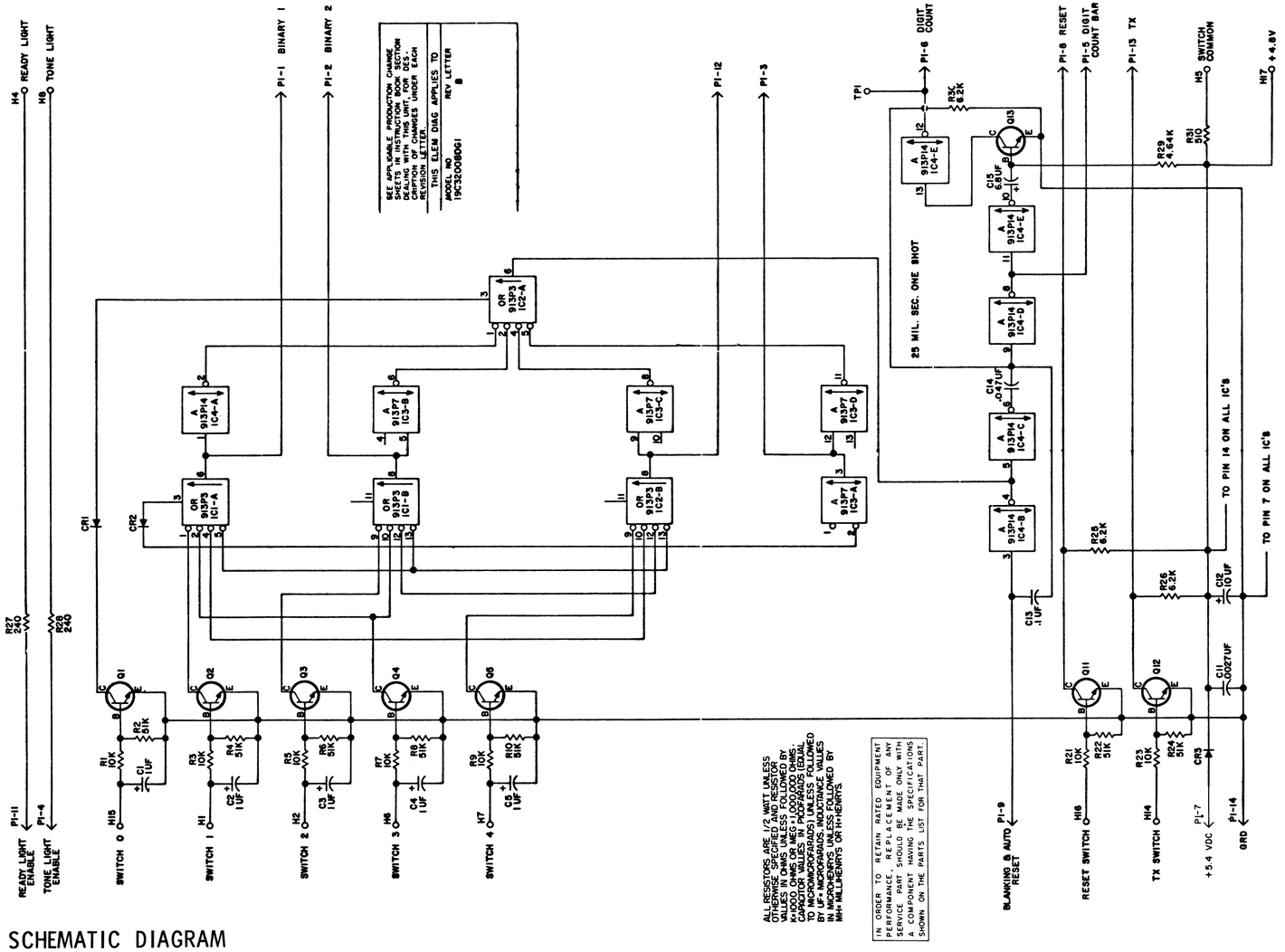
SPARE GATES

DEVICE	INPUT	OUTPUT
U1-C	9, 10	8
U1-D	12, 13	11
U2-F	13	12

(19D433204, Rev. 0)

SCHEMATIC DIAGRAM

OUTPUT SEQUENCE BOARD
19D433190G1



(19D416549, Rev. 5)

SCHEMATIC DIAGRAM

INPUT MATRIX BOARD (16-64 CALL)
19C320080G1

PARTS LIST

LBI4412C

INPUT MATRIX BOARD
TYPE 99 II TONE
19C320080G1

SYMBOL	GE PART NO.	DESCRIPTION
		---------- CAPACITORS ---------
C1 thru C5	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C11	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C13*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		Earlier than REV A:
	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C14	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C15*	5496267P201	Tantalum: 6.8 µf ±10%, 6 VDCW; sim to Sprague Type 150D.
		In REV A & earlier:
	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
		--------- DIODES AND RECTIFIERS ------
CR1 and CR2	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR3	4037822P1	Silicon, 1000 mA, 400 PIV.
		-------- INTEGRATED CIRCUITS -------
UC1 and UC2	19A115913P3	Digital, Expandable Dual 4-Input Nand Buffer: Identification No. 932.
UC3	19A115913P7	Digital, Quad 2-Input Nand Gate: Identification No. 946.
UC4	19A115913P14	Digital, Hex Inverter: Identification No. 936.
		---------- PLUGS ----------
P1		(Part of printed wiring board 19C320034P1).
		---------- TRANSISTORS --------
Q1 thru Q5	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q11 thru Q13	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		---------- RESISTORS -------
R1	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R2	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R3	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R4	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R5	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R6	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R7	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R8	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R9	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R10	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R21	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R22	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R23	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R24	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R25 and R26	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R27 and R28	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R29*	19A701250P265	Metal film: 4640 ohms ±1%, 1/4.
		In REV A & earlier:
	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R30	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R31	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
		---------- TEST POINTS ----------
TP1	19B211379P1	Spring (Test Point).
		---------- MISCELLANEOUS ---------
	4035306P26	Fiber washer. (Located between printed board & insulator).
	19B227689P1	Insulator.
	N80P9005C6	Machine screw: No. 4-40 x 5/16. (Secures insulator to printed board).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 - To insure Tone Encoder will reset after power is applied or after completion of Tone transmission. Changed C13.

REV. B - To change the time of the One-Shot. Changed C15 and R29.

PARTS LIST

LBI4415B

INPUT MATRIX BOARD
TYPE 99 II TONE
19C320080G2

SYMBOL	GE PART NO.	DESCRIPTION
		---------- CAPACITORS ----------
C1 thru C10	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C11	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TT.
C13*	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
		Earlier than REV A:
	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C14	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C15*	5496267P201	Tantalum: 6.8 µf ±10%, 6 VDCW; sim to Sprague Type 150D.
		In REV A & earlier:
	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
		---------- DIODES AND RECTIFIERS ----------
CR1 and CR2	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR3	4037822P1	Silicon, 1000 mA, 400 PIV.
		---------- INTEGRATED CIRCUITS ----------
UC1 and UC2	19A115913P3	Digital, Expandable Dual 4-Input Nand Buffer: Identification No. 932.
UC3	19A115913P7	Digital, Quad 2-Input Nand Gate: Identification No. 946.
UC4	19A115913P14	Digital, Hex Inverter: Identification No. 936.
		---------- PLUGS ----------
P1		(Part of printed wiring board 19C320034P1).
		---------- TRANSISTORS ----------
Q1 thru Q13	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		---------- RESISTORS ----------
R1	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R2	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R3	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R4	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R5	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R6	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R7	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R8	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R9	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R10	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R11	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R12	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R13	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R14	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R15	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R16	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R17	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R18	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R19	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R20	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R21	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R22	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R23	19A700106P87	Composition: 10K ohms ±5%, 1/4 w.
R24	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R25 and R26	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R27 and R28	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R29*	19A701250P265	Metal film: 4640 ohms ±1%, 1/4.
		In REV A & earlier:
	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R30	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R31	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
		---------- TEST POINTS ----------
TP1	19B211379P1	Spring (Test Point).
		---------- MISCELLANEOUS ----------
	4035306P26	Fiber washer. (Located between printed board & insulator).
	19B227689P1	Insulator.
	N80P9005C6	Machine screw; No. 4-40 x 5/16. (Secures insulator to printed board).

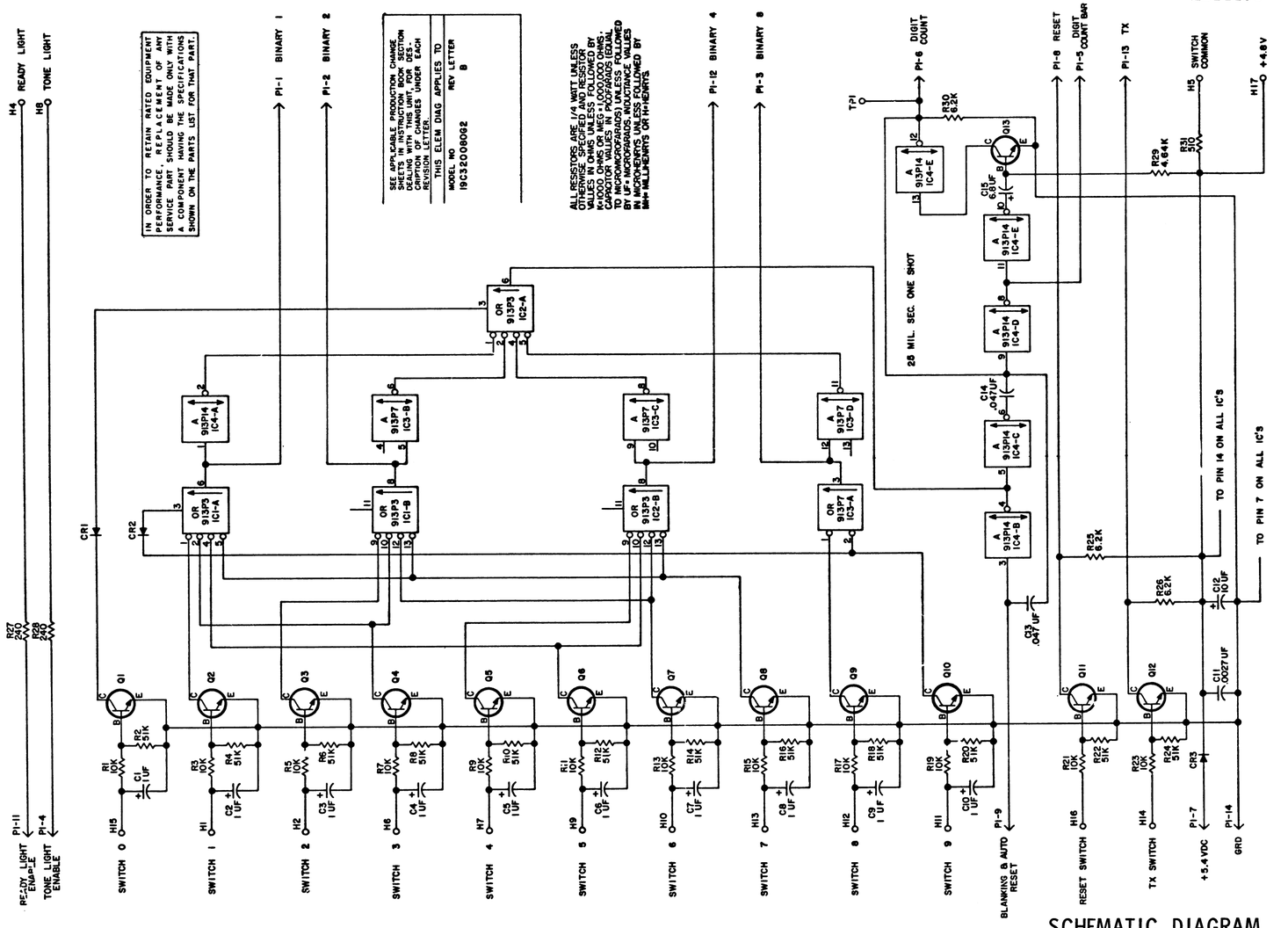
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 - To insure Tone Encoder will reset after Power is applied or after completion of Tone transmission. Changed C13.

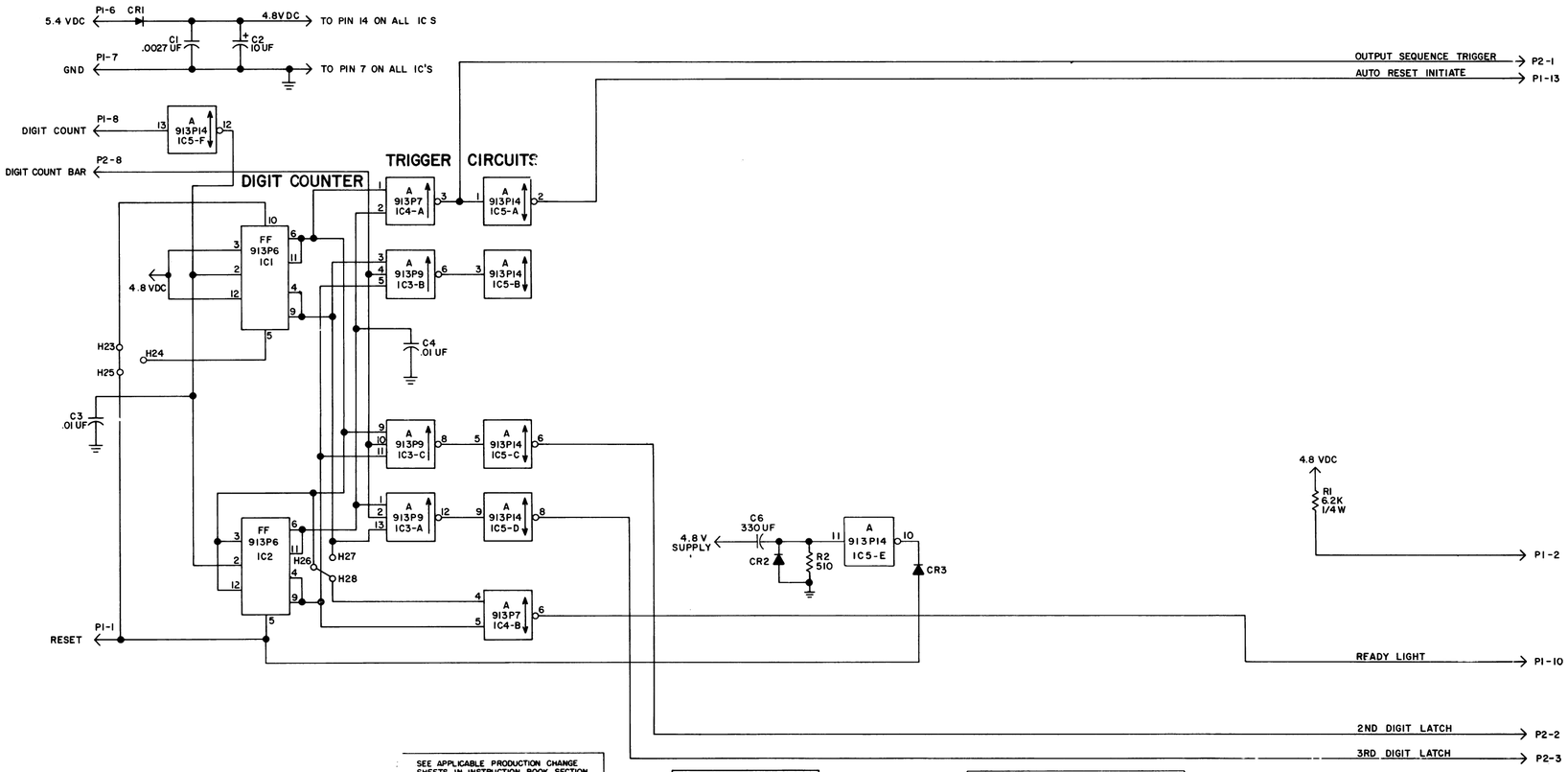
REV. B - To change the time of the One-Shot. Changed C15 and R29.



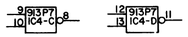
(19D416536, Rev. 4)

SCHEMATIC DIAGRAM

INPUT MATRIX BOARD (100-900 CALL)
19C320080G2



SPARE IC'S



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL 19D416327G1	A

CONNECTION CHART		
FROM	TO	WIRE
H23	H25	DM
H26	H28	DM

NOTE:
THESE CONNECTIONS ON GP. I ONLY

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

(19D416553, Rev. 4)

SCHEMATIC DIAGRAM

FORMAT BOARD (16 & 100 CALL)
19D416327G1

PARTS LIST

LBI-4410A

FORMAT BOARD
TYPE 99 II TONE
19D416327G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C3 and C4	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C6*	5496267P4	Tantalum: 330 µf ±20%, 6 VDCW; sim to Sprague Type 150D. Added by REV A.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	4037822P1	Silicon.
CR2* and CR3*	19A115250P1	Silicon. Added by REV A.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1 and IC2	19A115913P6	Digital, Clocked J-K/R-S Flip-Flop; sim to Fairchild DTL 945.
IC3	19A115913P9	Digital, Triple 3-Input Nand Gate; sim to Fairchild DTL 962.
IC4	19A115913P7	Digital, Quad 2-Input Nand Gate; sim to Fairchild DTL 946.
IC5	19A115913P14	Digital, Hex Inverter; sim to Fairchild DTL 936.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed wiring board 19D416321P1).
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R2*	3R152P511J	Composition: 510 ohms ±5%, 1/4 w. Added by REV A.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 description of parts affected by these revisions.

Rev. A - To detect power line fluctuation and generate a reset pulse.
Added C6,CR2,CR3,R2 and spare IC section (IC5-E).

PARTS LIST

LBI-4421B

FORMAT BOARD
TYPE 99 11 TONE
19D41632G2

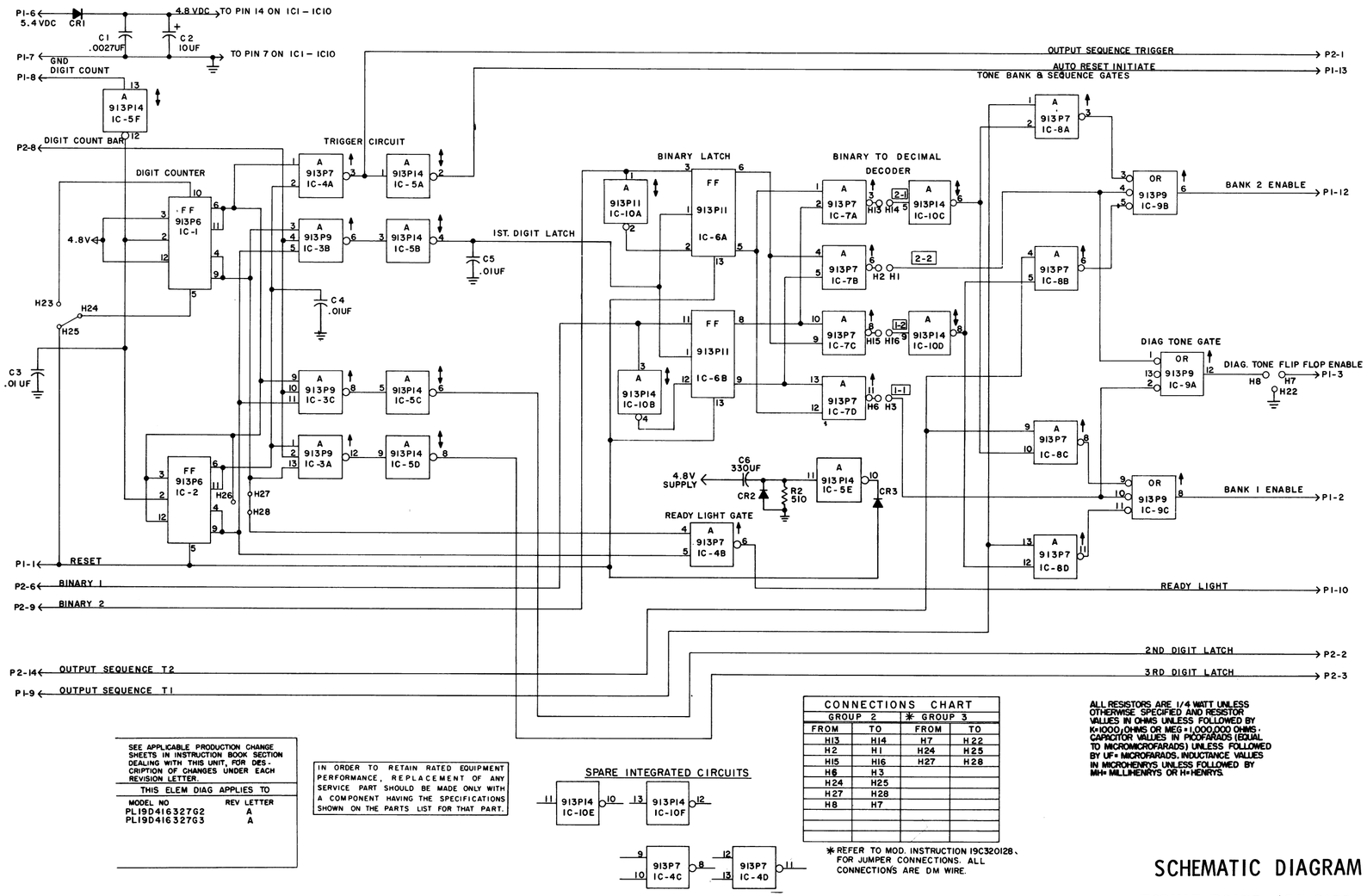
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C3 thru C5	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C6*	5496267P4	Tantalum: 330 µf ±20%, 6 VDCW; sim to Sprague Type 150D. Added by REV A.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	4037822P1	Silicon.
CR2* and CR3*	19A115250P1	Silicon. Added by REV A.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1 and IC2	19A115913P6	Digital, Clocked J-K/R-S Flip-Flop; sim to Fairchild DTL 945.
IC3	19A115913P9	Digital, Triple 3-Input Nand Gate; sim to Fairchild DTL 962.
IC4	19A115913P7	Digital, Quad 2-Input Nand Gate; sim to Fairchild DTL 946.
IC5	19A115913P14	Digital, Hex Inverter; sim to Fairchild DTL 936.
IC6	19A115913P11	Digital, Dual J-K Flip-Flop, Com. Clock; sim to Fairchild DTL 097.
IC7 and IC8	19A115913P7	Digital, Quad 2-Input Nand Gate; sim to Fairchild DTL 946.
IC9	19A115913P9	Digital, Triple 3-Input Nand Gate; sim to Fairchild DTL 962.
IC10	19A115913P14	Digital, Hex Inverter; sim to Fairchild DTL 936.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1 and P2		(Part of printed wiring board 19D416321P1).
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2*	3R152P511J	Composition: 510 ohms ±5%, 1/4 w. Added by REV A.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 description of parts affected by these revisions.

Rev. A - To detect power line fluctuation and generate a reset pulse. Added C6,CR2,CR3,R2 and spare IC section (IC5-E).



SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PLI9D41632TG2	A
PLI9D41632TG3	A

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

CONNECTIONS CHART

GROUP 2		* GROUP 3	
FROM	TO	FROM	TO
H13	H14	H7	H22
H2	H1	H24	H25
H15	H16	H27	H28
H6	H3		
H24	H25		
H27	H28		
H8	H7		

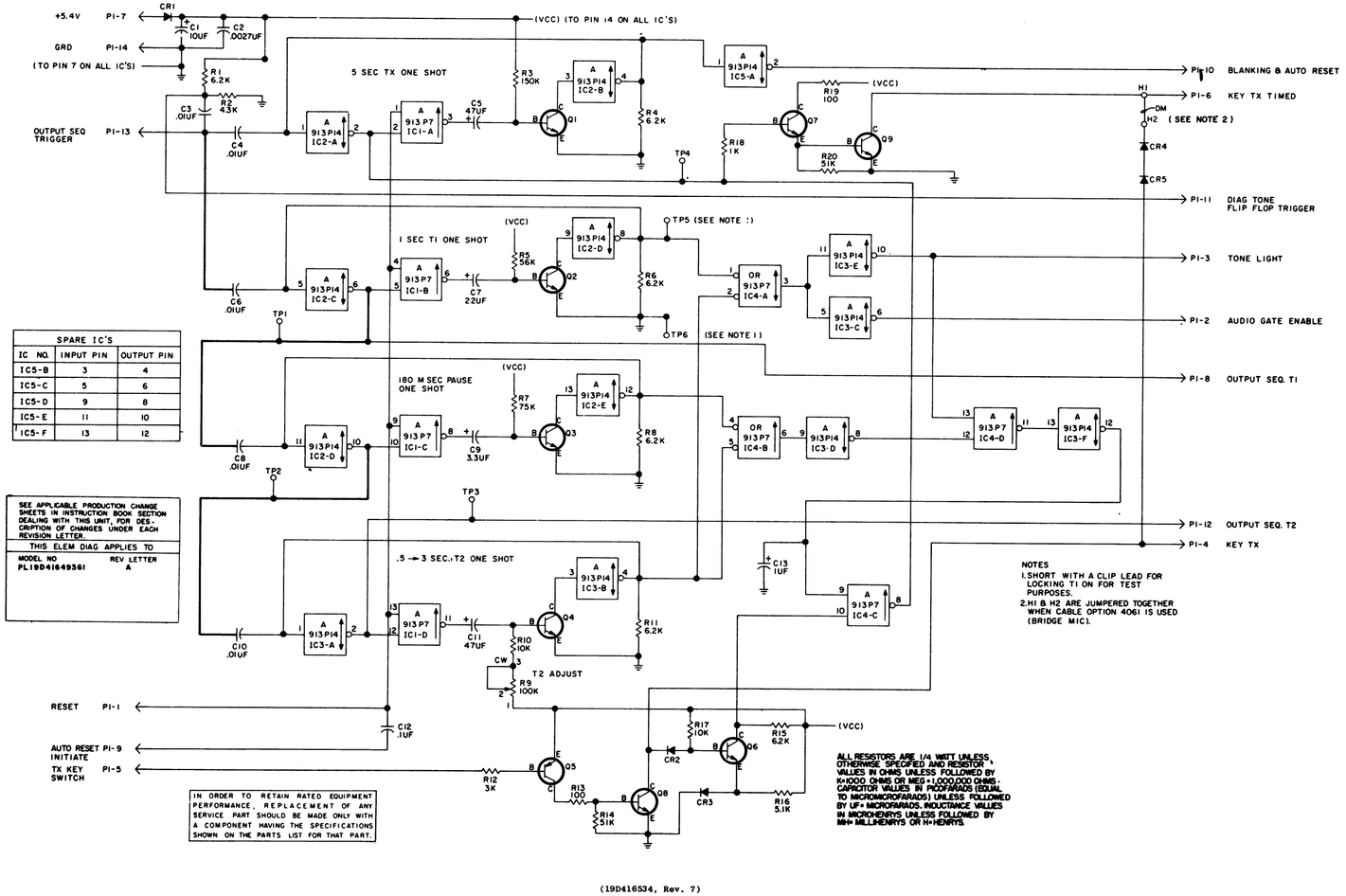
*REFER TO MOD. INSTRUCTION 19C320128, FOR JUMPER CONNECTIONS. ALL CONNECTIONS ARE DM WIRE.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000,OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

(19D416332, Rev. 6)

SCHEMATIC DIAGRAM

FORMAT BOARD (64 CALL)
19D416327G2



SPARE IC'S		
IC NO.	INPUT PIN	OUTPUT PIN
IC5-B	3	4
IC5-C	5	6
IC5-D	9	8
IC5-E	11	10
IC5-F	13	12

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19D416493G1	A

NOTES
1. SHORT WITH A CLIP LEAD FOR LOCKING T1 ON FOR TEST PURPOSES.
2. H1 & H2 ARE JUMPERED TOGETHER WHEN CABLE OPTION 4061 IS USED (BRIDGE MIC).

(19D416534, Rev. 7)

SCHEMATIC DIAGRAM

OUTPUT SEQUENCE BOARD 19D416493G1

PARTS LIST

LBI-4417A

OUTPUT SEQUENCE BOARD
TYPE 99 II TONE
19D416493G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - -
C1	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C2	5494481P27	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3 and C4	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C5	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C6	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C7	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C8	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C9	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C11	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C12	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C13	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - DIODES AND RECTIFIERS - - - -
CR1	4037822P1	Silicon.
CR2 and CR3	19A115250P1	Silicon.
CR4 and CR5	4037822P1	Silicon.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1	19A115913P7	Digital, Quad 2-Input Nand Gate; sim to Fairchild DTL 946.
IC2 and IC3	19A115913P14	Digital, Hex Inverter; sim to Fairchild DTL 936.
IC4	19A115913P7	Digital, Quad 2-Input Nand Gate; sim to Fairchild DTL 946.
IC5	19A115913P14	Digital, Hex Inverter; sim to Fairchild DTL 936.
		- - - - - - - - - - - PLUGS - - - - - - - - -
P1		(Part of printed wiring board 19D416483P1).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 thru Q4	19A115889P1	Silicon, NPN.
Q5	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q6 and Q7	19A115889P1	Silicon, NPN.
Q8* and Q9*	19A134437P1	Silicon, NPN; sim to Type 2N5786.
		Earlier than REV A:
	19A115300P4	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R2	3R152P432J	Composition: 4.3K ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R3	3R152P154J	Composition: 150K ohms ±5%, 1/4 w.
R4	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R5	3R152P563J	Composition: 56K ohms ±5%, 1/4 w.
R6	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R7	3R152P753J	Composition: 75K ohms ±5%, 1/4 w.
R8	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R9	19B209358P9	Variable, carbon film: approx 3K to 100K ohms ±20%, 0.25 w; sim to CTS Type U-201.
R10	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R11	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R12	3R152P302J	Composition: 3K ohms ±5%, 1/4 w.
R13	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R14	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
R15	3R152P622J	Composition: 6.2K ohms ±5%, 1/4 w.
R16	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R17	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R18	3R152P102J	Composition: 1K ohms ±5%, 1/4 w.
R19	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R20	3R152P513J	Composition: 51K ohms ±5%, 1/4 w.
		- - - - - - - - - TEST POINTS - - - - - - - -
TP1 thru TP6	19B211379P1	Spring (Test Point).
		- - - - - - - - - - MISCELLANEOUS - - - - - - -
	4036555P1	Insulator, washer: nylon. (Used with Q8, Q9).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PRODUCTION CHANGES

Changes in the equipment to improve performance 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 description of parts affected by these revisions.

Rev. A - To provide transistors with higher gain.
Changed Q8 & Q9.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19D416504G1	B
PL19D416477G1	C

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

(19R621793, Rev. 12)

INTERCONNECTION DIAGRAM

MOTHER BOARD A1301, COMPONENT BOARD A1302 AND SOUNDER BOARD A1303

PARTS LIST

LBI4420C

TYPE 99 II TONE ENCODER
BASE ASSEMBLY
19D416504G1

SYMBOL	GE PART NO.	DESCRIPTION
A1301		MOTHER BOARD 19D416477G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C2	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C3	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C4	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C5	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C6* and C7*	19A134933P1	Ceramic, disc: .001 µf ±20%, 150 VDCW; sim to RMC Type AU.
		In REV A & earlier:
	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8 and C9	19A115680P13	Electrolytic: 185 µf +150% -10%, 21 VDCW; sim to Mallory Type TTX.
C10	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C11	19A115680P8	Electrolytic: 10 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C12 thru C15	19A700105P34	Mica: 100 pf ±5%, 500 VDCW.
C16	19A115680P13	Electrolytic: 185 µf +150% -10%, 21 VDCW; sim to Mallory Type TTX.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 VDCW.
CR2 thru CR5	403782 2P1	Silicon, 1000 mA, 400 PIV.
CR6 thru CR9	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR10	403782 2P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - - FUSES - - - - - - - - - -
F1	7487942P8	Slow blowing: 1/10 amp at 250 v; sim to Bussman MDL-1/10.
		- - - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J14	4033513P2	Contact, electrical: sim to Bead Chain L93-2.
J15 and J16	19A116446P5	Connector, printed wiring: 14 contacts.
J17 thru J19	4033513P2	Contact, electrical: sim to Bead Chain L93-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q3 and Q4	19A115768P1	Silicon, PNP; sim to Type 2N3702.

SYMBOL	GE PART NO.	DESCRIPTION
Q5 and Q6	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	19B209358P107	Variable, carbon film: approx 800 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R2 and R3	3R152P243J	Composition: 24K ohms ±5%, 1/4 w.
R4	3R152P752J	Composition: 7.5K ohms ±5%, 1/4 w.
R5	19A700106P87	Composition: 10K ohms ±5%, 1/4 .
R6 and R7	3R152P243J	Composition: 24K ohms ±5%, 1/4 w.
R8	3R152P512J	Composition: 5.1K ohms ±5%, 1/4 w.
R9	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R10	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R11	3R152P104J	Composition: 100K ohms ±5%, 1/4 w.
R12	19A115416P9	Wirewound: 1.00 ohms ±1%, 2 w; sim to Dale Type RS-2B.
R13	3R152P103J	Composition: 10K ohms ±5%, 1/4 w.
R14	3R122P204J	Composition: 200K ohms ±5%, 1/4 w.
R15	3R152P222J	Composition: 2.2K ohms ±5%, 1/4 w.
R16	3R152P432J	Composition: 4.3K ohms ±5%, 1/4 w.
R17	3R152P362J	Composition: 3.6K ohms ±5%, 1/4 w.
R18	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R19	3R152P153J	Composition: 15K ohms ±5%, 1/4 w.
		- - - - - - - - - VOLTAGE REGULATORS - - - - -
VR1	4036887P4	Zener: 500 mw, 4.4 v. nominal.
A1302		COMPONENT BOARD 19D416473G1
		- - - - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J8	19A116446P5	Connector, printed wiring, one-part.
		SHIELD ASSEMBLY 19B219572G1
A1303		SOUNDER BOARD 19B219558G1
		- - - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C3	5496267P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - - - - - PLUGS - - - - - - - - - -
P1 thru P3	4029840P2	Contact, electrical: sim to Amp 42827-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 and Q2	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P202J	Composition: 2K ohms ±5%, 1/4 w.
R2 and R3	19A700106P99	Composition: 33K ohms ±5%, 1/4 w.

SYMBOL	GE PART NO.	DESCRIPTION
R4	3R152P202J	Composition: 2K ohms ±5%, 1/4 w.
R5	19A700106P53	Composition: 390 ohms ±5%, 1/4 w.
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS1351	19A116730P1	Transducer, Piezoelectric.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L1301	5490936P1	Reactor: .02 h min, 1.3 ohms ±10% DC res, 1.5 VDC operating.
		- - - - - - - - - TRANSISTORS - - - - - - - -
Q1301	19A116375P1	Silicon, PNP.
		- - - - - - - - - SWITCHES - - - - - - - - -
S1301	19B209261P8	Slide: DPDT, 2 poles, 2 positions, .5 amp VDC or 3 amps VAC at 125 v; sim to Switchcraft 46206L.
		- - - - - - - - - TRANSFORMERS - - - - - - - -
T1301	19A116685P2	Power, step-down: Pri input: 117 VRMS, 50/60 Hz. Sec output: 11±.5 VDC at 650 mA, 60 Hz.
		- - - - - - - - - CABLES - - - - - - - - -
W1301	19A134567P1	Power: 2 poles, 3 wire; approx 6 feet long.
		SHIELD ASSEMBLY 19B219480G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1301 thru C1315	19A116699P2	Ceramic, feed-thru: 1000 pf ±20%, 250 VDCW; sim to Aerovox Style EF-5.
		- - - - - - - - - MISCELLANEOUS - - - - - -
	19C320105G1	Base.
	19B219472G1	Cover.
	19B219480G1	Shield. (Contains A1302).
	19A116023P1	Insulated plate. (Used with Q1301).
	19A134016P1	Insulated bushing. (Used with Q1301).
	4029851P6	Cable clamp. (Used with W1301).
	4029851P9	Cable clamp: sim to Weckesser 1/2-4-128. (Located in front of A1302).
	19B201074P210	Tap screw, Phillips POZIDRIV®: No. 4-40 x 5/8. (Used with cable clamps).
	4032480P1	Nut, sheet spring; sim to Vector Electronic No. 440. (Used with S1301, T1301).
	N80P9006P2	Tap screw: No. 4-40 x 3/8. (Secures Q1301, S1301, T1301).
	19A115990P1	Rubber bumper. (Used as feet for Base Assembly).
	19B200525P204	Rivet, tubular. (Secures Rubber bumper to Base).
	19A116688P1	Fuse clip: sim to Littlefuse, Inc. 102071. (Used with F1 on A1301- order 2 for each fuse).
	19C320108G1	Shield. (For LS1351).
	19A121175P17	Insulator. (Located on LS1351 shield).
	4035656P67	Spacer, threaded. (Used with A1303).
	4033198P12	Eyelet, metal. (Located under A1303 on shield).

PRODUCTION CHANGES

Changes in the equipment to improve performance 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.

19D416477G1 Mother Board

REV. A - To correct field complaint of tone falsing due to improper battery standby operation . Changed the printed pattern.

19D416504G1 Base Assembly

REV. A - To stop tone falsing due to improper battery standby operation. Changed CR10 connection.

19D416477G1 Mother Board and 19D416504G1 Base Assembly

REV. B - To add components necessary to meet Canadian standards. Changed C6, C7 and printed pattern.

REV. C - Changed VR1 from 4.4 Volt Zener to 4.7 Volt Zener (19A700025P5).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-4406

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