COMMUNICATIONS

MAINTENANCE MANUAL

TRANSISTORIZED CONTROL CONSOLE (XC Series)
MODEL 4EC72A10

SPECIFICATIONS *

Transmitter Control Signals	
Tone Control	3000 cps
DC Control	+6 milliamps
Function Selection	Frequency-shift keying (1500, 2000 & 2500 cps)
Threshold of Compression	
Transmit	10 millivolts maximum
Receive	-12 dbm
Compression Range	With audio input increase of 30 db beyond start of compression, output level increases less than 3 db
Frequency Response	±3 db from 300 to 2750 cps, reference 1000 cps
Audio Output	
Speaker	3 watts with less than 5% distortion (-12 to +18 dbm)
Line	+18 dbm maximum with less than 3% distortion with compression
Input & Output Impedance	600 ohms
Power Requirements	95 watts maximum at 117-volts AC, 50/60 cps
Dimensions (H x W x D)	5-1/2" x 19-7/8" x 12"
Temperature Range	-30°C to +60°C (-22°F to +140°F)

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

GENERAL ELECTRIC

TABLE OF CONTENTS

SERVICE SHEETS FOR OPTIONS
(Includes Outline Diagram, Schematic Diagram & Parts List)

TROUBLESHOOTING PROCEDURES

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.

COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th Digit	9th Digit
X DIGITAL REMOTE CONTROL	**C** CONSOLE	**2** NO CLOCK	**2** NO METER	**1** STANDARD	**A** 1-FREQUENCY TRANSMITTER & RECEIVER	**S** STANDARD	**2** AC KEYING TONE	**2** ENCODE ONLY
				2 CHANNEL GUARD	**B** 2-FREQ. TRANS & 1-FREQ. RCVR.		**3** DC/TONE KEYING	**3** ENCODE/ DECODE
					C 2-FREQ. TRANS. & 2-FREQ. RCVR.			
					D 1-FREQ. TRANS. & 2-FREQ. RCVR.			
					E 3-FREQ. TRANS. & 3-FREQ. RCVR.			
					F 4-FREQ. TRANS. & 4-FREQ. RCVR.			
					R 1-FREQ. TRANS. & SEARCH LOCK MONITOR (OR 2 RECEIVERS)			
					S 2-FREQ. TRANS. & SEARCH LOCK MONITOR (OR 2 RECEIVERS)			

OPTION CHART

OPTION NO.	DESCRIPTION
5002	Handset Model 4EM26A10 and Hookswitch 19A122250-G18
5003	Pulse Tone Jack 19A122250-G17
5005	Swinging Arm Microphone Model 4EM13A1
5007	Footswitch Model 4KC1C1
5008	Military Microphone 19B209102-P1 and Mounting Bracket 7141414-P2
5107	60 cps, 12-hour clock 19A122250-G1
5108	60 cps, 12/24-hour clock 19A122250-G12
5109	50 cps, 12 hour clock 19A122250-G26
5110	50 cps, 12/24-hour clock 19A122250-G27
5111	VU meter 19A122250-G10
5112	Compression meter 19A122250-G9
5113	60 cps, 12-hour clock and VU meter
5114	60 cps, 12/24-hour and VU meter
5115	60 cps, 12-hour clock and VU meter
5116	50 cps, 12/24-hour clock and VU meter
5117	60 cps, 12-hour clock and compression meter
5118	60 cps, 12/24-hour clock and compression meter
5119	50 cps, 12-hour clock and compression meter
5120	50 cps, 12/24-hour clock and compression meter
5124	Intercom Switch 19A122450-G11
5176	Tone Alert Oscillator 19A122250-G8

Figure 1 - Combination Nomenclature and Option Chart

DESCRIPTION

General Electric Transistorized Control Console Model 4EC72A10 was designed to remotely control up to 12 functions in MASTR Progress Line Base Stations equipped with Remote Control Panel Model 4KC16A11 and Encoder/Decoder Panel Model 4KC17A10. The Console is fully transistorized -- utilizing silicon transistors for added reliability. Figure 2 shows a layout of the Console.

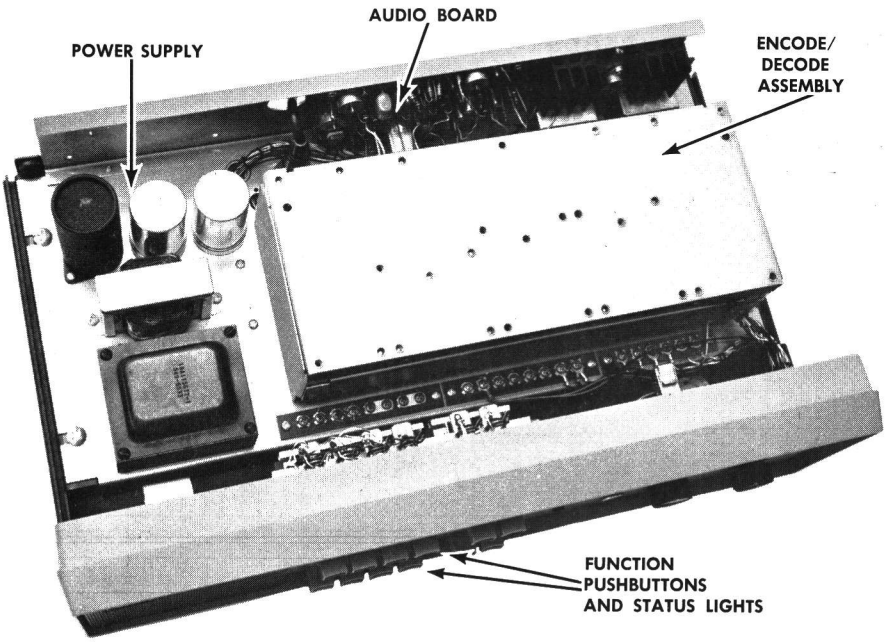


Figure 2 - Transistorized Control Console (XC Series)

The Encoder/Decoder section of the Console contains the solid-state logic circuitry that generates binary codes of frequency-shift tone for high speed function switching, and a continuous tone for transmitter keying. Since the control signals are transmitted as tones rather than DC voltages, DC continuity is not required between the Console and the base station. Therefore, either wire line, radio link, microwave or carrier current may be used to connect the Control Console to the base station.

Functions are selected by pushbuttons on the front of the Console. Status lights above each pushbutton indicate the function selected at the local Console, and to all parallel Consoles that are equipped for the decode function.

The Console can also provide a DC control voltage for keying the Control Station in Radio Control Base Station applications.

The audio section of the Console contains a compression-amplifier for equalizing audio and tone code output levels over a wide range of microphone or tone output signals. The compression-amplifier also prevents speaker "blasting" -- large differences in speaker volume resulting from audio input signals at different levels from the station or parallel Consoles.

The different accessories available for use with the Console are described in the Combination Nomenclature Chart and the Option Chart shown in Figure 1.

CONNECTIONS

All connections to the Console except microphone and power connections are made at terminal board TB801 at the rear of the chassis.

Make the following connections:

1 For Tone Control - Any transmission circuit capable of handling audio frequencies in the 300 to 3000-cps range can be used. It is not necessary to observe polarity in wire line connections. Make connections to TB801 as shown in Figure 3.

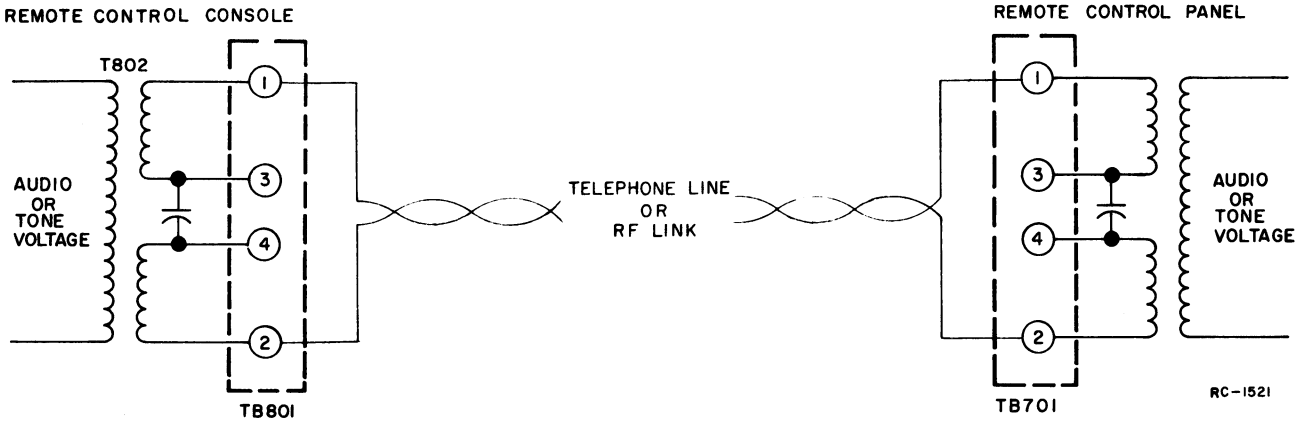


Figure 3 - Tone Control Wire Line Connections

2. For DC Control - Three types of telephone line connections are commonly used. Before choosing one of these methods, consider the cost and performance of each, as one method may be available at a much lower rate. Also, some telephone companies offer no choice, but will provide an audio pair and a control pair. The chart on the following page contains information to assist in selecting the Control Method and type of telephone line to be leased.

Method	Description	Advantages or Disadvantages
1	One metallic pair: for both audio and control voltages with control voltage simplexed from line to line.	Economical; dependable where earth currents may be large, or where a good earth ground cannot be obtained; keying clicks will be heard in paralleled Remote Control Units.
2	One metallic pair: for both audio and control voltages with control voltages simplexed from line to ground.	Economical; earth ground currents (encountered near power company sub-stations) may interference with control functions; keying clicks minimized.
3	Two telephone pairs; one for audio voltage and one for control voltage (metallic pair).	Provides best performance; keying clicks will not be heard; least susceptible to earth ground currents which may interfer with control functions.

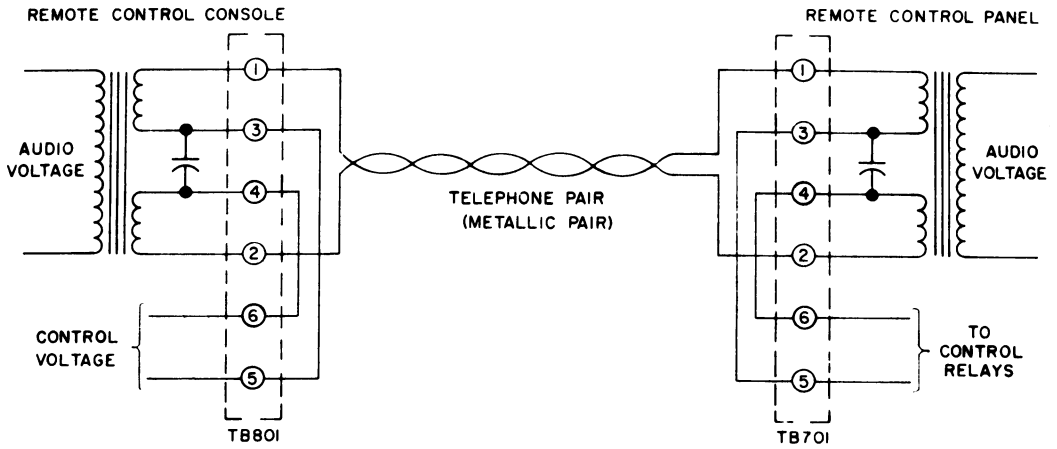
For proper operation of the DC control circuit, the polarity of the telephone pair carrying the control voltages must be the same at both the Transistorized Control Console and the Remote Control Panel (KC-16-A). TB801-5 and 6 on the Control Console must be connected by a DC path to TB701-5 and 6 on the KC-16-A, respectively. To identify the wires at each end of the telephone line, temporarily short one wire of the control pair (disconnected from the equipment) to a good earth ground at the KC-16-A and measure the resistance between each of the two wires and a good earth ground at the Control Console. The ungrounded wire will appear as an open circuit. The grounded wire will show a resistance which will depend upon the size and length of the pair used. Connect the telephone lines to terminal board TB801, using one of the following methods (Figure 4).

Method 1 - Single Telephone Pair (Control Voltage Simplexed Line to Line)

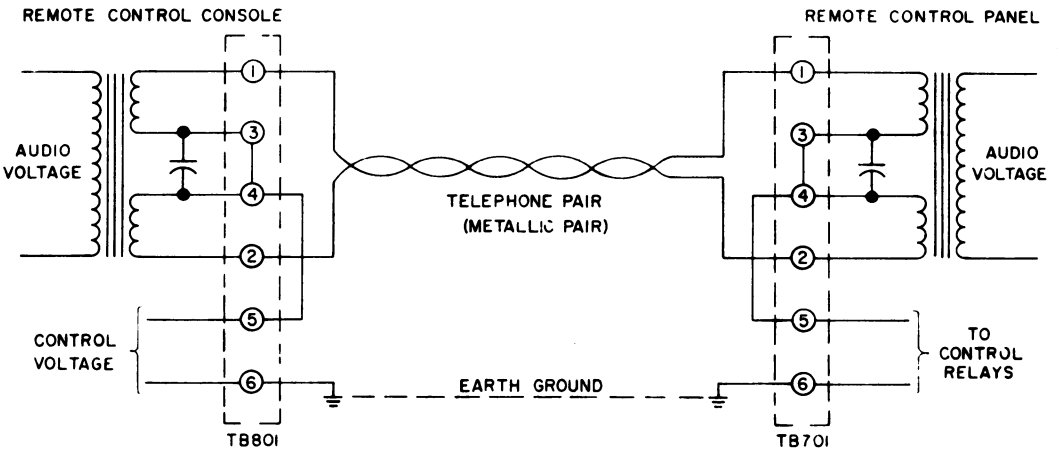
a. Connect telephone pair to TB801-1 and TB801-2.
b. Connect jumper between TB801-3 and TB801-5.
c. Connect jumper between TB801-4 and TB801-6.

Method 2 - Single Telephone Pair (Control Voltage Simplexed to ground)

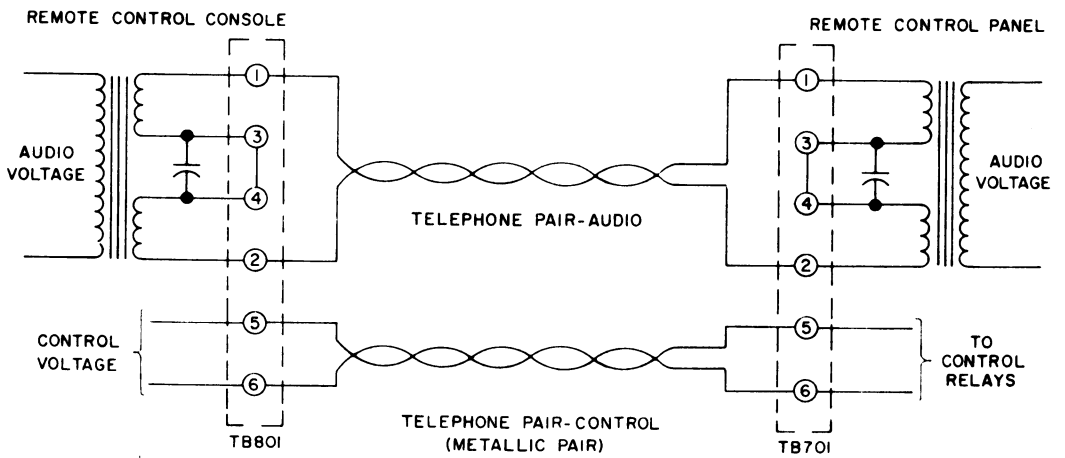
a. Connect telephone pair to TB801-1 and TB801-2.
b. Connect jumper between TB801-3 and TB801-4.
c. Connect jumper between TB801-4 and TB801-5.



METHOD 1 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED LINE TO LINE



METHOD 2 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED BETWEEN CENTER TAP AND GROUND



METHOD 3 - SEPARATE CONTROL AND AUDIO PAIRS

RC-1348A

Figure 4 - Telephone Line Connections

Method 3 - Separate Control and Audio Pairs

a. Connect audio pair to TB801-1 and TB801-2.
b. Connect control pair to TB801-5 and TB801-6.
c. Connect jumper between TB801-3 and TB801-4.

3. Connect terminal 10 of terminal board TB801 to a good earth ground, such as a cold water pipe or an electrical conduit. It is essential to have a good ground, regardless of the method of telephone line control used, as a safety measure for the dispatcher.

4. Connect the microphone to microphone jack J801 on the chassis of the control unit.

5. If Footswitch Model 4KC1C1 is used, connect it to terminals TB804-1 and TB803-8.

6. Connect the power cable (W801) to a 117-volt 50/60-cps AC line.

After the necessary connections have been made to the Remote Control Unit, a few adjustments are needed before placing the unit in service. Before applying power to the unit, be sure that the station installation and adjustment has been completed and that all lines have been connected to the Remote Control Panel. Adjustments for the Console are shown on the Adjustment Procedure (page 41).

INTRODUCTION TO LOGIC CIRCUITS

The information in this section is provided for the serviceman who may be unfamiliar with the operation of solid-state logic circuits and the application of binary arithmetic. A discussion of the following subjects is included:

- Solid-state switches
- Multivibrator circuit
- Binary counting and logic
- Logic circuits

It is suggested that anyone who is unfamiliar with these subjects study the following information carefully, as a good understanding of the basic circuitry used in the Console is essential for servicing the unit.

SOLID STATE SWITCHES

An ideal switch has infinite resistance when open and zero resistance when closed. The transistor and semiconductor diode can be made to approach these conditions while operating at a much higher rate than conventional switches. Logic circuits are primarily switching devices which are either in a state of full conduction (saturated) or turned off. These devices can be switched from one state to the other as rapidly as required by the circuit function.

DIODE SWITCH (Figure 5)

A semiconductor diode presents maximum resistance to the circuit when the diode is reversed biased or there is no difference of potential between the cathode or anode. If a negative potential is applied to the cathode of the diode (with respect to the anode), or a positive potential (with respect to the cathode) is applied to the anode of sufficient amplitude to overcome the series resistance of the diode, the diode is forward biased and will switch from maximum to minimum resistance.

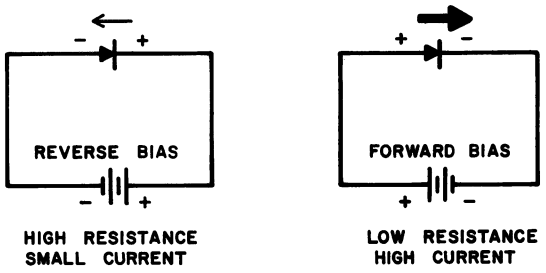


Figure 5 - Diode Circuit Operation

The resulting current flow in the diode circuit increases from near zero to the maximum value allowed by the amplitude of the switching voltage and the series resistance of the circuit.

TRANSISTOR SWITCH (Figure 6)

The high value of "off" resistance and the low value of "on" resistance make the transistor invaluable for switching applications. When no forward bias is applied to the emitter-base junction of the transistor switch shown in Figure 6, and the collector has the proper bias voltage applied, the open-circuit resistance of the transistor approaches several megohms. If sufficient base drive voltage is suddenly applied to drive the transistor into saturation (turned ON), the collector-emitter resistance will drop to as low as 1.0 ohm. Voltage across the transistor under these conditions may be only a few tenths of a volt.

The transistor stage shown in Figure 5 can also be used as an inverter for reversing the polarity of the input signal. A positive signal applied to the base-emitter junction will cause the collector voltage to drop from +13 volts to near ground potential.

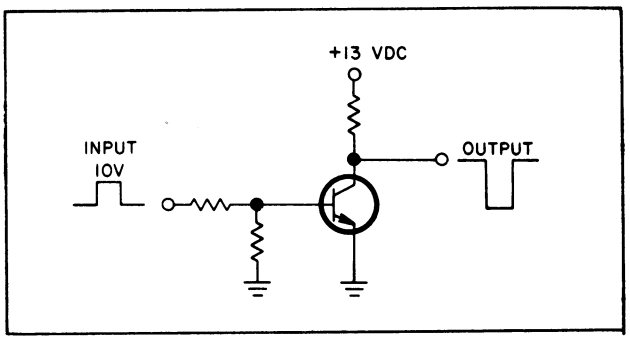


Figure 6 - Transistor Switch

MULTIVIBRATORS

A multivibrator is basically a resistance-capacitance coupled two-stage amplifier with the output of one stage coupled to the input of the other stage. The four basic types of multivibrator circuits used in the Console are described in the following paragraphs.

ASTABLE MULTIVIBRATOR (Figure 7)

The astable multivibrator is a free-running, self-sustaining oscillator. It is used as a 50-cps clock for generating timing frequencies, and as a 1500, 2000, 2500, and 3000-cps tone generator.

When power is applied to the astable multivibrator, one of the transistors will start conducting more than the other due to variations in component tolerances. Assume that Q1 starts conducting more than Q2. The negative-going collector voltage of Q1 is coupled through capacitor C1 to the base of Q2, decreasing the conduction of Q2. The positive-going collector voltage of Q2 is coupled through C2 to the base of Q1, turning Q1 on and turning Q2 off.

At this point, C1 begins to discharge through R1. Where the positive-going voltage at the base of Q2 reaches a certain level, Q2 begins to conduct. The negative-going collector voltage of Q2 is coupled through C2 to the base of Q1, and Q1 begins to turn off. The positive-going collector voltage of Q1 is coupled to the base of Q2 through C1, causing Q2 to conduct harder. Q2 quickly saturates and Q1 turns off. The multivibrator has now returned to its original state and the cycle will be repeated as long as power is applied to the circuit.

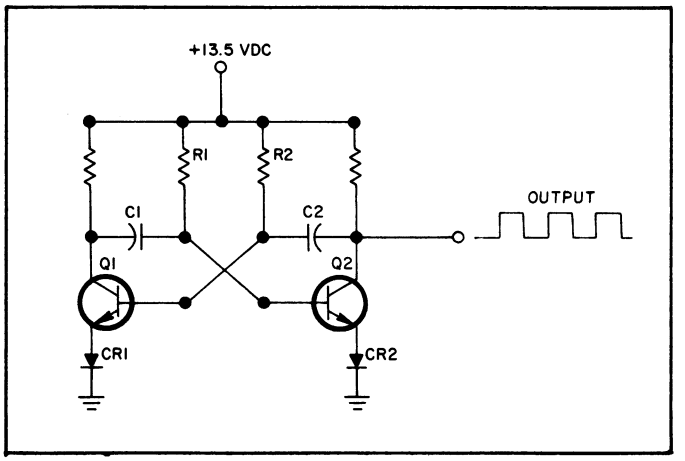


Figure 7 - The Astable Multivibrator

The output of the multivibrator is essentially a squarewave, with the frequency of oscillation determined by the R-C time constants of the circuit (R1-C1 and R2-C2). Diodes CR1 and CR2 prevent a breakdown of the base-emitter junction when the junction is reverse biased.

MONOSTABLE MULTIVIBRATOR (Figure 8)

The monostable multivibrator is a "one-shot" switching circuit with one stable state. It remains in this stable state until triggered.

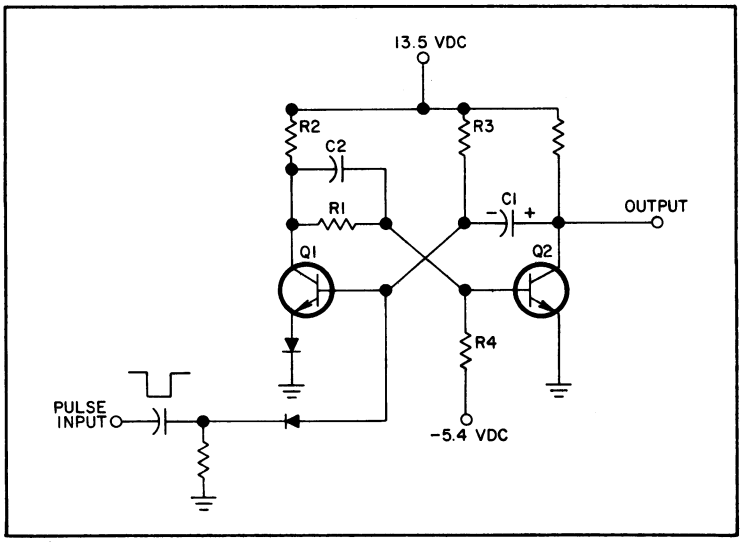


Figure 8 - Monostable Multivibrator Circuit

The Monostable multivibrator shown in Figure 8 has only one timing circuit, C1 and R3. R1 and R4 form a voltage divider connected to a reverse-bias source (-5.4 VDC) at the base of Q2. This bias holds Q2 off when Q1 is conducting.

A negative trigger pulse applied to the base of Q1 turns the transistor off. The positive-going collector voltage of Q1 is coupled through R1/C2 to the base of Q2, turning Q2 on. The negative-going collector voltage of Q2 is coupled through C1 to the base of Q1, holding Q1 off. Q2 will remain on for the time determined by the R-C time constant of C1 and R3. When Capacitor C1 charges through R3, the base of Q1 goes positive with respect to the emitter and it begins to conduct again. The negative-going collector voltage of Q1 is coupled through R1/C2 to the base of Q2, turning Q2 OFF. Q2 will be held OFF by this negative base bias until another trigger pulse is applied.

BISTABLE MULTIVIBRATOR (Figure 9)

The bistable multivibrator or flip-flop has two stable states. Each state must be triggered individually. When Q2 is conducting (saturated) a trigger pulse of the correct polarity applied to the pulse input will turn Q1 ON and Q2 OFF. Another trigger pulse is required to return the circuit to its original state.

Diodes CR1 and CR2 are known as steering diodes. The diode in the base circuit of the conducting transistor will be biased so that it is just turned ON. Assuming Q1 is conducting, diode CR1 will be forward biased. The anode of CR2 will be at a slightly negative potential and its cathode will be at +13 VDC. Under these conditions, a positive trigger pulse applied to the pulse input will have no effect. However, a negative trigger pulse of sufficient amplitude will turn Q1 OFF and Q2 ON. The steering diodes permit applying the correct polarity pulses to the proper point in the circuit to accomplish efficient triggering.

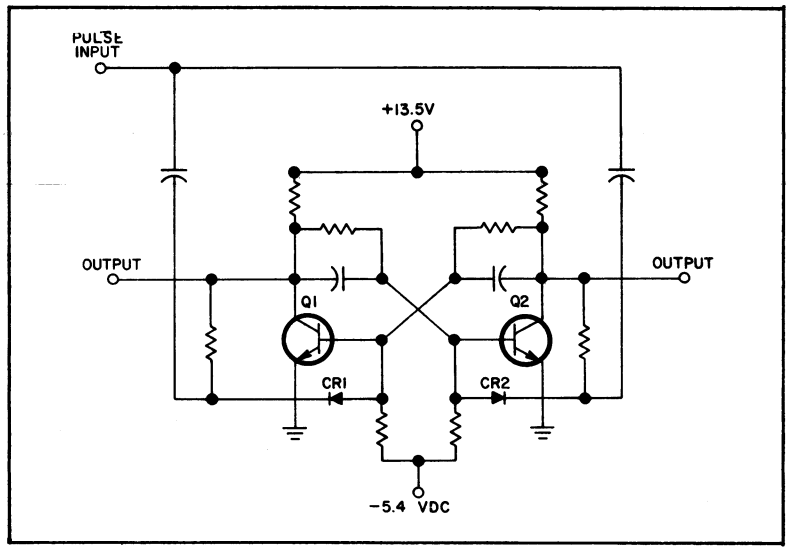


Figure 9 - Bistable Multivibrator Circuit

With Q1 turned OFF, its collector voltage (output) is approximately +13 volts. With Q2 turned ON, its collector voltage drops to approximately ground potential.

SCHMITT TRIGGER (Figure 10)

A Schmitt Trigger (or "one-shot" multivibrator) is a regenerative bistable circuit whose state depends on the amplitude of the input voltage. One of the coupling networks of the bistable circuit in Figure 9 is replaced by common-emitter resistor R1 in the Schmitt Trigger circuit. Regenerative feedback is increased by this arrangement, permitting a faster switching time than in the other multivibrator circuits. If Q1 is OFF, its collector is at 13 VDC. This makes the base of Q2 positive with respect to its emitter and permits Q2 to conduct. The emitter of Q1 is held positive with respect to its base by the voltage at its emitter, caused by current flow through common-emitter resistor R1.

When a positive trigger pulse of sufficient amplitude is applied to the base of Q1 to overcome the reverse bias at the emitter, Q1 will conduct. The negative-going collector voltage of Q1 is coupled to the base of Q2, turning Q2 OFF. Positive voltage at the emitter of Q2 holds the transistor OFF and regeneration in Q1 rapidly increases. As the trigger pulse begins to decrease (in a negative direction) the conditions just described reverse and the circuit returns to its original state.

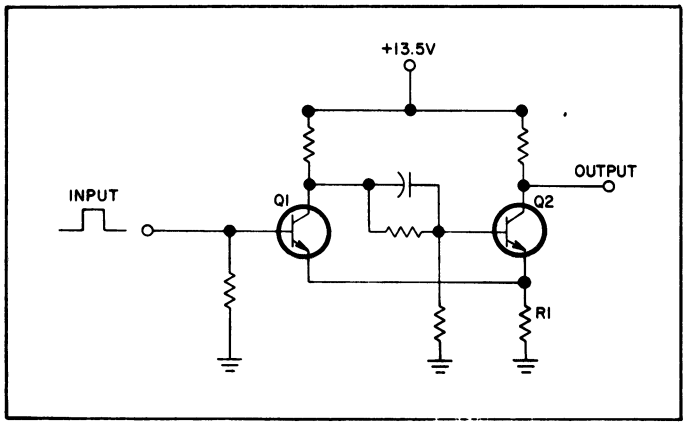


Figure 10 - Schmitt Trigger

BINARY COUNTING AND LOGIC

Binary numbers are composed of two digits ("1" and "0") the proper combination of which may represent any decimal number. Electrical circuits such as flip-flops lend themselves readily to "ON" and "OFF" conditions. Binary numbers can be represented in electrical circuits by "ON" for "1" and "OFF" for "0". The circuits may be arranged logically to perform arithmetic operations based on this system of numbering.

BINARY NUMBERING

The binary numbering system is based on successive powers of 2. For example: $2^0=1$, $2^1=2$, $2^2=4$, $2^3=8$, etc. The number of places in the binary number depends on the represented decimal number. Each place column, counting from 1st place, indicates a succeeding power of 2 as shown below.

Place - - - - - - -	4	3	2	1
Power of 2 -	2^3	2^2	2^1	2^0
Decimal Value - - - - -	8	4	2	1

Placing binary "1" in any place column represents the power of 2 for that place. Placing binary "0" in any place column represents decimal zero for that place. In binary notation, the decimal number 10 is represented as 1010 as shown below.

Place:	4	3	2	1
Power of 2	2^3	2^2	2^1	2^0
Binary Notation:	1	0	1	0
Decimal Equivalent:	8 +	0 +	2 +	0 = 10

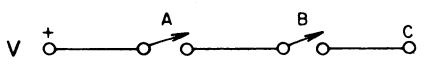
The following table helps to clarify this method of counting.

BINARY		DECIMAL
0000	=	0
0001	=	1
0010	=	2
0011	=	3
0100	=	4
0101	=	5
0110	=	6
0111	=	7
1000	=	8
1001	=	9
1010	=	10
1011	=	11
1100	=	12
1101	=	13
1110	=	14
1111	=	15

BINARY LOGIC

Formal logic requires that a statement be either true or false; no other condition can exist for the statement. A logic circuit is basically a switch or gate that is either closed or open; no other condition can exist for the circuit. By logical arrangement of these gating circuits, electrical functions can be performed in a predetermined sequence by opening or closing the gates at the proper time.

A single-pole, single-throw switch is equivalent to a binary device with only two possible operating conditions: either open or closed. If point "C" of Figure 11 is to be made equal to potential V, switches A and B must be closed. It can then be said that A AND B = C. If switches A and B are considered as gates, then potential V is said to be gated to "C" when both gates are closed. By representing the closed state of a switch or gate as "1" and the open state of a switch or gate as "0", then all possible conditions for the "AND" gate are shown in Figure 11.



A	AND	B	=	C
0		0		0
0		1		0
1		0		0
1		1		1

Figure 11 - Simple AND Gate

In Figure 12, if point "C" is to be made equal to potential V, either switch A or B (or both) may be closed. It can then be said A or B = C. All possible conditions for the "OR" gate are shown in Figure 12.

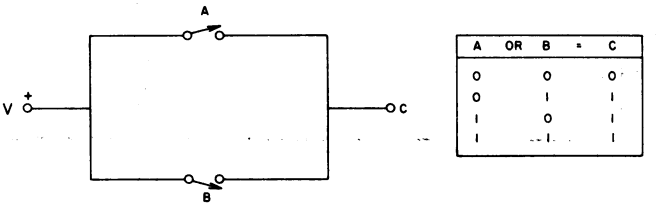


Figure 12 - Simple OR Gate

In gating circuits, the desired state of the gate is that condition of the circuit where the desired output is available from the circuit. The desired state may be represented by either "0" or "1". If the closed condition of the gate is the desired condition, then "1" is considered the desired state. If the open condition of the gate is the desired condition, then the desired state is represented by "0".

Diode Gating Circuits

A simple diode AND gate is shown in Figure 13. The same conditions exist in this circuit as in the switch gate of Figure 11. Application of a positive potential to the diodes at all inputs will result in a positive potential at the output. This represents the "1" state of the gate. Application of a positive potential to one or two terminals will result in no potential developed, representing the "0" state of the gate.

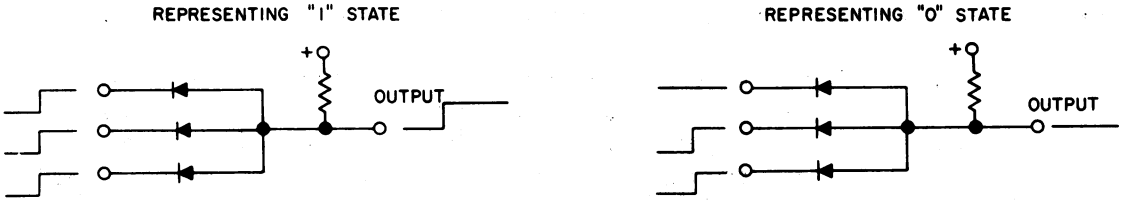


Figure 13 - Diode AND Gate

A simple diode OR gate is shown in Figure 14. The same conditions exist in this circuit at the switch gate of Figure 12. Application of a positive potential at any of the inputs will result in an output of the same polarity, representing the "1" state.

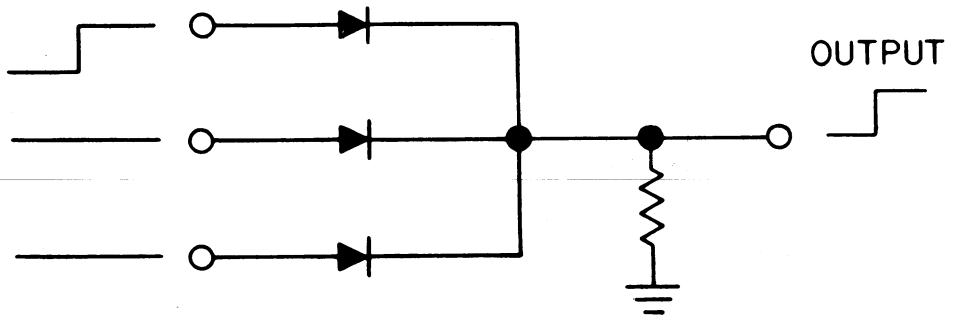


Figure 14 - Diode OR Gate

LOGIC CIRCUITS

SHIFT REGISTER

A shift register is a circuit capable of storing and transferring binary information. The base circuit in the shift register is the bistable or flip-flop. One flip-flop is required for each binary digit or "bit" that is to be used. In Figure 15, three flip-flops are shown connected in tandem to form a 3-bit shift register.

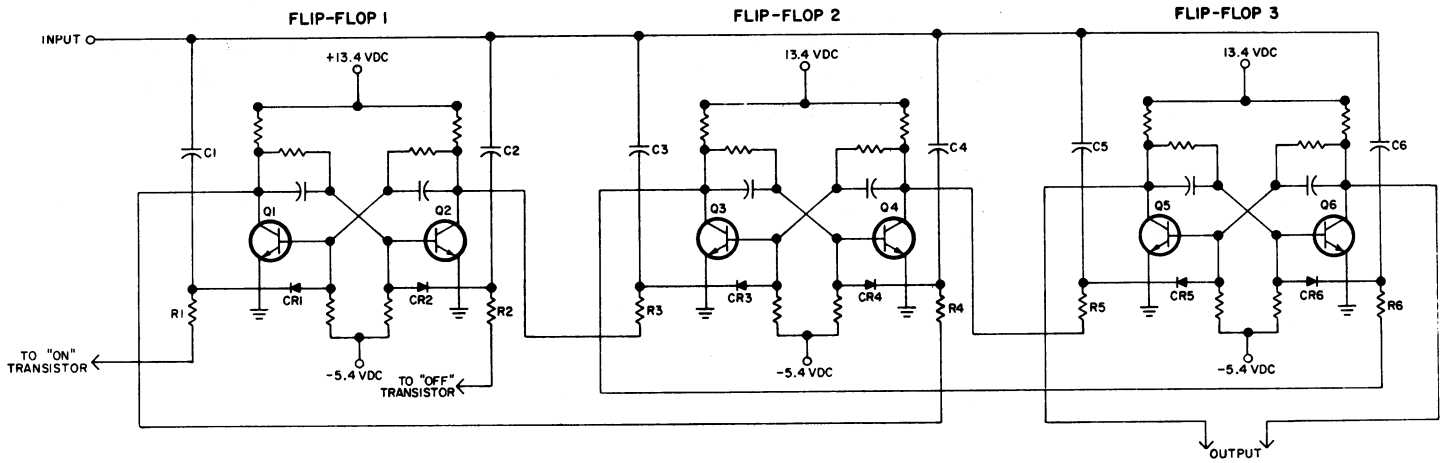


Figure 15 - Flip-Flops Connected as Shift-Register

The first transistor in each flip-flop is the significant transistor (i.e., Q1, Q3 and Q5). When the first transistor in ON (conducting), the flip-flop is said to be in the "1" state. When the first transistor is OFF (not conducting) the flip-flop is said to be in the "0" (zero) state.

Before a code can be loaded into the shift register, all of the flip-flops are set to the "0" or OFF state (Q1, Q3 and Q5 OFF - Q2, Q4 and Q6 ON). Therefore, a binary code can be loaded into the shift register by switching selected OFF transistors to the ON state. Assume that binary code 1 - 0 - 1 has been manually loaded into the shift register. Q1 is switched ON, Q3 remains OFF, and Q5 is switched ON as shown in Figure 16.

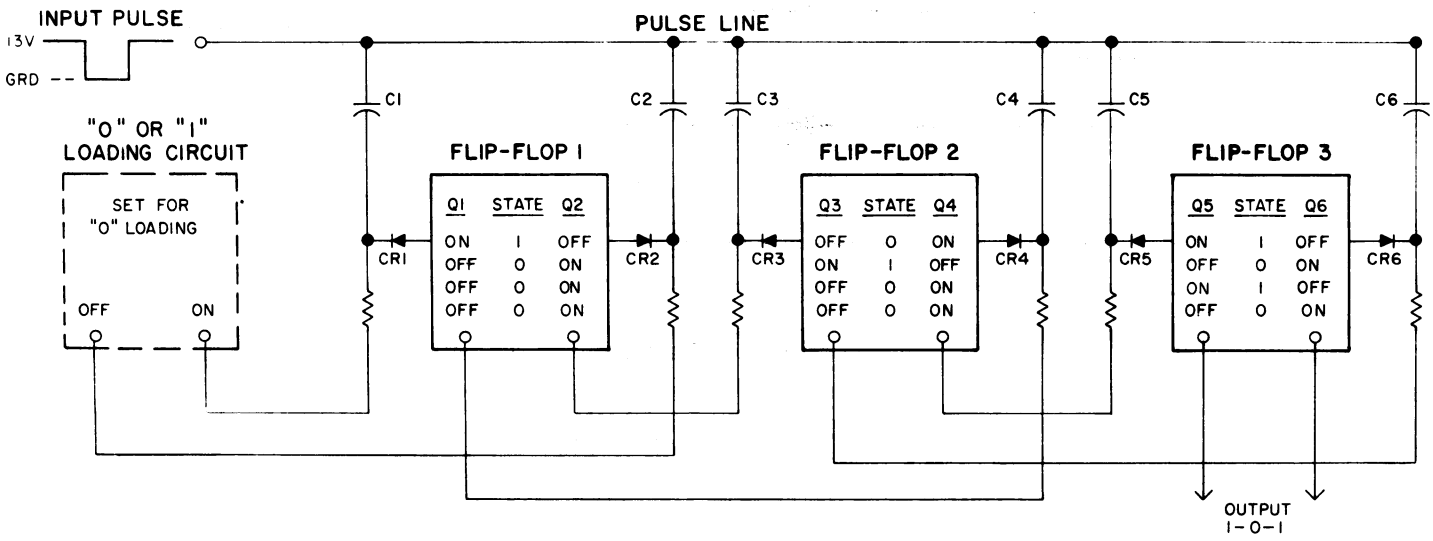


Figure 16 - Simplified 3-Bit Shift Register

The code can now be shifted out of the register in the following manner. Trigger capacitors C1, C4 and C5 charge from the positive voltage on the PULSE LINE through the ON transistor in the previous stage. In this example, the previous stage for Flip-Flop 1 is a "0" or "1" loading circuit set in the "0" state. Trigger capacitors C2, C3 and C6 do not charge because the voltage from the preceding circuit is the same as the voltage on the PULSE LINE.

A negative pulse applied to the input of the shift register grounds the PULSE LINE. C1, C4, and C5 begin to charge in the opposite direction, forward biasing steering diodes CR1, CR4 and CR5 and causing them to conduct. This drops the base current in Q1, Q4 and Q5, cutting off the transistors. With Q1, Q4 and Q5 OFF, the shift register is now in the 0 - 1 - 0 state. The code has been transferred one position to the right, and a "1" has been shifted out of the register. After the first pulse, C1, C3 and C6 charge from the positive voltage on the Pulse Line through the ON transistor in the previous stage.

The second negative pulse applied to the input of the shift register grounds the PULSE LINE. C1, C3 and C6 begin to charge in the opposite direction, forward biasing steering diodes CR1, CR3 and CR6, causing them to conduct. This drops the base current in Q1, Q3 and Q6, cutting off the transistors. With Q1, Q3 and Q6 OFF, the shift register is now in the 0 - 0 - 1 state. The code has now been transferred another position to the right, and a "0" has been shifted out of the register. After the second pulse, C1, C3 and C5 charge from the positive voltage on the Pulse Line through the ON transistor in the previous stage.

The third negative pulse applied to the input of the shift register grounds the PULSE LINE. C1, C3 and C5 begin to charge in the opposite direction, forward biasing steering diodes CR1, CR3, and CR5 and causing them to conduct. This drops the base current in Q1, Q3 and Q5, cutting off the transistors. With Q1, Q3 and Q5 OFF, the

shift register is now in the 0 - 0 - 0 state. The entire code has been shifted out of the register, and the register is ready to be loaded with another code.

A code received from a parallel console can be shifted into the register by the same procedure described above. In this case, the previous stage for Flip-Flop 1 changes state to load in a "0" or "1" according to the incoming code (Figure 17).

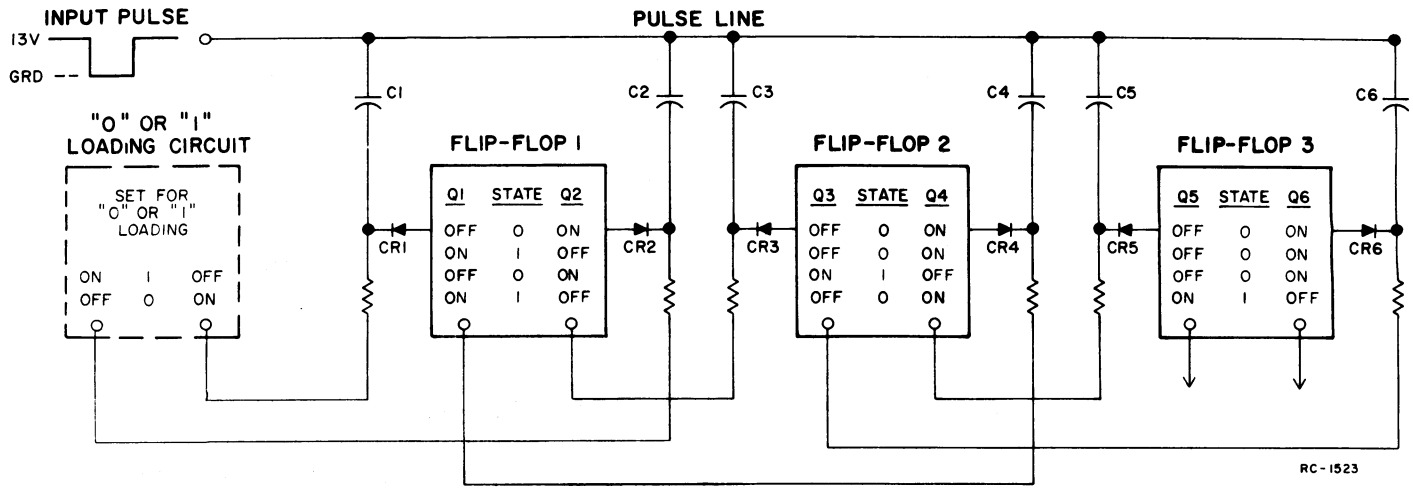


Figure 17 - Shifting Code Into Shift Register

Assume that binary code 1 - 0 - 1 is received at the Console. The first "1" received sets the 0/1 Loading Stage in the "1" state. Trigger capacitors C2, C3 and C5 charge from the positive voltage on the PULSE LINE. Trigger capacitors C1, C4 and C6 do not charge because the voltage from the preceding circuit is the same as the voltage on the pulse line. When a negative pulse is applied to the PULSE LINE, C2, C3 and C5 begin to charge in the opposite direction, forward biasing steering diodes CR2, CR3 and CR5, causing them to conduct. This drops the base current in Q2, Q3, and Q5, cutting off the transistors. With Q2, Q3, and Q5 OFF, the shift register is now in the 1 - 0 - 0 state. A "1" has been shifted in and a "0" shifted out of the register. As the 0/1 Loading circuit switches from a "1" to a "0" and back to a "1" condition, two more pulses are applied to the PULSE LINE to load the code 1 - 0 - 1 into the shift register.

ENCODE MATRIX

The encode matrix provides a simple method of simultaneously loading a 5-bit binary code in the shift register. The code is manually loaded by pressing one of the functional pushbuttons on the front of the console. Figure 18 shows a simplified schematic of the load matrix and pushbuttons.

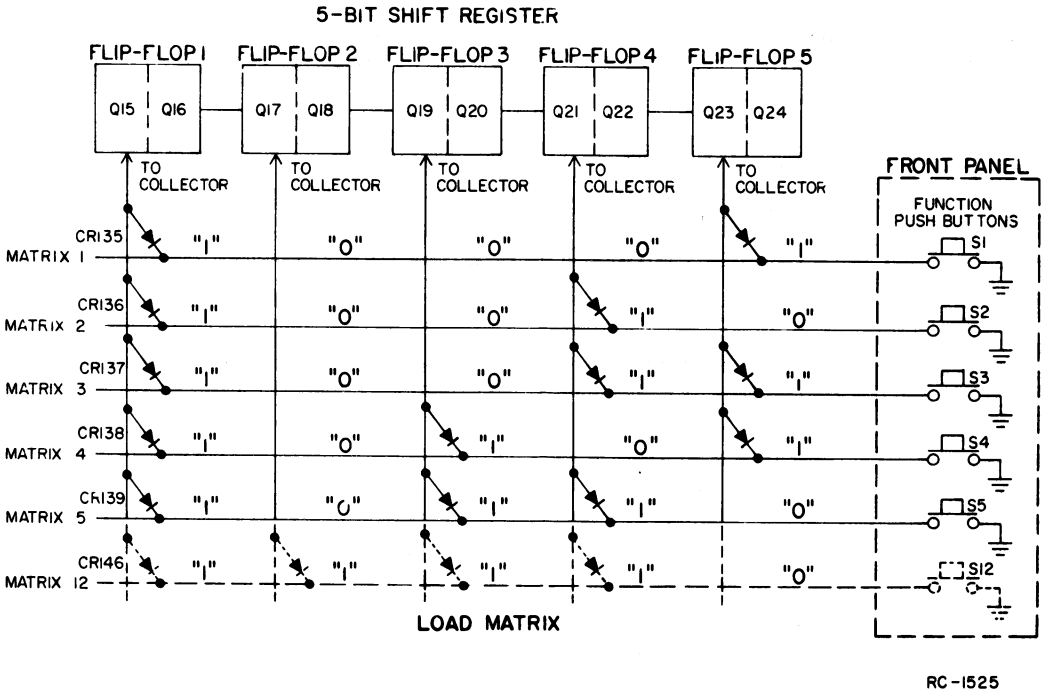


Figure 18 - Simplified Load Matrix

After a code has been shifted out of the register, all of the flip-flops remain in the "0" state (with the significant transistor OFF). The code is fed into the register by loading in "1's" (turning the significant transistor ON).

For example, pressing pushbutton S1 forward biases diodes CR135 and CR171, causing them to conduct. This grounds the collector of Q15 and Q23, turning them ON, and switching the flip-flop from the "0" to the "1" state. The code 1 - 0 - 0 - 0 - 1 has now been loaded into the shift register. Releasing the pushbutton starts a 50-cps multivibrator clock (not shown) that feeds pulses into the register shift line to shift the code out.

DECODE MATRIX

The decode matrix provides a simple method for simultaneously unloading or "reading" a binary code from the shift register. Figure 19 shows a simplified diagram of the decode matrix and 5-bit shift register. Assume that binary code 1 - 0 - 0 - 0 - 1 has been shifted into the register. The collector of each of the ON transistors in the flip-flops will be at ground potential, which forward biases the diodes in the collector line and grounds the corresponding matrix line. The collectors of the OFF transistors are at 13-volts DC, which back-biases the diodes in their collector line.

With any code in the register, all of the matrix lines except one will be shorted to ground. With the code 1 - 0 - 0 - 0 - 1 in the register, all of the diodes in Matrix Line 1 are back-biased. As soon as the code is loaded into the register, Q5 turns OFF for 30 milliseconds (called the "read" time). This removes the ground on the

matrix lines through the Read Gate diodes CR14 thru CR17, resulting in a 30-millisecond positive pulse on Matrix Line 1. The pulse is amplified and inverted by Memory Driver Q35 and fed to the Memory Board.

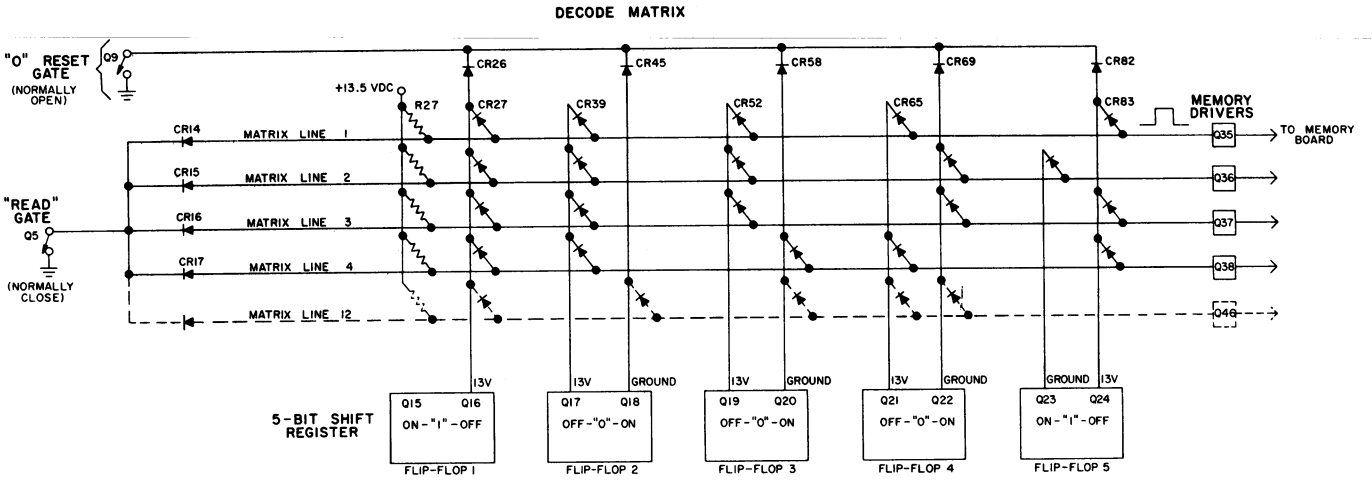


Figure 19 - Simplified Decode Matrix

After the 30-millisecond read time, Q5 turns ON, grounding all of the matrix lines. At the same time, transistor Q9 in the "0" Reset circuit switches ON momentarily, grounding the collectors of Q16, Q18, Q20, Q22, and Q24, turning these transistors ON. This resets all of the flip-flops in the shift register to the "0" state, and the register is ready to be loaded with another code.

CIRCUIT ANALYSIS

The Digital Control Console consists of a transistorized audio section and Encoder/Decoder assembly, a self-contained power supply and regulator board, controls and status indicator lights. The audio stages are mounted on the back panel of the chassis. The Encoder/Decoder stages are contained in a hinged assembly mounted on the main chassis. All operating controls, status lights, clocks and meter accessories are mounted on the front panel. A layout of the modules is shown in Figure 20.

Only four adjustments are required in tone control Consoles, with one additional adjustment for DC control Consoles. The LINE INPUT, LINE OUTPUT, MIKE GAIN and CONTROL CURRENT (DC control only) are adjusted through holes in the back panel. The 3-KC Tone Level control is mounted on the 3-KC oscillator board in the Encoder/Decoder assembly. Instructions for setting the controls are contained in the Complete Adjustment Procedure on page 41.

References to symbol numbers mentioned in the following text can be found on the applicable Schematic Diagram, Outline Diagram and Parts List as listed in the Table of Contents.

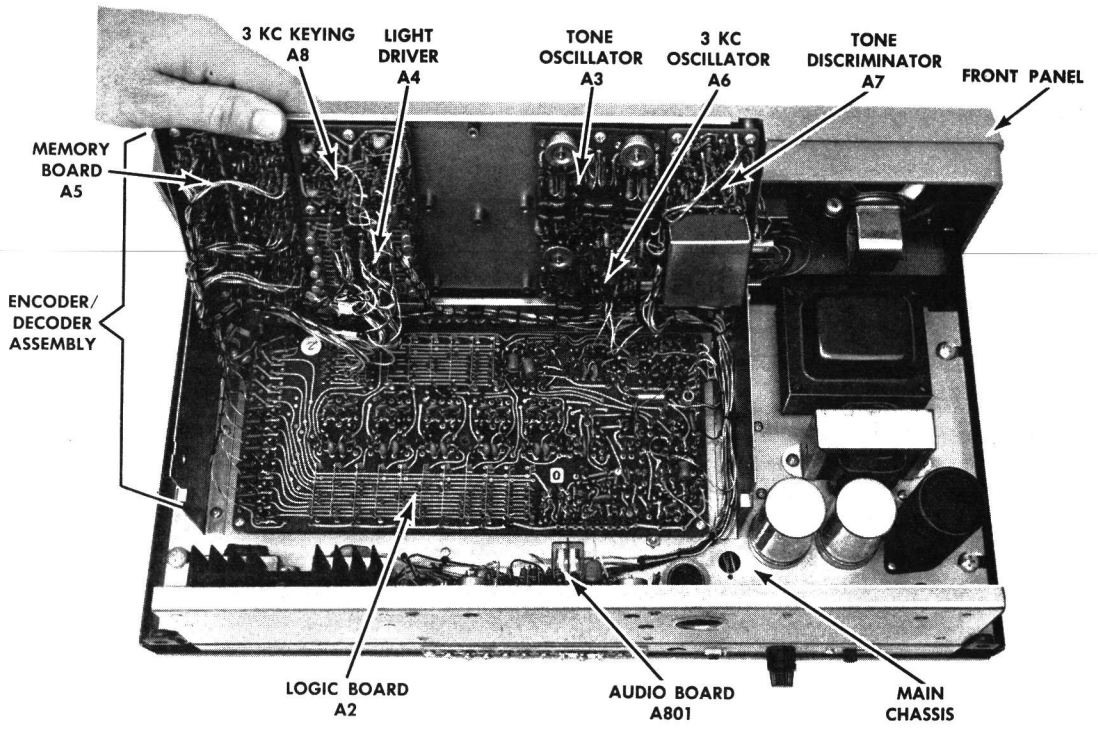


Figure 20 - Module Layout

CONTROL METHODS

The Console can be equipped for either tone control or DC/tone control applications. In tone control systems, a coded 3000-cps tone keys the station transmitter. In DC/tone control systems (required for Radio Control Base Station applications), a DC control current keys the control station transmitter and a coded 3000-cps tone keys the repeater base station. In both systems, remote functions are selected by 5-bit binary codes.

TONE CONTROL

In Consoles equipped for tone control, any circuit capable of carrying audio frequencies of 300 to 3000 cps can be used as a transmission path for the tones and binary codes. DC continuity is not required.

Function Selection

Pressing one of the function pushbuttons at the Console loads a unique code into the shift register and turns on the status light above the pushbutton. For example, pressing the R-F1 pushbutton loads binary code 1 - 0 - 0 - 0 - 1 into the register. At the same time, a 3000-cps tone is applied to the transmission path for a minimum of 50 milliseconds to mute the station receiver, removing all audio on the line from the receiver.

Releasing the pushbutton applies a 2500-cps gating tone to the transmission path for approximately 100 milliseconds to release a hold gate at the station decoder panel. After the gating tone, a

2000-cps carrier tone is fed out for approximately 40 milliseconds, and this is followed by the binary tone code. The binary codes are generated by frequency-shifting the 2000-cps carrier from 1500 cps (representing a "1"), to 2500 cps (representing a "0").

The code is fed to the base station to switch the station to the R-F1 receiver, and to all parallel Consoles equipped with the decode function to switch on the status light over the R-F1 pushbutton. Refer to Figure 21 for a tone and code sequence diagram.

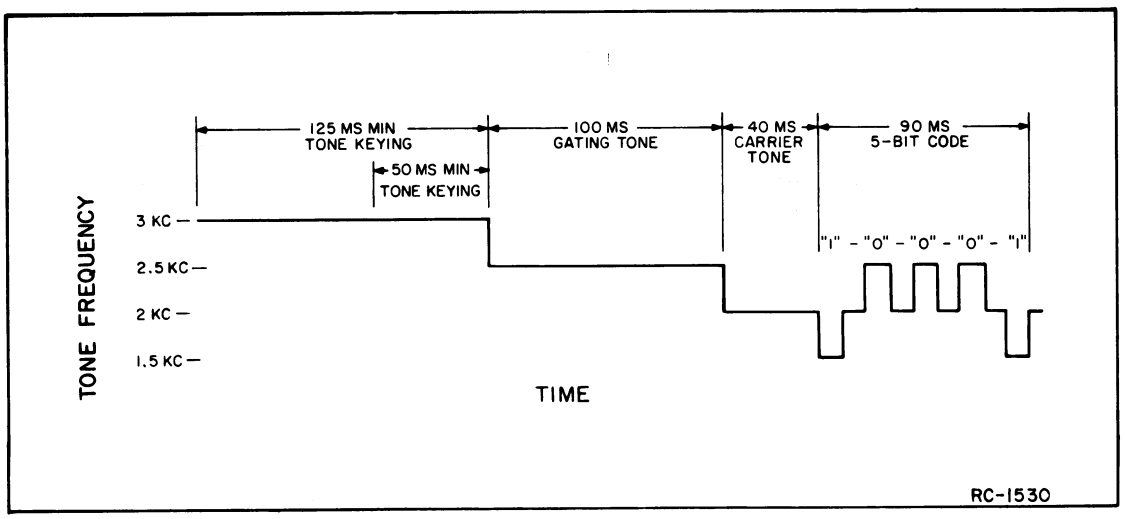


Figure 21 - Tone Sequence Waveform

Transmitter Keying

Pressing the microphone button at the Console applies a 3000-cps coded tone to the transmission path. The tone is coded by switching it on for 60 milliseconds, switching it OFF for 60 milliseconds and switching it ON again for the duration of the transmission. Using a coded keying tone prevents the transmitter from being keyed by the 3000-cps receiver muting tone that is sent out each time a function selection pushbutton is pressed.

At the station, the 3000-cps tone is detected and the resultant DC voltage energizes a relay to key the transmitter. The transmitter remains keyed as long as the 3000-cps tone is received at the station.

DC/TONE CONTROL

In Radio Control Base Station applications, a DC control voltage keys the Control Station, and a coded 3-KC tone keys the Repeater Base Station transmitter (see Figure 22). A telephone pair with DC continuity is required between the Console(s) and the Control Station.

Function Selection

Pressing one of the function pushbuttons at the Console applies 6 milliamps DC and a 3000-cps tone to the telephone pair, turns ON the status light above the pushbutton, and loads a unique code into the shift register. For example, pressing the R-F1 pushbutton loads binary code 1 - 0 - 0 - 0 - 1 into the register. The 6 milliamps keys the Control Station transmitter and the 3000-cps tone is transmitted for a minimum of 125 milliseconds to mute the Repeater Base Station receiver.

Releasing the pushbutton applies a 2500-cps gating tone for approximately 100 milliseconds to unlock a hold gate at the Repeater Base Station decoder panel. After the gating tone, a 2000-cps carrier tone is fed out for approximately 40 milliseconds, and this is followed by the binary tone code (see Figure 21). The code is coupled through the repeater panel on the Repeater Station to the Repeater Base Station where it switches the station to the R-F1 receiver. The code is also fed to all parallel Consoles where it switches ON the status light over the R-F1 pushbutton.

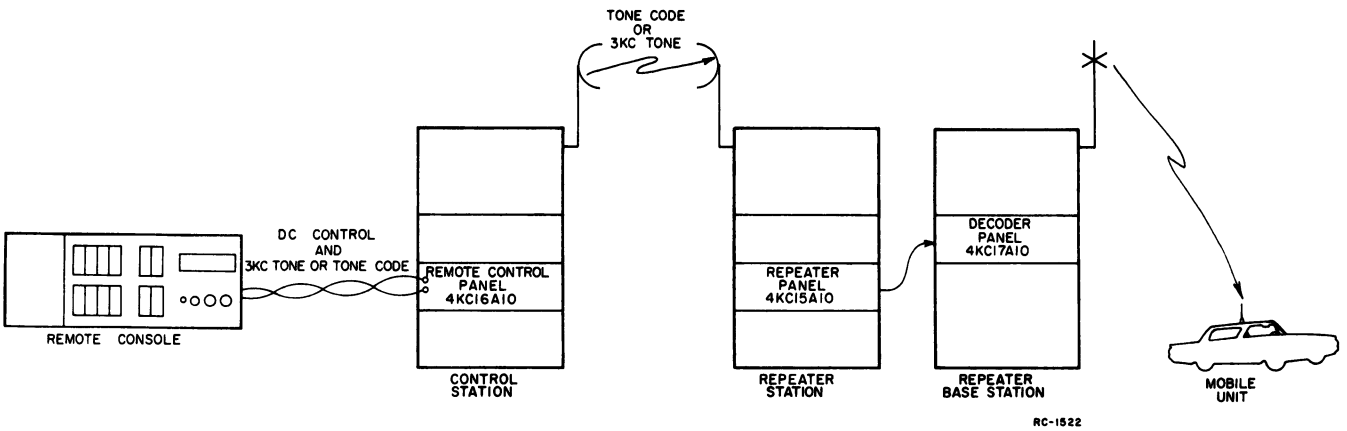


Figure 22 - Typical Radio Control Base Station System

Transmitter Keying

Pressing the microphone button at the Console applies 6 milliamps and a coded 3000-cps tone to the telephone pair. The tone is coded by switching it on for 100 milliseconds, switching it OFF for 100 milliseconds and switching it on again for the duration of the transmission. The coded keying tone prevents the transmitter from being keyed by the 3000-cps receiver muting tone that is transmitted each time a function pushbutton is pressed.

AUDIO BOARD A801

Audio Board A801 consists of microphone preamp Q1, compressor-amplifiers Q2 through Q7, relay K1 and audio PA Q8. A second audio PA (Q801) is mounted in a heatsink on the Console chassis. The board operates as a code and mike-to-line amplifier in the transmit or intercom mode, and as a line-to-speaker amplifier in the receive mode. A block diagram of the audio board is shown in Figure 23.

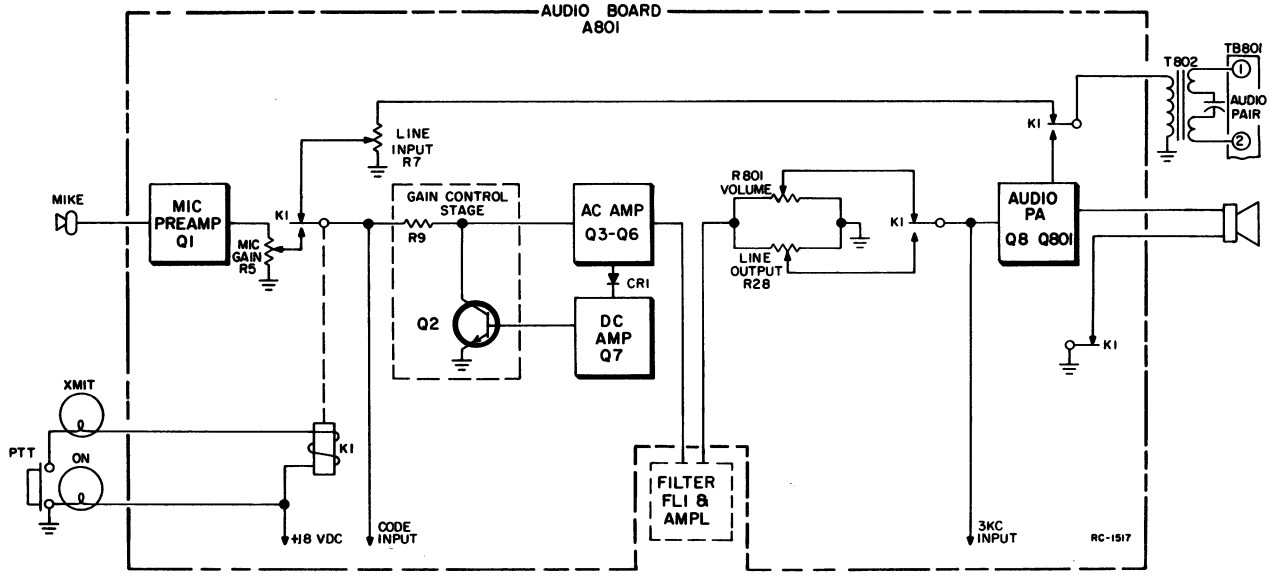


Figure 23 - Audio Board Block Diagram

TRANSMIT MODE

Keying the microphone energizes relay K1, muting the loudspeaker and applying the 3000-cps tone to compound-connected audio PA transistors Q8 and Q801. The tone is coupled through line matching transformer T802 to the audio pair for keying the transmitter. Audio from common emitter preamp, Q1, is then coupled through MIKE GAIN control, R5, to compressor-amplifier stages Q2 through Q7. The output of the compressor-amplifier is fed to a low-pass filter (FL1) on the under side of the main chassis where any components over 2750 cps in the voice frequency are attenuated to prevent voice falsing. The filter output is amplified and fed back to the audio board where it is connected by the relay through LINE OUTPUT control, R28, to the audio PA stage. The output of the audio PA is coupled through T802 to the audio pair.

Pressing one of the function pushbuttons also energizes relay K1, applying the 3000-cps receiver muting tone to the audio pair to remove any audio on the line from the station receiver. Releasing the pushbutton applies the tone code to the compressor amplifier stages, through the low-pass filter to the audio PA stage, and then through T802 to the audio pair.

In DC tone control applications, keying the transmitter or pressing one of the pushbuttons also applies 6 milliamps to control pair (TB801-5 and -6).

RECEIVE MODE

Incoming audio signals are coupled through line-matching transformer T802 to the audio board through J17, through the normally closed relay contact to LINE INPUT control R7 and then to the compressor-amplifier. The output of the compressor-amplifier is fed through low-pass filter FL1 and then connected by the relay through VOLUME control R801 to the audio PA. The audio output is connected through an output transformer (T803) to the speaker high lead by means of jumpers on TB801.

An incoming code from a parallel Console is connected from J17 on the audio board to the Encoder/Decoder circuitry where it turns ON one of the status lights. The code is also heard in the speaker, giving the dispatcher an audible indication that a function was changed.

COMPRESSOR-AMPLIFIER

The compressor-amplifier circuit consists of gain control stage Q2, high gain audio amplifiers Q3 through Q6, and DC amplifier Q7.

When a code or voice signal is applied to the compressor-amplifier, resistor Q9 and the AC impedance of transistor Q2 act as a voltage divider for the AC input signal. The output of Q2 is amplified by a four stage, direct-coupled amplifier (Q3 through Q6). Both AC and DC feedback in the amplifier circuit provides for extremely stable operation.

One portion of the amplified output is fed through line output control R28 to the audio PA stage. The remaining portion is rectified by detector CR1, filtered by C8 and amplified by DC current amplifier Q7. This DC output is fed back to the base of gain control transistor Q2.

The amount of DC feedback to the gain control stage determines the AC impedance of Q2. When the input level rises, the AC amplifier output starts to increase. The output is detected, amplified, and fed back to the base Q2. The increase in feedback reduces the AC impedance of Q2 which decreases the audio voltage to the AC amplifier, keeping the amplifier output constant.

When the audio input decreases, the output of the AC amplifier starts to decrease, reducing the feedback to Q2. This raises the AC impedance of Q2 and increases the audio voltage to the AC amplifier, keeping the amplifier output constant.

POWER SUPPLY AND REGULATOR BOARD

POWER SUPPLY

Turning OFF-ON switch S801 to the ON position applies 117-volts AC to the primary of power transformer T801. The primary is fused by F801. Two rectifier circuits in the secondary of T801 provide operating voltages for the Console, and a DC control voltage for DC control applications.

Full-wave rectifiers CR805 and CR806 provide a regulated and an unregulated output to operate the status lights, audio relay K1, and supplies voltage for the Audio Amplifier collectors and Regulator Board A1. The regulated output supplies the AC and DC amplifiers, Mic Preamplifier, and base bias for the Audio Amplifier. Bias Adjust potentiometer R30 is set at the factory for 0.65 volts (measured across R34) and will normally require no further adjustment. The voltage regulator circuit consists of C804, R804 and zener diode VR801.

The control current for DC control is supplied by full-wave bridge rectifiers CR801 through CR804. R806 is a bleeder resistor for filter capacitor C801. The output is taken from TB806-3, and connected through a jumper on TB803 to the control pair.

REGULATOR BOARD A1

The regulator board provides two regulated operating voltages for the Encode/Decode circuits, as well as push-to-talk, function selection and audio relay keying circuits.

13.5 Volt Supply

A +18 volts DC is fed from the power supply through fuse F1 to the collectors of compound-connected transistors Q2 and Q4. The transistors operate as a series regulator for the 13.5-volt supply. Zener diode VR1 and diodes CR4 and CR5 provide a reference voltage for the base of Q4. The 13.5-volt output connections are made to Holes 5 through 11.

-5.4 Volt Supply

AC voltage is taken from a tap on the secondary of T801. The AC is rectified by CR1, filtered by C1, R5 and C2 to provide a -5.4 volts bias voltage. Zener diode VR2 regulates the output voltage. Output connections are made to Holes 27 through 33.

Keying Circuits (Figure 24)

Pressing the Push-To-Talk (PTT) button forward biases diode CR2, energizing audio relay K1. It also turns ON a gating circuit on the 3-KC Keying Board which switches on the 3-KC oscillator, and the tone is applied to the audio pair.

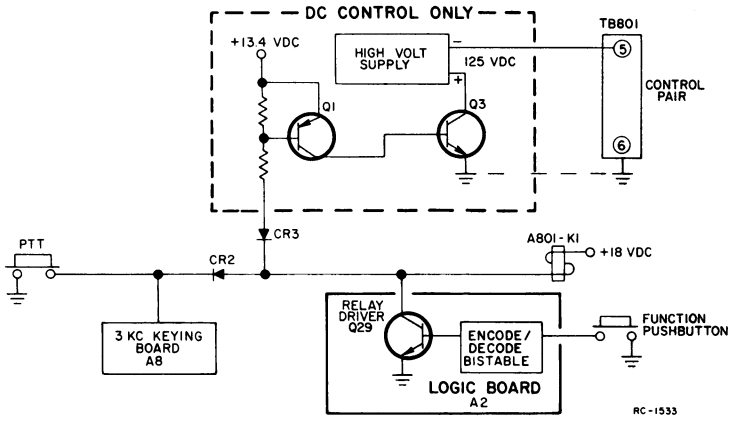


Figure 24 - Regulator Board Keying Circuits

Pressing one of the function pushbutton switches the encode/decode bistable on the Logic Board to the encode position, causing the relay driver stage to conduct. This energizes relay K1, applying the tones and code to the audio pair.

In DC control systems, transistors Q1 and Q3 are added. Pressing the PTT or function pushbutton forward biases diode CR3, turning ON Q1. This turns ON Q3, completing the ground path for the DC control current, so current will flow in the control pair.

ENCODE/DECODE FUNCTIONS

The Remote Control Console may be equipped to perform both the encode and decode function (for systems with parallel Consoles), or the encode function only. The encode circuitry changes the information from the pushbuttons to a binary code, and the decode circuitry changes a binary code to a DC voltage to turn on a status light. A brief description of each circuit board in the Encode/Decode assembly and its function is listed in the following chart (Figure 25).

CIRCUIT BOARD (Schematic Diagram)	FUNCTION	CIRCUIT DESCRIPTION
Logic Board A2 (19R620770)	Encode/Decode	Encode: contains the encode matrix, 5-bit shift register, pulse mixer, "AND" gate/drivers, 50-cps clock and manual memory set diodes. Decode: includes the decode matrix, 5-bit shift register, memory drivers, pulse delay and gating circuits.
Tone Oscillator A3 (19C311092)	Encode Only	Contains the 1500, 2000, and 2500-cps oscillators for generating the frequency-shift binary tone codes and the 2500-cps hold gate tone.
3-KC Oscillator A6 (19B205507)	Encode Only	Contains 3-KC oscillator circuit for tone keying and amplifier/filter stages for the filtered voice.
3-KC Keying A8 (19C311194)	Encode Only	Contains the timing circuits for the 3-KC oscillator, and hold-off gating circuits for the tone oscillator board.
Memory Board A5 (19R620766)	Encode/Decode	Contains an encode gate, memory flip-flops and decode gate to turn the light driver stages ON and OFF.
Light Driver A4 (19B205500)	Encode/Decode	Contains transistor switches to control status lights.
Tone Discriminator A7 (19D402729)	Decode Only	Contains the 1500 and 2500-cps tone detectors, the 2500-cps input hold gate, and 1500-cps and 2500-cps pulse generator circuits to drive the shift register.

Figure 25 - Encode/Decode Function Chart

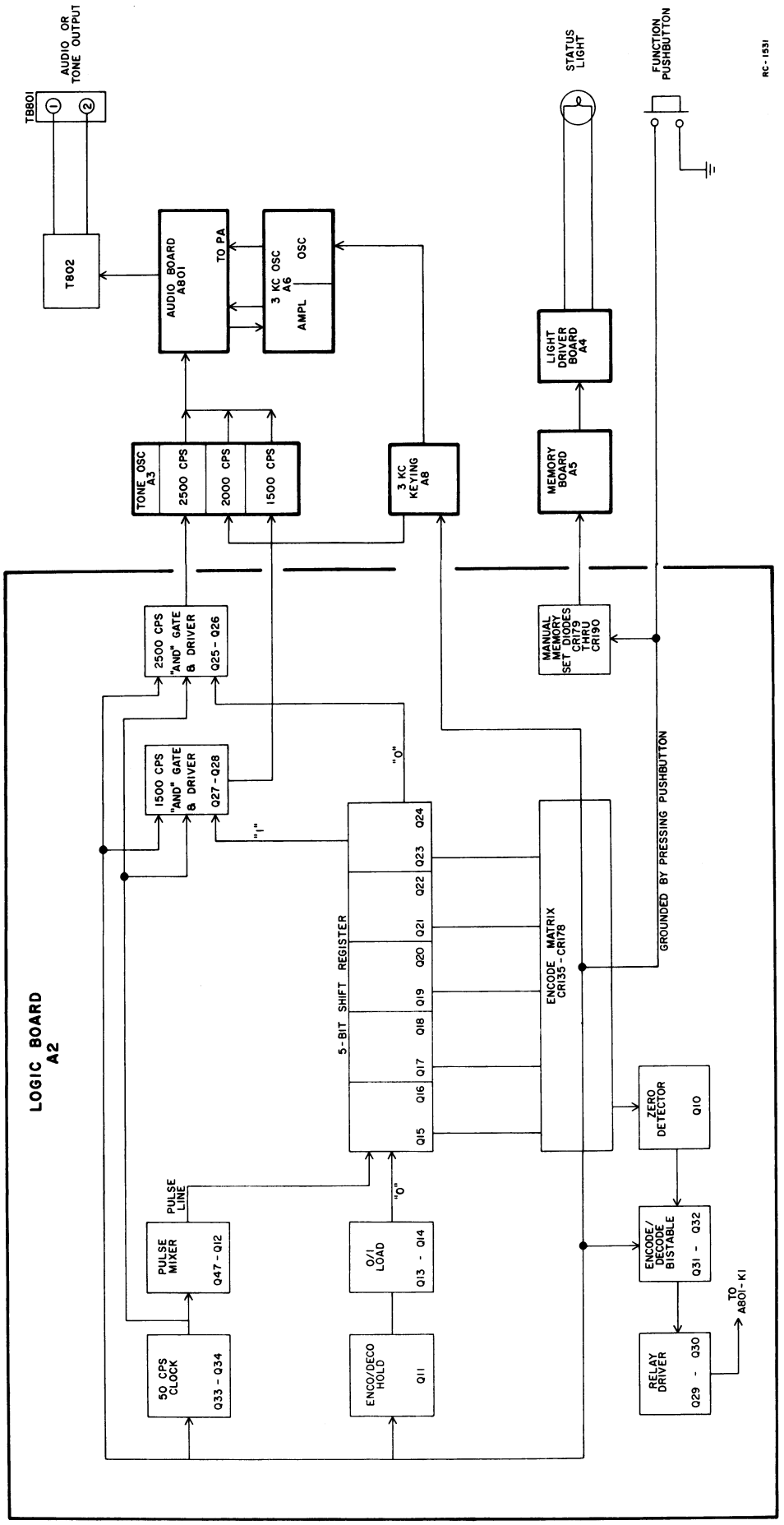


Figure 26 - Encode Block Diagram

ENCODE FUNCTION (Figure 26)

The encode function consists of two different series of events. The first series of events is initiated when the function selection pushbutton is pressed. The second series is initiated when the pushbutton is released.

Pushbutton Pressed

Pressing the pushbutton loads a binary code into the shift register, turns ON one of the status lights, and initiates a timing cycle.

1. Loading the Shift Register: Before a code can be loaded in, all of the flip-flops in the shift register are set in the "0" state. Pressing a pushbutton grounds one of the encode matrix lines, turning on those transistors in the flip-flop that have a matrix diode in their collector circuit. Turning on the significant transistor switches the flip-flop to the "1" state.

2. Turning ON a Status Light: Pressing the R-F1 pushbutton applies a ground through Manual Memory Set diode CR179 (on Logic Board A2) to output jack J25. The ground is connected to input jack J4 on Memory Board A5.

   The Memory Board contains two, four or eight flip-flops for four, eight or twelve remote functions. Each of the flip-flops has an input and output diode "AND" gate matrix. By adding or deleting these diodes, the flip-flops can be connected for four interlocked functions (only one of the four functions ON at a time), for groups of two interlocked functions (only one transistor ON in each pair), or for a combination of two and four interlocked functions.

   The ground at J4 (from the pushbutton) forward biases diodes CR2 and CR6, turning ON transistors Q2 and Q3, which turns OFF Q1 and Q4. The 13.4-volts DC at the collector of the OFF transistors reverse biases diodes CR26 and CR30 so that the potential at output jack J16 rises to 13.4 volts. J16 will remain at 13.4 volts as long as Q1 and Q4 are OFF. Output jacks J17, J18 and J19 are held at ground potential by the ON transistors.

   Output jack J16 is connected to J3 on Light Driver Board A4, and to the base of DC switch Q3. The positive voltage turns ON Q3 which completes a ground path for one of the status lights, turning it on.

3. Initiating the Timing Cycle: Grounding one of the matrix lines (on Logic Board A2) simultaneously supplies a ground for the Encode/Decode Bistable, the 2500-cps "AND" Gate/Driver and the 3-KC Keying jack J37. The ground also forward biases diodes CR118, CR117 and CR116, switching the Encode/Decode Bistable to the Encode state (Q32 ON and Q31 OFF), discharging capacitor C39 and holding off the 50-cps Clock (Q33 and Q34).

With Q31 OFF, the 13.4 volts at its collector back biases CR114 which turns ON Relay Drivers Q29 and Q30, providing a ground path to energize audio relay A801-K1. Turning Q32 ON grounds the base of PNP transistor Q11 in the Encode/Decode Hold stage through zener diode VR3, turning the transistor ON. The positive collector output of Q11 turns ON Q13 in the 0/1 load stage (which turns off Q14) so that only zeros can be loaded into the shift register. The ground at the collector of Q32 also turns OFF the decode Delay input (Q3), forward biases Read Gate diodes CR14 through CR25 to disable the Decode Matrix, and removes the "0" hold on the shift register by turning off Reset Gate Q9.

Diodes CR106 and CR105 are also forward biased by the ground, holding off the 2500-cps Driver Q25. Forward biasing CR106 also discharges capacitor C35.

The ground at J37 is connected to J10 on 3-KC Keying Board A8. Grounding J10 switches the "one-shot" multivibrator (Schmitt Trigger) by turning Q6 OFF and Q7 ON. Q7 will remain ON for the time determined by the R-C time constant of R20 and C12/C13, or as long as the pushbutton remains pressed in. As long as Q7 is ON, diodes CR10 and CR11 are forward biased to hold off the 2500-cps Driver on Logic Board A2 and the 2000-cps and 2500-cps oscillators on Tone Oscillator Board A3. Switching the "one shot" or pressing the pushbutton also forward biases CR7, applying a ground to J8 on the 3-KC oscillator Board A6. This starts the 3-KC oscillator (Q1 and Q2), and the 3000-cps tone is applied to emitter-follower Q3 and coupled through 3-KC Level Adjust R8 to the PA input on Audio Board A801. Potentiometer R8 is the only control in the Encode/Decode assembly that requires adjustment. The control should be set to provide a 3-KC output of approximately 300 millivolts at the station remote control panel.

The R-C time constant of the "one-shot" multivibrator on the 3-KC keying board keeps Q7 on for a minimum of 40 milliseconds in tone control applications, and 100 milliseconds in DC/Tone Control applications. This assures a specific receiver muting tone output regardless of the length of time the pushbutton is pressed. It also keeps the 2000 and 2500-cps oscillators disabled until the pushbutton is released and Q7 switches back to its normally off state.

Pushbutton Released

Releasing the pushbutton causes the 2500-cps and 2000-cps tone to be sent out, starts the 50-cps clock to shift the code out of the shift register, and resets the circuits after the code is shifted out. Figure 27 shows the encode waveforms on Logic Board A2 for the code 1 - 0 - 0 - 0 - 1.

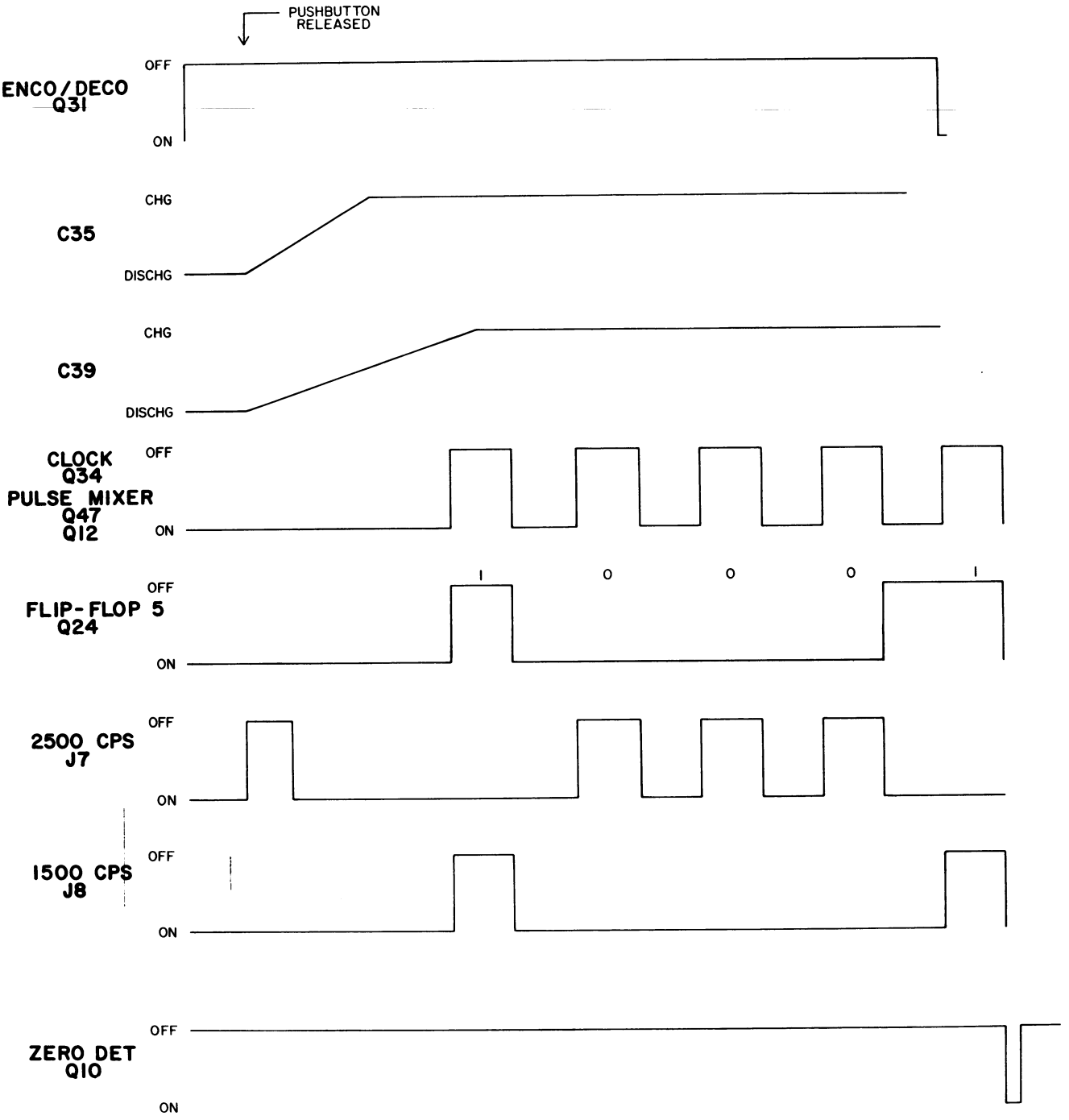


Figure 27 - Encode Waveforms For Logic Board A2

1. 2500 and 2000-cps Tone Output: Releasing the pushbutton removes the ground from the 3-KC keying jack (J37) and from the 2500 cps "AND" Gate/Driver on Logic Board A2. Removing the ground at J37 releases the hold on the 2000-cps and 2500-cps oscillators on Tone Oscillator Board A3, and turns off the 3000-cps oscillator.

   The 2500-cps "AND" Gate/Driver (Q25) remains off for a time determined by the R-C time constant of C35, R93 and R95. With Q25 OFF, the positive voltage at J7 is applied to J3 on Tone Oscillator Board A3 through a tie point on the 3-KC Keying Board. A positive voltage at J3 reverse biases CR5 and the 2500-cps output is coupled through CR3 and CR4 to the base of tone amplifier Q8. The tone is amplified, filtered and connected to the compressor amplifier input on Audio Board A801.

   After approximately 100 milliseconds, capacitor C35 charges sufficiently to back bias CR105, turning Q25 on again. Both "AND" Gate Drivers (Q25 and Q27) are now ON and their collectors are at ground potential. This ground is applied from J7 and J8 on the Logic Board to J3 and J5 on the Tone Oscillator Board, grounding the output of the 1500-cps and 2500-cps oscillators. The output of the 2000-cps oscillator is applied to the tone amplifier and filter, and connected to the compressor amplifier input on A801.

   Whenever "AND" Gate Drivers Q25 or Q27 are turned OFF, diodes CR15 or CR16 on Tone Oscillator A3 conduct, turning on transistor Q5. This grounds the 2000-cps output, permitting the 2500 cps or 1500 cps oscillator output to be transmitted.

2. Starting the 50-cps Clock: Removing the ground on Logic Board A2 removes the forward bias on CR116, CR117 and CR118 which releases the hold on the 50-cps Clock (Q33 and Q34). The clock will remain OFF until capacitor C39 charges through R109 and R111 and reaches a level sufficient to back-bias CR118. A charging time of 140 milliseconds allows the 2500-cps and 2000-cps tones to be transmitted. After C39 charges, the ground on the base of Q33 is removed, turning Q33 ON and Q34 OFF.

   When turned OFF, the positive collector voltage of Q34 is fed to the base of PNP transistor Q47, turning it OFF. This turns Q12 OFF and a positive voltage at the collector of Q12 allows shift register trigger capacitors C15 through C34 to charge. The positive voltage at the collector of C34 is also applied to "AND" Gate diodes CR109 and CR113. With the Encode/Decode Bistable in the encode state (Q31 OFF), a positive voltage is applied to "AND" Gate diodes CR108 and CR111. Figure 28 is a simplified diagram showing the circuits used in shifting the code out of the register.

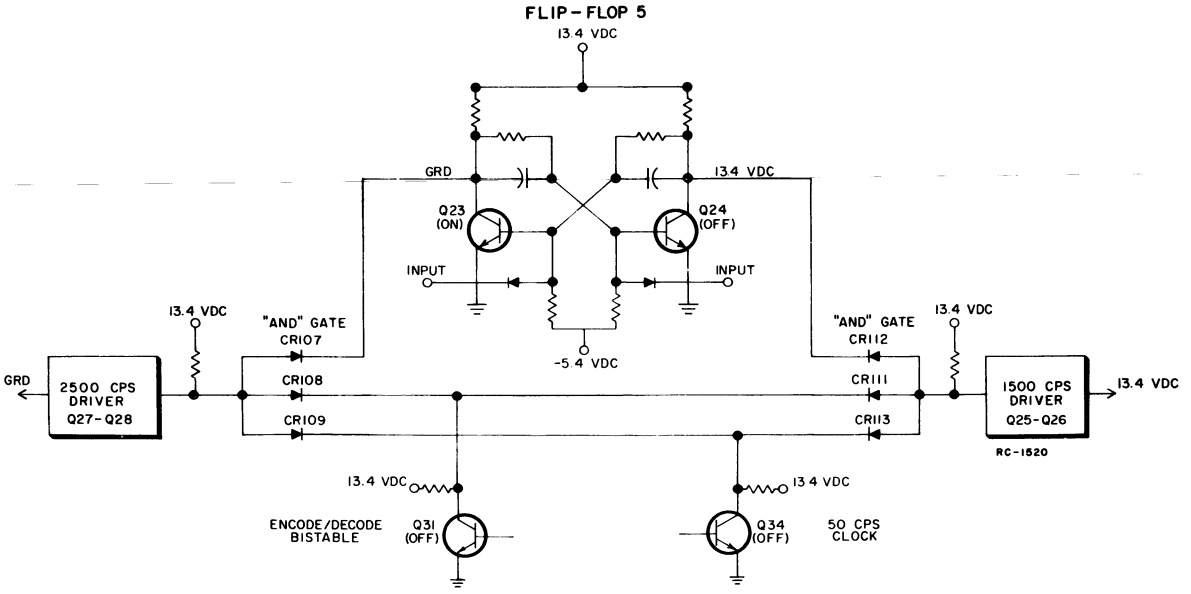


Figure 28 - Shifting the Code Out of the Register

The flip-flop shown in the figure is loaded with a "1" (Q23 ON, Q24 OFF). The instant clock transistor Q34 turns OFF, all of the 1500-cps "AND" Gate diodes are back-biased, and 13.4 volts is applied to the base of the 1500-cps Driver Q25, turning it ON. This turns off Driver Q26 and the 13.4 volts at the collector keys the 1500-cps oscillator.

When the last flip-flop is loaded with a "0" (Q23 OFF and Q24 ON), the 2500-cps "AND" Gate diode are back biased. This turns on 2500-cps Driver Q27 and turns OFF Q28, and the 13.4-volt output keys the 2500-cps oscillator.

On the next cycle, of the 50-cps Clock, Q33 turns OFF and Q34 turns ON. The ground on the collector of Q34 turns ON the PNP transistor Q47 which turns ON Q12. This momentarily grounds the pulse line causing the trigger capacitors to charge in the opposite direction, shifting the code one position to the right. As the 50-cps Clock continues to run, the code is shifted out of the register to key the 1500-cps or 2500-cps oscillator.

3. Resetting Circuits: As the code is shifted out of the register, zeros are fed in from the 0/1 Load circuit. After all of the code has been shifted out, the shift register flip-flops are all in the "0" state (all odd numbered transistors OFF, and all even numbered transistors ON). The collectors of all the OFF transistors are at 13.4 volts, which back-biases the zero detector "AND" Gate diodes (CR134, CR147, CR154, CR161, and CR170). This removes the ground from the base of Zero Detector Q10, turning it ON. The ground at the collector of Q10 turns OFF "AND" Gate Drivers Q26 and Q28 which turns ON Q25 and Q27 and grounds the output of the 2500-cps and 1500-cps oscillators on Tone Oscillator Board A3. The ground is also applied to the collector of Q31 in

the Encode/Decode Bistable, turning it ON and turning OFF Q32. With Q31 ON, the base of Q33 in the 50-cps Clock is grounded through CR115, disabling the clock.

Through Q32 OFF applies 13.4 volts to the base of PNP transistor Q11, turning it OFF and turning OFF Q13 in the 0/1 Load circuit. The 13.4 volts also turns ON Q3 in the decode input circuit, back-biases the Read Gate diodes to set up the Decode Matrix, and turns on Reset Gate transistor Q9 to restore the "0" hold on the shift register.

DECODE FUNCTION (Figure 29)

Tone Discriminator A7

The incoming tone and code from a parallel Console is connected from Audio Board A801 to tone input jack J1 on the Tone Discriminator where it is coupled through a limiter circuit (CR9, CR10 and R34) to amplifiers Q1 and Q2. DC feedback through R2, R6 and R35 provides a symmetrical squarewave output (proportional to the input) that is applied to the base of emitter-follower Q13.

Discriminator transformer T1 has a 2500-cps output and a 1500-cps output. The 2500-cps gating tone preceding the code is fed from pin 5 of T1 to the base of emitter-follower Q3 as a series of pulses. The first pulse turns on Q3, shorting capacitor C3. The positive voltage at the emitter of Q3 back biases CR1 and turns ON Q5. In the interval between pulses, Q3 turns OFF but C3 charging through R10 keeps CR1 back biased and Q5 ON until the next pulse. Q5 and Q7 are connected as a "one-shot" mulitvibrator (Schmitt Trigger) and turning Q5 ON turns Q7 OFF. The 2500-cps tone pulses have been converted to a single positive pulse at the collector of Q7. Figure 30 contains simplified waveforms of the code 1 - 0 - 0 - 0 - 1 applied to the Tone Discriminator Board.

The 100-millisecond gating pulse turns on Q9 and back biases CR5. This allows C7/C12 to start charging through R25. The capacitor charges up to approximately 5 volts in a minimum of 40 milliseconds to turn ON Q10. Turning Q10 ON discharges C8 and keeps it discharged until the gating pulse ends. Then Q10 cuts OFF and C8 starts charging through R26 so that a positive pulse appears at the junction of C8 and R28. The positive pulse forward biases CR8 and switches the "one-shot" (turns Q12 ON and Q11 OFF). With Q11 OFF, the positive collector voltage is applied from the Decode gate jack (J7) to the Delay circuit input (J6) on the Logic Board, releasing the hold on the Delay circuit. The "one-shot" remains triggered (Q11 OFF and Q12 ON) for approximately 200 milliseconds, keeping the Delay circuit open to accept an entire code that follows the gating tone. The 40-millisecond minimum charging time for C7/C12 prevents a noise pulse from triggering the "one-shot".

With the code 1 - 0 - 0 - 0 - 1 applied to the Tone Discriminator, a 10-millisecond, 1500-cps tone burst from T1-pin 5 is applied to Q4, Q6 and Q8, which is identical to the 2500-cps circuit Q3, Q5 and Q7. The positive pulse at the collector of Q8 is coupled through "OR" Gate diode CR4 to the Decode Clock jack J5.

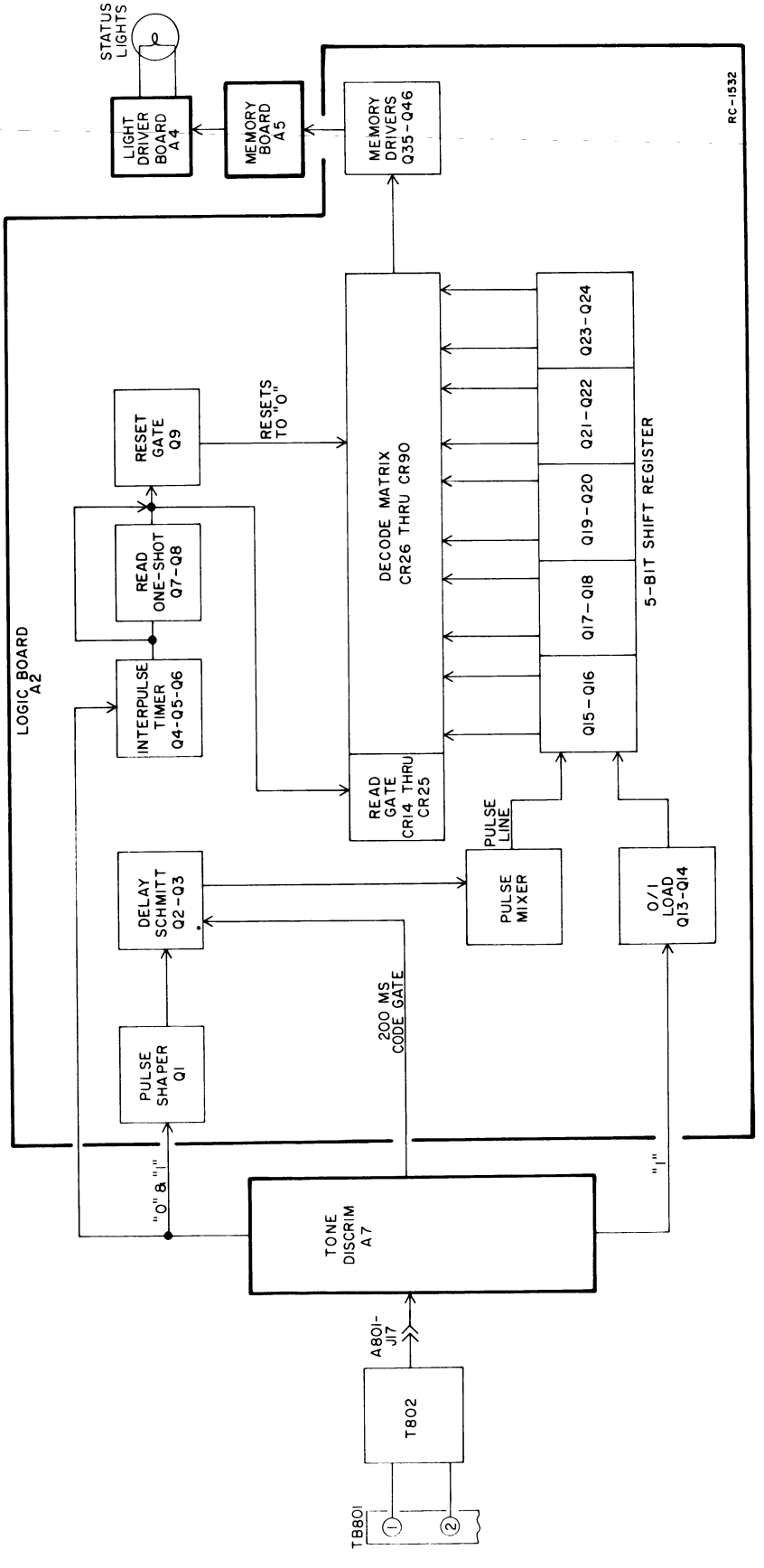


Figure 29 - Decode Block Diagram

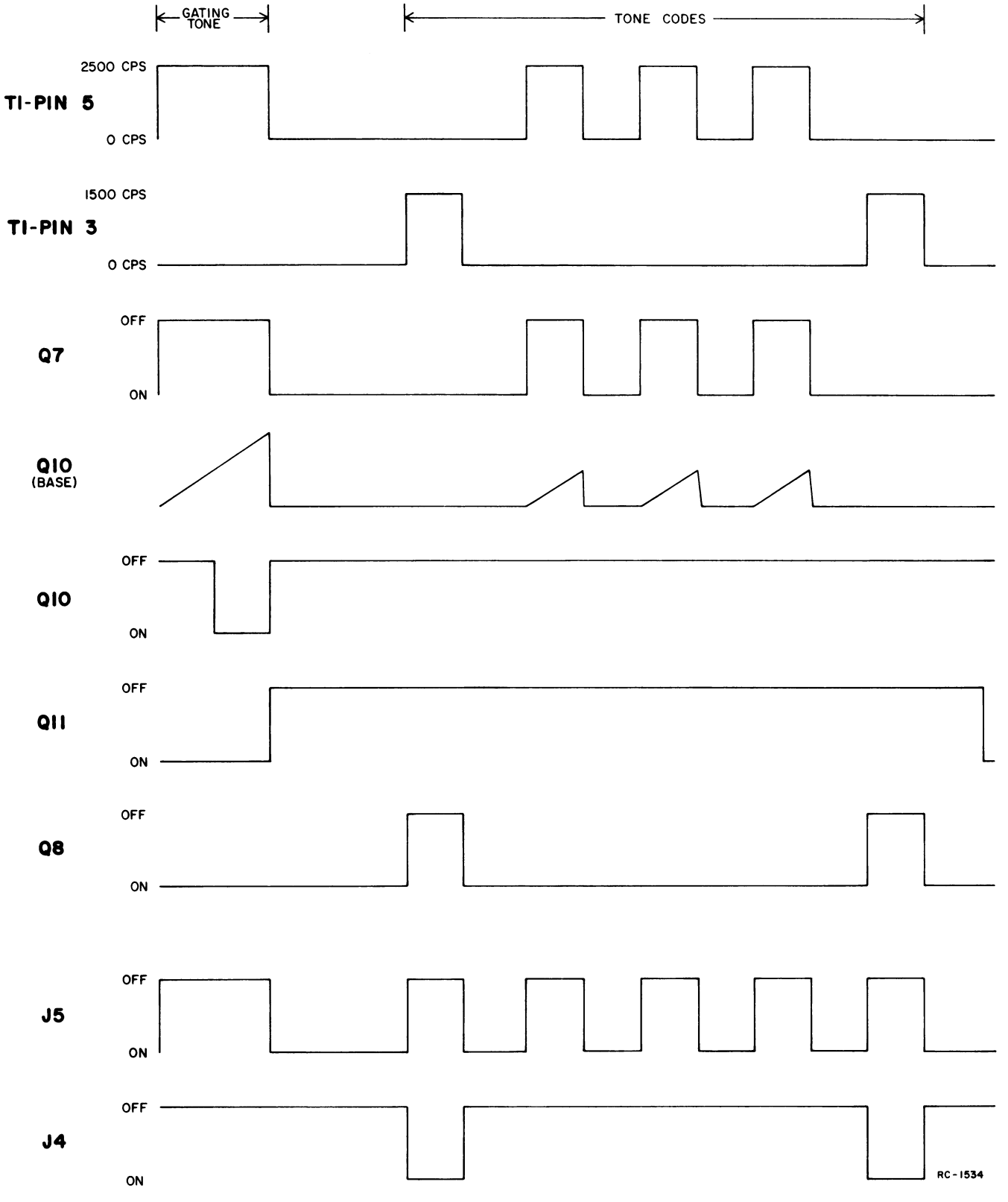


Figure 30 - Tone Discriminator Waveforms

Following the 1500-cps tone, a 2500-cps tone burst from T1-pin 3 is applied to Q3, Q4 and Q7, resulting in a 10 millisecond positive pulse at the collector of Q7. The pulse is coupled through "OR" Gate diode CR3 to the Decode Clock output jack J5. The entire 5-bit code is converted by the two circuits and "added" by the "OR" Gate diodes to supply five positive clock pulses to drive the shift register.

In addition to the clock pulses, a negative pulse from the collector of Q6 is applied to "1" output jack J4 wherever a 1500-cps tone is applied to the Tone Discriminator. This negative pulse is connected to J3 on the Logic Board.

Logic Board A2

Both the positive clock pulses and the negative "1" pulses are applied to the Logic Board simultaneously. The negative "1" pulse from input jack J3 turns off Q13 which turns on Q14 in the 0/1 Load circuit. This sets the circuit to load a "1" into the shift register whenever the first pulse is applied to the shift register pulse line. Refer to Figure 31 for the Logic Board Decode waveforms for the code 1 - 0 - 0 - 0 - 1.

Pulse shaper Q1 is normally OFF, keeping C1 discharged through CR2. The first clock pulse applied to the base of Q1 turns the transistor ON. This back biases CR2, so that C1 charges through R3 and turns on Q2 in the Delay "one-shot", turning OFF Q3. The pulse delay due to C1 charging protects the stage against noise falsing. Switching Q3 OFF applies a positive pulse to Pulse Mixer Q12 where it is inverted and applied to the shift register pulse line to shift in the first code bit.

The decode clock pulses are also fed from J2 to the base of Q4 in the Interpulse Timer circuit. The first pulse turns ON Q4, which acts as a short across C3. The positive voltage at the emitter of Q4 back biases CR4 which turns ON Q5 and turns OFF Q6. In the interval between clock pulses, Q4 turns OFF and C3 charges through R11 to keep CR5 back biased and Q5 turned ON. Keeping Q5 turned ON applies a ground through CR8 to the base of Q9, keeping it turned OFF. This releases the zero hold on Reset Gate diodes CR26, CR45, CR58, CR69 and CR82. The ground also forward biases CR9 and Read Gate diodes CR14 through CR25, disabling the Decode Matrix until a complete code has been shifted into the register. As long as Q5 is kept ON by the five clock pulses and the charging of C3, the code will be shifted into the register. However, if a code should be interrupted or a clock pulse missing, Q5 will turn OFF and Q9 will turn ON as soon as the Read "one-shot" releases. This restores the zero hold on the Decode Matrix and releases the ground on the Read Gate diodes, and another code will have to be received to restart the cycle.

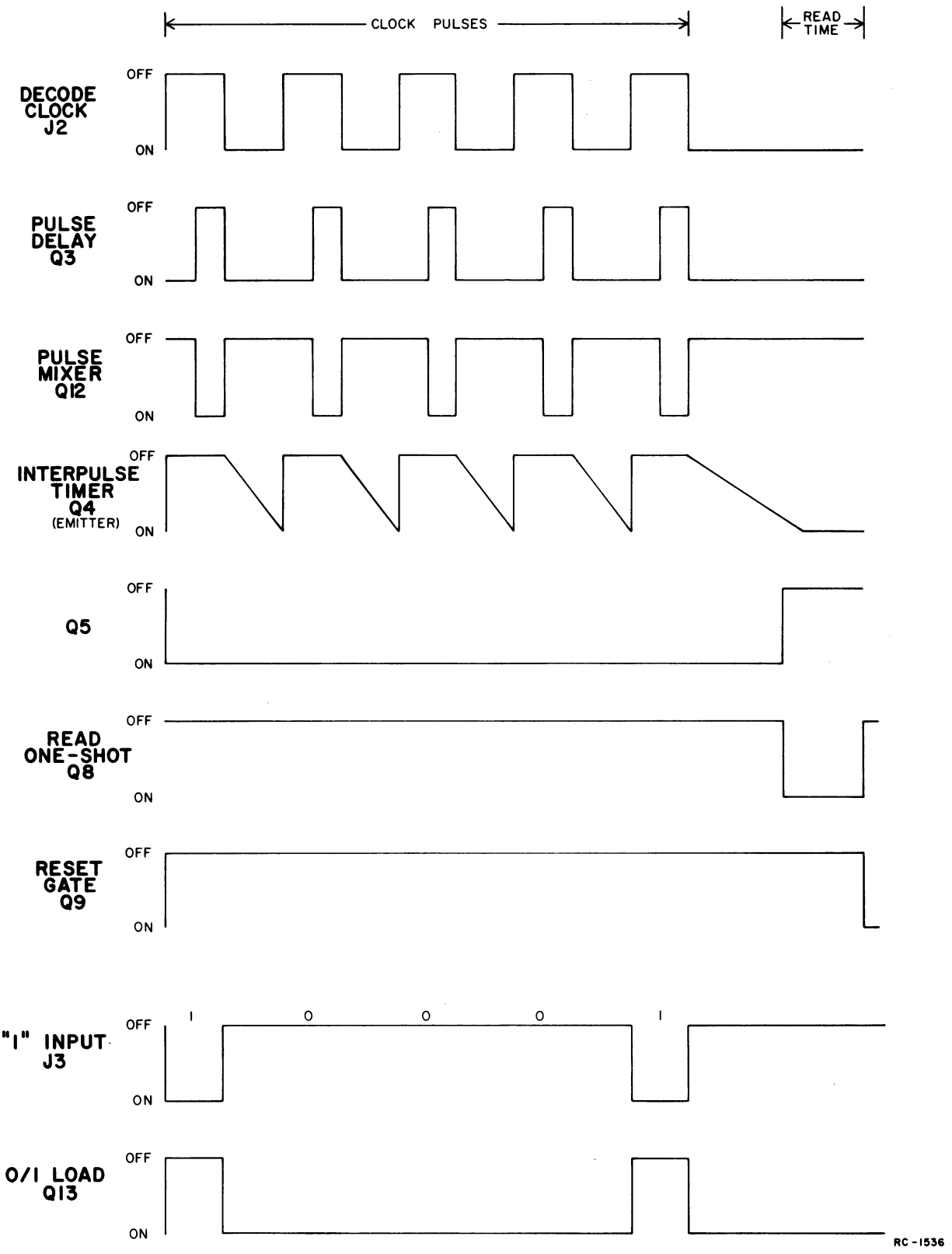


Figure 31 - Logic Board Decode Waveforms

At the end of the clock pulses, Q4 and Q5 turn OFF. This lets Q6 turn ON and discharges C4, which starts charging in the opposite direction through CR6. This turns OFF Q7 and turns ON Q8 in the Read "one-shot", forward biasing CR7 and keeping Q9 turned OFF and keeping the zero hold OFF in the matrix. The "one-shot" remains switched for 30 milliseconds which is the read time for the matrix. The code that has been shifted into the register is applied to the Decode Matrix and appears as a positive pulse at the base of one of the Memory Drivers (Q35-Q46) where it is inverted and applied to the Memory Board to switch ON one of the status lights. After 30 milliseconds, the "one-shot" switches back to its original state (Q7 and Q8 OFF). Q9 turns ON and switches the shift register back to the "0" state.

3-KC KEYING

Pressing the Push-To-Talk button grounds J4 on 3-KC Keying Board A8. This forward biases CR4, grounding the junction of C5 and C6. The capacitors start charging through CR2 and CR6. This switches the two "one-shots" by turning OFF Q1 and Q4 and turning ON Q2 and Q5. Turning ON Q2 forward biases CR3, applying a ground to J5 to key the 3000-cps oscillator. Q2 remains ON for a minimum of 60 milliseconds the "one-shot" switches back to its normal state (Q1 OFF and Q2 ON). Turning OFF Q2 removes the ground at J5 and turns OFF the 3-KC oscillator. The 3-KC keying waveforms are shown in Figure 32.

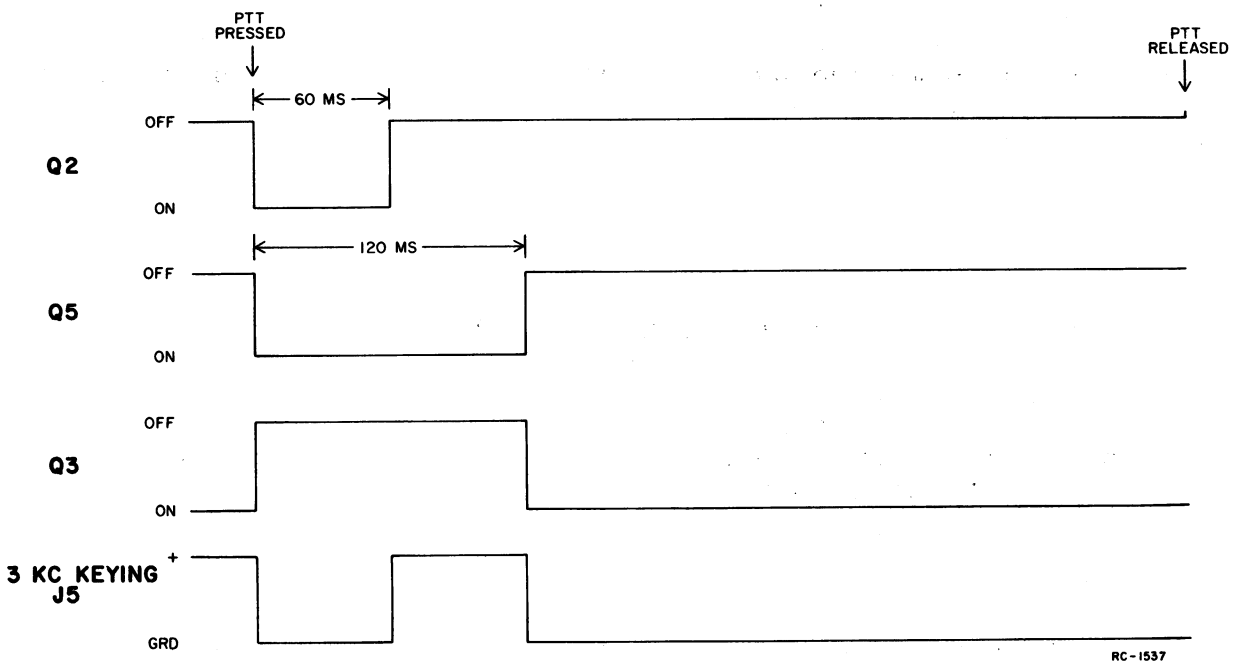


Figure 32 - 3-KC Keying Waveforms

Turning Q5 ON applies a ground to the base of Q3 holding it OFF. Q5 remains ON for a minimum of 120 milliseconds before switching back to its normal state (Q4 ON and Q5 OFF). When Q5 turns OFF, its collector goes positive and turns ON Q3. This forward biases CR13, applying a ground to J5 to again key the 3000-cps oscillator. Q3 remains ON (keying the 3-KC oscillator) until the Push-To-Talk switch is released.

OPTIONS

VU AND COMPRESSION METER

The VU meter or compression meter enables the operator to check the line level of the Transistorized Control Console in the transmit, intercom or receive mode.

The VU meter is calibrated to indicate the line levels in volume units. With a line level of +8 VU (+18 dbm), the meter reads "0 VU". Levels lower than 8 VU are indicated by negative VU readings, and levels higher than 8 VU are indicated by positive VU readings. If the Transmitter MOD ADJUST is set so that a line level of 8 VU produces maximum system deviation, the lower scale on the meter will indicate percentage of full modulation being produced. The meter can be adjusted to read "0 VU" with a line level of +4 VU by removing R4 and jumpering TB1-1 and TB1-5.

The dial of the compression meter is not numerically calibrated. The line levels are indicated by red and green areas. The threshold of compression is marked by the line between the red and green areas. A meter reading in the red area indicates under-compression, while a reading anywhere in the green area indicates a proper output level (within 1 db of normal).

CLOCKS

A 12-hour or a 24-hour electric clock is available for mounting on the Transistorized Control Console. The clocks are connected so that they operate with the power switch ON or OFF. In the event of a power failure, the clocks can be set by removing the top cover of the Console and turning the indicator wheels in either direction until the correct time shows in the window.

INTERCOM SWITCH KIT

The Intercom Switch Kit permits communication between paralleled Control Consoles without keying the transmitter. It also permits inter-communication between the Control Console and the base station when the Remote Control Panel (16A11) has been equipped with the intercom accessory.

Placing the INTERCOM-TRANSMIT in the INTERCOM position energizes audio relay K1, switching the board to the transmit mode. It also disables the transmit light and opens the control current path in DC control systems.

It is not necessary to operate the microphone Push-To-Talk Switch in either the TRANSMIT or INTERCOM position.

TONE ALERT OSCILLATOR

The Tone Alert Oscillator accessory is used by the dispatcher to transmit an alerting tone to call attention to messages of more than usual importance. The accessory consists of a tone board, pushbutton switch (marked tone), and indicator light. The Tone Oscillator includes a multivibrator circuit and a two-section R-C filter.

Pressing the Tone Alert pushbutton applies 13.5 volts to the tone oscillator, switches audio relay K1 to the transmit mode, keys the transmitter and lights the red transmit light DS802. It also turns ON the indicator light above the pushbutton at the local console only. The nominal 1000-cps output of the tone oscillator board is connected to J6 and J7 on Audio Board A801, fed to the audio pair and is then transmitted by the station.

HANDSET AND HOOKSWITCH

Handset Model 4EM26A10 can be used in place of Desk Mike 4EM28A10. When the Handset is on hook, audio is connected through the Hookswitch to the loudspeaker of the Control Console. Taking the Handset off hook mutes the speaker and applies audio to the Handset earpiece.

TONE JACK (Option 5003)

Tone Option jack J1 (mounted on the chassis next to the microphone jack) provides a connection for plugging in a Type 90 or Type 99 Decoder. The Decoders may be equipped with a CALL light, buzzer or external alarm to notify the operator of an incoming call.

MAINTENANCE

DISASSEMBLY

To gain access to the Encode/Decode assembly and main chassis, loosen the two captive knurled knobs at the back of the Console and lift off the top cover. Then spring open the retaining clips on the top of the Encode/Decode assembly and lift up the assembly cover.

To gain access to the Regulator board, 3-KC filter and components on the underside of the chassis, first remove all power to the Console. Next, remove the four Phillips-head screws holding the chassis to the frame, and tilt the chassis up towards the front of the console.

TROUBLESHOOTING

The following troubleshooting procedures are included for servicing the Console (refer to the Table of Contents).

- For Audio Board: a list of possible symptoms and suggested corrective action.
- For Encode/Decode circuits: DC voltage checks and encode/decode waveforms.
- For Power Supply and Regulator Board: supply voltage readings on the Schematic Diagram.

COMPLETE ADJUSTMENT PROCEDURE

LINE OUTPUT

The Control Console was set at the factory for a line output of 6-volts RMS (+18 dbm). This level may be reduced when required by local telephone company regulations, or whenever line losses and noise pickup permit an adequate signal-to-noise ratio.

PROCEDURE:

1. Connect an AC-VTVM across the audio pair (TB801-1 and TB801-2). Use a 0.5-mfd capacitor in series with the meter if a DC voltage is simplexed line-to-line.
2. Tune MIC GAIN control R5 fully clockwise (from the rear of the Console).
3. Apply a 1000-cps, 30-millivolt signal to pins 1 (GRD) and 2 of Mike Jack J801.
4. Adjust LINE OUTPUT control R28 for 6-volts RMS (or as required by local regulations).

MIC GAIN

The MIC GAIN control (R5) was set at the factory according to the type microphone ordered with the Console. Setting this control for excessive compression will accent background noise during pauses in transmission.

PROCEDURE A:

1. Key the microphone and talk into the mike from a normal distance (12 to 15 inches for the Desk or Boom mike, or across the face of the Military mike).
2. Adjust MIC GAIN control R5 for the threshold of compression as indicated by the line between the red and green areas on the Compression Meter, or by a reading of 0.4-volt DC on a 20,000 ohm-per-volt meter connected from A801-J19 to ground.

PROCEDURE B:

1. Apply a 1000-cps signal to pins 1 (GRD) and 2 of Mike Jack J801 at the level indicated in the following chart.

For Microphone Type:	Set Input Level For:
EM-28-A (Desk Mike)	12 millivolts
EM-25-A (Military Mike) or EM-26-A (Handset)	60 millivolts
EM-13-A (Boom Mike)	6 millivolts

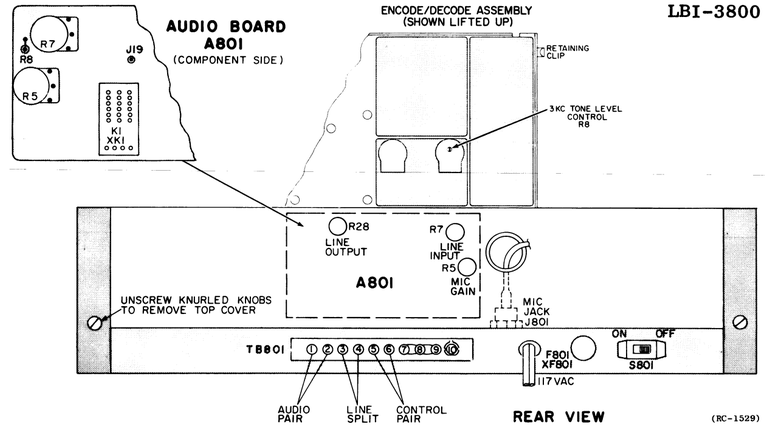
2. Adjust MIC GAIN control R5 for threshold of compression as indicated by the Compression Meter, or by a reading of 0.4-volt DC on a 20,000 ohm-per-volt meter connected from A801-J19 to ground.

LINE INPUT

The LINE INPUT control was adjusted at the factory for an input of 180-millivolts RMS (-12 dbm) for threshold of compression. Setting the control for excessive compression will accent background and line noise during pauses in transmission.

PROCEDURE:

1. Apply a 1000-cps signal to the audio pair from the source with the largest line loss (this may be the base station or another Console). Adjust the audio generator to produce +18 dbm on the audio pair (or less when required by local regulations).
2. Adjust LINE INPUT control R7 for threshold of compression as indicated by the Compression Meter, or by a reading of 0.4-volt DC on a 20,000 ohm-per-volt meter connected from A801-J19 to ground.



3-KC TONE LEVEL

1. Turn the power OFF. Next, slip off the two retaining clips on each side of the hinged Encoder/Decoder assembly and swing open the top section.
2. Turn the power ON. Then key the microphone and adjust 3-KC Tone Level control R8 for reading of 300 millivolts at TB701-1 and -2 of station remote control panel Model 4KC16A10.

ACCESSORIES

CLOCK ACCESSORY

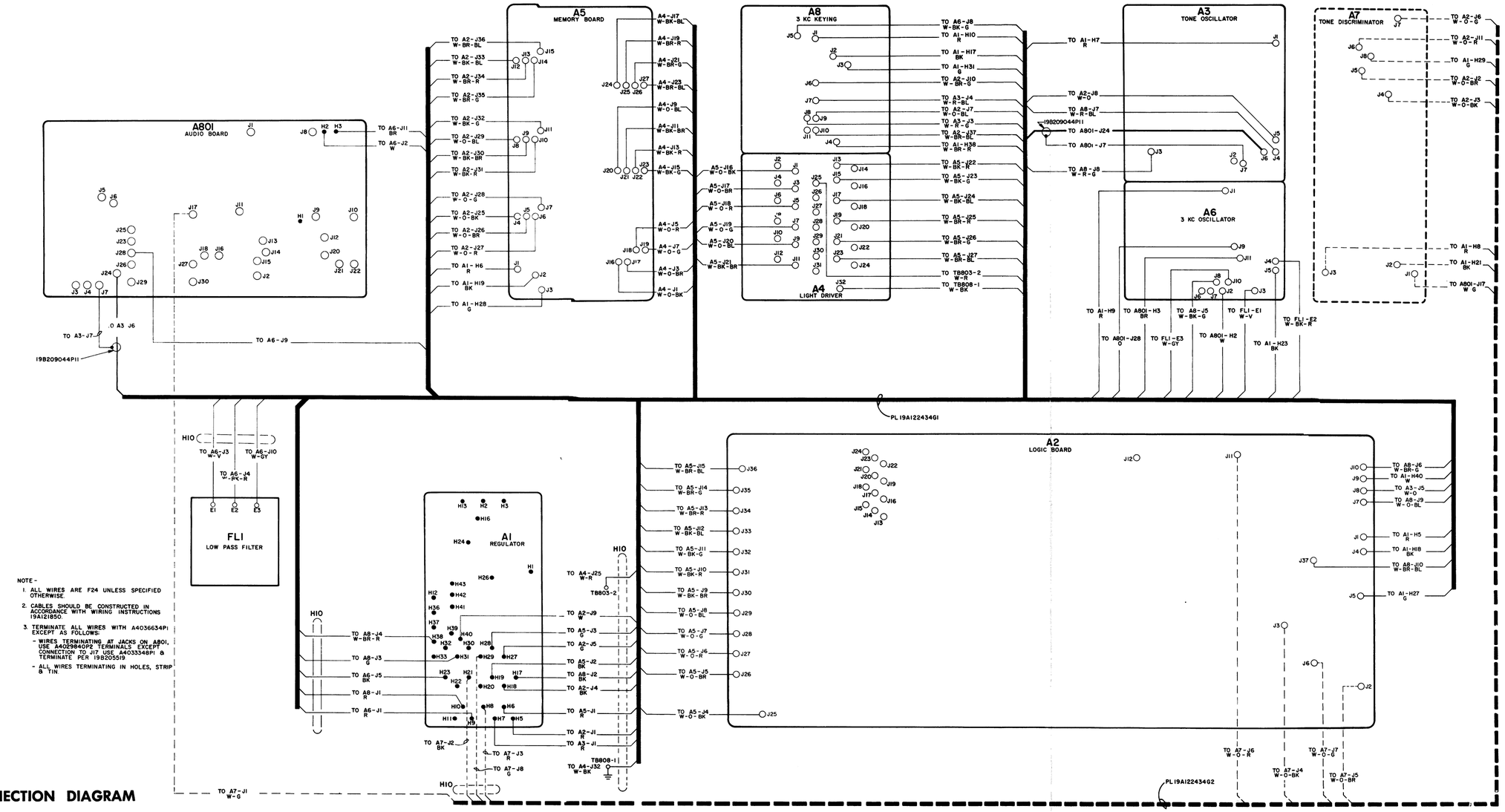
To set the clock, turn the power OFF and remove the top cover. Then turn the indicator wheels in either direction until the correct time shows in the window.

TONE JACK (Option 5003)

Turn the power OFF. Then remove the top cover and connect the tone option plug to the mike jack next to mike jack J801 on the Console Chassis.

HANDSET HOOKSWITCH (Option 5002)

1. Turn the power OFF. Then remove and discard link connectors between TB801-7 & -8 and TB801-8 & -9.
2. Connect Hookswitch leads as follows:
   Green-White lead to TB801-7; Brown-Green lead to TB801-8; White-Blue-Red lead to TB801-9; and White-Red-Black lead to TB801-10.

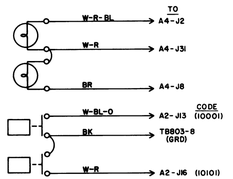


INTERCONNECTION DIAGRAM

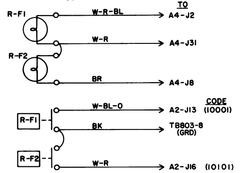
TRANSISTORIZED CONTROL CONSOLE (XC SERIES)
MODEL 4EC72A10

(19R640710, Rev. 5)

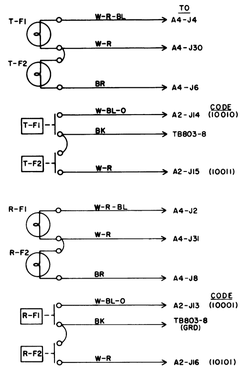
2 FREQ TRANSMIT-1 FREQ RECEIVE
19A122450-G1



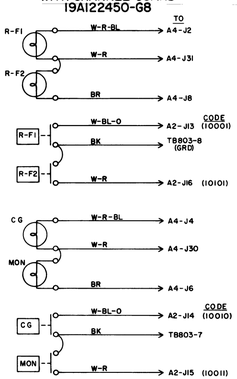
1 FREQ TRANSMIT-2 FREQ RECEIVE
19A122450-G2



2 FREQ TRANSMIT-2 FREQ RECEIVE
19A122450-G3

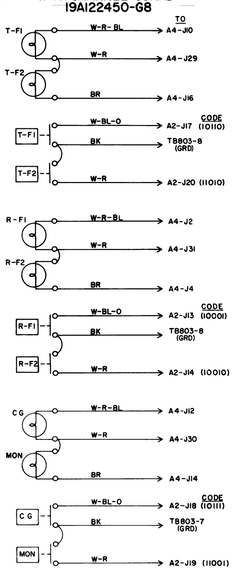


1 FREQ TRANSMIT-2 FREQ RECEIVE
19A122450-G2
WITH CHANNEL GUARD
19A122450-G8

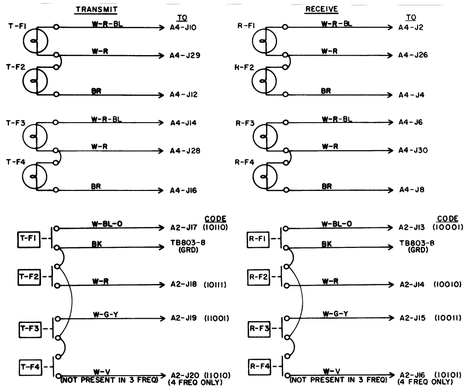


RC-1514

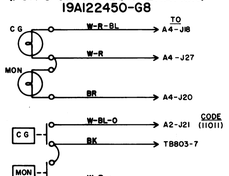
2 FREQ TRANSMIT-2 FREQ RECEIVE
19A122450-G3
WITH CHANNEL GUARD
19A122450-G8



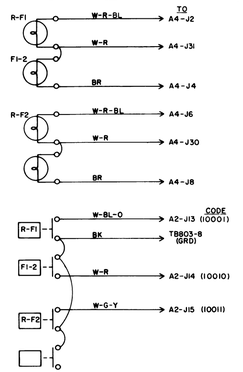
3 FREQ TRANSMIT-3 FREQ RECEIVE
19A122450-G4
4 FREQ TRANSMIT-4 FREQ RECEIVE
19A122450-G5



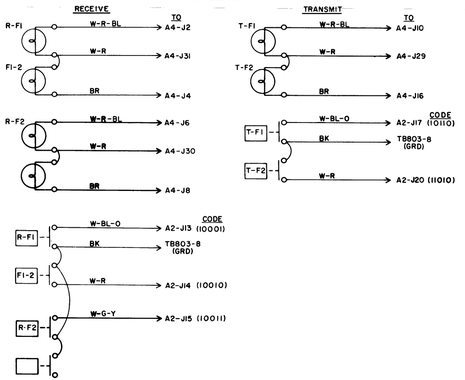
CHANNEL GUARD
(FOR 3 OR 4 FREQ OPERATION)
19A122450-G8



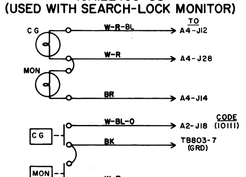
1 FREQ TRANSMIT-2 RECEIVERS (OR SLM)
19A122450-G6



2 FREQ TRANSMIT-2 RECEIVERS (OR SLM)
19A122450-G7



CHANNEL GUARD
19A122450-G8
(USED WITH SEARCH-LOCK MONITOR)

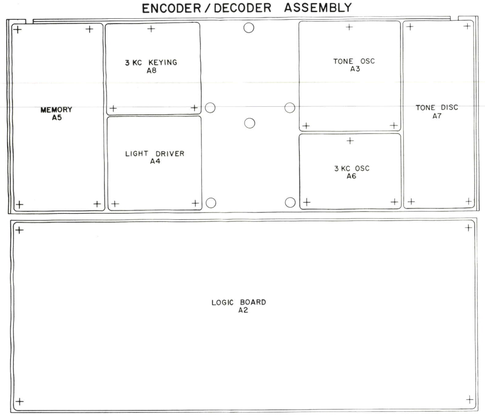


RC-1515

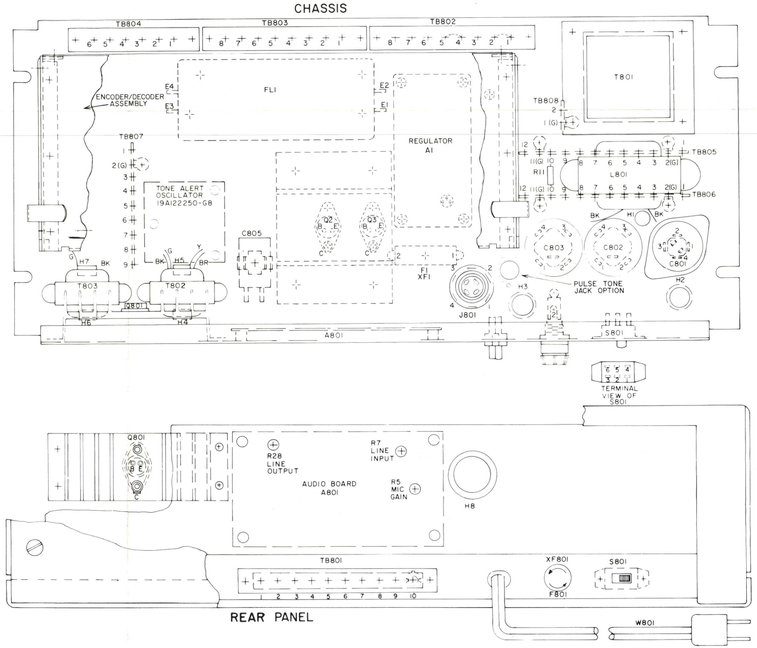
INTERCONNECTION DIAGRAM

PUSHBUTTONS AND STATUS LIGHTS

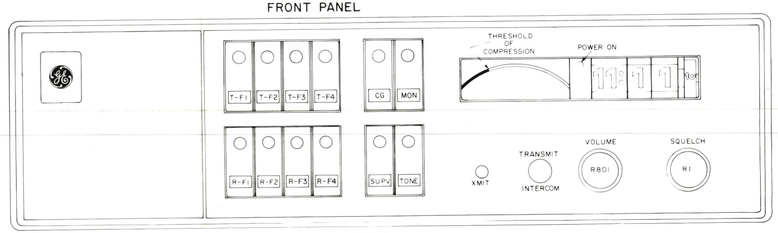
ENCODER / DECODER ASSEMBLY



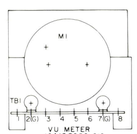
CHASSIS

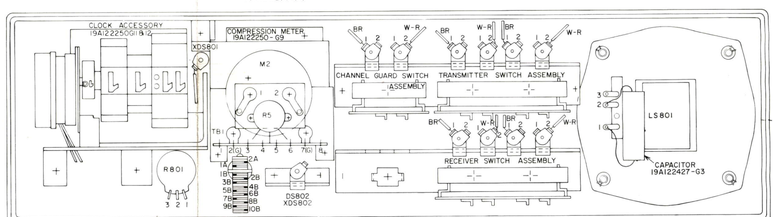


FRONT PANEL



FRONT VIEW

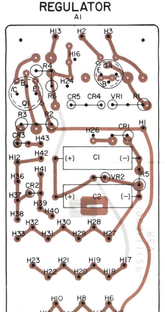




REAR VIEW

REGULATOR

A1

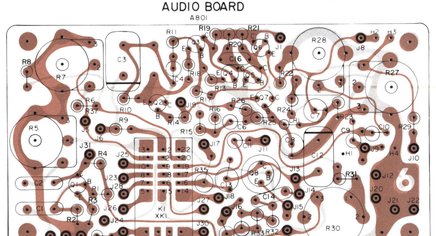


(19B205535, Sh. 1, Rev. 1)
(19B205535, Sh. 2, Rev. 1)

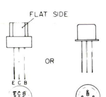
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

AUDIO BOARD

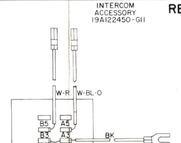
A801

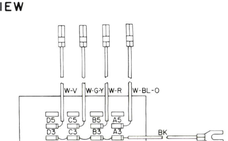


(19C303937, Sh. 1, Rev. 6)
(19C303937, Sh. 2, Rev. 6)



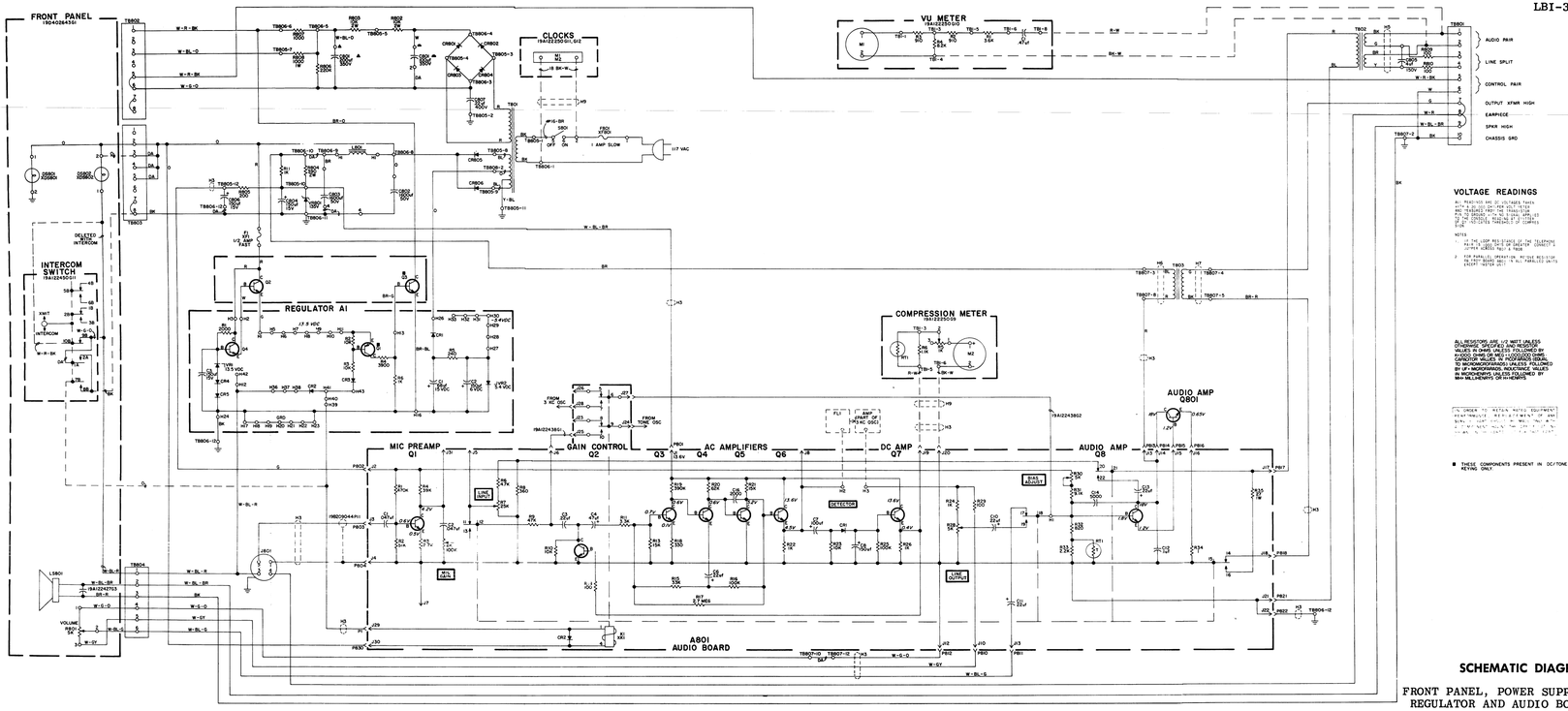
(19B640719, Rev. 0)





OUTLINE DIAGRAM

FRONT PANEL, POWER SUPPLY, REGULATOR AND AUDIO BOARD



SCHEMATIC DIAGRAM

FRONT PANEL, POWER SUPPLY, REGULATOR AND AUDIO BOARD

PARTS LIST

LBI-3812

FRONT PANEL, POWER SUPPLY, REGULATOR BOARD A1
and AUDIO BOARD A801

SYMBOL	G-E PART NO.	DESCRIPTION
		FRONT PANEL PL-19D602643-G1
		- - - - - - - - - INDICATING DEVICES - - - - - - - - -
DS801 and DS802	19C307037-P20	Lamp, incandescent: 28 v; sim to G-E 757.
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS801	5491260-P7	Permanent magnet, 5-inch: 3.2 ohms ±10% voice coil imp, 15 w max operating, 385 cps ±15% resonance, paper dust cap; sim to Jensen Model PD-T5S1275U.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R801	5496870-P11	Variable, carbon film: 5000 ohms ±20%, 0.5 w; sim to Mallory LC(5K).
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XDS801	19B209343-P2	Lampholder: sim to Leecraft 7-04-1.
XDS802	19B209343-P1	Lampholder: sim to Leecraft 7-04.
A1		REGULATOR BOARD PL-19B205538-G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267-P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2	5496267-P3	Tantalum: 150 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C3	5496267-P12	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	4037822-P1	Silicon.
CR2 thru CR5	19A115250-P1	Silicon.
VR1	4036887-P10	Silicon, Zener.
VR2	4036887-P5	Silicon, Zener.
		- - - - - - - - - PLUGS - - - - - - - - -
P1	4029840-P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q4	19A115300-P1	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3877-P203J	Composition: 2000 ohms ±5%, 1/2 w.
R2 and R3	3877-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R4	3877-P393J	Composition: 3900 ohms ±5%, 1/2 w.
R5	3877-P241K	Composition: 240 ohms ±10%, 1/2 w.
R6	3877-P102K	Composition: 1000 ohms ±10%, 1/2 w.

SYMBOL	G-E PART NO	DESCRIPTION
		MODIFICATION KITS Tone Keying Kit PL-19A122427-G1 DC/Tone Keying Kit PL-19A122427-G2
		- - - - - - - - - - FUSES - - - - - - - - - -
F1	1K16-P1	Quick blowing: 1/2 amp at 250 v; sim to Littelfuse 312,500 or Bussmann AGC-1/2.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P474J	Composition: 0.47 megohm ±5%, 1/2 w.
R2	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R3	3R77-P272J	Composition: 2700 ohms ±5%, 1/2 w.
R4	3R77-P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R5	19B209115-P7	Variable, carbon film: 100,000 ohms ±20%, .05 w; sim to CTS Type UPR-70.
R6	3R77-P473K	Composition: 47000 ohms ±10%, 1/2 w.
R7	19B209115-P6	Variable, carbon film: 20,000 ohms ±20%, .05 w; sim to CTS Type UPR-70.
R8	3R77-P361J	Composition: 360 ohms ±5%, 1/2 w.
R9	3R77-P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R10	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R11	3R77-P332J	Composition: 3300 ohms ±5%, 1/2 w.
R13	3R77-P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R14	3R77-P103J	Composition: 100 ohms ±5%, 1/2 w.
R15	3R77-P333J	Composition: 33,000 ohms ±5%, 1/2 w.
R16	3R77-P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R17	3R77-P275J	Composition: 2.7 megohms ±5%, 1/2 w.
R18	3R77-P331J	Composition: 330 ohms ±5%, 1/2 w.
R19	3R77-P394J	Composition: 0.39 megohm ±5%, 1/2 w.
R20	3R77-P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R21	3R77-P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R22	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R23	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R24	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R25	3R77-P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R26	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R28	19B209115-P4	Variable, carbon film: 5000 ohms ±20%, .08 w; sim to CTS Type UPR-70.
R29	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R30	19B209113-P7	Variable, wirewound: 5000 ohms ±20%, 2.5 w; sim to CTS Series 110.
R31	3R77-P912K	Composition: 9100 ohms ±10%, 1/2 w.
R32	3R77-P821K	Composition: 820 ohms ±10%, 1/2 w.
R33	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R34	19B209115-P15	Wirewound: 1 ohm ±5%, 2 w; sim to IRC Type BWH.
R35	3R78-P270K	Composition: 27 ohms ±10%, 1 w.
		- - - - - - - THERMISTORS - - - - - - -
RT1	19B209143-P2	Rod: 4000 ohms ±10%; sim to Global Type 788F-12.
		- - - - - - - SOCKETS - - - - - - -
XR1	19B209172-P1	Relay, phen: 22 contacts; sim to Allied Control 30054-34.
		- - - - - - - CAPACITORS - - - - - - -
C801	7772471-P42	Electrolytic: 100-200 µf +100% -10%, 300 VDCW; sim to Mallory Type TP.
C802 and C803	7476443-P30	Electrolytic: 1600 µf +250% -10%, 50 VDCW; sim to PR Mallory WP-068.
C804	5496367-P12	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C805	7486445-P1	Electrolytic: 4 µf +100% -10%, 150 VDCW.

SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q7	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q8	19A115300-P2	Silicon, NPN; sim to Type 2N3053.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P474J	Composition: 0.47 megohm ±5%, 1/2 w.
R2	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R3	3R77-P272J	Composition: 2700 ohms ±5%, 1/2 w.
R4	3R77-P393J	Composition: 39,000 ohms ±5%, 1/2 w.
R5	19B209115-P7	Variable, carbon film: 100,000 ohms ±20%, .05 w; sim to CTS Type UPR-70.
R6	3R77-P473K	Composition: 47000 ohms ±10%, 1/2 w.
R7	19B209115-P6	Variable, carbon film: 20,000 ohms ±20%, .05 w; sim to CTS Type UPR-70.
R8	3R77-P361J	Composition: 360 ohms ±5%, 1/2 w.
R9	3R77-P473K	Composition: 47,000 ohms ±10%, 1/2 w.
R10	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R11	3R77-P332J	Composition: 3300 ohms ±5%, 1/2 w.
R13	3R77-P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R14	3R77-P103J	Composition: 100 ohms ±5%, 1/2 w.
R15	3R77-P333J	Composition: 33,000 ohms ±5%, 1/2 w.
R16	3R77-P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R17	3R77-P275J	Composition: 2.7 megohms ±5%, 1/2 w.
R18	3R77-P331J	Composition: 330 ohms ±5%, 1/2 w.
R19	3R77-P394J	Composition: 0.39 megohm ±5%, 1/2 w.
R20	3R77-P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R21	3R77-P153J	Composition: 15,000 ohms ±5%, 1/2 w.
R22	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R23	3R77-P103K	Composition: 10,000 ohms ±10%, 1/2 w.
R24	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R25	3R77-P104K	Composition: 0.1 megohm ±10%, 1/2 w.
R26	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R28	19B209115-P4	Variable, carbon film: 5000 ohms ±20%, .08 w; sim to CTS Type UPR-70.
R29	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R30	19B209113-P7	Variable, wirewound: 5000 ohms ±20%, 2.5 w; sim to CTS Series 110.
R31	3R77-P912K	Composition: 9100 ohms ±10%, 1/2 w.
R32	3R77-P821K	Composition: 820 ohms ±10%, 1/2 w.
R33	3R77-P222K	Composition: 2200 ohms ±10%, 1/2 w.
R34	19B209115-P15	Wirewound: 1 ohm ±5%, 2 w; sim to IRC Type BWH.
R35	3R78-P270K	Composition: 27 ohms ±10%, 1 w.
		- - - - - - - THERMISTORS - - - - - - -
RT1	19B209143-P2	Rod: 4000 ohms ±10%; sim to Global Type 788F-12.
		- - - - - - - SOCKETS - - - - - - -
XR1	19B209172-P1	Relay, phen: 22 contacts; sim to Allied Control 30054-34.
		- - - - - - - CAPACITORS - - - - - - -
C801	7772471-P42	Electrolytic: 100-200 µf +100% -10%, 300 VDCW; sim to Mallory Type TP.
C802 and C803	7476443-P30	Electrolytic: 1600 µf +250% -10%, 50 VDCW; sim to PR Mallory WP-068.
C804	5496367-P12	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C805	7486445-P1	Electrolytic: 4 µf +100% -10%, 150 VDCW.

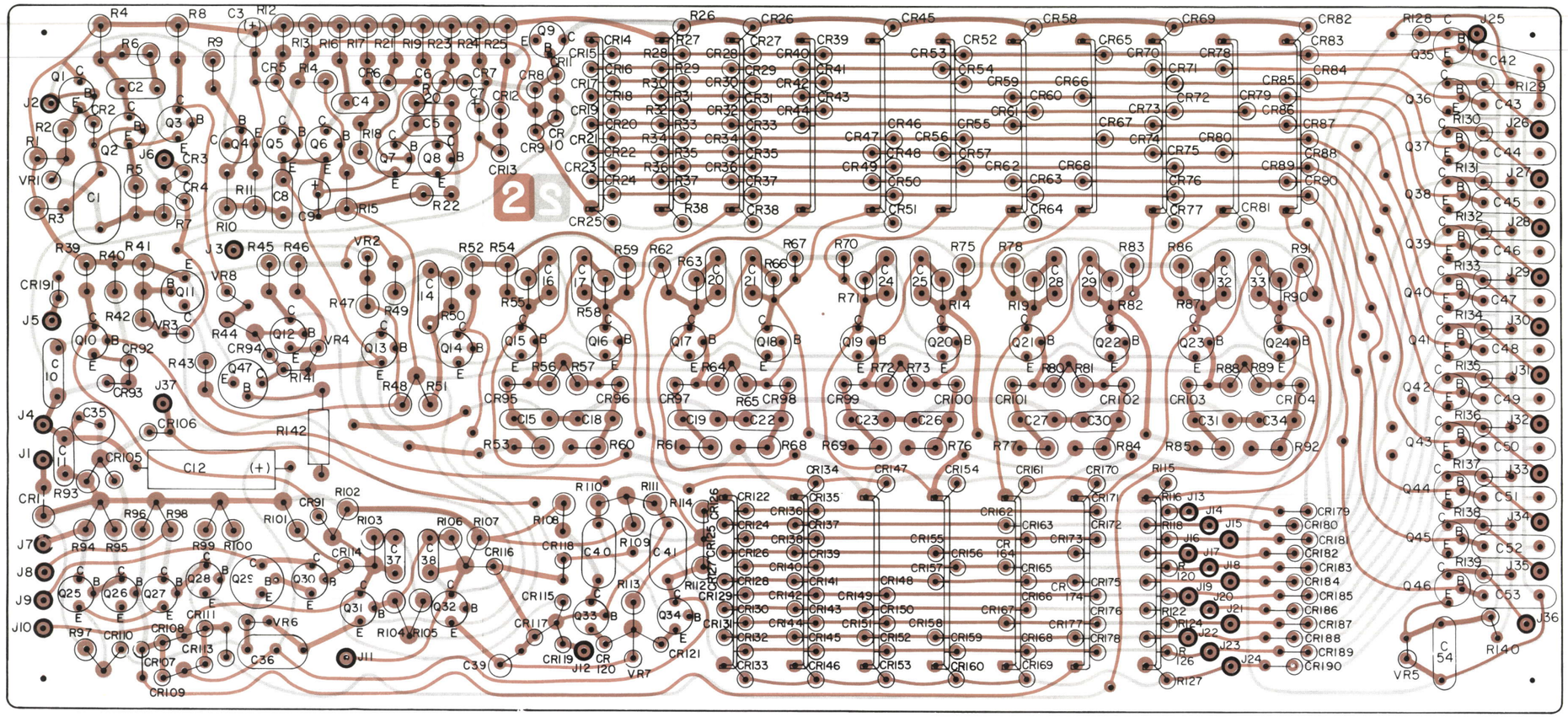
SYMBOL	G-E PART NO	DESCRIPTION
C806	5496267-P12	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C807	19A115028-P49	Polyester: .022 µf ±20%, 400 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR801 thru CR804	19A122325-P1	Silicon.
CR805 and CR806	4037822-P1	Silicon.
		- - - - - - - - - FUSES - - - - - - - - -
F801	7487942-P5	Slow blowing: 1 amp at 250 v; sim to Bussmann MDL-1.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J801	7117934-P2	Connector, chassis: 4 female contacts; sim to Amphenol Type 91-PC4F.
		- - - - - - - - - INDUCTORS - - - - - - - - -
L801	19A115671-P1	Reactor: 0.21 h min, 7.5 ohms DC res max, 20 VDC operating.
		- - - - - - - - - PLUGS - - - - - - - - -
P801 thru P803	4029840-P2	Contact, electrical: sim to AMP 42827-2.
P804	4029840-P1	Contact, electrical: sim to AMP 41854.
P810 thru P818	4029840-P2	Contact, electrical: sim to AMP 42827-2.
P821 thru P830	4029840-P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q801	19A115527-P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R802 and R803	3R78-P103K	Composition: 10,000 ohms ±10%, 2 w.
R804	3R78-P391K	Composition: 390 ohms ±10%, 2 w.
R805	3R77-P201K	Composition: 200 ohms ±10%, 1/2 w.
R806	3R77-P224J	Composition: 0.22 megohm ±5%, 1/2 w.
R807	3R77-P102K	Composition: 1000 ohms ±10%, 1/2 w.
R808	3R78-P102K	Composition: 1000 ohms ±10%, 1 w.
R809 and R810	3R78-P101J	Composition: 100 ohms ±5%, 1 w.
		- - - - - - - - - SWITCHES - - - - - - - - -
S801	7145098-P1	Slide: DPDT, 0.75 amp at 125 VAC or 0.5 amp at 125 VDC; sim to Stackpole SS-150.
		- - - - - - - TRANSFORMERS - - - - - - -
T801	19A115677-P1	Power, step-down, step-up: Pri: 117 VRMS ±20%, Sec: 9.7/18.5/125 VDC.
T802	19A115672-P1	Audio freq: 0.3-6 KC freq range, Pri: 9 ohms ±15% DC res, Sec 1: 16 ohms ±15% DC res, Sec 2: 16 ohms ±15% DC res.
T803	19A115612-P1	Audio freq: 0.3-3 KC freq range, Pri: 24.5 ohms ±5% imp, 1.28 ohms DC res, Sec: 3.3 ohms imp, 0.16 ohm DC res.
		- - - - - - - TERMINAL BOARDS - - - - - - -
TB801	7117710-P10	Phen: 10 terminals; sim to Cinch 1799.
TB802 and TB803	7117710-P8	Phen: 8 terminals; sim to Cinch 1780.

SYMBOL	G-E PART NO	DESCRIPTION
TB804	7117710-P6	Phen: 6 terminals; sim to Cinch 1776.
TB805 thru TB807	7775500-P28	Phen: 12 terminals.
TB808	7775500-P104	Phen: 2 terminals.
		- - - - - - - VOLTAGE REGULATORS - - - - - - -
VR801	4036887-P10	Silicon, Zener.
		- - - - - - - CABLES - - - - - - -
W801	4036441-P7	Cable, power: 2 conductor with 2-contact plug, approx 7 feet long.
		- - - - - - - SOCKETS - - - - - - -
XF801	19B209005-P1	Fuseholder, post type: 15 amps at 250 v; sim to Littelfuse 342012.
		- - - - - - - FILTERS - - - - - - -
FL1	PL-19C304250-G1	Lowpass Filter.
		SPEAKER KIT PL-19A122427-G3
		- - - - - - - - - CAPACITORS - - - - - - - - -
	19B209233-P1	Electrolytic: 25 µf ±20%, 25 VDCW; sim to Sprague Type D37461.
		MECHANICAL PARTS
	19B205292-P1	Window: clear plastic, (Used in Remote Control Front Panel, PL-19D602643-G1).
	19B204949-P2	Jewel: white transparent plastic, (Used in Remote Control Front Panel, PL-19D602643-G1).
	19B204949-P1	Jewel: red transparent plastic, (Used with DS802 in Remote Control Front Panel, PL-19D602643-G1).
	19A115679-P1	Knob, push-on: black plastic; sim to Rohden 25107.5-7E, (Used with S801 and Dummy button in Remote Control Front Panel, PL-19D602643-G1).
	8529-P16D	Button, plug, (Used in Remote Control Panel, PL-19D602643-G1).
	19C307036-P6	Nut, push-on: sim to Tinnerman C1522S5S-010, (Retains jewels in Remote Control Front Panel, PL-19D602643-G1).
	19B204045-P3	Dummy button: gray plastic, (Used in Remote Control Front Panel, PL-19D602643-G1).
	19A115725-P1	Bushing, strain relief, cable: natural nylon; sim to Pastex 22S-203302-00, (Used with W801 in Remote Control Chassis, PL-19D500826-G1).
	19A122217-P1	Heat sink, (Used with Q801 in Remote Control Chassis, PL-19D500826-G1).
	4029851-P8	Clip, loop: black nylon; sim to Wackesser 7/16-4-129, (Located at TB804 in Remote Control Chassis, PL-19D500826-G1).
	4035439-P1	Heat sink: sim to Birtcher 2AL-635-2B, (Used with Q8 in Component Board, PL-19C303936-G2).
	4036555-P1	Insulator, washer: nylon, (Used with Q8 in Component Board, PL-19C303936-G2 and Q4 in Regulator Board PL-19B205536-G1).
	19A115368-P1	Retainer, relay: sim to Allied Control 30040-2, (Used with K1 in Component Board PL-19C303936-G2).
	PL-19A122161-G1	Top Cover.
	19A121759-P1	Turn screw: 1/4-20 threads, (Used in Top Cover, PL-19A122161-G1).
	4036436-P2	Lockwasher, push-on: sim to Pastex 8063-21-00, (Used in Top Cover, PL-19A122161-G1).
	PL-19B205299-G1	Bottom Cover.

SYMBOL	G-E PART NO	DESCRIPTION
		ACCESSORY KITS PL-19A122450-G2
		COMPRESSION METER PL-19A122250-G8
		METER ASSEMBLY PL-19B205370-G2
M2	19A115695-P1	- - - - - - - - - METERS - - - - - - - - - Panel, DC: 1 ma mechanism.
		- - - - - - - - - RESISTORS - - - - - - - - -
R5	PL-19A122260-G1	Board Assembly: variable, wirewound, 1000 ohms ±20%, 2 w; sim to CTS BL3763 (modified).
R6	3R77-P113J	Composition: 1100 ohms ±5%, 1/2 w.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1	5490828-P33	Rod: 2200 ohms ±10%; sim to Global Type 032SP.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500-P24	Phen: 8 terminals.
		VU METER PL-19A122250-G10
		METER ASSEMBLY PL-19B205370-G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A115028-P59	Polyester: 0.47 µf ±20%, 400 VDCW.
		- - - - - - - - - METERS - - - - - - - - -
M1	19A115713-P1	Audio level, VU: -20 to +3 scale.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77-P362J	Composition: 3600 ohms ±5%, 1/2 w.
R2 and R3	3R77-P911J	Composition: 910 ohms ±5%, 1/2 w.
R4	3R77-P822J	Composition: 8200 ohms ±5%, 1/2 w.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500-P24	Phen: 8 terminals.
		12 HOUR CLOCK PL-19A122250-G11
		CLOCK ASSEMBLY PL-19B205374-G2
		- - - - - - - - - METERS - - - - - - - - -
M1	7491080-P1	Clock, cyclometer: 110 VAC, 60 cycles; sim to Pennwood Numechron 1P-12B.
		24 HOUR CLOCK PL-19A122250-G12
		CLOCK ASSEMBLY PL-19B205374-G3
		- - - - - - - - - METERS - - - - - - - - -
M2	7491080-P2	Clock, cyclometer: 110 VAC, 60 cycles; sim to Pennwood Numechron 1P-24H-AK/PW.
		INTERCOM SWITCH KIT PL-19A122450-G11
		- - - - - - - - - SWITCHES - - - - - - - - -
S1	19B205335-G2	Lever: momentary, 1 form A, 1 form B and 2 form C contacts; sim to Switchcraft 28000.

SYMBOL	G-E PART NO	DESCRIPTION
		FUNCTION LIGHT AND SWITCH KIT PL-19A122450-G4 - G8
		- - - - - - - - - SWITCHES - - - - - - - - -
S1	19B205539-G1	Push, momentary: 2 buttons, 1 form A contact; sim to Oak 247199-130, (Used in P1-19A122450-G1, 2, 3, 7 and 8).
S1	19B205540-G1	Push, momentary: 4 buttons, 1 form A contact; sim to Oak 247200-130, (Used in PL-19A122450-G4 - G7).
		- - - - - - - - - INDICATING DEVICES - - - - - - - - -
	19A122303-G1	Push button (T-P1), (Used in PL-19A122450-G1, 3, 4, 5, 7).
R5	PL-19A122260-G1	Board Assembly: variable, wirewound, 1000 ohms ±20%, 2 w; sim to CTS BL3763 (modified).
R6	3R77-P113J	Composition: 1100 ohms ±5%, 1/2 w.
	19A122250-G2	Push button (T-P2), (Used in PL-19A122450-G1, 3, 4, 5, 7).
	19A122305-G3	Push button (T-P3), (Used in PL-19A122450-G4, 5).
	19A122305-G4	Push button (T-P4), (Used in PL-19A122450-G8).
	19A122305-G5	Push button (B-P1), (Used in PL-19A122450-G2 thru G7).
	19A122205-G6	Push button (B-P2), (Used in PL-19A122450-G2 thru G7).
	19A122305-G7	Push button (B-P3), (Used in PL-19A122450-G4, 5).
	19A122305-G8	Push button (B-P4), (Used in PL-19A122450-G5).
	19A122305-G14	Push button (T-P2), (Used in PL-19A122450-G6, 7).
	19A122305-G11	Push button (CG), (Used in PL-19A122450-G8).
	19A122305-G16	Push button (MON), (Used in PL-19A122450-G8).
		LAMP ASSEMBLY PL-19B205541-G1 (Used with PL-19A122450-G1 thru G8)
		- - - - - - - - - INDICATING DEVICES - - - - - - - - -
DS1 and DS2	19C307037-P20	Lamp, incandescent: 28 v; sim to G-E 757.
		- - - - - - - - - SOCKETS - - - - - - - - -
XDS1 and XDS2	19B209342-P1	Lampholder: sim to Leecraft 7-04.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

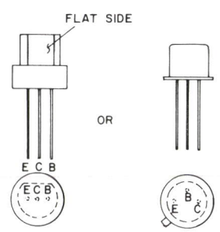


RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

LEAD ORIENTATION FOR
CR122 THRU CR133
CR135 THRU CR146
CR148 THRU CR153
CR155 THRU CR160
CR162 THRU CR169
CR171 THRU CR178
CR26, CR45, CR58, CR69
& CR82

LEAD ORIENTATION FOR
CR27 THRU CR44
CR46 THRU CR57
CR59 THRU CR68
CR70 THRU CR81
CR83 THRU CR90
CR134, CR147, CR154
CR161 & CR170
CR14 THRU CR25

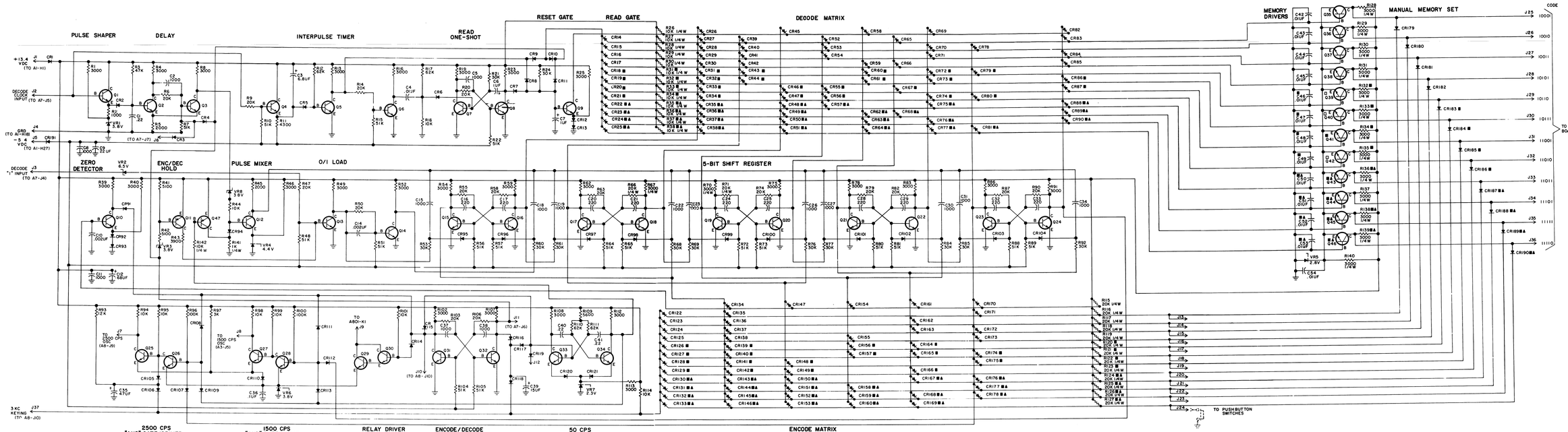
(19D402877, Rev. 0)
(19D402739, Sh. 1, Rev. 2)
(19D402739, Sh. 2, Rev. 2)



LEAD IDENTIFICATION
FOR Q1 THRU Q47

OUTLINE DIAGRAM

LOGIC BOARD A2
ENCODE/DECODE



SCHEMATIC DIAGRAM

LOGIC BOARD A2
ENCODE/DECODE

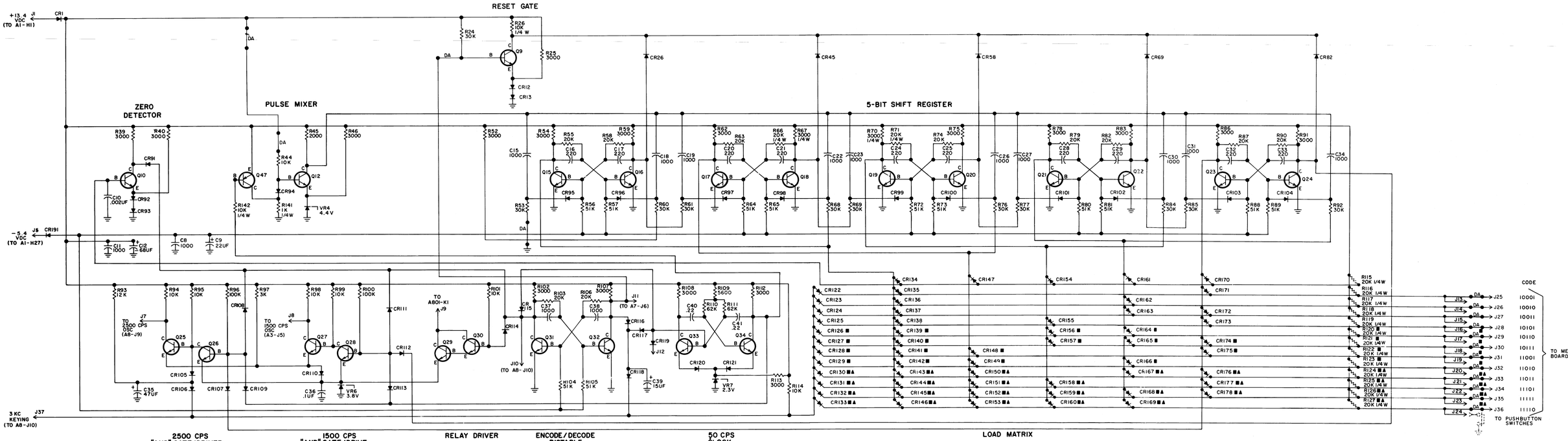
PARTS LIST

LBI-3803

LOGIC BOARD - A2
ENCODE/DECODE
PL-193D402742-G1-3

SYMBOL	G-E PART NO.	DESCRIPTION
		PL-193D402742-G1 12 Function PL-193D402742-G2 8 Function PL-193D402742-G3 4 Function
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	198D209243-P109	Polyester: 0.22 µf ±10%, 40 VDCW.
C2	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3	5496267-P218	Tantalum, dry solid: 6.8 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C4	5491189-P201	Polyester: .01 µf ±5%, 50 VDCW.
C5	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C6 and C7	5496267-P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C8	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	5494481-P113	Ceramic disc: .002 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C11	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	5496267-P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C14	5494481-P113	Ceramic disc: .002 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C15	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C16 and C17	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C18 thru C19	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C20 and C21	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C22 and C23	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C24 and C25	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C26 and C27	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C28 and C29	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C30 and C31	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C32 and C33	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C34	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C35	5496267-P215	Tantalum: 47 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C36	198D209243-P7	Polyester: 0.1 µf ±20%, 40 VDCW.
C37 and C38	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C39	5496267-P214	Tantalum: 15 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C40 and C41	198D209243-P109	Polyester: 0.22 µf ±10%, 40 VDCW.
C42 thru C45	198D209243-P1	Polyester: .01 µf ±20%, 40 VDCW.
C46 thru C49	198D209243-P1	Polyester: .01 µf ±20%, 40 VDCW. (Used in 8 and 12 Function).
C50 thru C53	198D209243-P1	Polyester: .01 µf ±20%, 40 VDCW. (Used in 12 Function only).
C54	198D209243-P1	Polyester: .01 µf ±20%, 40 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	4037822-P1	Silicon.
CR2 thru CR17	194A115250-P1	Silicon.
CR18 thru CR21	194A115250-P1	Silicon. (Used in 8 and 12 Function only). sim to RMC Type JF Discap.
CR22 thru CR25	194A115250-P1	Silicon. (Used in 12 Function only).
CR26 thru CR30	194A115250-P1	Silicon.
CR31 thru CR34	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR35 thru CR38	194A115250-P1	Silicon. (Used in 12 Function only).
CR39 thru CR42	194A115250-P1	Silicon.
CR43 and CR44	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR45	194A115250-P1	Silicon.
CR46 and CR47	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR48 thru CR49	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR50 thru CR53	194A115250-P1	Silicon. (Used in 12 Function only).
CR54 and CR55	194A115250-P1	Silicon.
CR56 and CR57	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR58 thru CR60	194A115250-P1	Silicon. (Used in 12 Function only).
CR61 thru CR63	194A115250-P1	Silicon.
CR64 thru CR66	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR67 thru CR69	194A115250-P1	Silicon. (Used in 12 Function only).
CR70 thru CR73	194A115250-P1	Silicon.
CR74 and CR75	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR76 thru CR78	194A115250-P1	Silicon. (Used in 12 Function only).
CR79 thru CR82	194A115250-P1	Silicon.
CR83 thru CR86	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR87 thru CR90	194A115250-P1	Silicon. (Used in 12 Function only).
CR91 thru CR125	194A115250-P1	Silicon.
CR126 thru CR129	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR130 thru CR133	194A115250-P1	Silicon. (Used in 12 Function only).
CR134 thru CR138	194A115250-P1	Silicon.
CR139 thru CR142	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR143 thru CR146	194A115250-P1	Silicon. (Used in 12 Function only).
CR147	194A115250-P1	Silicon.
CR148 and CR149	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR150 thru CR153	194A115250-P1	Silicon. (Used in 12 Function only).
CR154 and CR155	194A115250-P1	Silicon.
CR156 and CR157	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR158 thru CR160	194A115250-P1	Silicon. (Used in 12 Function only).
CR161 thru CR163	194A115250-P1	Silicon.
CR164 thru CR166	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR167 thru CR169	194A115250-P1	Silicon. (Used in 12 Function only).
CR170 thru CR173	194A115250-P1	Silicon.
CR174 and CR175	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR176 thru CR178	194A115250-P1	Silicon. (Used in 12 Function only).
CR179 thru CR182	194A115250-P1	Silicon.
CR183 thru CR186	194A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR187 thru CR190	194A115250-P1	Silicon. (Used in 12 Function only).
CR191	194A115250-P1	Silicon.
VR1	4036887-P3	Silicon, Zener*.
VR2	4036887-P6	Silicon, Zener*.
VR3	4036887-P3	Silicon, Zener*.
VR4	4036887-P4	Silicon, Zener*.
VR5	4036887-P2	Silicon, Zener*.
VR6	4036887-P3	Silicon, Zener*.
VR7	4036887-P1	Silicon, Zener*.
VR8	4036887-P3	Silicon, Zener*.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1 thru J37	4033513-P15	Contact, electrical: sim to Bead Chain 840-1A.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q10	194A115123-P1	Silicon, NPN: sim to Type 2N2712.
Q11	194A115706-P1	Silicon, PNP: sim to Type 2N3638.
Q12 thru Q28	194A115123-P1	Silicon, NPN: sim to Type 2N2712.
Q29	194A115300-P1	Silicon, NPN: sim to Type 2N3053.
Q30 thru Q38	194A115123-P1	Silicon, NPN: sim to Type 2N2712.
Q39 thru Q42	194A115123-P1	Silicon, NPN: sim to Type 2N2712. (Used in 8 and 12 Function only).
Q43 thru Q46	194A115123-P1	Silicon, NPN: sim to Type 2N2712. (Used in 12 Function only).
Q47	194A115706-P1	Silicon, PNP: sim to Type 2N3638.
		- - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R2	3R77-P103J	Composition: 1000 ohms ±5%, 1/2 w.
R3	3R77-P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R4	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R5	3R77-P202J	Composition: 2000 ohms ±5%, 1/2 w.
R6	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R7	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R8	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R9	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R10	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R11	3R77-P432J	Composition: 4300 ohms ±5%, 1/2 w.
R12	3R77-P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R13	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R14	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R15	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R16	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R17	3R77-P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R18	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R19	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R20	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R21	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R22	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R23	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R24	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R25	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R26 thru R30	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R31 thru R34	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w. (Used in 8 and 12 Function only).
R35 thru R38	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w. (Used in 12 Function only).
R39 and R40	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R41 and R42	3R77-P512J	Composition: 5100 ohms ±5%, 1/2 w.
R43	3R77-P392J	Composition: 3900 ohms ±5%, 1/2 w.
R44	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R45	3R77-P202J	Composition: 2000 ohms ±5%, 1/2 w.
R46	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R47	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R48	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R49	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R50	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R51	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R52	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R53	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R54	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R55	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R56 and R57	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R58	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R59	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R60 and R61	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R62	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R63	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R64 and R65	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R66	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R67	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R68 and R69	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R70	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R71	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R72 and R73	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R74	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R75	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R76 and R77	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R78	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R79	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R80 and R81	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R82	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R83	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R84 and R85	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R86	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R87	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R88 and R89	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R90	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R91	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R92	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R93	3R77-P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R94 and R95	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R96	3R77-P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R97	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R98 and R99	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R100	3R77-P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R101	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R102	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R103	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R104 and R105	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R106	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R107 and R108	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R109	3R77-P563J	Composition: 5600 ohms ±5%, 1/2 w.
R110 and R111	3R77-P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R112 and R113	3R77-P303J	Composition: 3000 ohms ±5%, 1/2 w.
R114	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R115 thru R119	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R120 thru R123	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w. (Used in 8 and 12 Function only).
R124 thru R127	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w. (Used in 12 Function only).
R128 thru R131	3R152-P303J	Composition: 3000 ohms ±5%, 1/4 w.
R132 thru R135	3R152-P303J	Composition: 3000 ohms ±5%, 1/4 w. (Used in 8 and 12 Function only).
R136 thru R139	3R152-P303J	Composition: 3000 ohms ±5%, 1/4 w. (Used in 12 Function only).
R140	3R152-P303J	Composition: 3000 ohms ±5%, 1/4 w.
R141	3R152-P103J	Composition: 1000 ohms ±5%, 1/4 w.
R142	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	4036555-P1	Insulator, washer: nylon. (Used with Q11 and Q29).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



▲ OMIT IN GROUP 5, 8 FUNCTION ENCODE.

■ OMIT IN GROUP 6, 4 FUNCTION ENCODE.

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

(19R620771, Rev. 3)

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
PLI9040274G4	
PLI9040274G5	
PLI9040274G6	

SCHEMATIC DIAGRAM

LOGIC BOARD A2
ENCODE ONLY

LBI-3800

PARTS LIST

LBI-3804

LOGIC BOARD - A2
ENCODE
PL-19D402742-G4-6

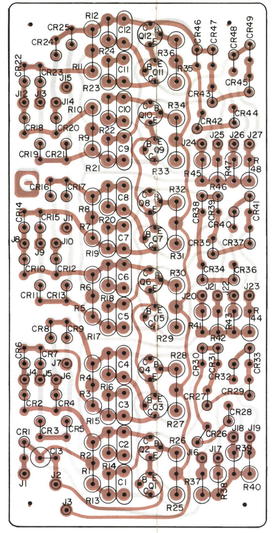
SYMBOL	G-E PART NO.	DESCRIPTION
		PL-19D402742-G4 12 Function PL-19D402742-G5 8 Function PL-19D402742-G6 4 Function
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C8	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	5494481-P113	Ceramic disc: .002 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C11	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	5496267-P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C15	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C16 and C17	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C18 and C19	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C20 and C21	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C22 and C23	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C24 and C25	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C26 and C27	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C28 and C29	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C30 and C31	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C32 and C33	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C34	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C35	5496267-P215	Tantalum, dry solid: 47 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C36	19B209243-P7	Polyester: 0.1 µf ±20%, 40 VDCW.
C37 and C38	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C39	5496267-P214	Tantalum: 15 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C40 and C41	19B209243-P109	Polyester: 0.22 µf ±10%, 40 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	4037822-P1	Silicon.
CR12 and CR13	19A115250-P1	Silicon.
CR26	19A115250-P1	Silicon.
CR45	19A115250-P1	Silicon.

SYMBOL	G-E PART NO	DESCRIPTION
CR58	19A115250-P1	Silicon.
CR69	19A115250-P1	Silicon.
CR82	19A115250-P1	Silicon.
CR91 thru CR125	19A115250-P1	Silicon.
CR126 thru CR129	19A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR130 thru CR133	19A115250-P1	Silicon. (Used in 12 Function only).
CR134 thru CR138	19A115250-P1	Silicon.
CR139 thru CR142	19A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR143 thru CR146	19A115250-P1	Silicon. (Used in 12 Function only).
CR147	19A115250-P1	Silicon.
CR148 and CR149	19A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR150 thru CR153	19A115250-P1	Silicon. (Used in 12 Function only).
CR154 and CR155	19A115250-P1	Silicon.
CR156 and CR157	19A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR158 thru CR160	19A115250-P1	Silicon. (Used in 12 Function only).
CR161 thru CR163	19A115250-P1	Silicon.
CR164 thru CR166	19A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR167 thru CR169	19A115250-P1	Silicon. (Used in 12 Function only).
CR170 thru CR173	19A115250-P1	Silicon.
CR174 and CR175	19A115250-P1	Silicon. (Used in 8 and 12 Function only).
CR176 thru CR178	19A115250-P1	Silicon. (Used in 12 Function only).
CR191	19A115250-P1	Silicon.
VR4	4036887-P4	Silicon, Zeners.
VR5	4036887-P3	Silicon, Zeners.
VR7	4036887-P1	Silicon, Zeners.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J37	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q9 and Q10	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q12	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q13 thru Q28	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q29	19A115300-P1	Silicon, NPN: sim to Type 2N3053.
Q30 thru Q34	19A115123-P1	Silicon, NPN: sim to Type 2N2712.
Q47	19A115706-P1	Silicon, PNP: sim to Type 2N3638.

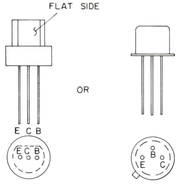
SYMBOL	G-E PART NO	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R24	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R25	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R26	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R39 and R40	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R44	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R45	3R77-P202J	Composition: 2000 ohms ±5%, 1/2 w.
R46	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R52	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R53	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R54	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R55	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R56 and R57	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R58	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R59	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R60 and R61	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R62	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R63	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R64 and R65	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R66	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R67	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R68 and R69	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R70	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R71	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R72 and R73	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R74	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R75	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R76 and R77	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R78	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R79	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R80 and R81	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R82	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R83	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R84 and R85	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R86	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R87	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R88 and R89	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R90 and R91	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R91	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R92	3R77-P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R93	3R77-P123J	Composition: 12,000 ohms ±5%, 1/2 w.
R94 and R95	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.

SYMBOL	G-E PART NO	DESCRIPTION
R96	3R77-P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R97	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R98 and R99	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R100	3R77-P104J	Composition: 0.1 megohm ±5%, 1/2 w.
R101	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R102	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R103	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R104 and R105	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R106	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R107 and R108	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R109	3R77-P562J	Composition: 5600 ohms ±5%, 1/2 w.
R110 and R111	3R77-P623J	Composition: 62,000 ohms ±5%, 1/2 w.
R112 and R113	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R114	3R77-P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R115 thru R119	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R120 thru R123	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w. (Used in 8 and 12 Function only).
R124 thru R127	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w. (Used in 8 and 12 Function only).
R141	3R152-P102J	Composition: 1000 ohms ±5%, 1/4 w.
R142	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4036555-P1	Insulator, washer: nylon. (Used with Q29).

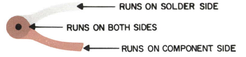
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



(19C311358, Rev. 0)
(19B205444, Sh. 1, Rev. 0)
(19B205444, Sh. 2, Rev. 0)



LEAD IDENTIFICATION
FOR Q1 THRU Q12



OUTLINE DIAGRAM

MEMORY BOARD A5

Issue 1

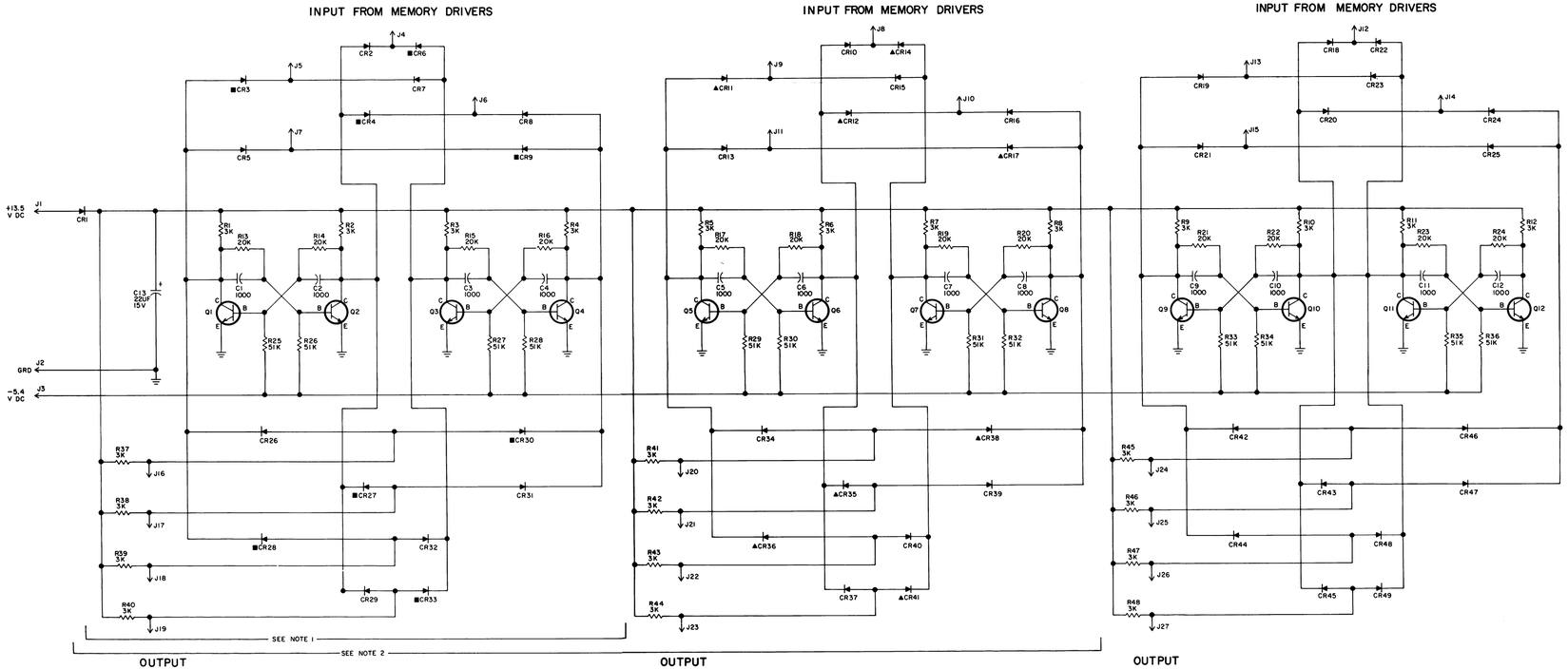
PARTS LIST

LBI-3806

MEMORY BOARD - A5
PL-19C311029-G1-5

SYMBOL	G-E PART NO.	DESCRIPTION
		PL-19C311029-G1 12 Functions (4 + 4 + 4) PL-19C311029-G2 8 Functions (4 + 4) PL-19C311029-G3 4 Functions PL-19C311029-G4 8 Functions (4 + 2 + 2) PL-19C311029-G5 4 Functions (2 + 2)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C4	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C5 thru C8	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap. (Used in PL-19C311029-G1, 2 and 4).
C9 thru C12	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap. (Used in PL-19C311029-G1).
C13	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 and CR2	19A115250-P1	Silicon.
CR3 and CR4	19A115250-P1	Silicon. (Used in PL-19C311029-G1-4).
CR5	19A115250-P1	Silicon.
CR6	19A115250-P1	Silicon. (Used in PL-19C311029-G1-4).
CR7 and CR8	19A115250-P1	Silicon.
CR9	19A115250-P1	Silicon. (Used in PL-19C311029-G1-4).
CR10	19A115250-P1	Silicon. (Used in PL-19C311029-G1, 2 and 4).
CR11 and CR12	19A115250-P1	Silicon. (Used in PL-19C311029-G1 and 2).
CR13	19A115250-P1	Silicon. (Used in PL-19C311029-G1, 2 and 4).
CR14	19A115250-P1	Silicon. (Used in PL-19C311029-G1 and 2).
CR15 and CR16	19A115250-P1	Silicon. (Used in PL-19C311029-G1, 2 and 4).
CR17	19A115250-P1	Silicon. (Used in PL-19C311029-G1 and 2).
CR18 thru CR25	19A115250-P1	Silicon. (Used in PL-19C311029-G1).
CR26	19A115250-P1	Silicon.
CR27 and CR28	19A115250-P1	Silicon. (Used in PL-19C311029-G1-4).
CR29	19A115250-P1	Silicon.
CR30	19A115250-P1	Silicon. (Used in PL-19C311029-G1-4).
CR31 and CR32	19A115250-P1	Silicon.
CR33	19A115250-P1	Silicon. (Used in PL-19C311029-G1-4).
CR34	19A115250-P1	Silicon. (Used in PL-19C311029-G1, 2 and 4).
CR35 and CR36	19A115250-P1	Silicon. (Used in PL-19C311029-G1 and 2).
CR37	19A115250-P1	Silicon. (Used in PL-19C311029-G1, 2 and 4).
CR38	19A115250-P1	Silicon. (Used in PL-19C311029-G1 and 2).
CR39 and CR40	19A115250-P1	Silicon. (Used in PL-19C311029-G1, 2 and 4).
CR41	19A115250-P1	Silicon. (Used in PL-19C311029-G1 and 2).
CR42 thru CR49	19A115250-P1	Silicon. (Used in PL-19C311029-G1).
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J27	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q4	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
Q5 thru Q8	19A115123-P1	Silicon, NPN; sim to Type 2N2712. (Used in PL-19C311029-G1, 2 and 4).
Q9 thru Q12	19A115123-P1	Silicon, NPN; sim to Type 2N2712. (Used in PL-19C311029-G1).
		- - - - - - - - - RESISTORS - - - - - - - - -
R1 thru R4	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R5 thru R8	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1, 2 and 4).
R9 thru R12	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1).
R13 thru R16	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w.
R17 thru R20	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1, 2 and 4).
R21 thru R24	3R77-P203J	Composition: 20,000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1).
R25 thru R28	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w.
R29 thru R32	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1, 2 and 4).
R33 thru R36	3R77-P513J	Composition: 51,000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1).
R37 thru R40	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R41 thru R44	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1, 2 and 4).
R45 thru R48	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w. (Used in PL-19C311029-G1).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



NOTES:
1. THESE COMPONENTS PRESENT IN GROUPS 3 & 5. COMPONENTS MARKED WITH ■ ARE OMITTED IN GROUP 5 ONLY.
2. THESE COMPONENTS PRESENT IN GROUPS 2 & 4. COMPONENTS MARKED WITH ▲ ARE OMITTED IN GROUP 4 ONLY.

G1-12 FUNCTIONS (4+4+4)
G2-8 FUNCTIONS (4+4)
G3-4 FUNCTIONS
G4-8 FUNCTIONS (4+2+2)
G5-4 FUNCTIONS (2+2)

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1,000 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 MEETING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19R620766, Rev. 1)

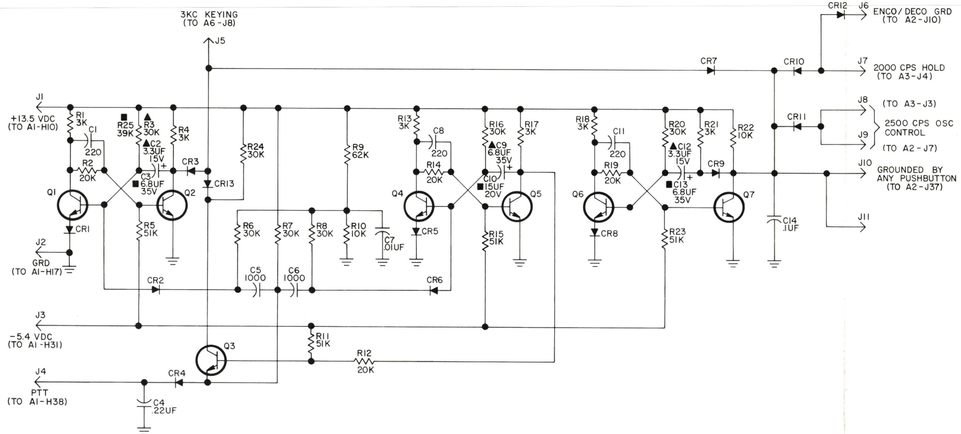
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19C311029G1	
PL19C311029G2	
PL19C311029G3	
PL19C311029G4	
PL19C311029G5	

SCHEMATIC DIAGRAM

MEMORY BOARD A5



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 MICROFARADS (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.

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
19B205633-G1	
19B205633-G2	

▲ GROUP 1 (TONE KEYING)
■ GROUP 2 (DC/TONE KEYING)

(19C311194, Rev. 1)

SCHEMATIC & OUTLINE DIAGRAM

3-KC KEYING A8

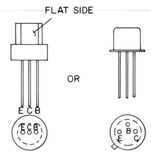
PARTS LIST

LBI-3808

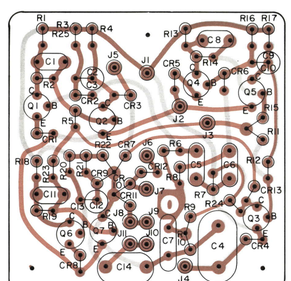
3-KC KEYING - A8
PL-19B205633-G1-2

SYMBOL	G-E PART NO.	DESCRIPTION
		PL-19B205633-G1 Tone Keying PL-19B205633-G2 DC/Tone Keying
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	5496267-P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D. (Used in PL-19B205633-G1).
C3	5496267-P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D. (Used in PL-19B205633-G2).
C4	19B209243-P9	Polyester: 0.22 µf ±20%, 40 VDCW.
C5 and C6	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	19B209243-P1	Polyester: .01 µf ±20%, 40 VDCW.
C8	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5496267-P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D. (Used in PL-19B205633-G1).
C10	5496267-P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D. (Used in PL-19B205633-G2).
C11	5494481-P103	Ceramic disc: 220 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C12	5496267-P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D. (Used in PL-19B205633-G1).
C13	5496267-P18	Tantalum: 6.8 µf ±20%, 35 VDCW; sim to Sprague Type 150D. (Used in PL-19B205633-G2).
C14	19B209243-P7	Polyester: 0.1 µf ±20%, 40 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 thru CR13	19A115250-P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1 thru J11	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q7	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R2	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R3	3R152-P303J	Composition: 30,000 ohms ±5%, 1/4 w. (Used in PL-19B205633-G1).
R4	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R5	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R6 thru R8	3R152-P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R9	3R152-P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R10	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R11	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R12	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R13	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R14	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R15	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R16	3R152-P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R17 and R18	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R19	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R20	3R152-P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R21	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R22	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R23	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R24	3R152-P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R25	3R152-P393J	Composition: 39,000 ohms ±5%, 1/4 w. (Used in PL-19B205633-G2).

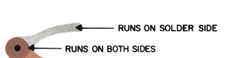
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



LEAD IDENTIFICATION
FOR Q1 THRU Q7



(19B205852, Rev. 0)
(19B205632, Sh. 1, Rev. 0)
(19B205632, Sh. 2, Rev. 0)



PARTS LIST

LBI-3807

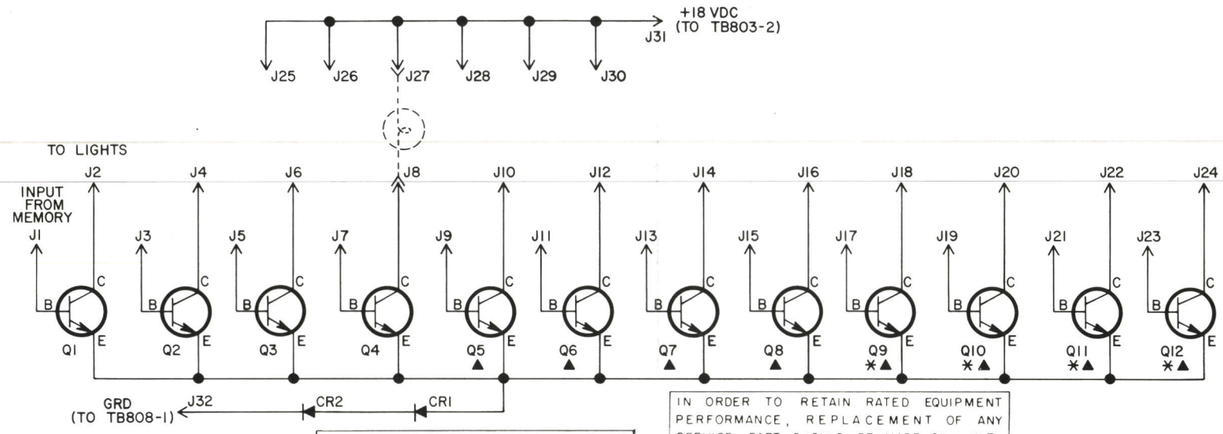
LIGHT DRIVER - A4
PL-19B205499-G1-3

SYMBOL	G-E PART NO.	DESCRIPTION
		PL-19B205499-G1 12 Functions PL-19B205499-G2 8 Functions PL-19B205499-G3 4 Functions
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 and CR2	4037822-P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1 thru J32	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q4	19A115786-P1	Silicon, NPN.
Q5 thru Q8	19A115786-P1	Silicon, NPN. (Used in PL-19B205499-G1 and 2).
Q9 thru Q12	19A115786-P1	Silicon, NPN. (Used in PL-19B205499-G1).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SCHEMATIC DIAGRAM

LBI-3800



✱ OMIT IN GROUP 2
▲ OMIT IN GROUP 3

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

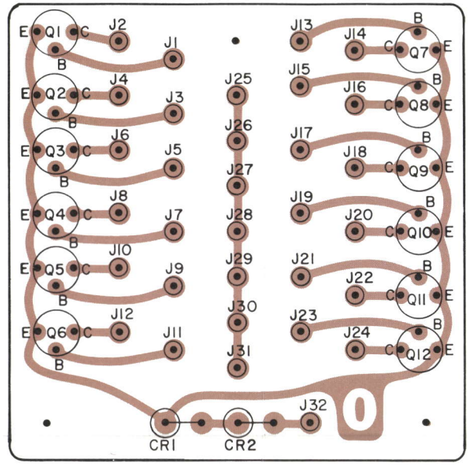
THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19B205499G1 (12 FUNCTIONS)	
PL19B205499G2 (8 FUNCTIONS)	
PL19B205499G3 (4 FUNCTIONS)	

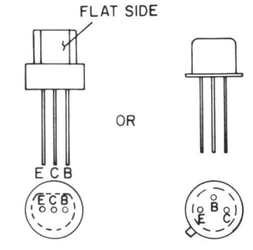
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19B205500, Rev. 1)

OUTLINE DIAGRAM



(19B205849, Rev. 0)
(19B205498, Sh. 1, Rev. 0)
(19B205498, Sh. 2, Rev. 0)



LEAD IDENTIFICATION
FOR Q1 THRU Q12

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

SCHEMATIC & OUTLINE DIAGRAM

LIGHT DRIVER A4

Issue 1 55

SCHEMATIC DIAGRAM

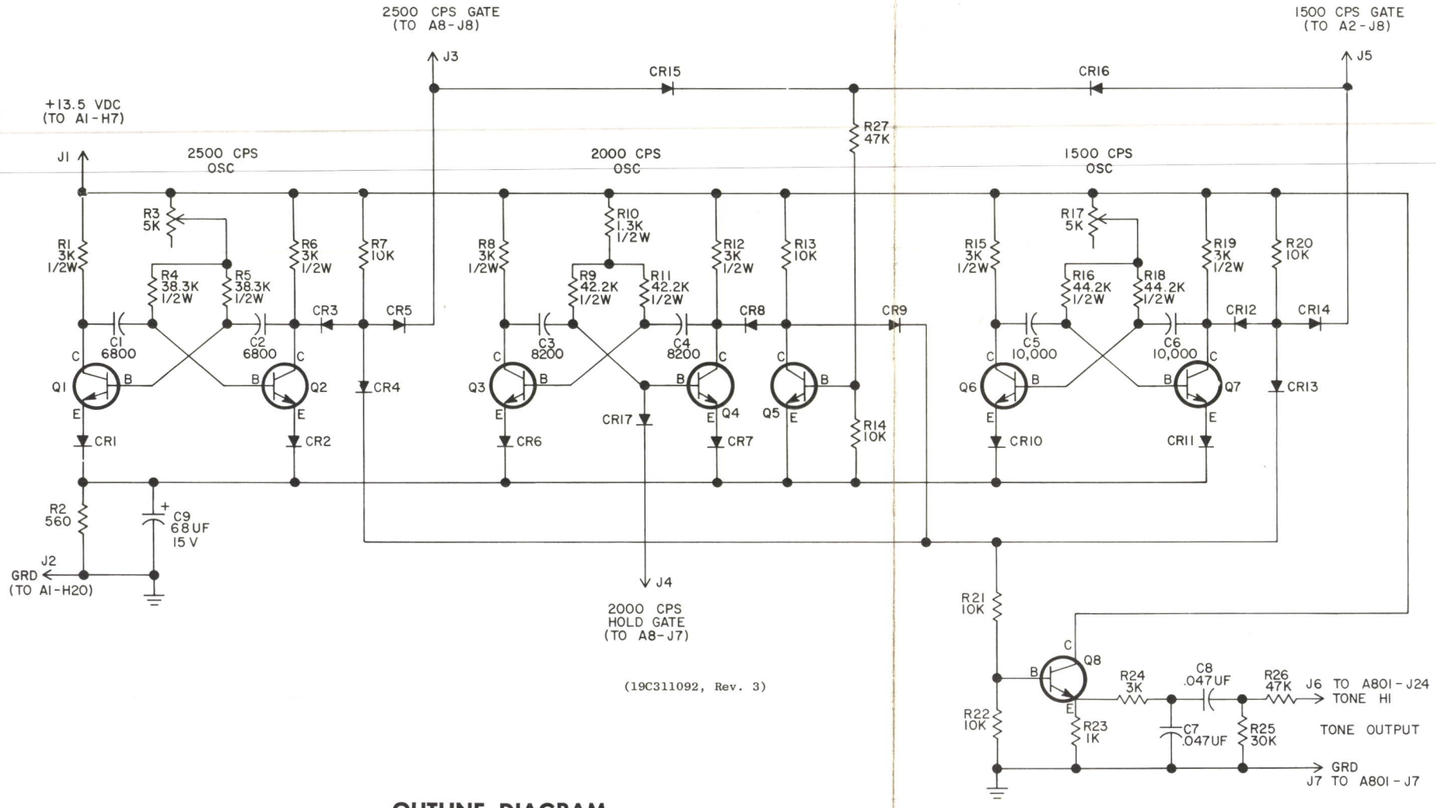
SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
19B205503G1	

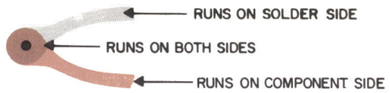
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR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

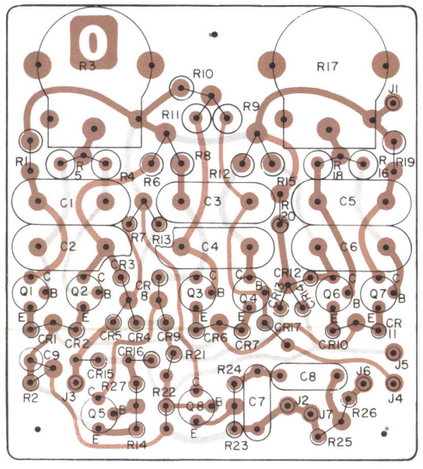
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

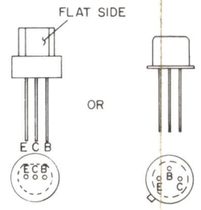


(19C311092, Rev. 3)

OUTLINE DIAGRAM







(19B205848, Rev. 0)
(19B205502, Sh. 1, Rev. 0)
(19B205502, Sh. 2, Rev. 0)

SCHEMATIC & OUTLINE DIAGRAM

TONE OSCILLATOR A3

PARTS LIST

LBI-3809

TONE OSCILLATOR - A3
PL-19B205503-G1

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	5493551-P6800G	Mica: 6800 pf ±2%, 100 VDCW; sim to Electro Motive Type DM-30.
C3 and C4	5493551-P8200G	Mica: 8200 pf ±2%, 100 VDCW; sim to Electro Motive Type DM-30.
C5 and C6	5493551-P10000G	Mica: 10,000 pf ±2%, 100 VDCW; sim to Electro Motive Type DM-30.
C7 and C8	19B209243-P105	Polyester: .047 µf ±10%, 40 VDCW.
C9	5496267-P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 thru CR17	19A115250-P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J7	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q8	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R2	3R152-P561J	Composition: 560 ohms ±5%, 1/4 w.
R3	7491365-P2	Variable, carbon film: 5000 ohms ±20%, 0.15 w, sim to CTS Type UPE-70.
R4 and R5	5495948-P357	Deposited carbon: 38,300 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R6	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R7	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R8	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R9	5495948-P361	Deposited carbon: 42,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R10	3R77-P132J	Composition: 1300 ohms ±5%, 1/2 w.
R11	5495948-P361	Deposited carbon: 42,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R12	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R13 and R14	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R15	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R16	5495948-P363	Deposited carbon: 44,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R17	7491365-P2	Variable, carbon film: 5000 ohms ±20%, 0.15 w, sim to CTS Type UPE-70.
R18	5495948-P363	Deposited carbon: 44,200 ohms ±1%, 1/2 w; sim to Texas Instrument Type CD1/2MR.
R19	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R20 thru R22	3R152-P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R23	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R24	3R152-P302K	Composition: 3000 ohms ±10%, 1/4 w.
R25	3R152-P303K	Composition: 30,000 ohms ±10%, 1/4 w.
R26	3R152-P473J	Composition: 47,000 ohms ±5%, 1/4 w.
R27	3R152-P473K	Composition: 47,000 ohms ±10%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

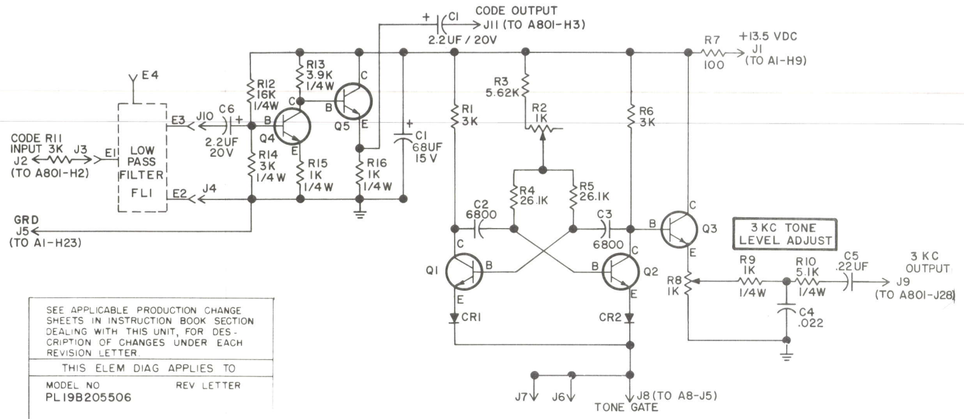
LBI-3810

3 KC OSCILLATOR - A6
PL-19B205506-G1

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267-P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C2 and C3	5493551-P6800F	Mica: 6800 pf ±1%, 100 VDCW; sim to Electro Motive Type DM-30.
C4	19B209243-P103	Polyester: .022 µf ±10%, 40 VDCW.
C5	19B209243-P109	Polyester: 0.22 µf ±10%, 40 VDCW.
C6 and C7	5496267-P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 and CR2	19A115250-P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1 thru J11	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q5	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R2	7491365-P1	Variable, carbon film: 1000 ohms ±20%, 0.15 w, sim to CTS Type UPE-70.
R3	19B209131-P21	Metal film: 5620 ohms ±1%, 1/2 w; sim to IRC Type MEC.
R4 and R5	19B209131-P20	Metal film: 26,100 ohms ±1%, 1/2 w; sim to IRC Type MEC.
R6	3R77-P302K	Composition: 3,000 ohms ±10%, 1/2 w.
R7	3R77-P101K	Composition: 100 ohms ±10%, 1/2 w.
R8	7491365-P1	Variable, carbon film: 1000 ohms ±20%, 0.15 w, sim to CTS Type UPE-70.
R9	3R152-P102K	Composition: 1000 ohms ±10%, 1/4 w.
R10	3R152-P512K	Composition: 5100 ohms ±10%, 1/4 w.
R11	3R77-P302J	Composition: 3000 ohms ±5%, 1/2 w.
R12	3R152-P163J	Composition: 16,000 ohms ±5%, 1/4 w.
R13	3R152-P392J	Composition: 3900 ohms ±5%, 1/4 w.
R14	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R15 and R16	3R152-P102J	Composition: 1000 ohms ±5%, 1/4 w.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SCHEMATIC DIAGRAM



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

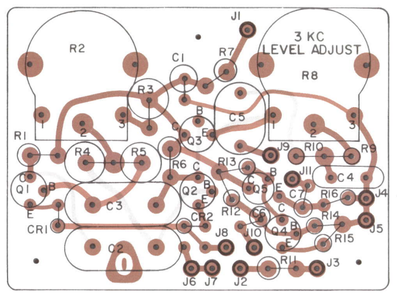
MODEL NO. PL19B205506 REV LETTER

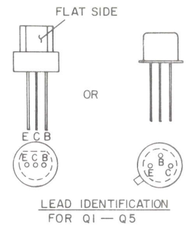
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS, OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR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

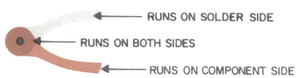
(19B205507, Rev. 2)

OUTLINE DIAGRAM





(19B205845, Rev. 0)
(19B205505, Sh. 1, Rev. 0)
(19B205505, Sh. 2, Rev. 0)

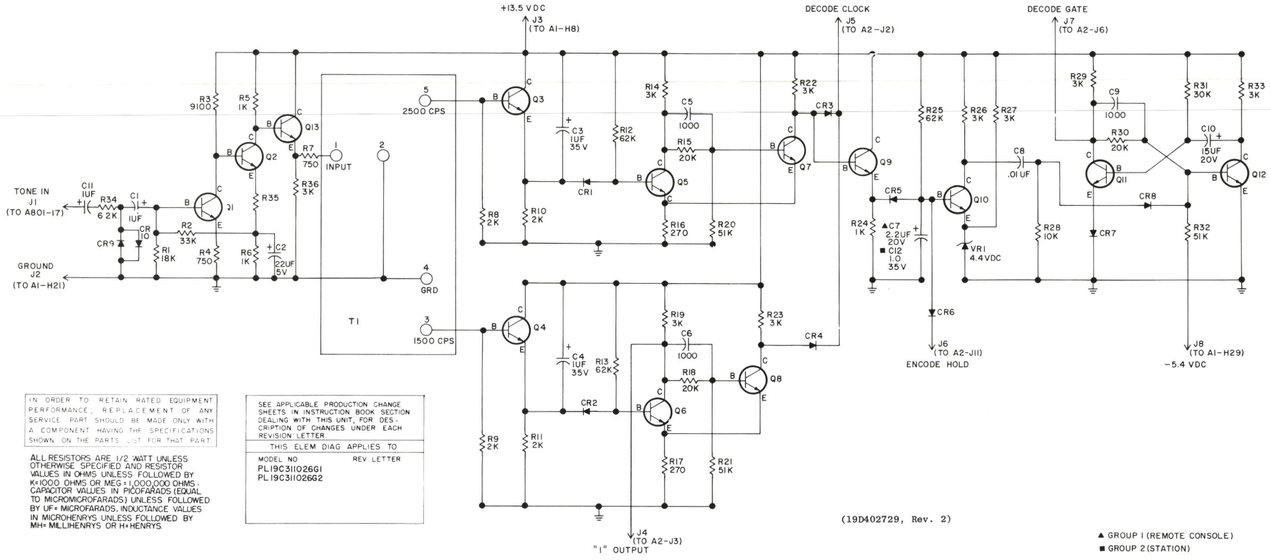


SCHEMATIC & OUTLINE DIAGRAM

3-KC OSCILLATOR A6

Issue 1

SCHEMATIC DIAGRAM



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 1/2 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.

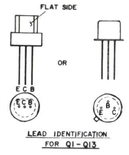
THIS ELEM DIAG APPLIES TO

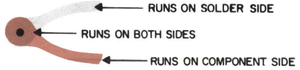
MODEL NO	REV LETTER
PL19C311026G1	
PL19C311026G2	

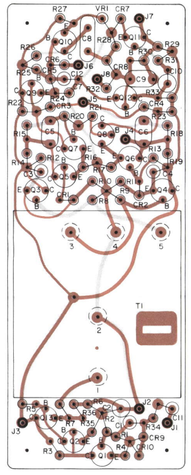
(19D402729, Rev. 2)

▲ GROUP 1 (REMOTE CONSOLE)
■ GROUP 2 (STATION)

OUTLINE DIAGRAM







(19C311359, Rev. 0)
(19B205443, Sh. 1, Rev. 1)
(19B205443, Sh. 2, Rev. 1)

SCHEMATIC & OUTLINE DIAGRAM

TONE DISCRIMINATOR A7

PARTS LIST

LBI-3811

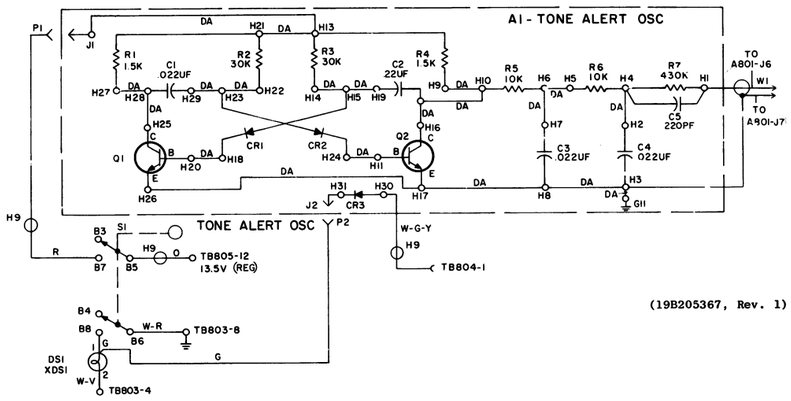
TONE DISCRIMINATOR - A7
PL-19C311026-G1-2

SYMBOL	G-E PART NO.	DESCRIPTION
		PL-19C311026-G1 Console PL-19C311026-G2 Station Panel
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267-P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C2	5496267-P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C3 and C4	5496267-P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C5 and C6	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	5496267-P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D. (Used in PL-19C311026-G1).
C8	19B209243-P101	Polyester: .01 µf ±10%, 40 VDCW.
C9	5494481-P111	Ceramic disc: .001 µf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C10	5496267-P214	Tantalum: 15 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C11	5496267-P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C12	5496267-P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D. (Used in PL-19C311026-G2).
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1 thru CR10	19A115250-P1	Silicon.
VR1	4036887-P4	Silicon, Zener.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J8	4033513-P15	Contact, electrical: sim to Bead Chain R40-1A.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q13	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152-P183J	Composition: 18,000 ohms ±5%, 1/4 w.
R2	3R152-P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R3	3R152-P912J	Composition: 9100 ohms ±5%, 1/4 w.
R4	3R152-P751J	Composition: 750 ohms ±5%, 1/4 w.
R5 and R6	3R152-P102J	Composition: 1000 ohms ±5%, 1/4 w.
R7	3R152-P751J	Composition: 750 ohms ±5%, 1/4 w.
R8 thru R11	3R152-P202J	Composition: 2000 ohms ±5%, 1/4 w.
R12 and R13	3R152-P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R14	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R15	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R16 and R17	3R152-P271J	Composition: 270 ohms ±5%, 1/4 w.
R18	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R19	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R20 and R21	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R22 and R23	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R24	3R152-P102J	Composition: 1000 ohms ±5%, 1/4 w.
R25	3R152-P623J	Composition: 62,000 ohms ±5%, 1/4 w.
R26 and R27	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R28	3R152-P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R29	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R30	3R152-P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R31	3R152-P303J	Composition: 30,000 ohms ±5%, 1/4 w.
R32	3R152-P513J	Composition: 51,000 ohms ±5%, 1/4 w.
R33	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
R34	3R152-P622J	Composition: 6200 ohms ±5%, 1/4 w.
R35	3R152-P101J	Composition: 100 ohms ±5%, 1/4 w.
R36	3R152-P302J	Composition: 3000 ohms ±5%, 1/4 w.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	PL-19B206719-G1	Discriminator assembly.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	4035306-P40	Fiber washer. (Used between T1 and board).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

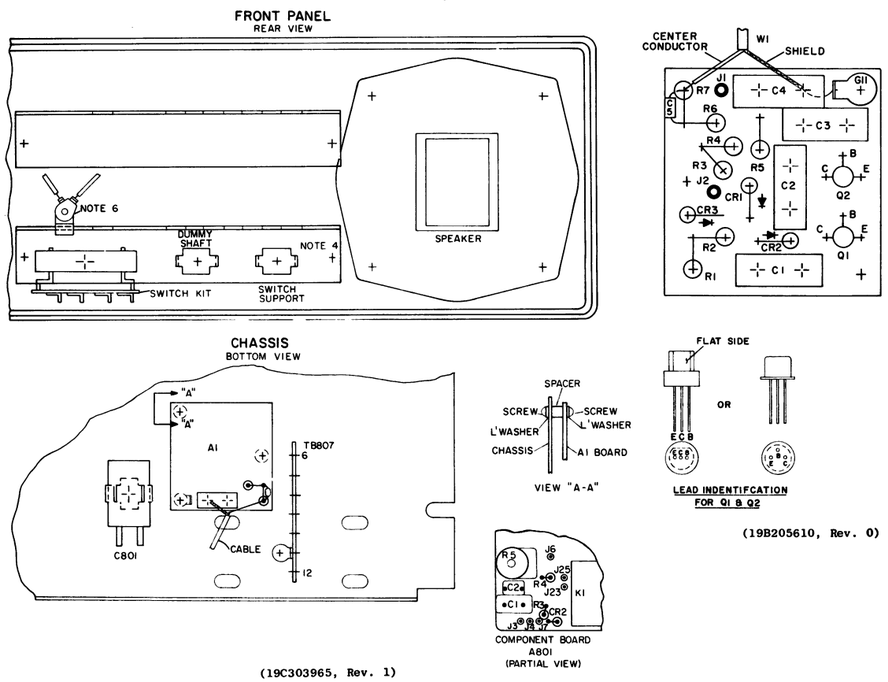
TONE ALERT OSC
19A122250-G8

SCHEMATIC DIAGRAM



(19B205367, Rev. 1)

OUTLINE DIAGRAM



(19C303965, Rev. 1)

(19B205610, Rev. 0)

PARTS LIST

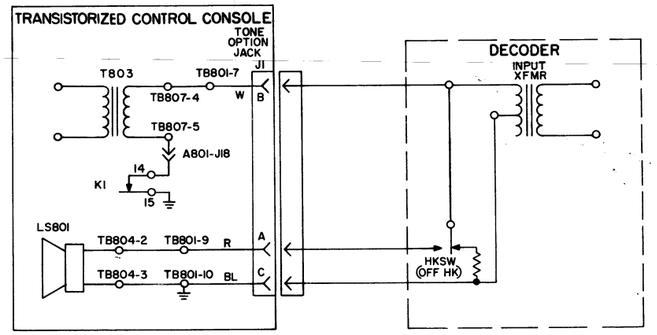
TONE ALERT OSCILLATOR
PL-19A122250-G8

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	PL-19A122205-G12	Button Assembly (TONE).
		SWITCH ASSEMBLY PL-19B205362-G1
		- - - - - - - - - INDICATING DEVICES - - - - - - - - -
DS1	19C307037-P20	Lamp, incandescent: 28 v; sim to G-E 757.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P1 and P2	4029840-P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - - - SWITCHES - - - - - - - - - - -
S1	19A122211-P1	Two pushbutton: 2 form C contacts, 2 amps at 28 VDC or 1 amp at 110 VAC; sim to Oak 247198-130 (modified).
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
XDS1	19B209342-P1	Lampholder: sim to Leecraft 7-04.
		COMPONENT BOARD ASSEMBLY PL-19B205373-G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C4	19A115028-P109	Polyester: .022 µf ±20%, 200 VDCW.
C5	7489162-P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR1 thru CR3	19A115250-P1	Silicon.
		- - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 and Q2	19A115123-P1	Silicon, NPN; sim to Type 2N2712.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P152K	Fixed composition: 1500 ohms ±10%, 1/2 w.
R2 and R3	3R77-P303K	Fixed composition: 30,000 ohms ±10%, 1/2 w.
R4	3R77-P152K	Fixed composition: 1500 ohms ±10%, 1/2 w.
R5 and R6	3R77-P103K	Fixed composition: 10,000 ohms ±10%, 1/2 w.
R7	3R77-P434K	Fixed composition: 0.43 megohms ±10%, 1/2 w.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W1	PL-19A122228-G1	RF: includes 1 contact, approx 15 inches long.
		- - - - - - - - - SUBASSEMBLIES - - - - - - - - -
		EYELET BOARD ASSEMBLY PL-19A122225-G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1 and J2	4033513-P2	Contact, electrical: sim to Bead Chain L93-2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

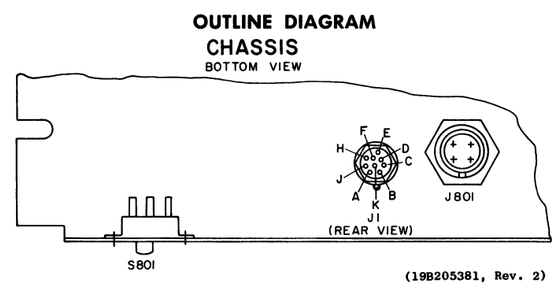
PULSE TONE OPTION JACK
19A122250-G17 (OPTION 5003)

SCHEMATIC DIAGRAM



(19B205380, Rev. 2)

OUTLINE DIAGRAM



(19B205381, Rev. 2)

PARTS LIST

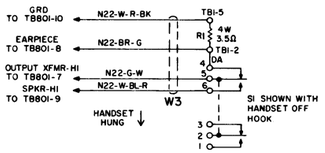
PULSE TONE OPTION JACK
PL-19A122250-G17

SYMBOL	G-E PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77-P270J	Fixed composition: 27 ohms ±5%, 1/2 w.
		JACK ASSEMBLY PL-19A122232-G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	7489183-P5	Socket: 9 contacts; sim to Winchester M9S-LRN (modified).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

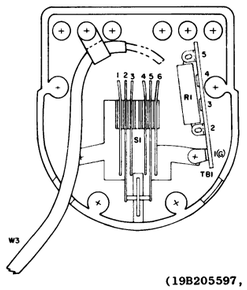
HOOKSWITCH 19A122250-G18

SCHEMATIC DIAGRAM



(19A122235, Rev. 1)

OUTLINE DIAGRAM



(19B205597, Rev. 0)

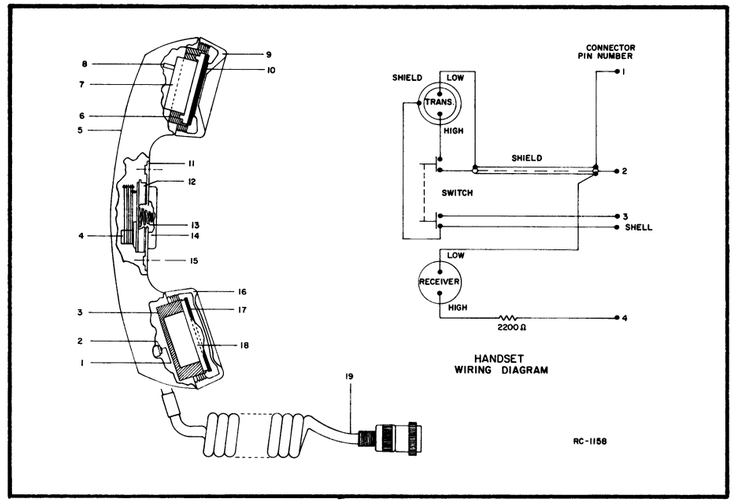
PARTS LIST

HANDSET HOOKSWITCH
PL-19A122250-G18

SYMBOL	G-E PART NO.	DESCRIPTION
		HANDSET HOOKSWITCH ASSEMBLY PL-19B204867-G3
		- - - - - - - - - - - - RESISTORS - - - - - - - - - - - -
R1	5493035-P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
		- - - - - - - - - - - SWITCHES - - - - - - - - - - -
S1	19A121612-P1	Holder and switch: black thermoplastic case, 2 form C contacts, 1 amp at 125 v; sim to Telephone Compnents Brook-Tel 1010S (modified).
		- - - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500-P55	Phen: 5 terminals.
		- - - - - - - - - - - - CABLES - - - - - - - - - - - -
W3	PL-19A121720-G2	Cable: approx 9 feet long.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

HANDSET MODEL 4EM26A10



PARTS LIST

LBI-3559
HANDSET
MODEL 4EM26A10
(PL-19B209100-G1)

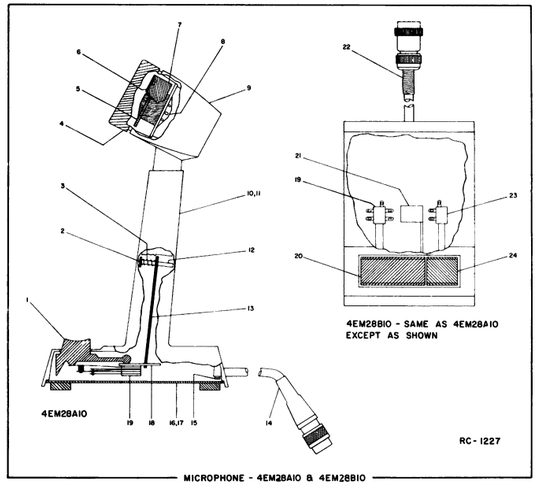
SYMBOL	G-E PART NO.	DESCRIPTION
		(REFER TO RC-1158)
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C640C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers 53A341.
4		Switch. Shure Brothers 90A925.
5		Handle. Shure Brothers 90A971.
6		Adapter. Shure Brothers 65A230.
7		Magnetic controlled cartridge. Shure Brothers 99A562.
8	3R77-P222K	Resistor, composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. Shure Brothers 65A199A.
10		Washer. Shure Brothers 34A321.
11		Escutcheon. Shure Brothers 53A536A.
12		Actuator. Shure Brothers 53A556.
13		Spring. Shure Brothers 44A140.
14		Plunger bar. Shure Brothers 65B206A.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C557B.
16		Transmitter cap. Shure Brothers 65A197A.
17		Washer. Shure Brothers 34A309.
18		Magnetic controlled cartridge. Shure Brothers 99A86.
19		Cable and plug. Shure Brothers 90AB619.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

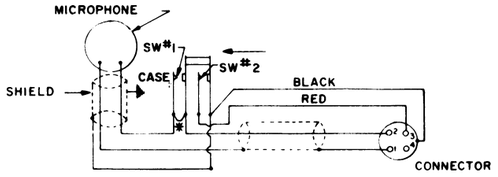
SERVICE SHEET

HOOKSWITCH, HANDSET & DESK MICROPHONE

MAGNETIC CONTROLLED DESK MICROPHONE MODEL 4EM28A10 (19C307105-P1)



MICROPHONE - 4EM28A10 & 4EM28B10



CIRCUIT DIAGRAM
4EM28A10

NOTES.
1. SWITCH *1 OF THE MICROPHONE CIRCUIT MUST CLOSE FIRST AND OPEN LAST.

* JUMPER MAY BE REMOVED FOR PARALLEL OR SPECIAL OPERATION

(RC-302, Sh. 2)

PARTS LIST

MAGNETIC CONTROLLED DESK MICROPHONE
MODEL 4EM28A10 (19C307105-P1)
(SEE RC-1227)

SYMBOL	G-E PART NO.	DESCRIPTION
		MECHANICAL PARTS MODEL 4EM28A10
1		Pushbutton. Shure Brothers 65A605A.
2		Washer. Shure Brothers 30A697.
3		Spring. Shure Brothers 44A149.
4		Cap and grille. Shure Brothers 90A1019.
5		Magnetic controlled cartridge. Shure Brothers 99A86.
6		Washer. Shure Brothers 34A223.
7		Shield. Shure Brothers 53A528.
8		Damping pad. Shure Brothers 20B33.
9		Housing. Shure Brothers 90A1017.
10		Base. Shure Brothers 90A1016.
11		(Not used).
12		Pin. Shure Brothers 31A848.
13		Bracket. Shure Brothers 53A637.
14		Cable and plug. Shure Brothers 90A1018.
15		Cable clamp. Shure Brothers 53A532.
16		Bottom plate. Shure Brothers 90A1015.
17		(Not used).
18		Mounting bracket. Shure Brothers 53A633.
19		Switch. Shure Brothers 90B970.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

MILITARY MICROPHONE — 19B209102-P1 (OPTIONS 5008)

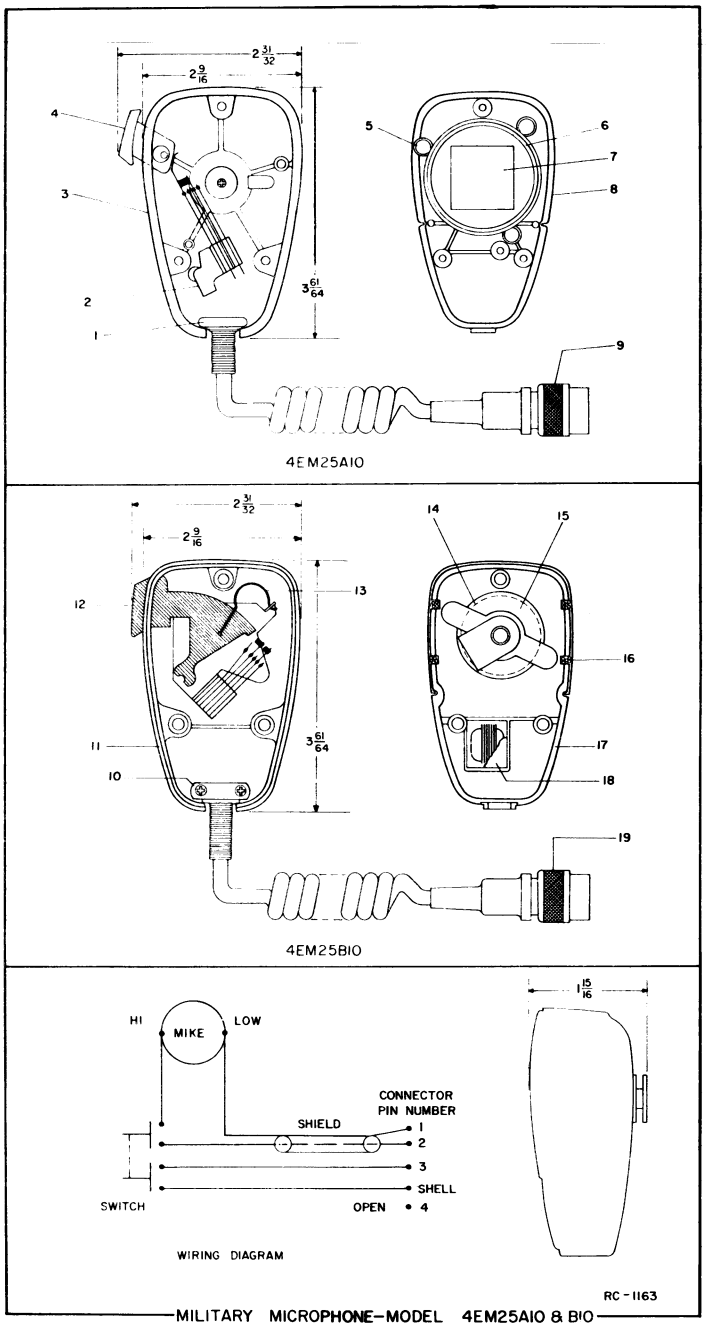
PARTS LIST

LBI-3558

MILITARY MICROPHONE
MODELS 4EM25A10 and 4EM25B10
(PL-19B209102-G1)
(SEE RC-1163)

SYMBOL	G-E PART NO.	DESCRIPTION
		MECHANICAL PARTS
		MODEL 4EM25A10
1		Cable clamp. Shure Brothers 53A532.
2		Switch. Shure Brothers 90D938.
3		Case (back) and mounting button: plastic. Shure Brothers 90B618.
4		Switch button: red plastic. Shure Brothers 65A152B.
5		Spring. Shure Brothers 44A113.
6		Shield. Shure Brothers 53A341.
7		Magnetic controlled cartridge. Shure Brothers 99A86.
8		Case (front): plastic. Shure Brothers 90A969.
9		Cable and plug: approx 6 feet long. Shure Brothers 90A619.
		MODEL 4EM25B10
10		Cable clamp. Electro Voice 75881.
11		Case (back): includes switch and mounting button. Electro Voice 83610.
12		Switch button: red plastic. Electro Voice 75815.
13		Spring. Electro Voice 19006.
14		Gasket. Electro Voice 38277.
15		Magnetic controlled cartridge. Electro Voice 83444.
16		Grille screen. Electro Voice 75814.
17		Case (front): plastic. Electro Voice 75816.
18		Transformer shield. Electro Voice 75873.
19		Cable and plug: approx 6 feet long. Electro Voice 83445.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

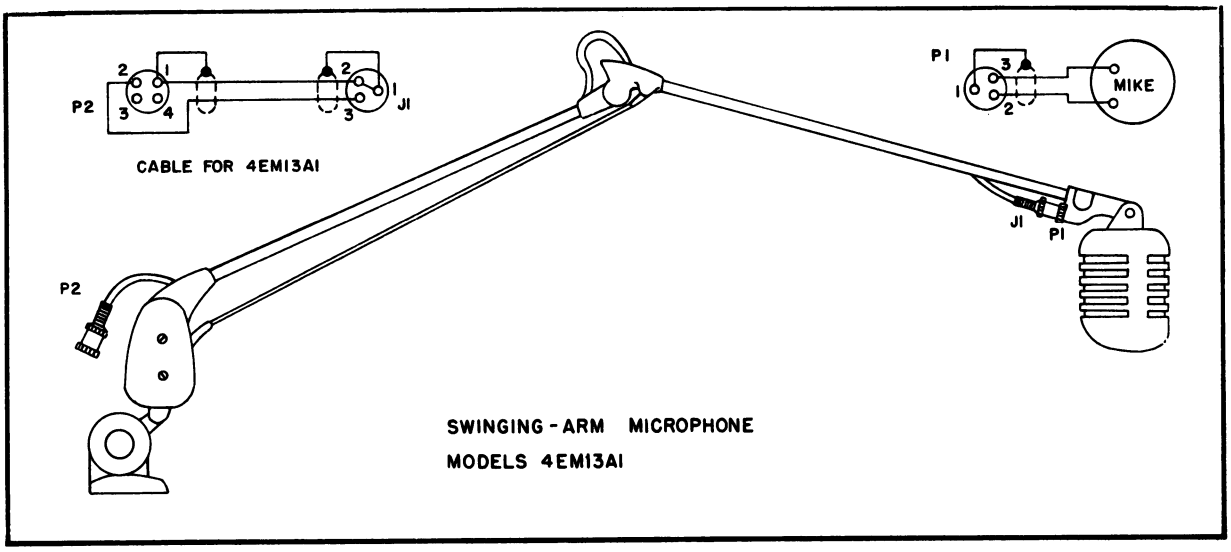


MILITARY MICROPHONE—MODEL 4EM25A10 & B10

SERVICE SHEET

MILITARY MIKE - 19B209102-P1
(OPTION 5008)

SWINGING - ARM MIKE MODEL 4EM13A1
(OPTIONS 5005)
(Mtg Kit 7774934-P2)



(RC-302)

PARTS LIST

SYMBOL	DESCRIPTION	G-E DRAWING & PART NO.
	SWINGING-ARM MICROPHONE MODEL 4EM13A1	
	Microphone, multi-impedance, dynamic: moving coil type with freq range of 50 to 15,000 cps, has swivel adjustment from 0 to 80°. Shure Bros. Model 55S (DY12).	B-7487533-P1
	Microphone bracket: 24" reach, includes shielded two conductor rubber or PVC jacketed microphone cable, Belden Cat. #8412, 2 amphenol plugs Type 91 MC3M. Dazor Mfg. Co. Cat. MP-866. Also has 4 pin connector amphenol Type 91-MC4M on cable end away from mike.	C-7774934-P2

SERVICE SHEET

SWINGING-ARM MICROPHONE MODEL 4EM13A1
(OPTIONS 5005)

QUICKCHECKS

THESE QUICKCHECKS PROVIDE THE SERVICEMAN AN EASY METHOD OF ISOLATING A DEFECTIVE STAGE IN THE CONSOLE. FIRST, CHECK THE SUPPLY VOLTAGES, AND THEN FOLLOW THE APPLICABLE PROCEDURE IN THE CHART BELOW. AFTER THE DEFECTIVE STAGE IS ISOLATED, THE DC VOLTAGE READINGS MAY BE USED TO LOCATE ANY DEFECTIVE COMPONENTS.

SYMPTOM	PROCEDURE
Unit will Encode but not Decode	1. Make waveform checks D1 thru D4 on Tone Discriminator Board A7 (see following page). 2. Make waveform checks D5 thru D11 on Logic Board A2 (see following page). 3. Check DC voltages of Memory Drivers Q35 thru Q46 on Logic Board A5 (see Step 7). 4. Check DC voltages of Memory Board A5 (see Step 7). 5. Check DC voltages of Q1 thru Q12 on Light Driver Board A4 (see Step 7).
Unit will Decode but not Encode	1. Make waveform checks E1 thru E8 on Logic Board A2 (see following page). 2. Make waveform check E15 on Tone Oscillator Board A3 (see following page). 3. Check output of 3-kHz Oscillator A6. 4. Make waveform checks D18 thru D21 on 3-kHz Keying Board A8 (see following page).
Unit will neither Encode or Decode	1. Make waveform checks D1 thru D4 on Tone Discriminator Board A7 (see following page). 2. Check Shift Register (see Step 5).

LOGIC & KEYING CIRCUIT CHECKS

ALL MEASUREMENTS MADE WITH A DC-VTVM FROM TRANSISTOR PINS TO GROUND.

NOTE

WHEN CHECKING SWITCHING TRANSISTORS, PLACE METER PROBE ON TRANSISTOR PIN BEFORE PRESSING PUSHBUTTON.

MAKE CHECKS (1) THRU (7) AS DIRECTED:

(5) SHIFT REGISTER & CODES

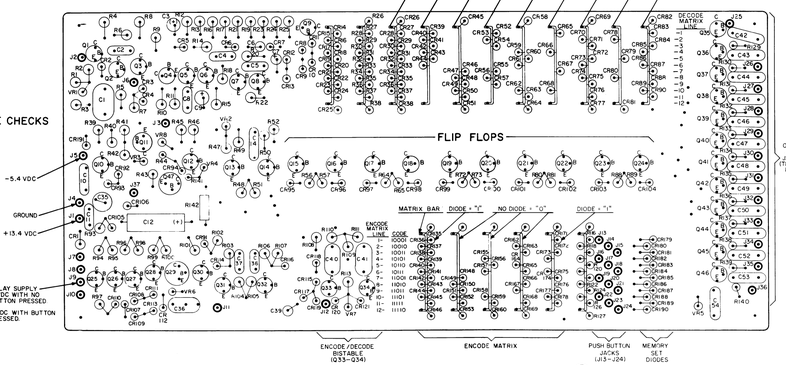
WITH NO TONE OR CODE APPLIED TO THE CONSOLE, THE SHIFT REGISTER SHOULD BE IN THE "0" STATE. CHECK FOR READINGS SHOWN IN THE CHART BELOW. NEXT, LOAD A CODE INTO THE SHIFT REGISTER BY GROUNDING THE PUSHBUTTON JACK (J3 THRU J26) AND CHECK FOR APPROXIMATE READINGS ON MATRIX BARS AS SHOWN IN THE CHART.

JACK GROUNDED	CODE	VOLTAGE AT MATRIX BAR									
NONE	ALL "0"	0.6V	12V	0.6V	12V	0.6V	12V	0.6V	12V	0.6V
J13	10001	12V	12V	0.6V	12V	0.6V	12V	0.6V	12V	0.6V
J14	10010	12V	12V	0.6V	12V	0.6V	12V	0.6V	12V	0.6V
J15	10011	12V	12V	0.6V	12V	0.6V	12V	0.6V	12V	0.6V
J16	10101	12V	12V	0.6V	12V	12V	0.6V	12V	0.6V	12V
J17	10110	12V	12V	0.6V	0.6V	12V	0.6V	12V	12V	0.6V
J18	10111	12V	12V	0.6V	0.6V	12V	0.6V	12V	0.6V	12V
J19	11001	12V	0.6V	12V	12V	0.6V	12V	0.6V	0.6V	12V
J20	11010	12V	0.6V	12V	12V	0.6V	12V	12V	12V	0.6V
J21	11011	12V	0.6V	12V	12V	0.6V	0.6V	12V	0.6V	12V
J22	11101	12V	0.6V	12V	0.6V	12V	0.6V	0.6V	12V	12V
J23	11111	12V	0.6V	12V	0.6V	12V	0.6V	12V	0.6V	12V
J24	11110	12V	0.6V	12V	0.6V	12V	0.6V	12V	12V	0.6V

ALL VOLTAGE READINGS ARE TAKEN WITH A DC-VTVM AND MEASURED FROM TRANSISTOR PIN TO GROUND. ALL READINGS ARE POSITIVE (+) UNLESS OTHERWISE INDICATED.

(6) DECODE MATRIX

LOAD A CODE INTO THE SHIFT REGISTER AS DIRECTED IN STEP 5. NEXT, MOMENTARILY GROUND THE BASE OF Q5 AND CHECK FOR A POSITIVE METER DEFLECTION ON THE APPLICABLE MATRIX LINE.



(2) ENCODE/DECODE BISTABLE

WITH NO CODE APPLIED TO THE CONSOLE, READING AT J11 SHOULD BE APPROXIMATELY 12 VDC. WITH ONE OF THE PUSHBUTTONS PRESSED, READING SHOULD DROP TO APPROXIMATELY 0.6 VDC.

(3) ENCODE MATRIX

LOAD A CODE INTO SHIFT REGISTER BY GROUNDING PUSHBUTTON JACK J13, OR HOLDING IN THE N-F1 PUSHBUTTON. CHECK EACH BAR IN THE MATRIX FOR A READING OF 0.6 VDC FOR "1", OR 12 VDC FOR A "0".

NOTE

A DIODE IN THE MATRIX LINE INDICATES A "1". NO DIODE IN THE MATRIX LINE INDICATES A "0".

(4) PUSHBTTONS & MEMORY SET DIODES

WITH NO PUSHBUTTONS PRESSED, READING AT OUTPUT JACKS J25 THRU J36 SHOULD BE APPROX 12 VDC. WITH THE N-F1 PUSHBUTTON PRESSED (J13 GROUNDED), READING AT J25 SHOULD BE APPROX 0.6 VDC. WITH THE N-F2 PUSHBUTTON PRESSED (J14 GROUNDED), READING AT J26 SHOULD BE APPROXIMATELY 0.6 VDC, ETC.

(7) DC VOLTAGE CHECKS OF TRANSISTOR STAGES

All voltage readings are taken with a DC-VTVM and measured from transistor pin to ground. All readings are positive (+) unless otherwise indicated.

TRANSISTOR	VOLTAGE IN STANDBY CONDITION (No Button Pressed and No Code In) BASE	COLLECTOR	EMITTER	VOLTAGE WITH R-F1 BUTTON HELD IN (Or J13 Grounded) BASE	COLLECTOR	EMITTER
LOGIC BOARD A2-						
Q1	1.0	12.5	4.0	No Change	No Change	No Change
Q2	4.5	7.0	4.0			
Q3	1.5	12.5	4.0			
Q4	-1.0	12.5	-1.0			
Q5	-0.1	11.5	0	No Change	No Change	No Change
Q6	1.0	0.6	0	1.0	12.5	1.2
Q7	1.0	0.6	0	0.7	12.5	1.2
Q8	-1.3	12.5	0	12	12.5	12.5
Q9	2.2	1.5	1.2	5	5.0	4.4
Q10	2.2	1.5	1.2			
Q11	12.5	0.6	12.5	1.0	0.6	0
Q12	5.0	5.0	4.4	-1.3	12.5	0
Q13	1.0	0.6	0	See Step 5		
Q14	-1.3	12.5	0	See Step 5		
Q15,17,19,21,23	-1.3	12	0			
Q16,18,20,22,24	1.0	0.6	0			
Q25,27	5.5	5.0	4.5	5.2 (Note 1)	1.7	4.5
Q26,28	1.0	5.5	3.8	4.0 (Note 2)	2.2	3.8
Q29	1.0	24	3.8	5.2	5.0	3.8
Q30	1.0	24	1.0	5.8	5.0	5.2
Q31	1.0	0.6	0	-1.3	12	0
Q32	-1.0	12.5	0	1.0	0.6	0
Q33	1.0	12.5	0.6	1.0	12.5	0.6
Q34	0.6	3.3	3.0	2.6	3.3	3.0
Q35,Q46	1.0	12.5	2.8	1.4 (Note 3)	1.0	2.8
Q47	12.0	12.5	12.0	12	12.5	12
3-KHz KEYING BOARD A8-						
Q1	1.5	1.0	0.6			
Q2	-1.0	13.5	0			
Q3	8	13.5	13.5			
Q4	1.5	1.0	0.6			
Q5	-1.0	13.5	0			
Q6	1.5	1.0	0.6			
Q7	-1.0	13.5	0			
TONE OSC BOARD A3-						
Q1	5	10	5.5			
Q2	5	10	5.5			
Q3	7	6.5	5.5			
Q4	1.3	13.5	1.0			
Q5	5	10	5.5			
Q6	5	10	5.5			
Q7	5	10	5.5			
Q8	3	13.5	2.5			
3-KHz OSC BOARD A6-						
Q1,Q2	12	12	12			
Q3	12	12	11.5			
Q4	2.3	7	1.2			
Q5	7	12	6.2			
TONE DISC BOARD A7-						
Q1	1.3	5	0.7			
Q2	5	10	4.5			
Q3,Q4	0	13.5	0.4			
Q5,Q6	1.0	12.5	1.3			
Q7,Q8	2	1.5	1.3			
Q9	1.5	13.5	0.8			
Q10	1.4	13.5	4.4			
Q11	1.4	1.0	0.6			
Q12	-0.6	13.5	0			
Q13	10.0	13.5	9.3			

Note 1 - Readings for Q25 only. Q27 does not change.
Note 2 - Readings for Q26 only. Q28 does not change.
Note 3 - Readings for Q35 only. Q36-Q46 do not change.

MEMORY BOARD A5

The Memory flip-flops are switched by momentarily grounding the appropriate input jack. Output jack readings are taken with the output leads disconnected.

INPUT JACK GROUNDED	Symbol	TRANSISTOR VOLTAGE Base	Collector	Emitter	OUTPUT READINGS Jack	Voltage
J4	Q1	-1.5	12	0	J16	12.5
	Q2	1.0	0.6	0	J19	1.0
J7	Q1	1.0	0.6	0	J16	1.0
	Q2	-1.5	12	0	J19	12.5
J6	Q3	-1.5	12	0	J18	12.5
	Q4	1.0	0.6	0	J17	1.0
J5	Q3	1.0	0.6	0	J18	1.0
	Q4	-1.5	12	0	J17	12.5
J8	Q5	-1.5	12	0	J20	12.5
	Q6	1.0	0.6	0	J23	1.0
J11	Q5	1.0	0.6	0	J20	1.0
	Q6	-1.5	12	0	J23	12.5
J10	Q7	-1.5	12	0	J22	12.5
	Q8	1.0	0.6	0	J21	1.0
J9	Q7	1.0	0.6	0	J22	1.0
	Q8	-1.5	12	0	J21	12.5
J12	Q9	-1.5	12	0	J24	12.5
	Q10	1.0	0.6	0	J27	1.0
J15	Q9	1.0	0.6	0	J24	1.0
	Q10	-1.5	12	0	J27	12.5
J14	Q11	-1.5	12	0	J26	12.5
	Q12	1.0	0.6	0	J25	1.0
J13	Q11	1.0	0.6	0	J26	1.0
	Q12	-1.5	12	0	J25	12.5

LIGHT DRIVER A4

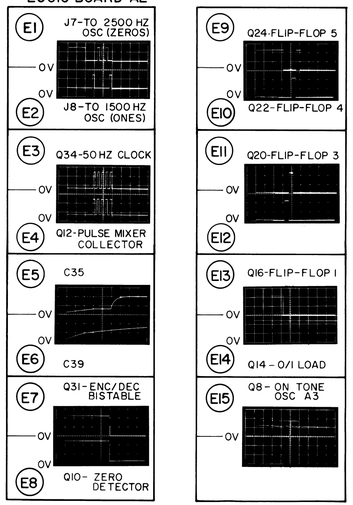
CONDITIONS	TRANSISTOR VOLTAGES For Q1 thru Q12 Base	Collector	Emitter
Light ON (Transistor on)	2.4	2.2	1.8
Light OFF (Transistor off)	1.2	0.6	18

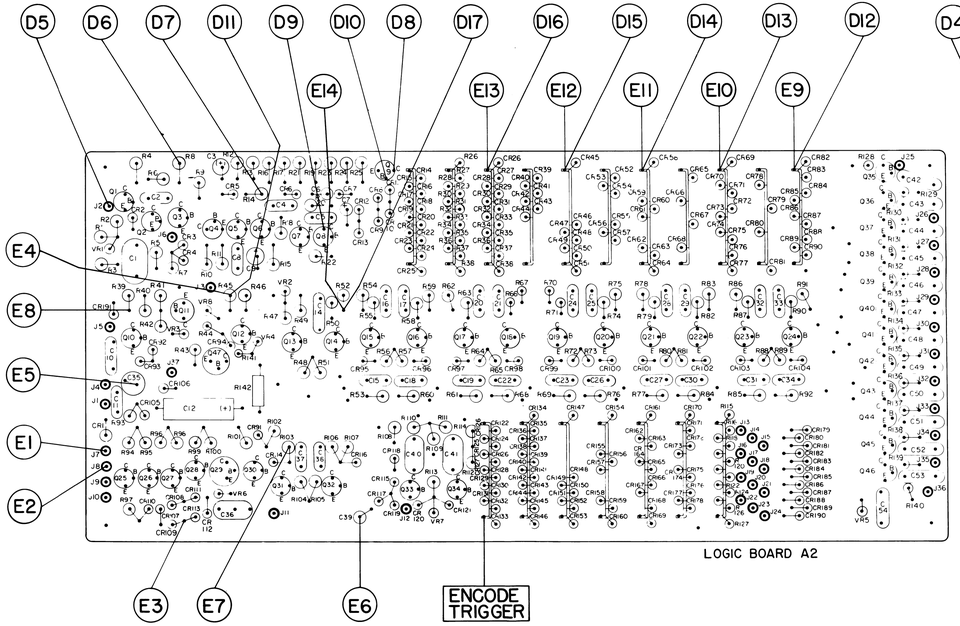
ENCODE WAVEFORMS

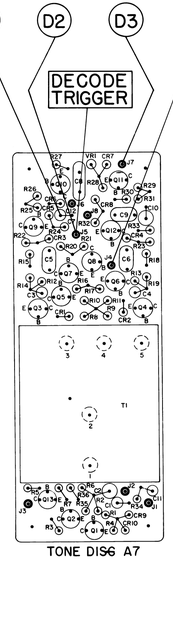
CHECK ENCODE WAVEFORMS E1 THRU E15. ALL WAVEFORMS TAKEN WITH AN EXTERNALLY TRIGGERED, SINGLE TRACE SCOPE (OR DUAL TRACE SCOPE IF AVAILABLE), AND WITH THE R-F-I PUSHBUTTON MOMENTARILY DEPRESSED. TRANSISTOR WAVEFORMS ARE TAKEN FROM THE COLLECTOR, AND CAPACITOR WAVEFORMS TAKEN FROM THE POSITIVE (TOP) LEAD. THE TRIGGER PULSE IS TAKEN FROM THE ANODE BAR OF CR122 THRU CR133.

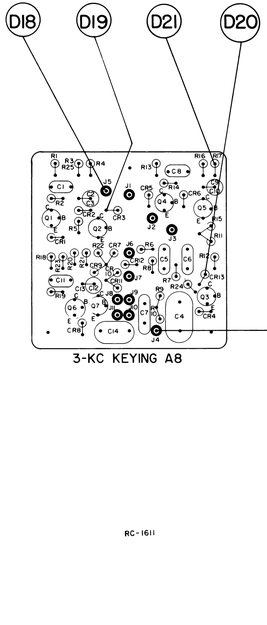
SCOPE SETTINGS FOR ALL READINGS:
VERTICAL - 5VDC PER DIVISION
HORIZONTAL - 50 MILLISECONDS PER DIVISION

LOGIC BOARD A2

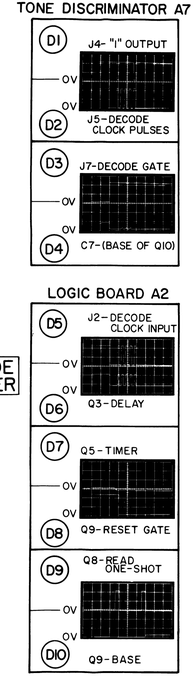




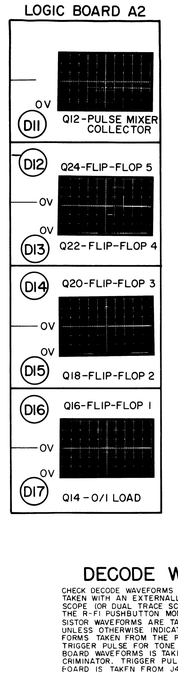


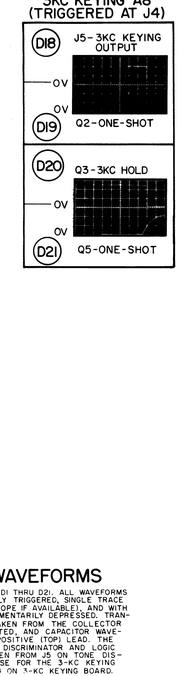


RC-1611



DECODE TRIGGER





DECODE WAVEFORMS

CHECK DECODE WAVEFORMS D1 THRU D21. ALL WAVEFORMS TAKEN WITH AN EXTERNALLY TRIGGERED, SINGLE TRACE SCOPE (OR DUAL TRACE SCOPE IF AVAILABLE), AND WITH THE R-F-I PUSHBUTTON MOMENTARILY DEPRESSED. TRANSISTOR WAVEFORMS ARE TAKEN FROM THE COLLECTOR UNLESS OTHERWISE INDICATED, AND CAPACITOR WAVEFORMS TAKEN FROM THE POSITIVE (TOP) LEAD. THE TRIGGER PULSE FOR TONE DISCRIMINATOR AND LOGIC BOARD WAVEFORMS IS TAKEN FROM J5 ON TONE DISCRIMINATOR. TRIGGER PULSE FOR THE 3-KC KEYING BOARD IS TAKEN FROM J4 ON 3-KC KEYING BOARD.

SCOPE SETTING FOR ALL READINGS:
VERTICAL - 5VDC PER DIVISION
HORIZONTAL - 50 MILLISECONDS PER DIVISION

TROUBLESHOOTING PROCEDURES

ENCODER/DECODER WAVEFORMS

TROUBLESHOOTING PROCEDURE

AUDIO BOARD A801

SYMPTOM	PROCEDURE
No audio from the speaker.	1. Check the audio input with an AC-VTVM across TB801-1 & -2. 2. Make sure that VOLUME control R801 is not set at minimum (fully counterclockwise). 3. Check to see that the Console is not in the transmit mode (red Transmit light on). If the light is on, check for a short in the push-to-talk circuit. 4. Check the audio imput with an AC-VTVM at A801-J17. If no audio, check T801 and C805. 5. Check the setting of LINE INPUT control R7 (refer to the Adjustment Procedure). If R7 cannot be adjusted for the correct reading, check relay contacts K1-11, -12 and -13. 6. Check supply voltages at J1, J2, J12 and J14 on A801 (refer to the Schematic Diagram). 7. Check Bias Adjust R30 for a setting of 0.65 volt DC measured across R34 on A801. If R30 cannot be adjusted for the correct reading, check Q8, Q801, T803 and relay contacts K1-14,-15 and -16. 8. Check the DC voltages on Q3 thru Q6 (refer to the Schematic Diagram).
No audio on the line when the microphone is keyed.	1. Check the microphone leads, and relay contacts K1-11 thru -22. 2. Check the setting of MIC GAIN R5 and LINE OUTPUT R28 (refer to the Adjustment Procedure). 3. Key the microphone and check the DC voltages on Q1 (refer to the Schematic Diagram). 4. Check capacitor C13 on A801.
No 3-KHz tone output.	1. Check relay contacts K1-5, -6 and -7. 2. Check DC voltages on 3-KHz Keying Board and 3-KHz Oscillator Board (refer to DC Voltage reading in Troubleshooting Procedure).
If status light does not turn on.	1. Check the bulb. 2. Check Light Driver A4 and Memory Board A5 (refer to Troubleshooting Procedure).

TROUBLESHOOTING PROCEDURE

AUDIO BOARD A801

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 G-E Part Number.

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

1. G-E 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-3800

DF-4078

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