GE MOBILE RADIO

MAINTENANCE MANUAL

MOBILE CONTROL UNIT MODELS 4EC59A91-94 WITH 4 FREQUENCY PRIORITY SEARCH LOCK MONITOR (Options 8376-8379)

F1 — Green
F2 — Brown
F3 — Black
F4 — white
Scan Disable — yellow

Fremont Police Ba[se] and Perkins Police Ba[se]

Maintenance Manual LBI-4316 A

EC-59-A

SPECIFICATIONS *

MODEL NUMBERS	4EC59A91 thru 4EC59A94
USED WITH	MASTR Royal Professional 4-Frequency Mobile Combinations
CONTROLS	VOLUME Control SQUELCH Control OFF-ON-STBY Switch F1-F4 Selector Switch SEARCH-OFF Switch
OPTIONAL CONTROLS	CHANNEL GUARD Monitor Switch
INDICATORS	Transmitter filament-on light: green Transmit light: red Frequency Select Indicators
PRIORITY SQUELCH SENSITIVITY	20-dB quieting
TEMPERATURE RANGE	-30°C to +60°C

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

GENERAL ELECTRIC

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WARNING

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

DESCRIPTION

MASTR Progress Line Control Units with four-frequency Priority Search-Lock Monitor (Models 4EC59A91-94) are used in three or four frequency MASTR Mobile combinations. These control units are compact, highly functional units designed for Trunk Mount installation. A mounting bracket is supplied for mounting the control unit within convenient reach of the operator. Cable connections are secured to the control unit by means of captive locking screws.

The four-frequency Priority Search-Lock Monitor (PSLM) has the feature of selecting the priority channel from one of four frequencies by the position of the frequency selector switch on the control unit. The PSLM assures reception of all signals on the priority channel regardless of signal strength or which channel receives the first signal.

When a signal is received on the priority channel, the PSLM stops searching and locks on the priority channel for the duration of the message. When a signal is received on a non-priority channel, the PSLM stops on that channel but continues to monitor the priority channel. If a signal is then received on the Priority channel, the PSLM reverts to the priority channel and locks for the duration of the priority message.

An automatic pilot light dimmer has been incorporated in these control units. This dimmer uses a photo-resistor to sense ambient light and adjust the lamp regulator to provide the proper lamp current to the pilot lamps for the existing ambient light conditions. The intensity of the green power on lamp and the four channel lamps are controlled by this automatic pilot light dimmer. The red transmit lamp intensity is not adjustable. The lamps are extinguished when the combination is in STANDBY.

The mobile option numbers and the applications of each option are shown in the following chart.

OPTION NUMBER	MODEL NO.	CHANNEL GUARD SWITCH	TONE OPTION JACK
8376	4EC59A91		
8377	4EC59A92	X	
8378	4EC59A93		X
8379	4EC59A94	X	X

NOTE

The PSLM is compatible with receive Channel Guard in the five-Watt MASTR mobile receiver. PSLM is not compatible with two-Watt receivers with Channel Guard. The presence or absence of the correct Channel Guard encode tone will only determine whether audio is or is not heard from the speaker. Priority channel will always be heard. Carrier without Channel Guard will not be heard, but the channel lamp will light and serve as a channel busy indicator.

CIRCUIT ANALYSIS

CONTROLS

In addition to VOLUME and SQUELCH controls, the control units are provided with the controls described in the following paragraphs.

OFF-ON-STBY Switch (S701)

The OFF-ON-STBY (standby) switch determines the operating modes of the transmitter and receiver. With the switch in the OFF position, all power is removed from the Two-Way Radio. Turning the switch to STBY applies power to the receiver only, and the green pilot lamp does not light.

Turning the switch to the ON position applies filament voltage to the transmitter, activates the push-to-talk (PTT) circuits, and lights the green power-on pilot lamp. After a short warm-up time, the PTT button may be pressed to key the transmitter. Pushing the PTT button energizes the system relay which, in turn, activates the power supply, switches the antenna and mutes the receiver. Keying the transmitter also lights the red transmit pilot lamp.

F1-F4 Frequency Selector Switch (S702)

The frequency selector switch selects the desired channel (F1-F) for both transmitting and receiving. However, frequency selection for the receiver is also determined by the SEARCH-OFF switch S703. When S703 is in the SEARCH position, the frequency selector switch determines the priority channel. When S703 is in the OFF position, the search function of the PSLM board is disabled and the frequency selector switch determines which channel is monitored.

SEARCH-OFF Switch (S703)

When the SEARCH-OFF switch is OFF, pin 5 of the CHANNEL FLIP FLOP (IC-4) on the PSLM board is grounded, disabling the search function. The frequency selector switch grounds the transmitter switching diode and the input to a logic circuit on the PSLM board, which applies to 10 Volts to the selected receiver oscillator switching diode. This allows the position of the frequency selector switch to determine which channel is monitored.

When SEARCH is selected, the +10 Volts is applied to the pre-selected receiver oscillator from the PSLM circuits. The transmitter oscillator switching diode connected to ground is determined by the position of the frequency selector switch also determines which channel is the priority channel to be monitored.

INDICATOR LIGHT CONTROL CIRCUITS (A701)

Turning the OFF-ON-STBY switch to the ON position completes the emitter circuit of series regulator transistor Q702. Conduction of Q702 lights the green power-on lamp. Current through Q702 is controlled by the conduction of Q18, whose base bias is controlled by the setting of adjustable potentiometer R46 and the series resistance of photo-resistor V701. The resistance of V701 is determined by the ambient light falling on its photosensitive surface.

When the receiver is squelched a positive voltage is applied to the base of INVERTER Q25, causing it to conduct. When Q25 conducts, Q24 is turned off and no frequency pilot light will be on. When a signal is received the position voltage on the base of Q25 goes negative, causing Q25 to turn off and Q24 to conduct. The frequency pilot light corresponding to the channel received will light, as the emitter circuit of its driver transistor (Q20-Q23) is completed through Q24.

+10 Volts is applied to the base of the PILOT LAMP DRIVERS (Q20-Q23) from the collectors of F1-F4 DRIVERS (Q5-Q8).

VEHICLE IGNITION SWITCH CONNECTIONS

The Control Unit may be connected for three different modes of operation, depending on the way the three ignition switch cables are connected in the vehicle system. The black ignition switch cable provides the receiver ground connection. The yellow fused lead provides the receiver hot connections, and the red fused lead provides the +12 Volts for the power regulator. The three types of operation are:

1. Ignition Switch Standby - For this type of operation, the red fused lead (power regulator voltage) is connected to the ACCESSORY or ON terminal of the ignition switch. The yellow fused lead (receiver hot) is connected to the hot side of the ignition switch, and the black lead connects to vehicle ground.

   With the ignition switch OFF, the receiver automatically reverts to STBY, ready to receive messages. Turning the ignition switch to the ON or ACCESSORY position turns on the green pilot light and supplies power regulator voltage. Turning the OFF-ON-STBY switch to OFF removes all power to the Two-Way Radio.

2. Ignition Switch Control - For ignition switch control, the yellow and red fused leads are connected to the ACCESSORY or ON terminal of the ignition switch. The transmitter and receiver will operate only when the ignition switch is in the ACCESSORY or ON position. Turning the ignition switch OFF removes all power to the radio.

3. Ignition Switch Bypass - For ignition switch bypass, the yellow and red fused leads connect to the "hot" side of the ignition switch or the vehicle fuse block assembly. Both the transmitter and receiver operate independently of the ignition switch and can be turned on and off only by the OFF-ON-STBY switch on the MASTER Control Unit.

LOGIC CIRCUIT

This section contains a detailed description of all of the logic circuits used in the PSLM board. It is suggested that the serviceman study the following information carefully, as a good understanding of basic logic circuitry is essential for servicing the PSLM.

SOLID STATE SWITCHES

An ideal switch has infinite resistance when open and zero resistance when

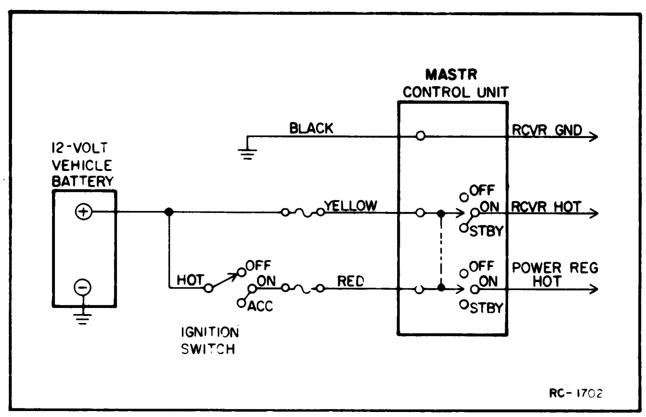


Figure 1 - 12-VDC Connections for Ignition Switch Standby

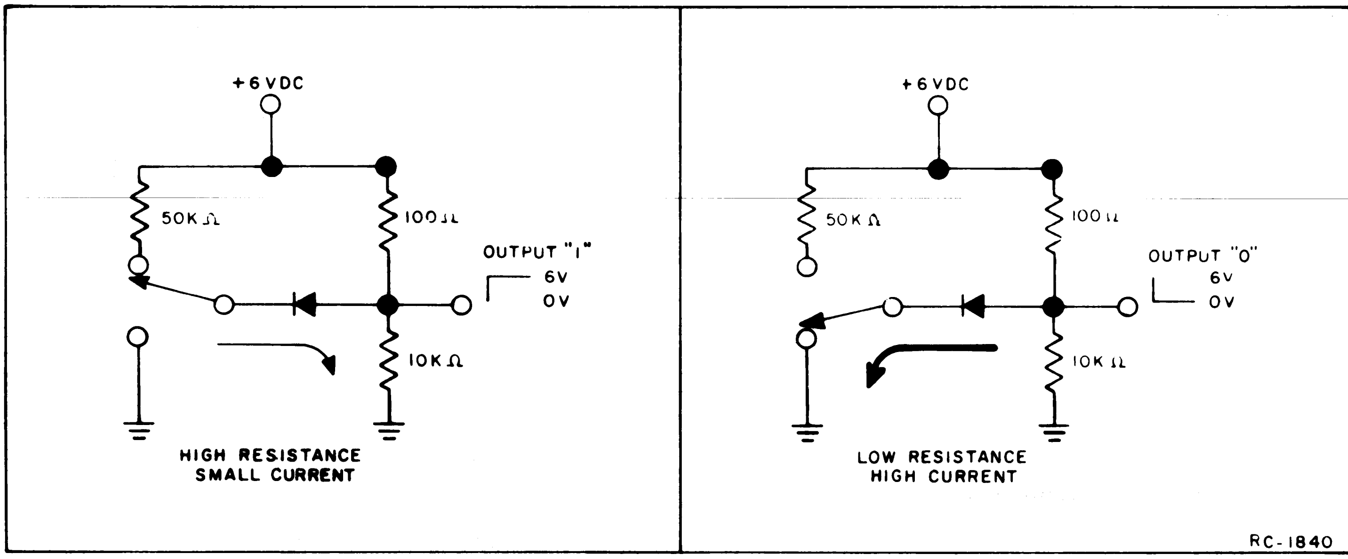


Figure 2 - Diode Switching Circuit

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 stage 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

A semiconductor diode presents maximum resistance to the circuit when the diode is reverse-biased or there is no difference of potential between the cathode or anode (see Figure 2). Applying a negative potential to the cathode of the diode (with respect to the anode), or a positive potential (with respect to the cathode) to the anode of sufficient amplitude to overcome the series resistance of the diode, forward biases the diode causing it to conduct. The diode now switches from maximum to mimimun resistance.

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 & INVERTER

The high value of "off" resistance and the low value of "on" resistance make the transistor invaluable for switching applications. When no base current is applied to the transistor switch shown in Figure 3, and the collector has the proper voltage applied, the open circuit resistance of the transistor approaches several megohms. If sufficient base current 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 3 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 +6 Volts to near ground potential.

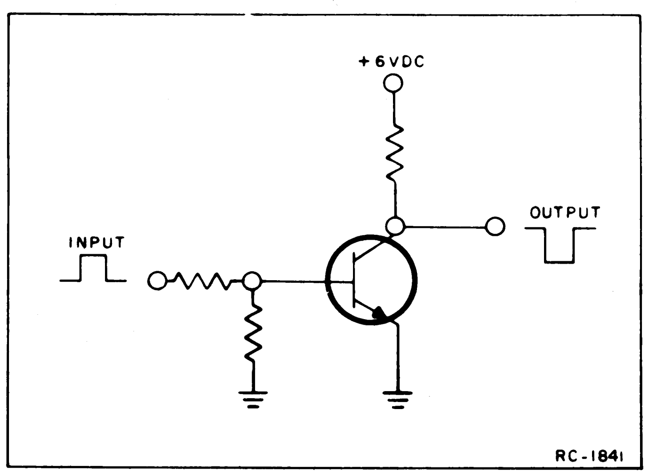


Figure 3 - Transistor Switch & Inverter

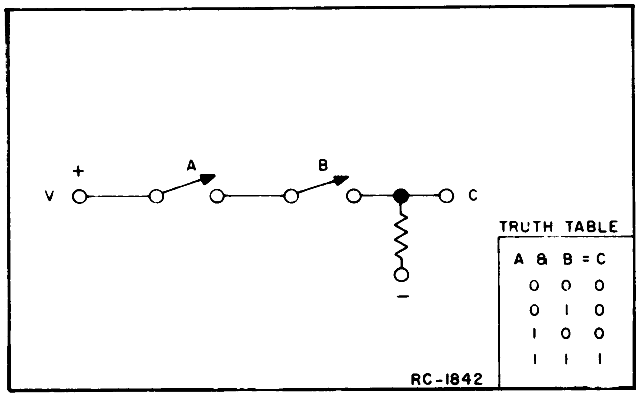


Figure 4 - Simple AND Gate

GATING CIRCUITS

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 pre-determined 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 4 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 the Truth Table in Figure 4.

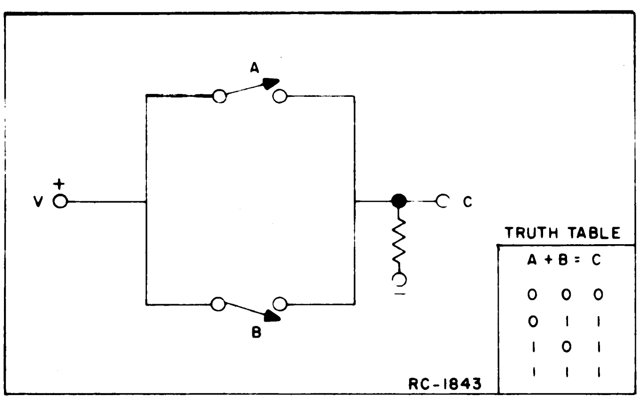


Figure 5 - Simple OR Gate

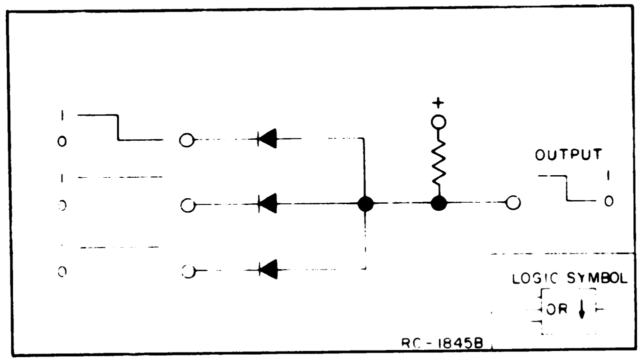


Figure 6 - Diode OR Gate

In Figure 5, 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 the Truth Table in Figure 5.

DIODE GATING CIRCUITS

In gating circuits, the desired state of the gate may be represented by either "0" or "1". In this section, "1" will be used to represent a positive potential (approximately +6 Volts) and "0" will be used to represent a low potential (near zero Volts).

Logic Symbols

The use of logic symbols in this manual provides a simple method of showing the function of complicated logic circuits without drawing each diode, resistor and transistor in the circuit. The individual symbols can be tied together to form a logic diagram of a complete unit. Logic symbols of circuits used in the PSLM are shown in the following simplified diagrams.

OR Gate

A simple diode AND gate is shown in Figure 7. The same conditions exist in this circuit as in the switch gate of Figure 4. 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.

NAND Gate

The basic logic circuitry used in the PSLM is the NAND gate (NOT-AND). A NAND

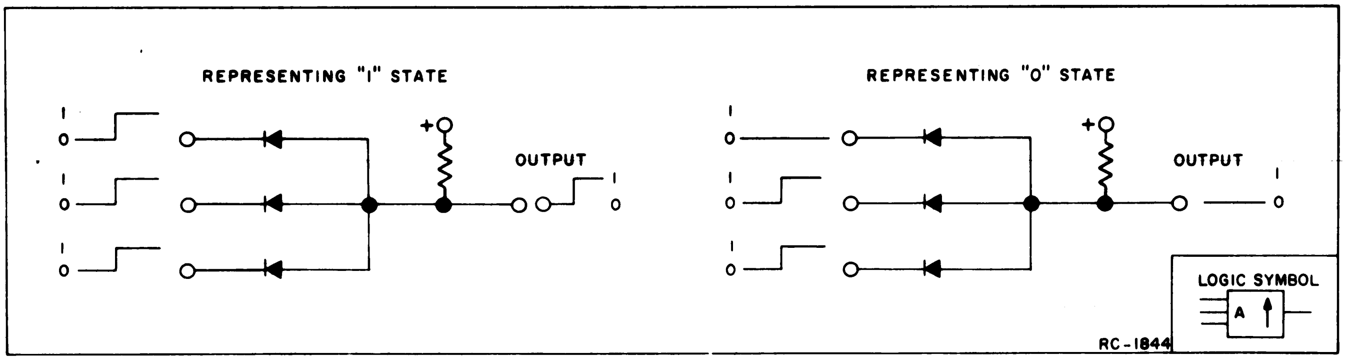


Figure 7 - Diode AND Gate

gate is simply an AND gate with a transistor inverter (NOT) stage added (see Figure 8). Applying a positive potential to inputs A and B back biases diodes CR1 and CR2, permitting inverter Q1 to conduct. When conducting, the collector of Q1 drops to near ground potential.

Additional buffer or amplifier stages are usually added to the NAND gate to provide better isolation and increased gain. These additional stages are connected so that the logical output of the inverter is not changed.

NAND Gate One-Shot

Two NAND gates may be connected as shown in Figure 9 to provide virtually the same function as a conventional "one-shot" multivibrator. One of the NAND gates is required to have a direct input (called an expander node).

Assume that the inputs to Gate 1 are positive, making the output near ground potential. This ground is applied to the input of Gate 2, making its output positive so that C1 charges. Applying a negative-going pulse to the input of Gate 1 causes its output to go positive. This positive output is applied to the input of Gate 2, causing its output to drop to ground, discharging capacitor C1. C1 starts charging through the circuitry in Gate 1, keeping the output of Gate 1 positive until the capacitor charges. When C1 is charged, both inputs to Gate 1 are positive, and the output drops to near ground potential. The output of the "one-shot" is a square wave whose pulse width is determined by the value of C1 and the resistance in NAND gate 1.

FLIP-FLOPS

Two NAND gates connected as shown in Figure 10 will provide the same logic functions as the conventional flip-flop (bistable multivibrator).

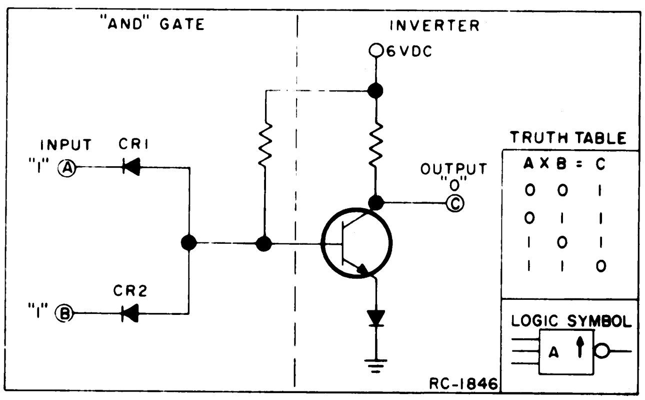


Figure 8 - Simplified NAND Gate

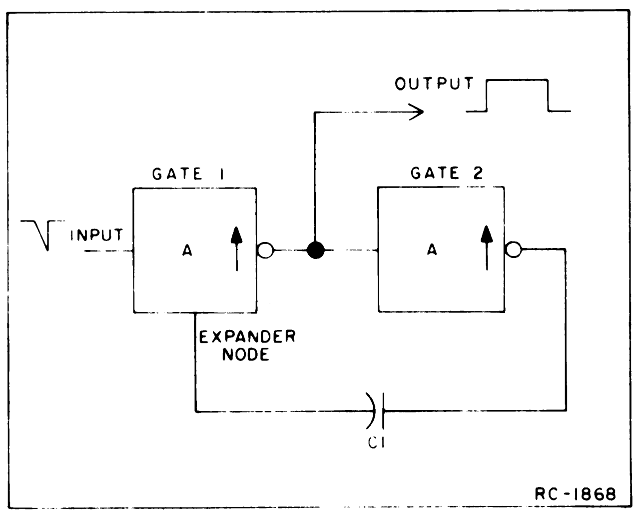


Figure 9 - NAND Gate One-Shot

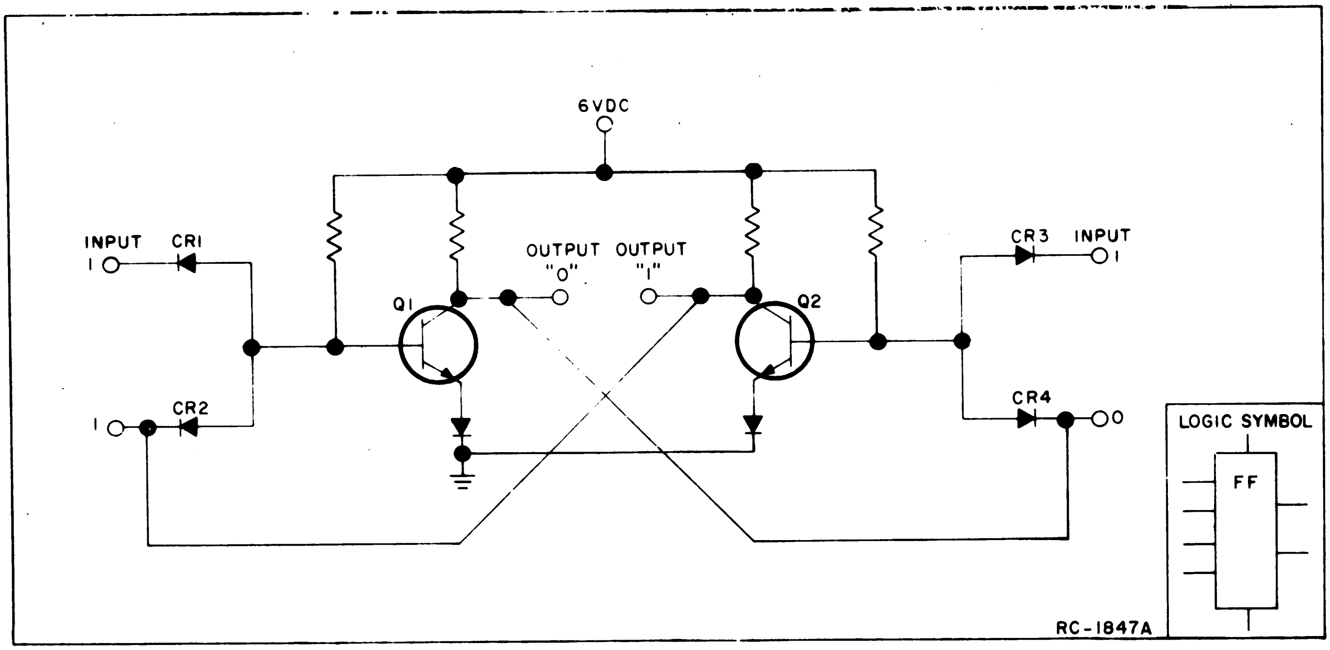


Figure 10 - NAND Gate Flip-Flop

Assume that a positive potential is applied to all inputs. Momentarily grouding the cathode of CR4 turns off Q2, causing its collector voltage to rise to approximately +6 Volts. This turns on Q1, causing its collector voltage to drop to near ground potential, keeping Q2 turned off. The flip-flop will remain in this state until CR1 is grounded.

Usually, two or more of the flip-flops are connected in a "master-slave" configuration (one flip-flop driving the other) for additional flexibility. Terminal identification for the flip-flop is shown in Figure 11A. However, the flip-flops used in the PSLM are actually connected as shown in Figure 11B, with external connections from input terminal 3 to output terminal 5, and from input terminal 2 to input terminal 6. This leaves terminal 1 as the input terminal or "Trigger". A flip-flop connected in this manner (J-K connected) will change state each time a pulse is applied to the trigger (terminal 1).

For purposes of simplicity, supply and ground terminals (as well as any unused terminal) are not shown in the logic diagrams.

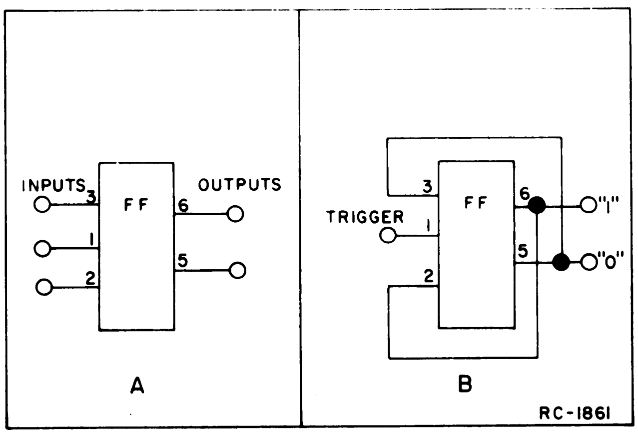


Figure 11 - Flip-Flop Terminal Identification

PSLM CIRCUITS (A701)

The heart of the PSLM is the Master Pulse Generator. The pulse generator consists of unijunction transistor Q1, resistors R1 through R4 and capacitor C1. When power is applied to the circuit, C1 charges up and causes Q1 to conduct (emitter to base-1). This quickly discharges C1, causing Q1 to stop conducting until C1 again charges up through R1 and R2. This cycle is repeated as long as power is applied to the circuit and provides a positive (1) output pulse every 84 milliseconds. This output is the timing pulse required for the different modes of operation of the PSLM. The rates were chosen in the different modes of operation to assure the reception of the first syllable of a message received on any one of the four channels and to assure full intelligibility of a message received on the non-priority channel.

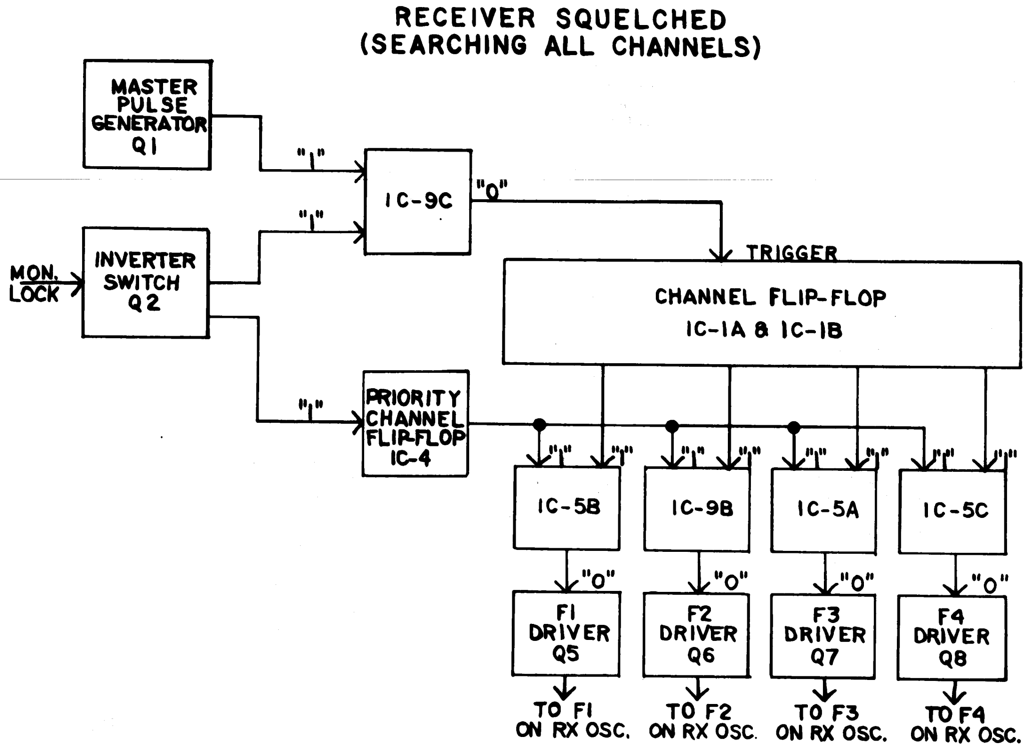


Figure 12 - Receiver Squelched

RC-2234

Operation of the PSLM is divided into three different modes:

1. Receiver squelched
2. Receiving priority channel
3. Receiving non-priority channel

RECEIVER SQUELCHED

When the receiver is squelched (no signal received), the PSLM alternately monitors each channel three times per second for a duration of 84 milliseconds. A block diagram with the associated logic for this mode of operation is shown in Figure 12.

The base of Inverter Switch Q2 is tied to the Monitor Lock Input (collector of DC amplifier in receiver). When the receiver is squelched, approximately 8.5 Volts are applied to the base of Q2, keeping the transistor turned off. The emitter of Q2 is at a positive potential ("1") which is continuously applied to terminal 11 of NAND gate IC-9C. When a positive pulse from the Master Pulse Generator (Q1) is applied to terminal 10 of IC-9C, the "1" at both inputs causes output terminal 8 to drop to "0". This triggers the Channel Flip-Flop (IC-1A and IC-1B). A "1" is applied to terminals 4 and 5 of IC-5B, resulting in a "0" at terminal 6 of IC-5B. Zener diode CR1 is forward biased, allowing Q5 to conduct. Conduction of Q5 applies +10 Volts to J7 and to the F1 oscillator in the receiver.

Flip-Flop IC-1 is triggered every 84 milliseconds by the pulse generator, which sequentially turns on the F1 through F4 drivers (Q5-Q8), applying +10 Volts to each receiver oscillator (F1-F4) in turn. The PSLM will continue searching until a signal unsquelches the receiver.

RECEIVING PRIORITY CHANNEL

When a signal is received on the priority channel, the PSLM locks on that channel for the duration of the message. A block diagram with the associated logic for this mode of operation is shown in Figure 13.

Assume that F1 is selected as the priority channel. Receiving a signal on F1 unsquelches the receiver and grounds the base of Q2, turning it on. When turned on, the emitter of Q2 drops to ground potential, applying a "0" to terminal 11 of IC-9C. This results in "1" at output terminal 8 of IC-9C. The output will remain at "1" as long as the "0" is applied to terminal 11. This prevents the Channel Flip-Flop

RECEIVING PRIORITY CHANNEL

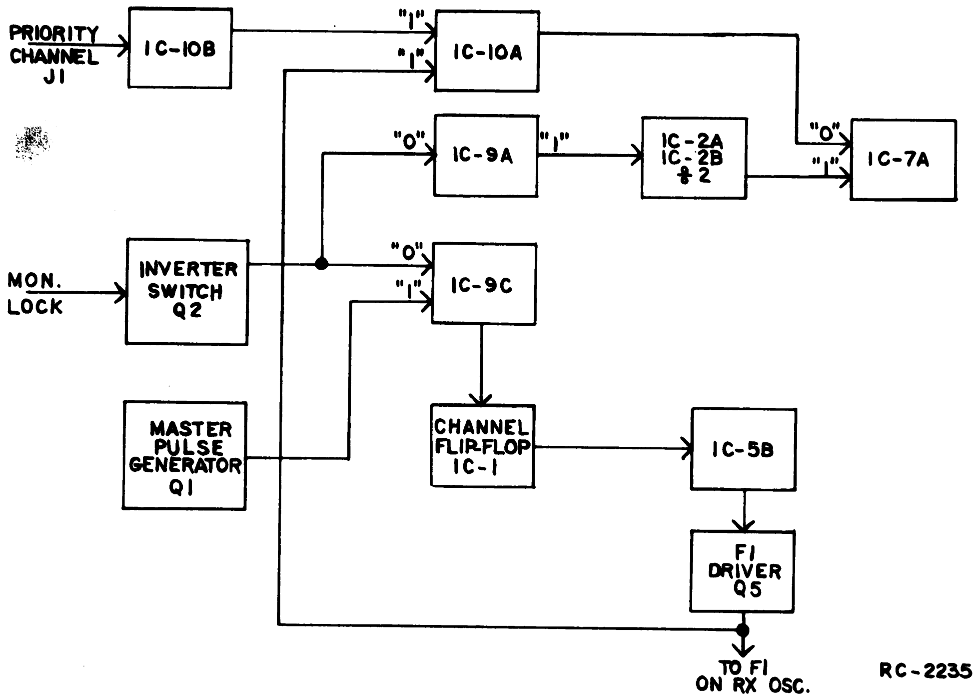


Figure 13 - Receiving Priority Channel

IC-1 from being triggered. The "1" at terminal 6 of IC-5B keeps the F1 driver Q5 turned on, applying +10 Volts to the F1 receiver oscillator.

The "O" output of INVERTER SWITCH Q2 is also applied to the input of the IC INVERTER (IC-9A) enabling DIVIDER FLIPFLOPS IC-2A and IC-2B. The Divider Flip-Flops IC-2A and IC-2B each divide the pulse generator output by a factor of 2, resulting in a 3 Hz pulse applied to terminal 12 of NAND gate IC-7A.

When F1 is the priority channel, ground is continuously applied to F1 Priority Jack J1. This results in a "O" at terminal 11 of IC-10A which is, in turn, applied to terminal 13 of IC-7A, blocking the gate. The output of the Priority-Selector Identifier Gates (IC-8A, IC-8D, IC-10A, IC-10D) prevents the timing pulses from being applied to the GATE IC-7A and triggering the Channel Flip-Flop. With gates IC-9C and IC-7A blocked, the PSLM remains locked on the F1 channel until the priority message is completed (receiver squelched).

RECEIVING NON-PRIORITY CHANNEL

When a signal is received on the non-priority channel, the PSLM stops on that channel while monitoring the priority channel three times a second for a duration of six milliseconds. If a signal is received on the priority channel while receiving the non-priority channel, the PSLM will revert from the non-priority channel and lock on the priority channel for the duration of the priority message. A block diagram with the associated logic for this mode of operation is shown in Figure 14.

Assume that F2 is the non-priority channel received. The signal on the F2 channel turns on Inverter Switch Q2. This blocks IC-9C and the Channel Flip-Flop turns on the F2 driver Q6, aplying +10 Volts to the F2 receiver oscillator.

The "O" output of INVERTER SWITCH Q2 is also applied to the input of the IC INVERTER (IC-9A) enebling DIVIDER FLIPFLOPS IC-2A and IC-2B. The Divider Flip-Flops IC-2A and IC-2B each divide the pulse generator output by a factor of 2, resulting in pulses applied to terminal 12 of NAND gate IC-7A. Ground is not applied to Priority Jack J2 which is the received non-priority channel. Thus the input to gate IC-10D is "O". With the Channel Flip-Flop stopped on the F2 channel, a "1" and a "O" are applied to the inputs of gate IC-10D, resulting in a "1" at the output does not disable IC-7A so that the

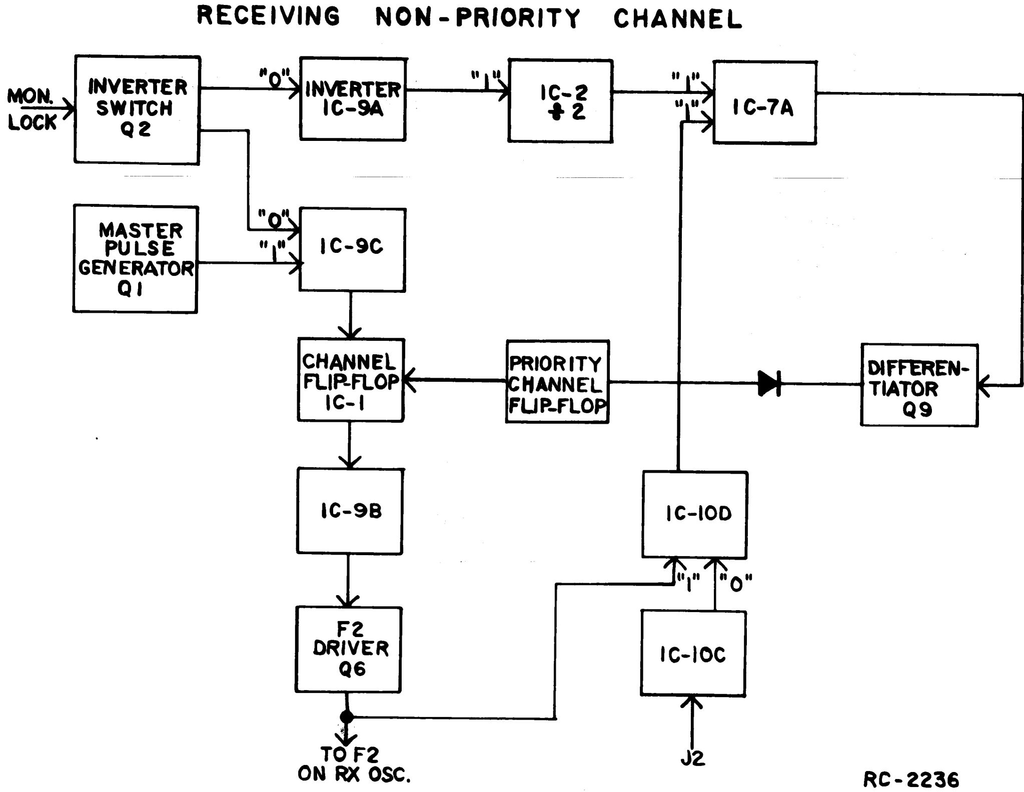


Figure 14 - Receiving Non-Priority Channel

timing pulses are passed to the Differentiator Q9.

SWITCHING BETWEEN PRIORITY & NON-PRIORITY CHANNELS

While the PSLM is locked on the non-priority channel, the priority channel is monitored three times a second for a duration of six milliseconds. Refer to Figures 14 and 15.

The output of IC-7A is differentiated by C10 and R41 and the resulting pulses are applied to the base of Q9. As Q9 is an NPN transistor, only the positive going output pulses cause the transistor to conduct. When Q9 conducts, the negative-going output pulse at its collector forward biases CR12 and switches the Channel Flip-Flop to the priority channel.

The output of Q9 also activates One-Shot Time Delay IC-3. This provides a six millisecond positive output pulse which is applied to Inverter IC-7C and the audio muting circuits.

AUDIO MUTING CIRCUITS

To prevent a rise in white noise in the audio circuits of the receiver while sampling the priority channel, the receiver audio is muted by the eight millisecond time delay circuit output. Refer to Figure 15.

Audio and noise from the audio noise amplifier in the receiver are connected to J14. The audio is normally conducted through C8, R23 and C7 to emitter follower Q13. The audio is then passed to J13 and to volume high in the receiver.

The positive pulse from the One-Shot Time Delay IC-3 turns on Q11 and then Q12 for a total time of eight milliseconds. When turned on, the collectors of Q11 and Q12 drop to ground potential, shunting the receiver audio path. This prevents an objectionable noise burst from being heard at the speaker each time the priority channel is monitored. The additional two milliseconds delay accommodates the receiver crystal oscillator re-start time.

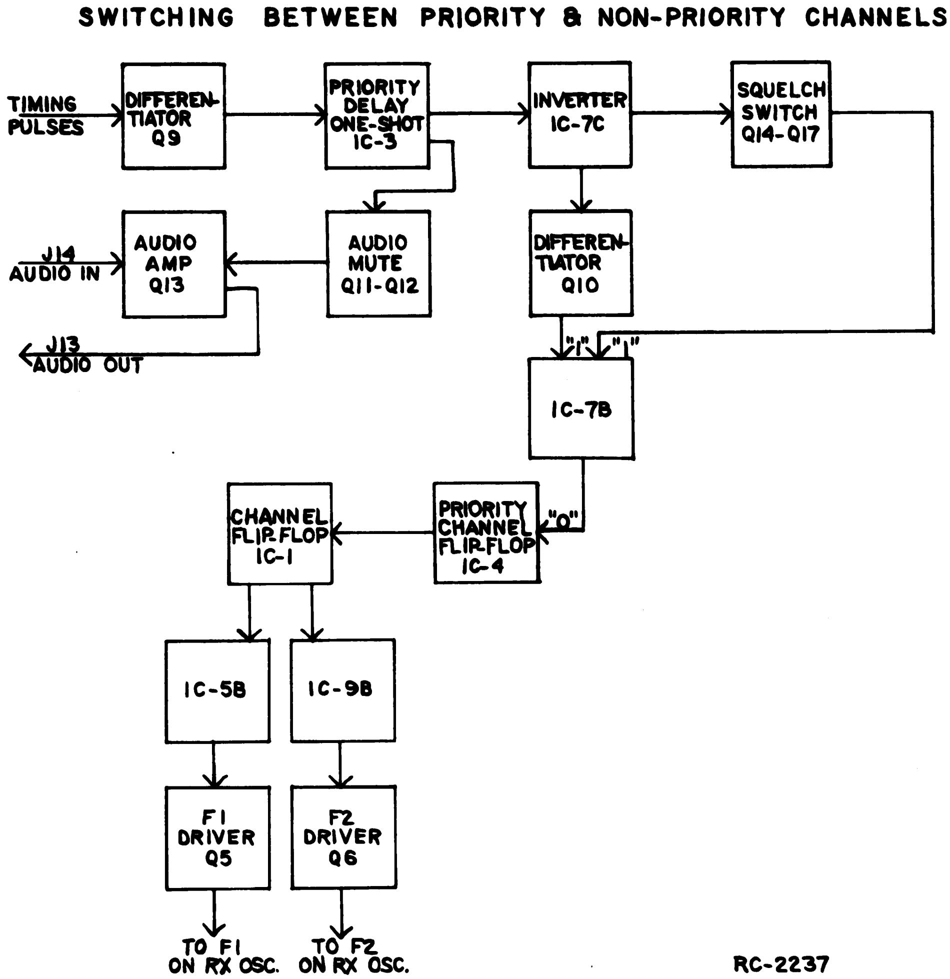


Figure 15 - Switching between Priority and Non-Priority Channels

At the same time the audio is muted, the output of the One-Shot Time Delay is inverted and applied to the Squelch Muting transistor Q14. The fast squelch circuit consist of Q14 through Q17. When the priority channel is not being monitored, audio and noise applied to the fast squelch circuit is shunted to ground by normally conducting transistor Q14. When the Channel Flip-Flop is switched to the priority channel, the negative-going six millisecond inverter output of IC-7C is applied to the base of Q14, turning the transistor off. While Q14 is turned off, the noise output of the active high-pass noise filter (consisting of C9, C11, C13, R28, R29, R32 and Q15) is applied to the base of Noise Amplifier Q16. Instructions for setting R32 are listed in the Table of Contents.

The output of Q16 is rectified by CR13 and CR14 and the resultant negative voltage turns off DC switch Q17. This removes the "0" at the input of IC-7B, unlocking the gate.

While Q17 is turned off, the output of Inverter IC-7C is differentiated by C16 and R43. The positive-going pulse turns off Q10. Turning off Q10 applies a "1" to IC-7B, switching the output on terminal 3 to a "0". This triggers the Priority Channel Flip-Flop, causing it to switch back to the non-priority channel. The entire cycle is repeated three times a second until a signal is received on the priority channel or the non-priority message is completed.

If a signal is received on the priority channel during the six millisecond monitor period, the signal quiets the receiver. With the receiver quieted, there is insufficient noise to operate the fast squelch circuit so that Q17 continues to conduct with its collector at ground potential. The "0" at the collector of Q17 blocks IC-7B while the output of the Priority Selector/ Identifier gates block IC-7A. With both gates blocked, the Priority Channel Flip-Flop remains locked on the priority channel for the duration of the priority message.

When a priority signal is received the Priority Selector/Identifier gates apply a "O" to the base of Audio Boost transistor Q26, turning it off. With Q26 turned off, the audio level is increased 6 dB (± 2 dB).

SYSTEM MODIFICATION

The following modifications are required for MASTR mobile combinations when the Priority Search Lock Monitor options are installed. The modifications change receivers equipped with standard crystal oscillators (non-ICOM) to reduce the oscillator starting time.

1. On all Receiver and Dual Front End oscillator boards, C5, C6, C7 and C8 were removed. C17, C18, C19 and C20 were replaced with 7pF, NPO ceramic capacitors (GE Part No. 19C300685P95).

2. On all UHF Receivers and Dual Front End oscillator boards, removed C5, C6, C7 and C8. Replaced C17, C18, C19 and C20 with 7pF, NPO ceramic capacitors (GE Part No. 19C300685P95). Also removed RT9 and C43.

PRIORITY SQUELCH ADJUSTMENT

Priority Squelch Adjust R32 was set at the factory for proper operation and will normally require no further adjustment. If it should become necessary to set R32, use the following procedure. A signal generator (M560 or equivalent) with a 6-dB pad is required.

Before starting the procedure, make sure that the receiver is properly aligned with the PSLM disabled (SEARCH-OFF switch in the OFF position). Then measure and record the priority channel 20-dB quieting sensitivity.

1. Place the Frequency Selector Switch in a non-priority frequency position and the SEARCH-OFF switch in the SEARCH position.

2. Alternately squelch and unsquelch the receiver until the PSLM stops on a non-priority channel The PSLM searches when the teceiver is squelched and may lock on either the priority or non-priority channel when the receiver is unsquelched. Therefore, several attempts may be required to stop the PSLM on a non-priority channel by checking the light on the mobile control unit.

3. Next, apply a signal on the priority channel from the signal generator. Then slowly increase the signal generator output until the receiver switches to the priority channel. This should be at the 20-dB quieting level as measured previously.

4. If necessary, adjust the Priority Squelch control R32 until the PSLM switches channels at the 20-dB level. Check all channels for this same function.

MAINTENANCE

DISASSEMBLY

Access to the inside of the Control Unit is obtained by removing the four Phillips-head screws in the back of the unit and pulling the back plate away from the housing.

PILOT LAMP REPLACEMENT

The polot lamps can be replaced by removing the front name plate and removing the two Phillips-head screws holding the lamp bracket in place. The wires attached to the bracket are removed and then the lamps may be replaced.

REISTALLATION

The Royal Professional mobile combination operates in 12-Volt, negative ground vehicle systems only! If the radio is ever moved to a different vehicle, always check the battery polarity and voltage of the new system before using the radio.

CAUTION

Do not install the Royal Professional in a vehicle system using a circuit breaker. The radio must be operated in a system protected by a 15-amp quick blow fuse (similar to GE Fuse Assembly 19B216021G4 and fuse 1R11-P4).

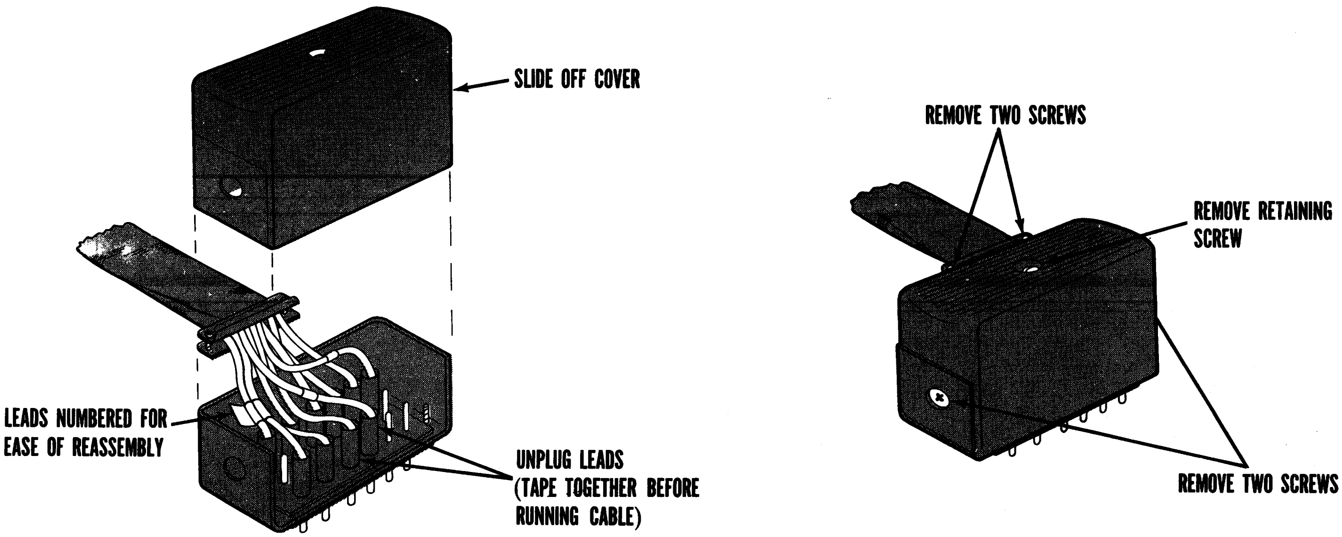


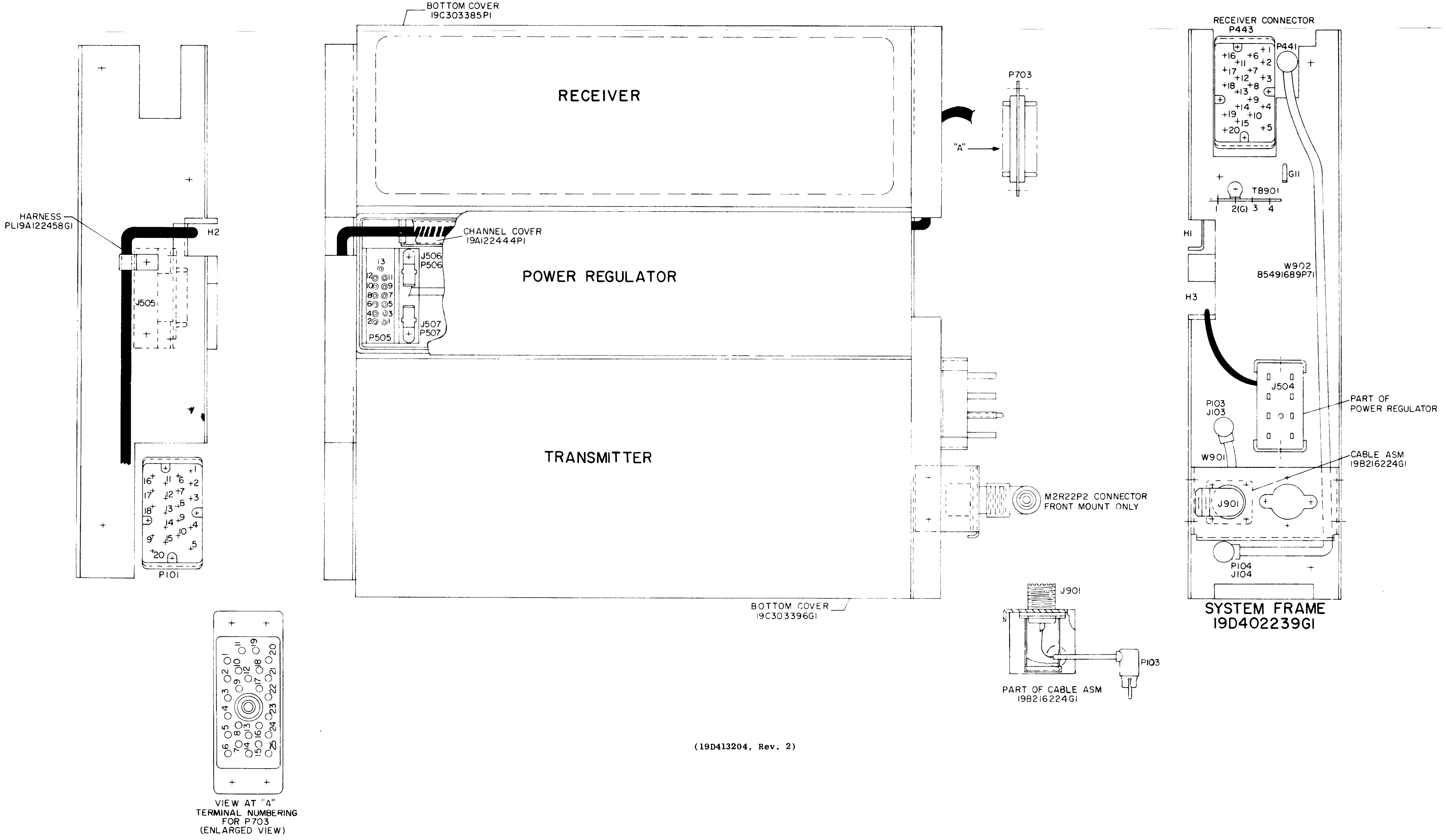
Figure 16 - Disassembly of Control Cable Plug

If it becomes necessary to move the Two-Way Radio and Control Unit to another vehicle, the 25-pin control cable plug may need to be disassembled. Refer to Figure 16 for disassembly of the plug.

NOTE

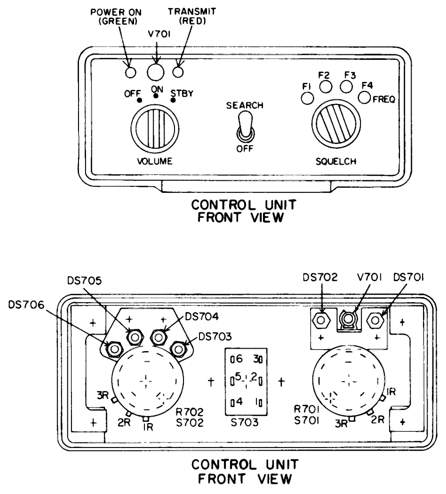
The plug is assembled so that the cable comes out of the top of the plug when connected to the Control Unit. To have the cable come out of the bottom of the plug, remove the remaining two screws and rotate the metal frame 180 degrees.

SYSTEM FRAME AND HARNESS



(19D413204, Rev. 2)

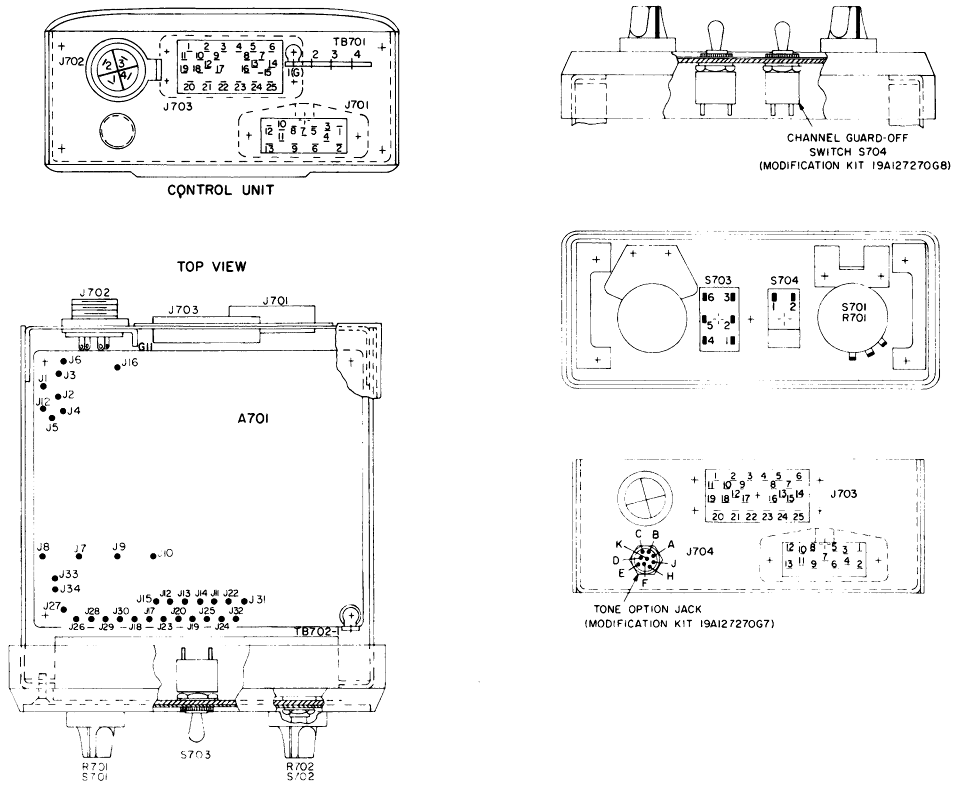
CONTROL UNIT



SYMBOL	FUNCTION
R701	VOLUME CONTROL
R702	SQUELCH CONTROL
S701	OFF - ON - STBY
S702	FREQUENCY SELECTOR
S703	SEARCH - OFF
S704 *	CHANNEL GUARD - OFF
J704 #	TONE OPTION JACK

* THIS SWITCH PRESENT IN MODELS 4EC59A92 AND 4EC59A94 ONLY

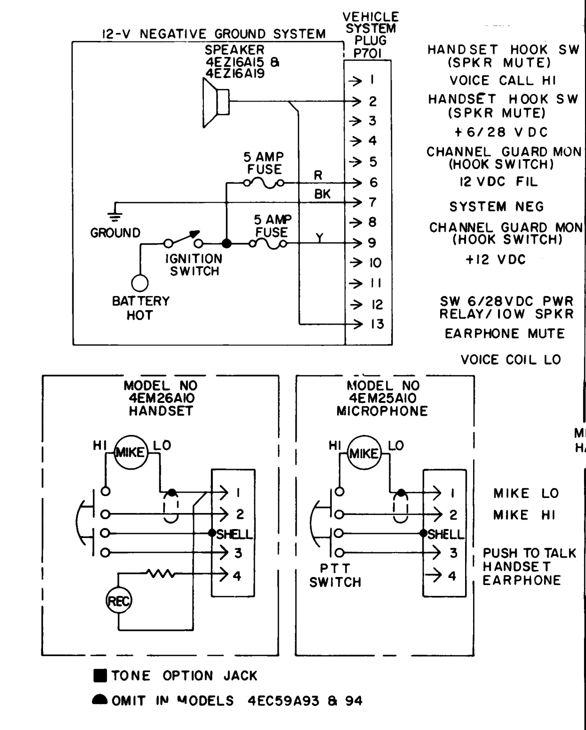
\# THIS JACK PRESENT IN MODELS 4EC59A97 AND 4EC59A98 ONLY.



(19D416498, Rev. 1)

OUTLINE DIAGRAM

MOBILE CONTROL UNIT
MODELS 4EC59A91—94



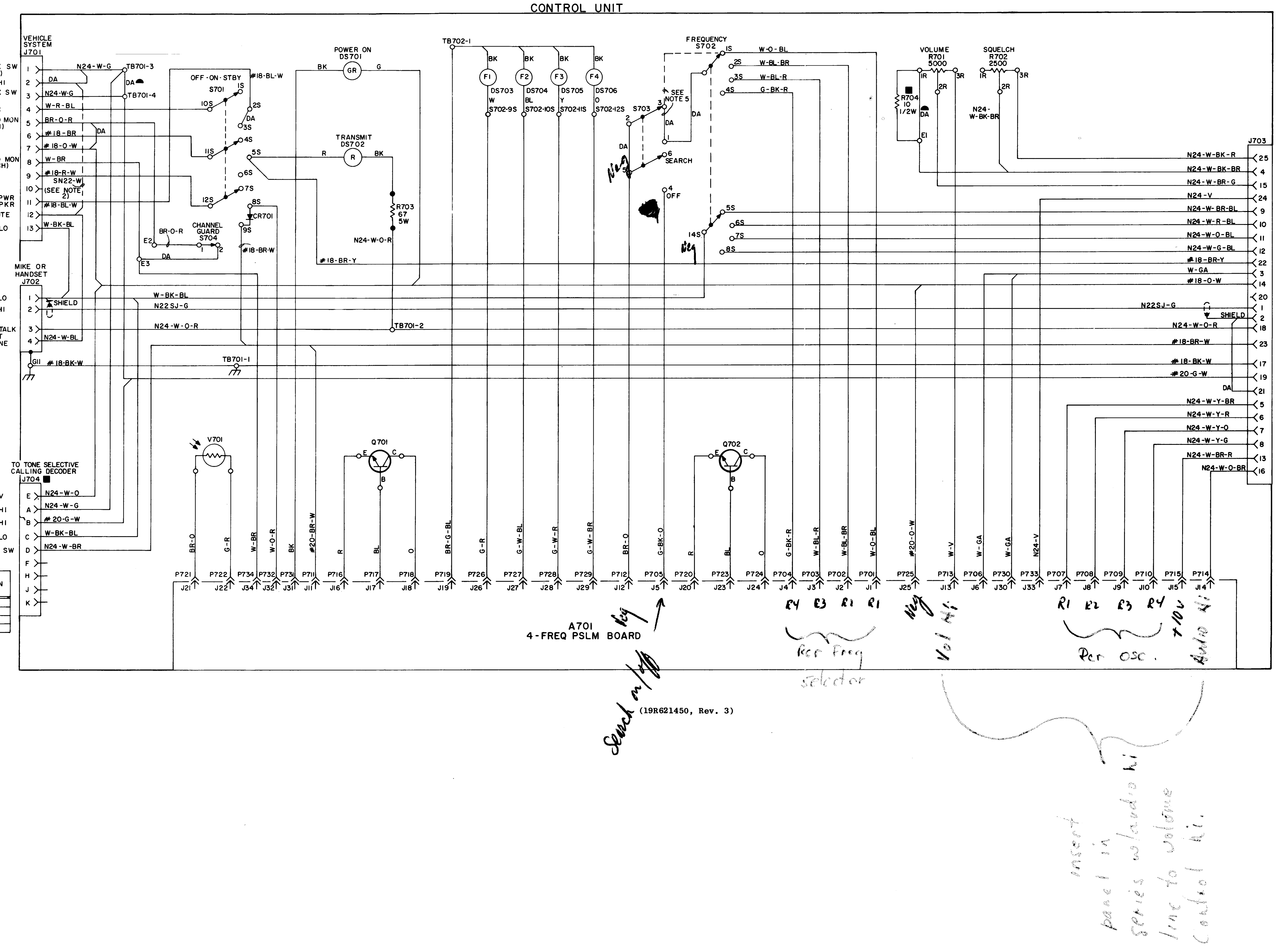
■ TONE OPTION JACK

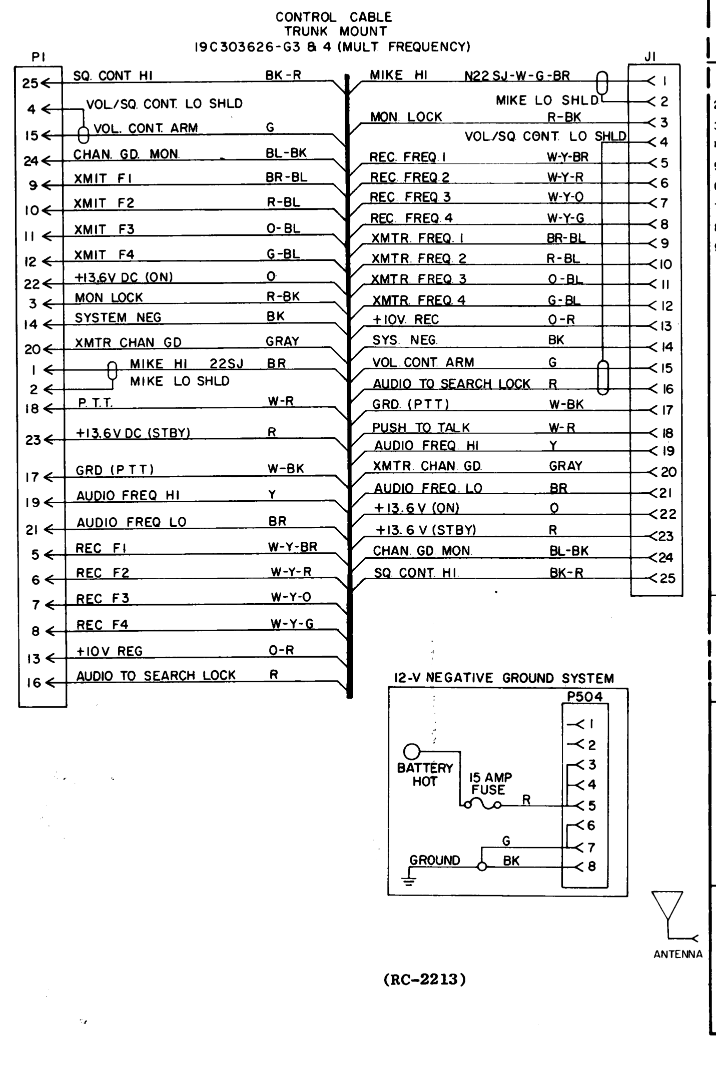
● OMIT IN MODELS 4EC59A93 & 94

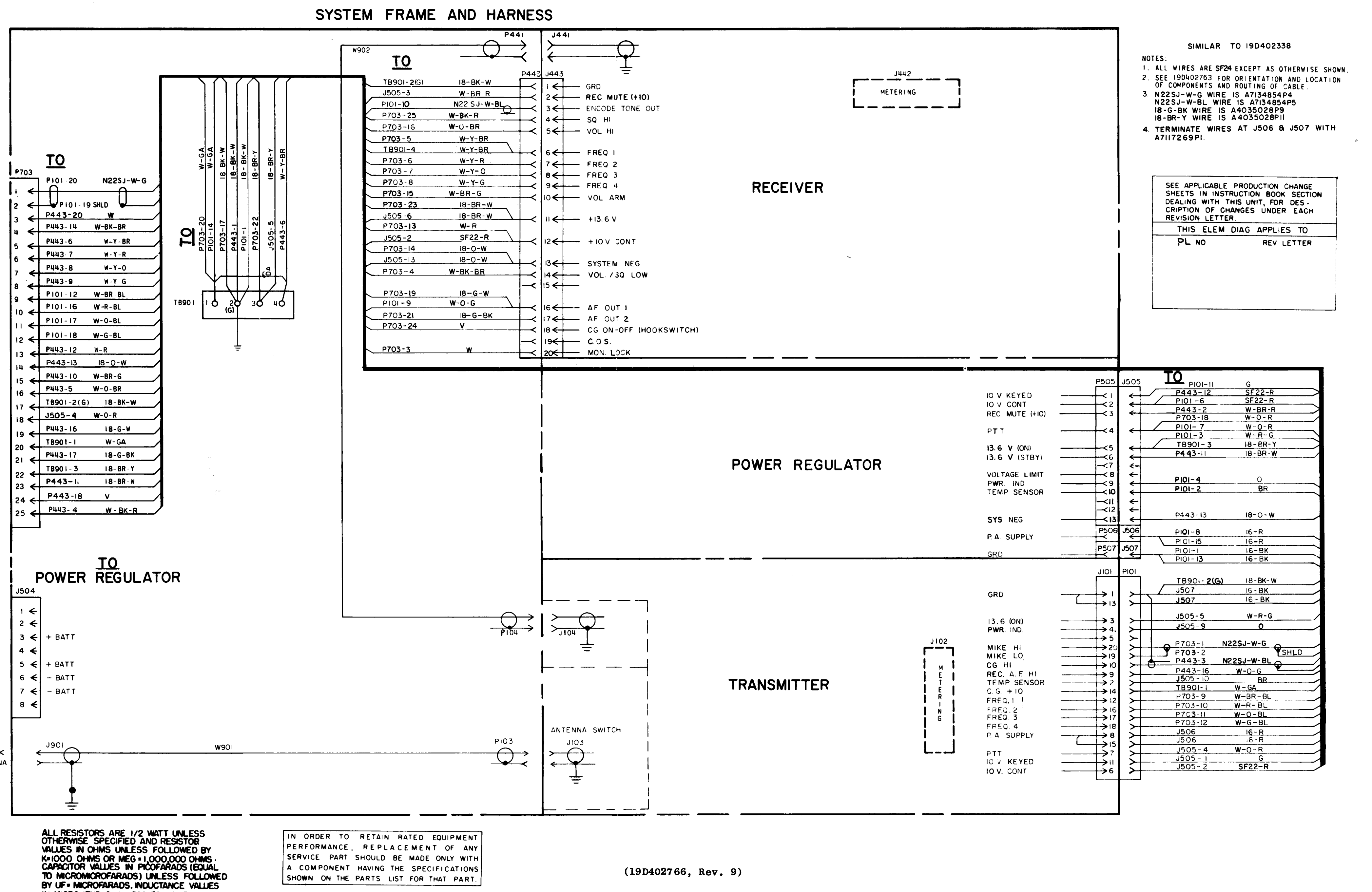
NOTES:

1. ALL WIRE TO BE N22 UNLESS OTHERWISE SPECIFIED.
2. ADD SN22 WHITE WIRE WHEN PL19B204970G1 HOOKSWITCH IS USED.
3. TO DISABLE CHANNEL GUARD ON: F1 REMOVE A701-CR19
   F2 REMOVE A701-CR20
   F3 REMOVE A701-CR21
   F4 REMOVE A701-CR22
4. J1-J34 TO BE A4033513P4. P701-P734 TO BE A4029840P2.
5. TO LOCK PRIORITY CHANNEL REMOVE JUMPER FROM S703-1 AND ATTACH TO S702-1S FOR F1 PRIORITY
   2S FOR F2 PRIORITY
   3S FOR F3 PRIORITY
   4S FOR F4 PRIORITY

MODEL NUMBER	REV. LETTER	NO. OF FREQ.	FREQ. INDICATOR LIGHTS	CHANNEL GUARD	SEARCH OFF SWITCH	TONE OPTION JACK
4EC59A91		4	X		X	
4EC59A92		4	X	X	X	
4EC59A93		4	X		X	X
4EC59A94		4	X	X	X	X







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.

SCHEMATIC & INTERCONNECTION DIAGRAM

MOBILE CONTROL UNIT, MODELS 4EC59A91—94

Issue 1

PARTS LIST

LBI-4320

CONTROL UNIT
4-FREQUENCY PSLM
MODELS 4EC59A91-94

SYMBOL	GE PART NO.	DESCRIPTION
A701	19D413992G1	PSLM Board. Refer to LBI-4324.
		- - - - - - - - DIODES AND RECTIFIERS - - - - -
CR701	4037822P2	Silicon.
		- - - - - - - - - INDICATING DEVICES - - - - - -
DS701	19B209449P6	Light, incandescent: white lens; sim to Drake Mfg 6036-006-804-2.
DS702	19B209449P5	Light, incandescent: red lens; sim to Drake Mfg 6036-006-804-1.
DS703	19B209449P1	Light, incandescent: white lens; sim to Drake 6036-005-844-1.
DS704	19B209449P2	Light, incandescent: white lens; sim to Drake Mfg 6036-005-844-2.
DS705	19B209449P3	Light, incandescent: white lens; sim to Drake Mfg 6036-005-844-3.
DS706	19B209449P4	Light, incandescent: white lens; sim to Drake 6036-005-844-4.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J701	19C303576P1	Receptacle: 13 contacts rated at 5 amps.
J702	19A116061P1	Connector, chassis: 4 female contacts; sim to Amphenol Type 91-PN4F-1000.
J703	19D402408P1	Receptacle: 25 contacts rated at 5 amps.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P701 thru P710	4029840P2	Contact, electrical: sim to Amp 42827-2.
P711	4029840P1	Contact, electrical: sim to AMP 41854.
P712 thru P724	4029840P2	Contact, electrical: sim to Amp 42827-2.
P725	4029840P1	Contact, electrical: sim to AMP 41854.
P726 thru P734	4029840P2	Contact, electrical: sim to Amp 42827-2.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q701 and Q702	19A116203P3	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - - -
R701		(Part of S701).
R702		(Part of S702).
R703	5493035P19	Wirewound: 67 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
R704	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
		- - - - - - - - - - - SWITCHES - - - - - - - - - -
S701	19C307089P19	Switch/Resistor: includes Switch, rotary, 3 poles, 3 positions, momentary shorting contacts, 250 ma at 500 VRMS; Resistor (R701), variable, 5000 ohms ±20%, 1/2 w max; sim to Mallory Type LC.
S702	19C307089P21	Switch/Resistor: includes Switch, rotary, 3 poles, 4 positions, momentary shorting contacts, 250 ma at 500 VRMS; Resistor (R702), variable, 2500 ohms ±20%, 1 w max; sim to Mallory Type LC.
S703	5491899P4	Toggle: DPST, 6 amps at 125 VAC/VDC; sim to Cutler-Hammer 8373K8.

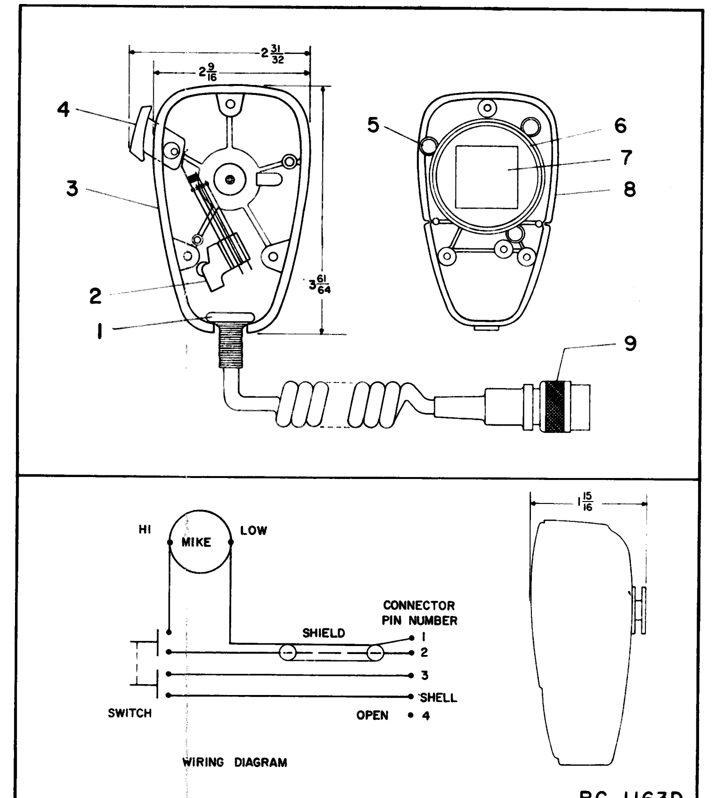
SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - PHOTO CELLS - - - - - - - - -
V701	19A115994P1	Photoconductive, cell: 60 v, 75 mw at 25°C; sim to Clairex Co CL605L.
		TONE CONNECTOR KIT 19A127270G7
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J704	19B216279G1	Jack assembly: 9 female contacts rated at 5 amps at 900 VRMS; sim to Winchester M9S-LRN.
		CHANNEL GUARD SWITCH KIT 19A127270G8
		- - - - - - - - - - - SWITCHES - - - - - - - - - -
S704	5491899P5	Toggle: SPST, 3 amps at 250 VAC/VDC; sim to Cutler-Hammer 8280K15.
		RECEIVER OSCILLATOR MODIFICATION KIT 19A129141G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C4	19C300685P95	Ceramic disc: 7 pf ±0.1 pf, 500 VDCW, temp coef 0 PPM.
		MECHANICAL PARTS (SEE RC-2241)
1	4038930P1	Clip. (Used with R703).
2	N529P18C13	Button plug.
3	19A121891G3	Cover.
4	19C317816G1	Chassis.
5	19A116023P2	Insulator, plate. (Used with Q701 and Q702).
6	19A116022P1	Insulator, bushing. (Used with Q701 and Q702).
7	N84P9006C6	Screw: 4-40 x 3/8.
8	19B219310G1	Front cap.
9	7115130P9	Lockwasher: 3/8 inch; sim to Shakeproof 1220-2.
10	7165075P2	Hex nut, brass: No. 3/8-32.
11	7115195P2	Hex nut: 15/32-32.
12	4033394P1	Knurled nut: 15/32-32.
13	7115130P11	Lockwasher: 15/32 inch; sim to Shakeproof 1222-1.
14	NP270603A	Nameplate. (With Channel Guard).
15	NP270603B	Nameplate. (Without Channel Guard).
16	19B204443G1	Knob. (OFF-ON-STBY, 1-2-3-4 Freq).
17	19B204949P2	Lens: white plastic.
18	19C303413P1	Knob. (VOLUME, SQUELCH).
19	19B209209P308	Tap screw, Phillips Pozidriv: 6-32 x 1/2. (Secures cap to chassis).
20	19A129018G1	Support. (Secures DS701 and DS702).
21	19A129016G1	Support. (Secures DS703-DS706).
		ASSOCIATED ASSEMBLIES
	19D402239G1	12 volt vehicles frame.
	19A122444P1	Cover, wire channel (on systems frame).
	19C303452G2	Front casting.
	5491682P2	Lock: Yale and Towne. (Part of Front casting).
	5491682P7	Cam. (Used with lock).
	19A121902G1	Mounting bracket, Control Unit.
		POWER CABLE ASSEMBLY 19C303601G2 (12 VOLT TRUNK MOUNT)
	19B209189P1	Connector, phen: 8 contacts rated at 15 amps at 1100 VRMS; sim to Beauchaine and Sons S-5401-76.

SYMBOL	GE PART NO.	DESCRIPTION
	19D402438P1	Cap, connector.
	19A115314P1	Cable: 3 conductor, approx 18 feet long.
		CONTROL CABLE ASSEMBLY 19C303626G3, G4 (MULTI-FREQ)
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	19C303626G5	Plug, male, includes: connector 19D402408P3, cap 19C303290P2.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19C303626G6	Plug, female, includes: connector 19D402408P1, cap 19C303290P1.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19D402408P1	Connector, female phen: 25 contacts rated at 5 amps max.
	19D402408P3	Connector, male phen: 25 contacts rated at 5 amps max.
	19C303290P1	Cap, connector. (Used with 19D402408P1 connector).
	19C303290P2	Cap, connector. (Used with 19D402408P3 connector).
	7139880P11	Cable, multi freq: 23 conductors, approx 18 feet long. (Specify length when ordering).
	7139880P11	Cable, multi freq: 23 conductors, approx 23 feet long. (Specify length when ordering).
		VEHICLE SYSTEM CABLE KIT 19A121454G1 (12 VOLT VEHICLES)
	19A121429-P1	Pin: 1/2 inch long.
	19A121441G1	Plug: 13 contacts.
	19C303574P1	Cover.
		FUSED LEAD ASSEMBLY 19A121454G1
	1R16P8	Fuse, cartridge, quick blowing: 5 amps at 250 v; sim to Littelfuse 312005 or Bussmann MTH-5.
	19A115776P2	Fuseholder: sim to Bussmann Type HDJ-B.
		INTERCONNECTION HARNESS ASSEMBLY 19A122458G1
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J505	19A122683-G1	Plug, male: 13 pin contacts.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P101	19C303506P1	Connector, phen: 20 contacts rated at 5 amps max at 600 VDC.
P443	19C303506P1	Connector, phen: 20 contacts rated at 5 amps max at 600 VDC.
P703	19D402408P2	Connector, phen: 25 contacts rated at 5 amps max.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - -
TB901	7775500P10	Phen: 4 terminals.
		ANTENNA CABLE ASSEMBLY 19B216224G1
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J901	2R22P3	Receptacle, panel, coaxial: mica-filled insert, UHF contact. Signal Corps SO-239 or sim to Amphenol 83-1R.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P103		(Part of W901).
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W901	5491689P56	Cable, RF: coaxial, approx 12 inches long. Includes phono type plug (P103).

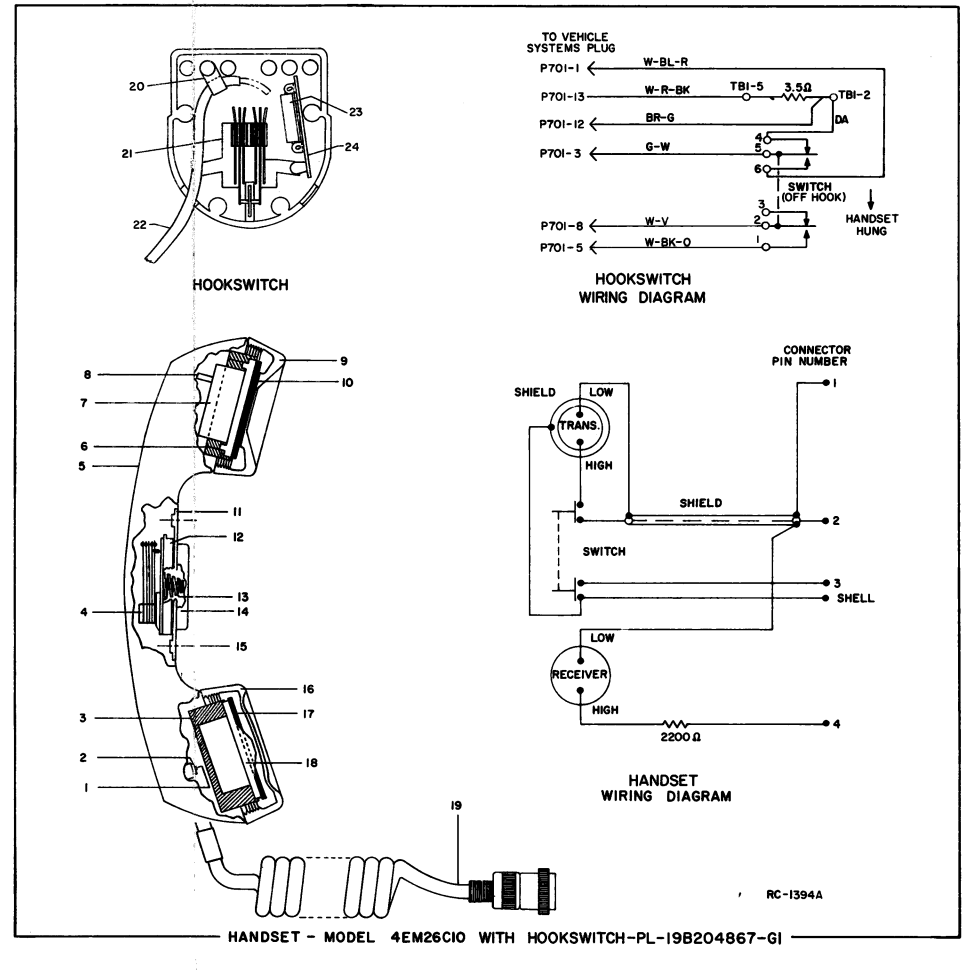
SYMBOL	GE PART NO.	DESCRIPTION
	2R22P2	Adapter, right angle, coaxial: polystyrene, UHF contact. Signal Corps M-359; sim to Amphenol 83-1AP. (Front mount only) (Connect to J901).
		RECEIVER RF CABLE ASSEMBLY
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P104		(Part of W902).
P441		(Part of W902).
		- - - - - - - - - - - - CABLES - - - - - - - - - -
W902	5491689P71	Cable, Receiver, RF: includes two phono type plugs (P104 and P441), 350 VRMS max, approx 12 inches long.
		12 VOLT FUSEHOLDER 19B216021G4
	19D413045P1	Base.
	19D413046P1	Cover.
	19B205950P1	Fuse clip.
		- - - - - - - - - - - - FUSES - - - - - - - - - -
	1R11P4	Quick blowing: 15 amps, 250 v; sim to Bussmann NON15. (transmitter).
		130 - 470 MHz ANTENNA MODEL 4EY12A13 (5490969P13)
		Antenna: includes stainless steel whip approx 20 inches long; ball tip; whip socket; No. 6-32 set screw; rubber mounting gasket; antenna cable; cable adapter; PL-259 coaxial plug; sim to Antenna Specialists ASPD201GE or Danbury-Knudsen Type PA-25.
	5490969P4	Whip: stainless steel, approx 20 inches long; ball tip.
	5490969P5	Socket, whip: with (2) No. 6-32 set screws.
	5490969P6	Whip and whip socket: stainless steel whip approx 20 inches long with ball tip; whip socket with (2) No. 6-32 set screws.
		Cable, antenna: approx 15 feet long. Type RG-58/U. (Used with GE Dwg 2R22P1 and GE Dwg 7105381P1).
	7105381P1	Adapter, cable, Type UG-175/U. (Used with GE Dwg 2R22P1 and Type RG-58/U cable).
	2R22P1	Plug, coaxial: mica-filled insert, UHF contact. Signal Corps PL-259; sim to Amphenol 83-1SP. (Used with GE Dwg 7105381P1 and Type RG-58/U cable).
		25 - 50 MHz ANTENNA
	7491074P1	Antenna: includes stainless steel rod approx 96-1/2 inches long; ball tip; lockwasher; No. 10-32 hex socket set screw; sim to Antenna Specialists ASPA3BGE.
	7102930P3	Adapter, antenna: approx 2-5/16 inches long. (Used with GE Dwg 7491074P1).
	4033101G1	Antenna package: includes base; adapter spring; cable and plug.
	7472880G5	Antenna base. (Used in 4033101G1).
	7476632G4	Adapter spring. (Used in 4033101G1).
	5492239P1	Cable, antenna: includes Type RG-58/U cable approx 15 feet long; PL-259 coaxial plug; mounting clip; ring tongue terminal; sim to Antenna Specialists 15A43. (Used in 4033101G1).
	2R22P1	Plug, coaxial: mica-filled insert, UHF contact. Signal Corps PL-259; sim to Amphenol 83-1SP. (Used with GE Dwg 5492239P1 in 4033101G1).
	4KY9A1	Coil, loading: 25 to 33 MHz; sim to Antenna Specialists ASPA87.
	19A121577G1	Antenna hook kit.
	7134724P1	Antenna hook. (Used in 19A121577G1).

SYMBOL	GE PART NO.	DESCRIPTION
		HANDSET MODEL 4EM26C10 (19B209100G1) (SEE RC-1394)
1		Self tap screw, bind head: No. 4 x 5/16. Shure Brothers 30C640C.
2		Cable clamp. Shure Brothers 53A532.
3		Shield. Shure Brothers RP19.
4		Switch. Shure Brothers RP81.
5		Case. Shure Brothers 21RP899F.
6		Adapter. Shure Brothers 65A230.
7		Magnetic controlled cartridge. Shure Brothers RP41.
8	3R77P222K	Resistor, composition: 2200 ohms ±10%, 1/2 w.
9		Receiver cap. Shure Brothers 65A199A. (Part of RP49).
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 RP82.
15		Flat head screw, socket cap: No. 4-40 x 1/4. Shure Brothers 30C557B.
16		Transmitter cap. Shure Brothers 65A197A. (Part of RP49).
17		Washer. Shure Brothers 34A309.
18		Magnetic controlled cartridge. Shure Brothers RP13.
19		Cable and plug. Shure Brothers 21RP738F.
		HOOKSWITCH ASSEMBLY 19B204867G1
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
20	4029851P4	Cable clamp; sim to WEC Kesser 3/6-4.
21	19A121612P1	Holder and switch: thermoplastic case, contact rating 1 amp at 125 v.
22	19A121581G1	Cable: approx 8-1/2 feet long.
23	5493035P10	Resistor, wirewound, ceramic: 3.5 ohms ±5%, 5 w; sim to Tru-Ohm Type X-60.
24	7775500P55	Terminal board, phen: 5 terminals.
		MILITARY MICROPHONE MODEL 4EM25A10 19B209102G1
		(SEE RC-1163)
1		Cable clamp. Shure Brothers 53A532.
2		Switch. Shure Brothers RP26.
3		Case (back) and mounting button: plastic. Shure Brothers RP67.
4		Switch button: red plastic. Shure Brothers RP25.
5		Spring. Shure Brothers RP16.
6		Shield. Shure Brothers RP23.
7		Magnetic controlled cartridge. Shure Brothers RP13.
8		Case (front): plastic. Shure Brothers RP67.
9		Cable and plug: approx 6 feet long. Shure Brothers RP14.
		5 WATT SPEAKER 4EZ16A19 19D402449G12
C1	19B209233P1	Electrolytic, non-polarized: 25 µf ±20%, 25 VDCW; sim to Sprague 44DC.

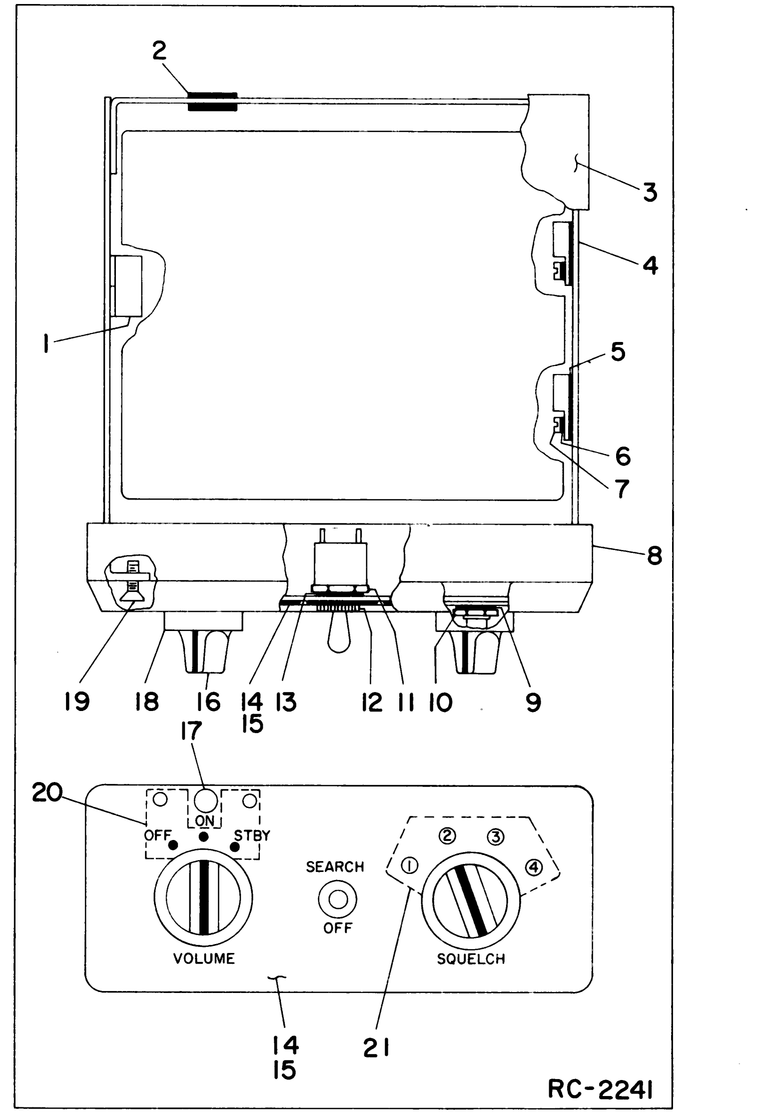
SYMBOL	GE PART NO.	DESCRIPTION
LS3	19B209422P1	Permanent magnet: 5 inch, 3.2 ohms ±10% imp, 2.98 ohms ±15% DC res, 7.5 w max operating.
W1	19A121546G1	Cable assembly: approx 48 inches long, includes (2) 19A121429P1 pins.
	19B216269G2	Speaker housing.
	19A121550G3	Cover.
	19A121521G1	Mounting support.
	5490407P3	Neoprene grommet. (Upper)
	19A115470P1	Rubber grommet. (Lower)



RC-1163D



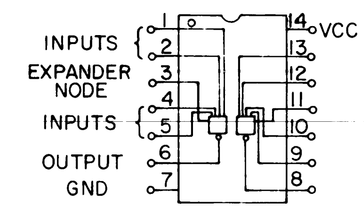
HANDSET - MODEL 4EM26C10 WITH HOOKSWITCH-PL-19B204867-G1



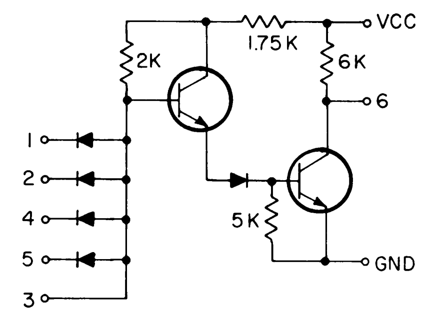
RC-2241

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

DUAL 4-INPUT GATES
19A115913-P1

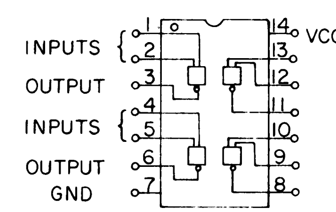


LOGIC DIAGRAM

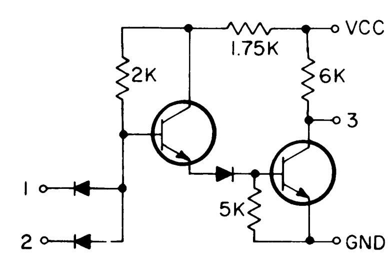


TYPICAL SCHEMATIC DIAGRAM
(ONE GATE ONLY)

QUADRUPLE 2-INPUT GATES
19A115913-P7

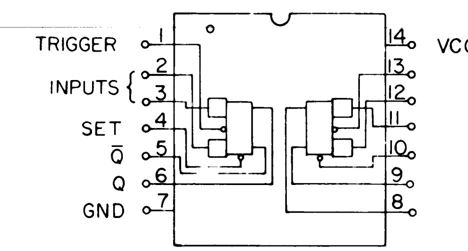


LOGIC DIAGRAM

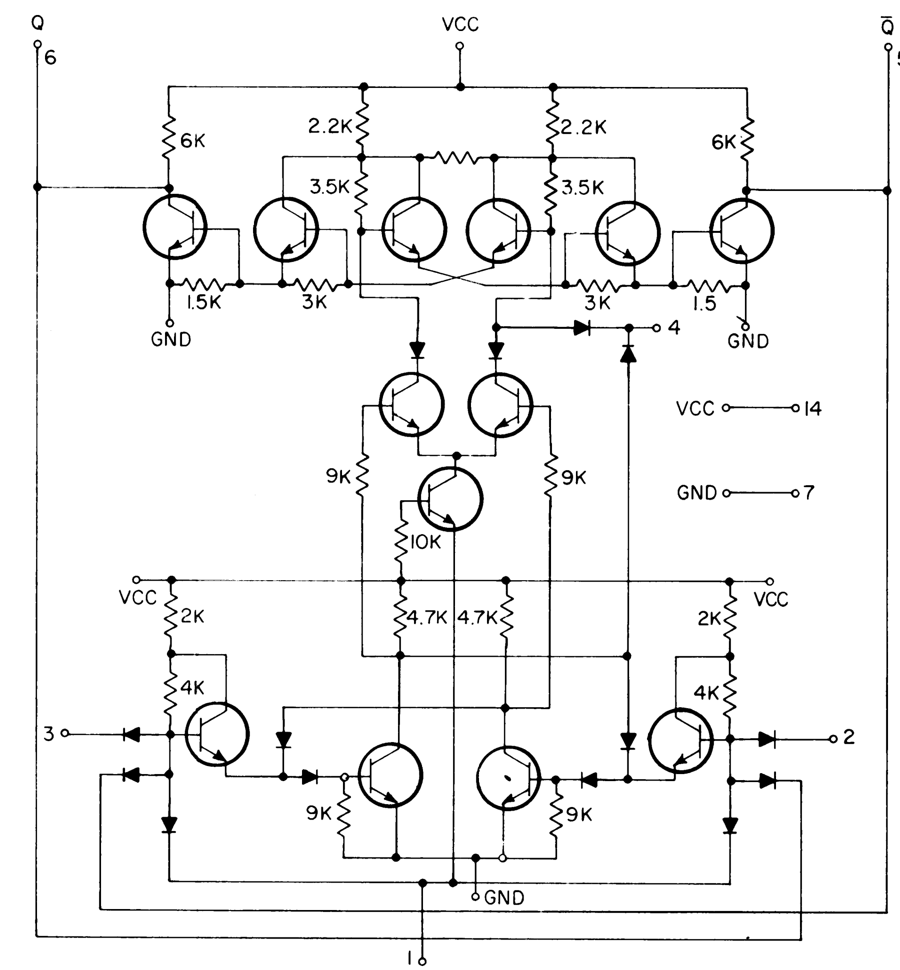


TYPICAL SCHEMATIC DIAGRAM
(ONE GATE ONLY)

MASTER-SLAVE FLIP-FLOP
19A115913-P10



LOGIC DIAGRAM

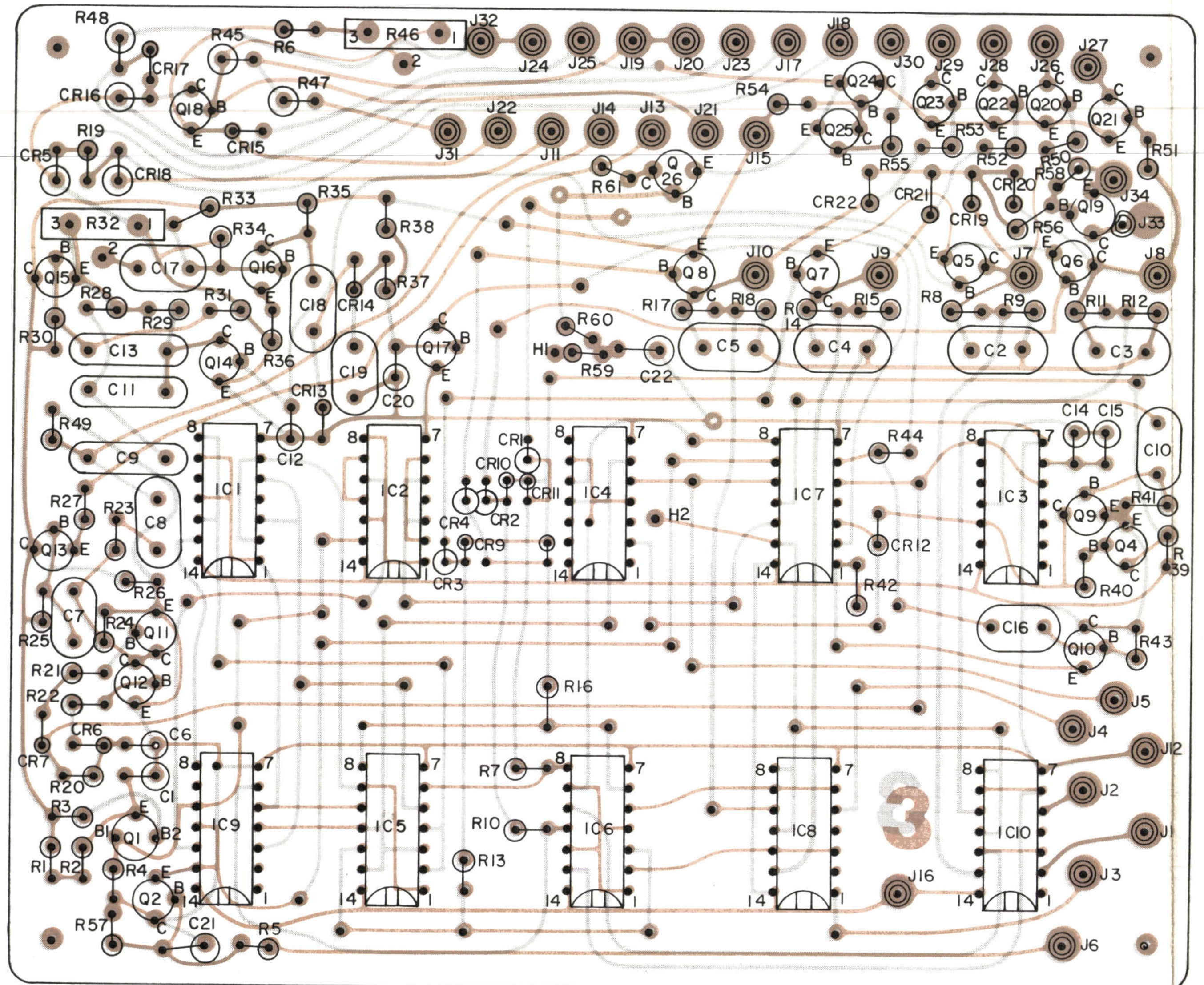


TYPICAL SCHEMATIC DIAGRAM
(ONE FLIP-FLOP ONLY)

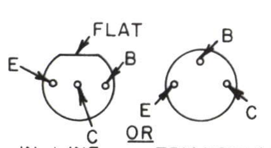
RC-1873

LOGIC & SCHEMATIC DIAGRAMS

FOR INTERGRATED CIRCUIT MODULES
PRIORITY SEARCH-LOCK MONITOR



(19D416474, Rev. 1)
(19C317801, Sh. 1, Rev. 3)
(19C317801, Sh. 2, Rev. 3)

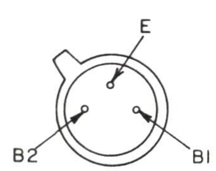


IN-LINE OR TRIANGULAR

VIEW FROM LEAD END

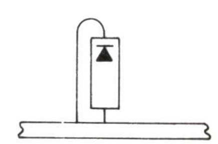
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR Q2–Q26

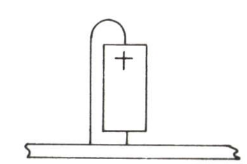


VIEW FROM LEAD END

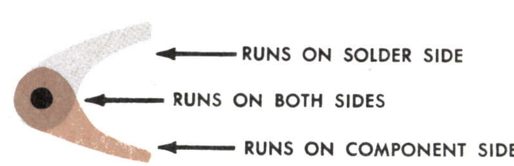
LEAD IDENTIFICATION FOR Q1



CATHODE IDENTIFICATION FOR ALL DIODES

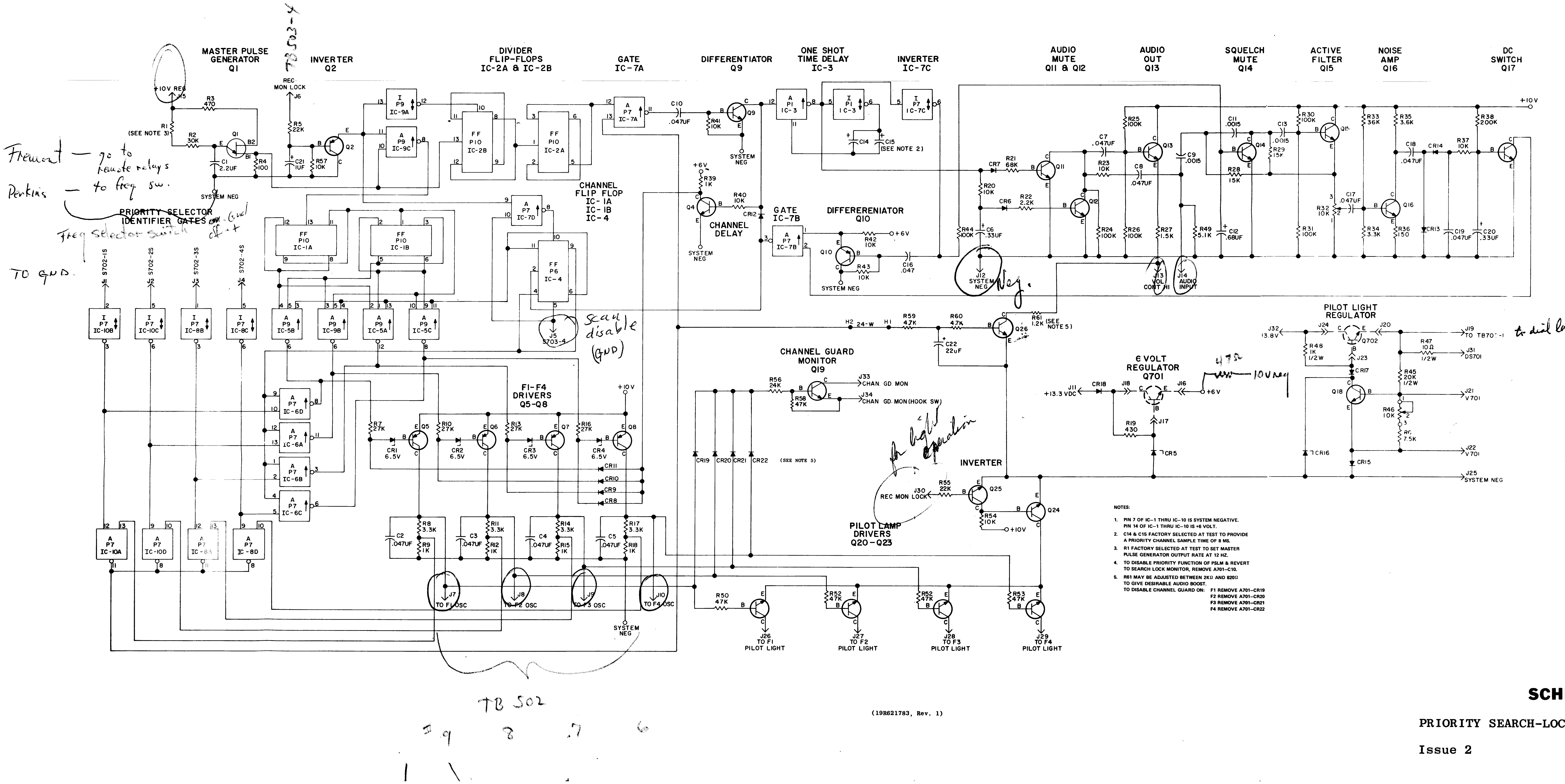


POLARITY IDENTIFICATION FOR C1, C6, C12, C14, C15, C20 AND C21.



OUTLINE DIAGRAM

PRIORITY SEARCH-LOCK MONITOR BOARD A701



CHANGES TO THIS DIAGRAM MAY AFFECT 19R621465, 19D413287 & 19R621450.

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

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
4EC59A91	A
4EC59A92	A
4EC59A93	A
4EC59A94	A

NOTES:

1. PIN 7 OF IC–1 THRU IC–10 IS SYSTEM NEGATIVE. PIN 14 OF IC–1 THRU IC–10 IS +6 VOLT.
2. C14 & C15 FACTORY SELECTED AT TEST TO PROVIDE A PRIORITY CHANNEL SAMPLE TIME OF 8 MS.
3. R1 FACTORY SELECTED AT TEST TO SET MASTER PULSE GENERATOR OUTPUT RATE AT 12 HZ.
4. TO DISABLE PRIORITY FUNCTION OF PSLM & REVERT TO SEARCH LOCK MONITOR, REMOVE A701–C10.
5. R61 MAY BE ADJUSTED BETWEEN 2KΩ AND 820Ω TO GIVE DESIRABLE AUDIO BOOST.
   TO DISABLE CHANNEL GUARD ON: F1 REMOVE A701–CR19
   F2 REMOVE A701–CR20
   F3 REMOVE A701–CR21
   F4 REMOVE A701–CR22

(19R621783, Rev. 1)

SCHEMATIC DIAGRAM

PRIORITY SEARCH-LOCK MONITOR BOARD A701

Issue 2

PARTS LIST

LBI-4324A

A701
4 FREQUENCY PSLM BOARD
19D413992G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C2 thru C5	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C6	5496267P227	Tantalum: 0.33 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C7 and C8	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C9	5494481P124	Ceramic disc: 1500 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C11	5494481P124	Ceramic disc: 1500 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C12	5496267P29	Tantalum: 0.68 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C13	5494481P124	Ceramic disc: 1500 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C14A	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C14B	19B200240P11	Tantalum: 1.8 µf ±10%, 35 VDCW.
C14C	5496267P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
C14D	5496267P209	Tantalum: 3.3 µf ±10%, 15 VDCW; sim to Sprague Type 150D.
C15A	5496267P227	Tantalum: 0.33 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C15B	5496267P228	Tantalum: 0.47 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C15C	5496267P229	Tantalum: 0.68 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C15D	5496267P230	Tantalum: 0.82 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C15E	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C15F	5496267P226	Tantalum: 0.22 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C15G	5496267P224	Tantalum: 0.1 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C16 thru C19	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C20	5496267P27	Tantalum: 0.33 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C21	5496267P217	Tantalum: 1.0 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C22*	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. Added to 4EC59A91-94 by REV A.
		- - - - - - - DIODES AND RECTIFIERS - - - - -
CR1 thru CR4	4036887P48	Silicon, Zener.
CR5	4036887P6	Silicon, Zener.
CR6 thru CR11	19A115250P1	Silicon.
CR12	4038056P1	Germanium.
CR13 thru CR15	19A115250P1	Silicon.
CR16	4036887P6	Silicon, Zener.
CR17	19A115250P1	Silicon.
CR18	4037822P1	Silicon.
CR19 thru CR22	19A115250P1	Silicon.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
IC1 and IC2	19A115913P10	Monolithic, Dual 945 Flip-Flop; sim to Fairchild DTL 093.
IC3	19A115913P1	Monolithic, Dual 4-Input Gate; sim to Fairchild DTL 930.
IC4	19A115913P6	Monolithic, Clocked Flip-Flop; sim to Fairchild DTL 945.
IC5	19A115913P9	Monolithic, Triple 3-Input Gate; sim to Fairchild DTL 962.
IC6 thru IC8	19A115913P7	Monolithic, Quad 2-Input Gate; sim to Fairchild DTL 946.
IC9	19A115913P9	Monolithic, Triple 3-Input Gate; sim to Fairchild DTL 962.
IC10	19A115913P7	Monolithic, Quad 2-Input Gate; sim to Fairchild DTL 946.
		- - - - - - - JACKS AND RECEPTACLES - - - - -
J1 thru J34	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A115364P1	Unijunction: N Type; sim to 2N2646.
Q2	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q4	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q5 thru Q8	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q9	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q10	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q11 and Q12	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q13 thru Q15	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q16	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q17	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q18	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q19	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q20 thru Q24	19A116272P1	Monolithic; sim to Type 2N5305.
Q25	19A115123P1	Silicon, NPN; sim to Type 2N2712.
Q26*	19A115889P1	Silicon, NPN; sim to Type 2N2712. Added to 4EC59A91-94 by REV A.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1A	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R1B	3R152P362J	Composition: 3600 ohms ±5%, 1/4 w.
R1C	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R1D	3R152P432J	Composition: 4300 ohms ±5%, 1/4 w.
R1E	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R1F	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R1G	3R152P562J	Composition: 5600 ohms ±5%, 1/4 w.
R1H	3R152P622J	Composition: 6200 ohms ±5%, 1/4 w.
R1J	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R1K	3R152P752J	Composition: 7500 ohms ±5%, 1/4 w.
R1L	3R152P822J	Composition: 8200 ohms ±5%, 1/4 w.
R1M	3R152P912J	Composition: 9100 ohms ±5%, 1/4 w.
R1N	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1O	3R152P113J	Composition: 11,000 ohms ±5%, 1/4 w.
R1P	3R152P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R1Q	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R1R	3R152P153J	Composition: 15,000 ohms ±5%, 1/4 w.
R2	3R152P303K	Composition: 30,000 ohms ±10%, 1/4 w.
R3	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R4	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R5	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R6	3R152P752K	Composition: 7500 ohms ±10%, 1/4 w.
R7	3R152P273K	Composition: 27,000 ohms ±10%, 1/4 w.
R8	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R9	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R10	3R152P273K	Composition: 27,000 ohms ±10%, 1/4 w.
R11	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R12	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R13	3R152P273K	Composition: 27,000 ohms ±10%, 1/4 w.
R14	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R15	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R16	3R152P273K	Composition: 27,000 ohms ±10%, 1/4 w.
R17	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R18	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R19	3R152P431K	Composition: 430 ohms ±10%, 1/4 w.
R20	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R21	3R152P683K	Composition: 68,000 ohms ±10%, 1/4 w.
R22	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R23	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R24 thru R26	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R27	3R152P152K	Composition: 1500 ohms ±10%, 1/4 w.
R28 and R29	3R152P153K	Composition: 15,000 ohms ±10%, 1/4 w.
R30 and R31	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R32	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R33	3R152P363K	Composition: 36,000 ohms ±10%, 1/4 w.
R34	3R152P332K	Composition: 3300 ohms ±10%, 1/4 w.
R35	3R152P362K	Composition: 3600 ohms ±10%, 1/4 w.
R36	3R152P151K	Composition: 150 ohms ±10%, 1/4 w.
R37	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R38	3R152P204K	Composition: 0.20 megohm ±10%, 1/4 w.
R39	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R40 thru R43	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R44	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R45	3R77P203K	Composition: 20,000 ohms ±10%, 1/2 w.
R46	19B209358P106	Variable, carbon film: approx 75 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R47	3R77P100K	Composition: 10 ohms ±10%, 1/2 w.
R48	3R77P102K	Composition: 1000 ohms ±10%, 1/2 w.
R49	3R152P512K	Composition: 5100 ohms ±10%, 1/4 w.
R50 thru R53	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
R54	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R55	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R56*	3R152P243J	Composition: 24,000 ohms ±5%, 1/4 w.
		In 4EC59A91-94 earlier than REV A:
	3R77P243J	Composition: 24,000 ohms ±5%, 1/2 w.
R57	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R58*	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w. Added to 4EC59A91-94 by REV A.
R59* and R60*	3R152P472K	Composition: 4700 ohms ±10%, 1/4 w. Added to 4EC59A91-94 by REV A.
R61*	3R152P122K	Composition: 1200 ohms ±10%, 1/4 w. Added to 4EC59A91-94 by REV A.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

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

REV. A - PSLM (19D413992G1)

To add Audio Boost and assure positive switching of Channel Guard Switch Q19. Added C22, Q26, R58, R59, R60, and R61.

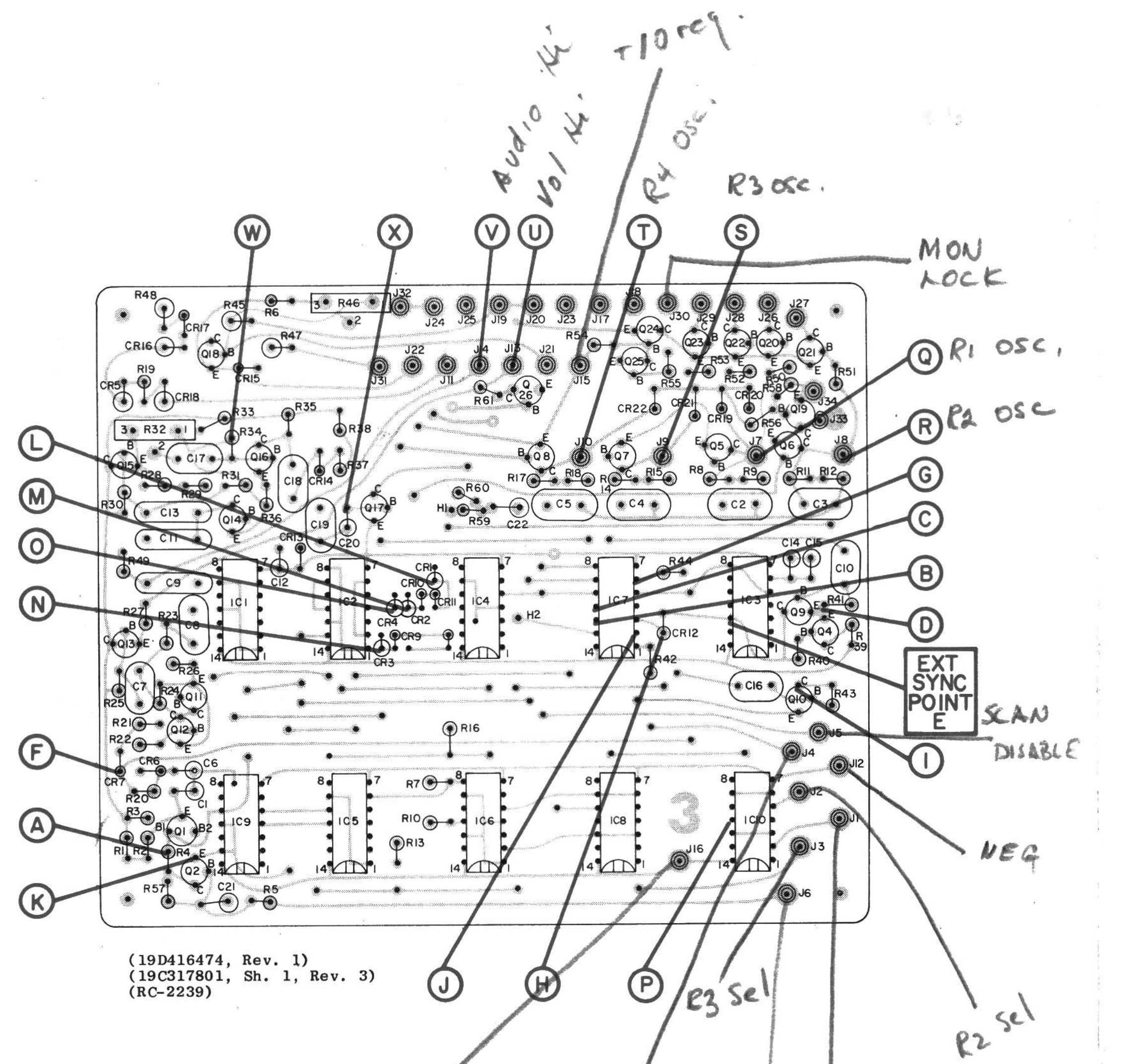


Figure A - Chassis Test Points

TROUBLESHOOTING PROCEDURE

PRIORITY SEARCH-LOCK MONITOR BOARD A701

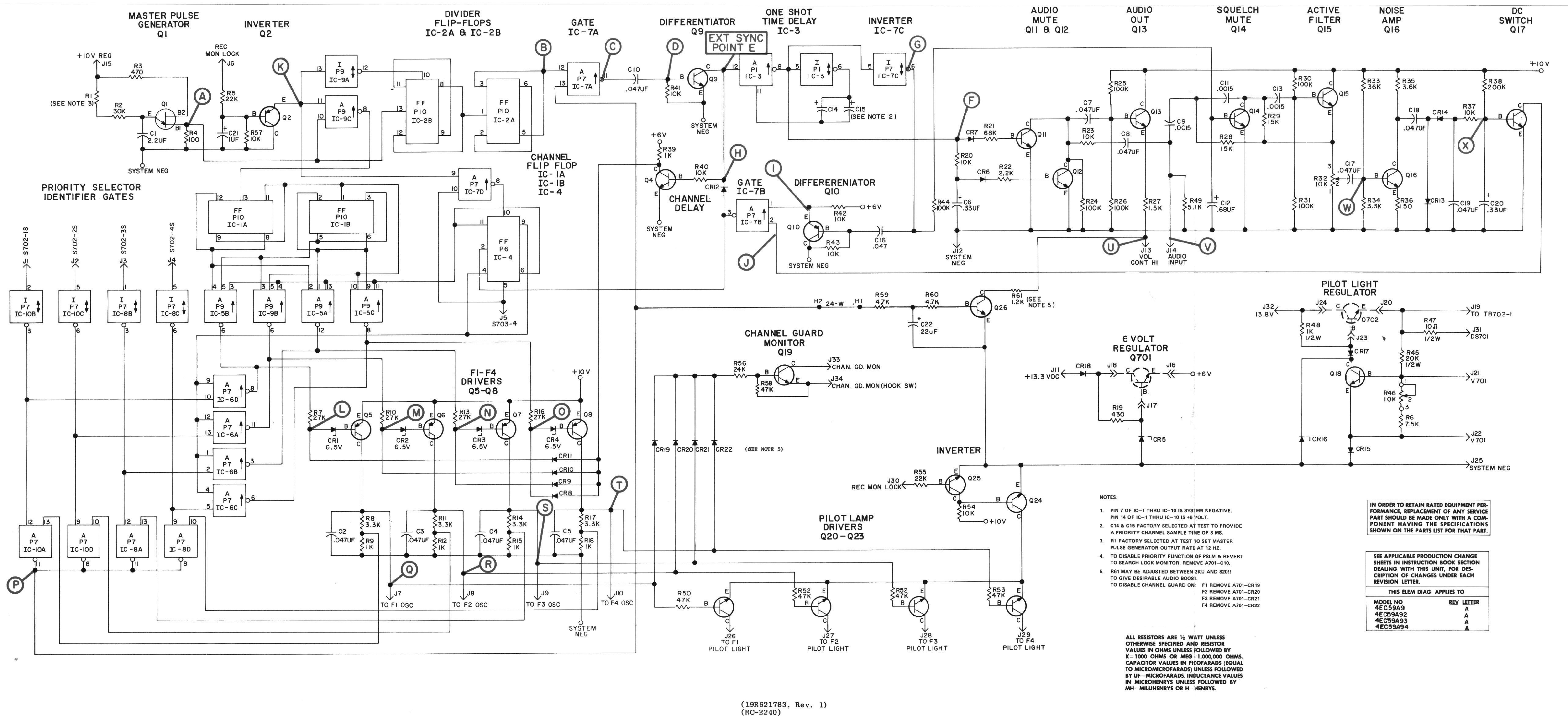


Figure B - Schematic Test Points

TROUBLESHOOTING PROCEDURE

NOTE

The audio quality of a Non-Priority channel can best be checked with an unmodulated carrier or voice modulation. When the PSLM is on the Non-Priority channel, applying a constant tone to the receiver will result in a pulsed sound.

Preliminary Checks

1. Check for a regulated +10 Volts DC at J15.
2. Check for +5.4 Volts DC at Pin 14 of IC1 thru IC-10.

SYMPTOM	PROCEDURE
No receiver audio	1. Check the receiver in a different system (with or without PSLM). 2. Check waveforms at Test Points (U) and (V).
No 1st oscillator activity	Check waveforms at Test Points (Q) thru (T) with search mode disabled.
Receiver rapidly alternates between Channels while trying to receive the Non-Priority channel. - - - - OR - - - - Obnoxious white noise received on a Non-Priority channel	1. Check the setting of Priority Squelch Adjust R32 (see Table of Contents). 2. Check receiver oscillator modifications (refer to System Modifications as listed in the Table of Contents). 3. Check waveforms at Test Points (U) and (V). 4. Check system interconnections (refer to Interconnection Diagram).
Fails to receive Priority channel	1. Check setting of Priority Squelch Adjust R32 (see Table of Contents). 2. Check voltage readings and waveforms at J1, J2, J3 and J4, also Test Points (G), (L) thru (O).
Incorrect Priority channel	1. Check system interconnections (refer to Interconnection Diagram). 2. Check voltage readings and waveforms at J1, J2, J3 and J4 and Test Points (L) thru (O).
Missed syllables on the first part of transmissions	Check waveform at Test Point (A) for incorrect sample rate. Resistor R1 is selected at the factory for an output of 12 Hz (±5%). See Parts List for values of R1.

VOLTAGE READINGS

All voltage readings are DC readings measured with a Triplett VTVM Model 850 with reference to System Negative. (J12)

Readings followed by a (P) are averages of pulsating meter deflections, these may vary.

DC voltage readings will vary on transistors Q18, Q20, Q21, Q22, Q23, Q24 and Q702 with light ambient due to light dimmer circuit.

TRANSISTOR	RECEIVER SQUELCHED			RECEIVING P.-CH. UNSQUELCHED		
Q2	E 2.1 V	B 6.0 V	C OV	E 1.24 V	B .6 V	C OV
Q4	0.V	.65V	.018V	0.V	.65V	.018V
Q5	10 V	9.5 V	3.3 V.P	10.V	9.4 V	9.8V
Q6	10 V	9.5 V	3.3 V.P	10.V	9.4 V	9.9V
Q7	10 V	9.5 V	3.3 V.P	10.V	9.4 V	9.8V
Q8	10 V	9.5 V	3.3 V.P	10V	9.4 V	9.8V
Q9	9.V	OV	4.4 V.P	OV	OV	4.4V
Q10	.65V	.035V	O.V.	.64V	.032V	OV
Q11	0.V	.01V	.03V	0.V	.01V	.01V
Q12	0.V	-.01V	.03V	OV	-.01V	.01V
Q13	4.2V	4.8V	10V	4.2V	4.8V	10V
Q14	0.V	.07V.P	.6V	0.V	.59V	.05V
Q15	4.2V	4.8V	10V	4.2V	4.8V	10V
Q16	.22V	.85V	1.9V	.22V	.85V	1.9V
Q17	0.V	.62V	.13V	0.V	.63V	.11V
Q18	.01V	.63V	4.7V	.01V	.64V	4.9V
Q19	Used only with Channel Guard Options.					
Q20	4.3V	2.0VP	4.8V	.69V	2.0V	1.38V
Q21	4.3V	2.1V	5.0V	.69V	2.0V	1.38V
Q22	4.5V	2.5V	5.0V	.7V	2.0V	1.38V
Q23	4.6V	2.5V.P	4.7V	.7V	2.0V	1.38V
Q24	4.7V	.02V	4.7V	0.V	1.36V	.70V
Q25	0.V	.65V	.02V	0.V	.26V	1.38V
Q701	6V	6.9V	13.0V	6V	6.9V	13.0V
Q702	6V	6.6V	13.6V	5.7V	6.3V	13.6V
UNIJUNCTION TRANSISTOR Q1	E 5.2V	B1 .41V	B2 9.5V	E 5.2V	B1 .41V	B2 9.5V

WAVEFORMS

All waveforms are taken at Test Points (A) thru (X) as shown in Figures A and B, and are taken with the PSLM board connected for F1 priority (see note 2 of the Schematic Diagram). When applicable, the waveforms are shown for three different modes of operations as follows:

1. Receiver Squelched (PSLM Searching)
2. Receiver Unsquelched (Receiving Non-Priority Channel) (PSLM Searching)
3. Receiver Unsquelched (Receiving Priority Channel) (PSLM Not Searching)

NOTE

All waveforms are taken using Test Point E as the SYNC SOURCE (Trigger Pulse) except where NOTED.

TEST POINT	RECEIVER SQUELCHED	RECEIVING PRIORITY CHANNEL	RECEIVING NON-PRIORITY CHANNEL
A	20ms/Div. 2V/Div. NOTE: INTERNAL SYNC	20ms/Div. 2V/Div. NOTE: INTERNAL SYNC	20ms/Div. 2V/Div. NOTE: INTERNAL SYNC
B	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC
C	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC
D	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 0.2/Div. NOTE: INTERNAL SYNC	0.1 sec./Div. 5V/Div. NOTE: INTERNAL SYNC
E	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
F	1ms/Div. 5V/Div.	1ms/Div. 5V/Div.	1ms/Div. 5V/Div.
G	1ms/Div. 5V/Div.	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div.
H	1ms/Div. 5V/Div.	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div.
I	1ms/Div. 5V/Div.	1ms/Div. 1V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
J	2ms/Div. 2V/Div.	1ms/Div. 1V/Div. NOTE: INTERNAL SYNC	2ms/Div. 2V/Div.
K	20ms/Div. 5V/Div. NOTE: INTERNAL SYNC	20ms/Div. 5V/Div. NOTE: INTERNAL SYNC	20ms/Div. 5V/Div. NOTE: INTERNAL SYNC
L	50ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC
M	50ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC
N	50ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC
O	50ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC
P	50ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 2V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
Q	50ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
R	50ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
S	50ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
T	50ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 5V/Div. NOTE: INTERNAL SYNC
U	1ms/Div. 1V/Div. NOTE: INTERNAL SYNC	1ms/Div. 0.5V/Div. NOTE: INTERNAL SYNC	2ms/Div. 0.2V/Div.
V	1ms/Div. 1V/Div. NOTE: INTERNAL SYNC	1ms/Div. 0.5V/Div. NOTE: INTERNAL SYNC	2ms/Div. 1V/Div.
W	1ms/Div. 0.1V/Div. NOTE: INTERNAL SYNC	1ms/Div. 0.5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 0.1V/Div. NOTE: INTERNAL SYNC
X	1ms/Div. 0.5V/Div. NOTE: INTERNAL SYNC	1ms/Div. 0.5V/Div. NOTE: INTERNAL SYNC	2ms/Div. 0.2V/Div. NOTE: INTERNAL SYNC

TROUBLESHOOTING PROCEDURE

PRIORITY SEARCH-LOCK MONITOR BOARD A701

ORDERING SERVICE PARTS

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

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

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

MAINTENANCE MANUAL
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DF-4080

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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