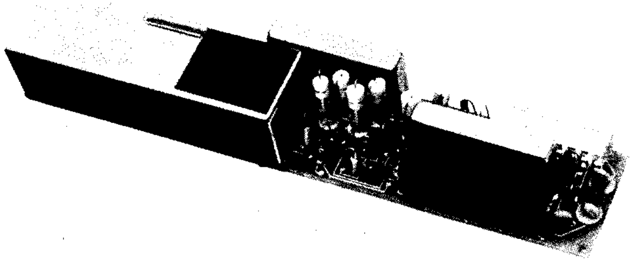
GE MOBILE RADIO

MASTR® II
MAINTENANCE MANUAL

CHANNEL GUARD ENCODE / DECODE, SINGLE TONE
CHANNEL GUARD ENCODE ONLY, SINGLE TONE
CHANNEL GUARD ENCODE / DECODE, MULTI TONE
CHANNEL GUARD ENCODE ONLY, MULTI TONE
CHANNEL GUARD ENCODE / DECODE, DIFFERENT TONE
CHANNEL GUARD DECODE ONLY



SPECIFICATIONS *

Tone Frequencies	71.9 to 203.5 Hertz
Power Requirements	10 VDC @ 25 Milliamperes
Number of Integrated Circuits	5
Temperature Range	-40°C to +70°C (-40°F to 158°F)
Decode Sensitivity	6 dB SINAD
Decode Response Time	250 Milliseconds above 100 Hz; 300 Milliseconds below 100 Hz
Encode Tone Distortion	1%
Encode Response Time	25 Ms
Frequency Stability	±0.5%

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

Maintenance Manual LBI4743E

DATAFILE FOLDER - DF 5046

CHANNEL GUARD 19D417261G1-6

GENERAL ELECTRIC

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WARNING

Although the highest DC voltage in the radio is supplied by the vehicle battery, high current may be drawn under short circuit conditions. These currents can possibley heat metal objects such as tools, rings, watchbands, etc. enough to cause burns. Be careful when working near energized circuits:

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns. KEEP AWAY FROM THESE CIRCUITS WHEN THE TRANSMITTER IS ENERGIZED!

DESCRIPTION

General Electric MASTR II Channel Guard utilizes thick film integrated circuits (IC's) and discrete components for maximum reliability.

Tone frequencies are selected by plug-in "Versatone" networks that can be easily changed, if desired, by replacing the tone network with one of the desired frequency.

The encoder provides tone coded modulation to the transmitter.

The decoder operates in conjunction with the receiver to inhibit all calls that are not tone coded with the proper Channel Guard tone frequency.

MASTR II Channel Guard consists of single and Multi-Tone Encode and Decode units and a Different Tone Encode/Decode unit. The Different Tone Encode/Decode unit utilizes two different tones with automatic tone selection to transmit and receive messages that are tone coded with different frequencies. Selection of the Tone Network associated with the encode and decode functions is controlled by the push-to-talk switch (PTT).

OPTIONS

The single tone Encode/Decode Channel Guard unit is standard in Mobile Applications. Other Channel Guard Units with Multi-tone Encode/Decode, Encode only, Decode only, or Different Tone Encode/Decode with automatic tone selection are available as options. Options for Mobile and Station Applications are identified below.

Each MASTR II receiver is equipped with a tone reject filter to prevent the Channel Guard tone from being heard. In addition, all transmitters have a Channel Guard Modulation control which is set in accordance with the "Transmitter Alignment Procedures".

OPERATION

GENERAL

A Channel Guard "disable" switch on the microphone or handset hookswitch controls the operation of the Channel Guard decode circuitry. When the disable switch on the microphone hookswitch is in the "down" position (away from the small speaker symbol) and the microphone or handset is in the hanger, only those calls that are tone coded with the correct Channel Guard frequency are heard. Removing the microphone or handset from its hanger disables the Channel Guard and permits monitoring the channel before transmitting.

Placing the Channel Guard "disable" switch in the "up" position (towards the small speaker symbol) disables the Channel Guard decode function and allows all incoming calls to be heard whether the microphone or handset is in or out of the hanger. The encode function is controlled by the PTT switch and is enabled only during the time the PTT switch is operated. All transmitted calls are tone coded with the channel guard frequency determined by the Tone Network.

SINGLE TONE ENCODE/DECODE

In single tone applications, tone networks are controlled by the presence or absence of A- on control pin 3. When A- is present at pin 3 the tone network is active. In those applications (Groups 1, 3 and 6) where all transmissions are tone coded with the same frequency, pin 3 is hardwired to A-.

MULTI-TONE ENCODE/DECODE (GROUPS 2 AND 4)

Where multi-tone Channel Guard units are used the operating Channel Guard frequency is determined by the selected tone network. The same tone network is active in the encode and decode modes and is selected by the frequency selector switch on the control unit. A- is applied to pin 3 of the tone network by the frequency selector switch.

TABLE 1 - OPTION IDENTIFICATION

STATION OPTION	MOBILE OPTION	PART NO.	FUNCTION	NUMBER OF TONES	DIAGRAM
	-----	19D417261G1	Encode/Decode	One	19R622025
	9042-9048	19D417261G2	Encode/Decode	Two-Eight	19R621999
9531	9004	19D417261G3	Encode	One	19R622025
	9035-9041	19D417261G4	Encode	Two-Eight	19R621999
9529	9024	19D417261G5	Encode/Decode	Two (1 Encode, 1 Decode)	19R622026
9533	9068	19D417261G6	Decode	One	19R622025

The frequency selector switch is a 12-position switch with a mechanical stop that limits rotation from one through twelve positions as required. Although up to twelve frequencies may be provided in radio, Channel Guard is limited to frequencies F1-F8. Channel Guard tones A-H correlate with operating frequencies F1-F8 so that selecting the operating frequency simultaneously selects and activates the associated Channel Guard tone network.

DIFFERENT TONE ENCODE/DECODE (Group 5)

Where different channel guard frequencies are used for the encode and decode functions, the active tone network is selected automatically by the tone selector, switch consisting of Q1003 and Q1004, under control of the PTT switch. Consider two tone networks - "A" and "B". When the PTT switch is operated (encode mode) A- is applied to the tone selector which in turn applies A- to pin 3 of tone network A and removes A- from Pin 3 of tone network B. Under this condition transmitted calls are coded with tone A. Conversely, when the PTT switch is released, (decode mode) the opposite conditions occur and all received calls coded with tone B are decoded. Tone network A is inactive.

CIRCUIT ANALYSIS

Channel Guard is a continuous-tone controlled squelch system that provides communications control in accordance with EIA standard RS-220. The basic Channel Guard system utilizes standard tone frequencies from 71.9 to 203.5 hertz with both the encoder and decoder operating on the same frequency. The standard channel guard tone frequencies are listed below.

STANDARD TONE FREQUENCIES				
71.9	88.5	107.2	131.8	162.2
74.4	91.5	110.9	136.5	167.9
77.0	94.8	114.8	141.3	173.8
79.7	97.4	118.8	146.2	179.9
82.5	100.0	123.0	151.4	186.2
85.4	103.5	127.3	156.7	192.8
				203.5

A Squelch Tail Elimination (STE) circuit in the encoder uses a phase shift of approximately 225° to eliminate undesirable noise bursts after each transmission.

Five integrated circuit modules including the Tone Network(s) and associated discrete components comprise the Channel Guard assembly. The IC's consist of the Filter/Limiter, Selective Amplifier, Decoder, Encoder, and Tone Network(s). The Selective Amplifier and Tone Network function together to form the Frequency Switchable Selective Amplifier (FSSA). The FSSA when properly calibrated provides maximum flexibility in channel guard tone selection. By replacing the plug-in "Versatone" Tone Network with another of the desired frequency, the Channel Guard operating frequency can be changed. No adjustments are required.

Typical diagrams of the Filter/Limiter, FSSA, Decoder, and Encoder are shown in Figures 1-4. References to symbol numbers mentioned in the text are found on the Schematic Diagrams, Outline Diagram and Parts List.

DECODE MODE

The channel guard circuitry continuously monitors all calls via the Volume/Squelch Hi circuit in the receiver. All channel guard frequencies are received and buffered by Q1001 at the input to the Filter Limiter IC. Q1001 provides isolation and eliminates any loading effects the Channel Guard may have on the receiver. Associated coupling and attenuation networks determine the frequency characteristics and signal level presented to the input of the Filter/Limiter.

Filter/Limiter

The Filter/Limiter IC consists of a voice reject filter (VRF), CG tone switch and amplifier/limiter. The VRF filter is a 5-pole active filter that presents a minimum attenuation of 30 dB to all voice frequencies above 300 Hz and passes all tone frequencies.

CG tone switch Q5 controls the channel guard frequency receive path. When receiving (decode mode), Q5 is turned on and the channel guard frequencies are coupled to the amplifier/limiter through C1010, R1011 and L1002. The output of the amplifier/limiter is taken from pin 14 of the IC and applied to the Selective Amplifier in the FSSA and to the comparator in the Decode IC. The clipping action of the amplifier/limiter eliminates variations in the squelch performance due to changes in tone deviation.

When transmitting (encode mode), A- from the delayed push-to-talk (DPTT) circuit in the Encode IC is applied to the base of Q5 through pin 9 of the filter/limiter, CR1, and R14 turning it off. With Q5 turned off, the receive path for the receiver channel guard frequencies is interrupted and the channel guard frequencies are not coupled to the amplifier/limiter. The amplifier/limiter also forms a part of the positive feedback path from the Encode IC to the FSSA. When the CG tone switch, Q5, is turned off the amplifier/limiter receives channel guard tone from the Encode IC, causing the FSSA to oscillate at the tone frequency.

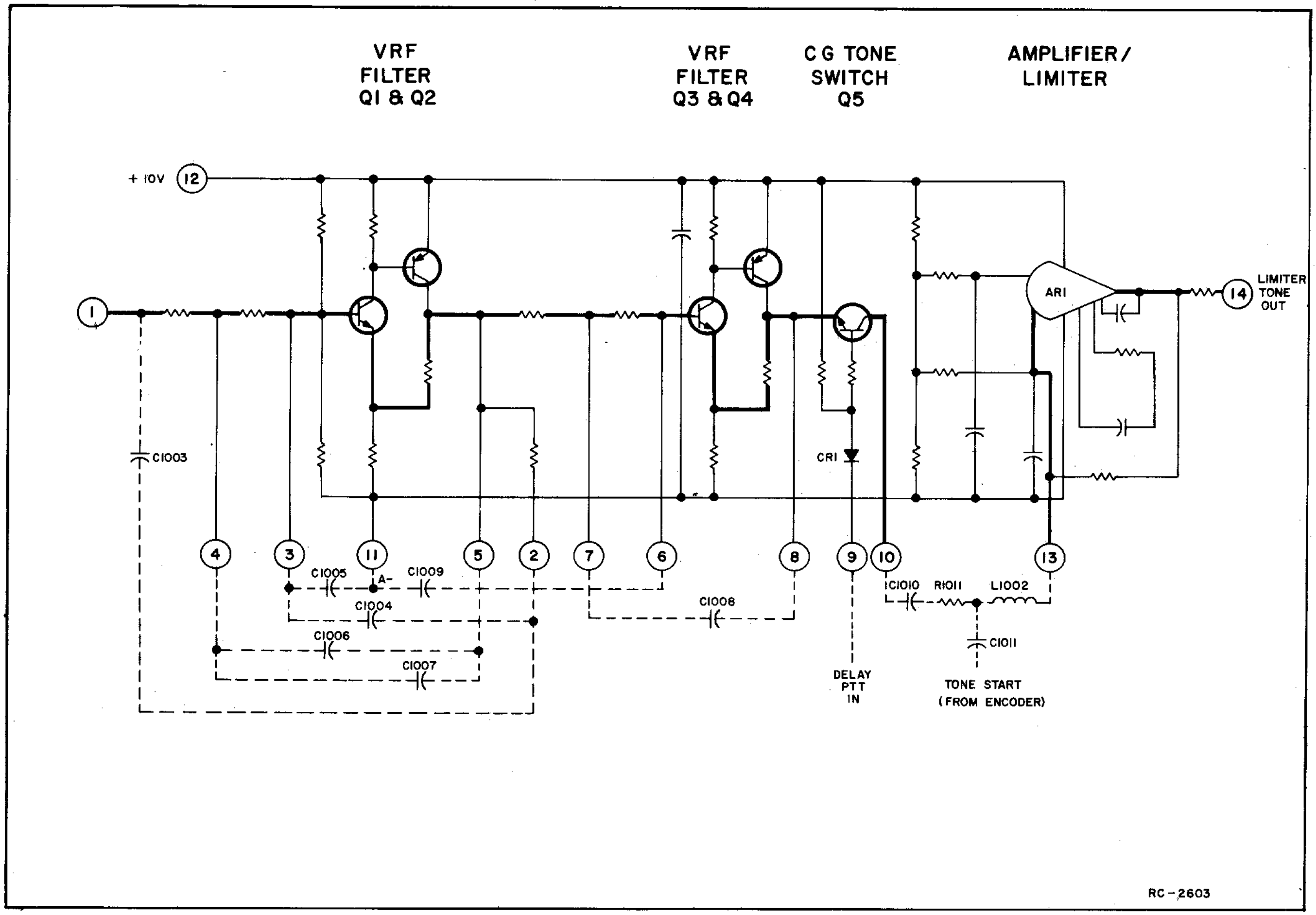


Figure 1 - Typical Filter/Limiter IC

Frequency Switchable Selective Amplifier (FSSA)

The FSSA responds only to properly encoded calls and generates, on command, the (selected) encode tone. Having a nominal Q of 60, the frequency response characteristics of the FSSA are similar to that of a parallel resonant LC tank circuit. The Q is determined by R1 in the tone network. R1 is selected for each operating frequency.

Frequency calibration control R1005 is preset at the factory using a precision Reference Tone Network with an operating frequency of 139.64 Hz.

Once calibrated, the operating frequency and Q of the circuit are controlled by the tone network. Specifically, the operating frequency is controlled by the resistance ratio of R2 to R3 in the tone network: the Q is determined by R1. The frequency stability of the FSSA is ±0.5% R5 in the Tone Network sets the DC loop bias for the FSSA.

When operating in the decode mode all incoming channel guard tones are coupled from pin 14 of the Filter/Limiter to pin 1 of the Selective Amplifier. If the incoming tone frequency is not within the band-pass of the FSSA, the FSSA output at pin 4 falls below the input threshold level of the Decode IC and the receiver is muted. However, when the incoming tone frequency matches the resonant frequency of the FSSA, the tone is amplified and the tone output of the FSSA exceeds the input threshold level of the Decode IC. This permits an in-phase comparison at Q4 in the decoder and the receiver is unmuted.

When transmitting (PTT switch operated) a positive feedback path is completed from the output of the FSSA (pin 4 Selective Amplifier) through the encode switch (Q7) in the Encode IC and amplifier AR1 in the Filter/Limiter back to the input of the FSSA (pin 1 of the selective amplifier). A negative pulse generated by the encode start circuit (Q5 and Q6) in the Encode IC is applied to the FSSA output to rapidly initiate oscillation at the resonant frequency. The resonant frequency is determined by the tone network.

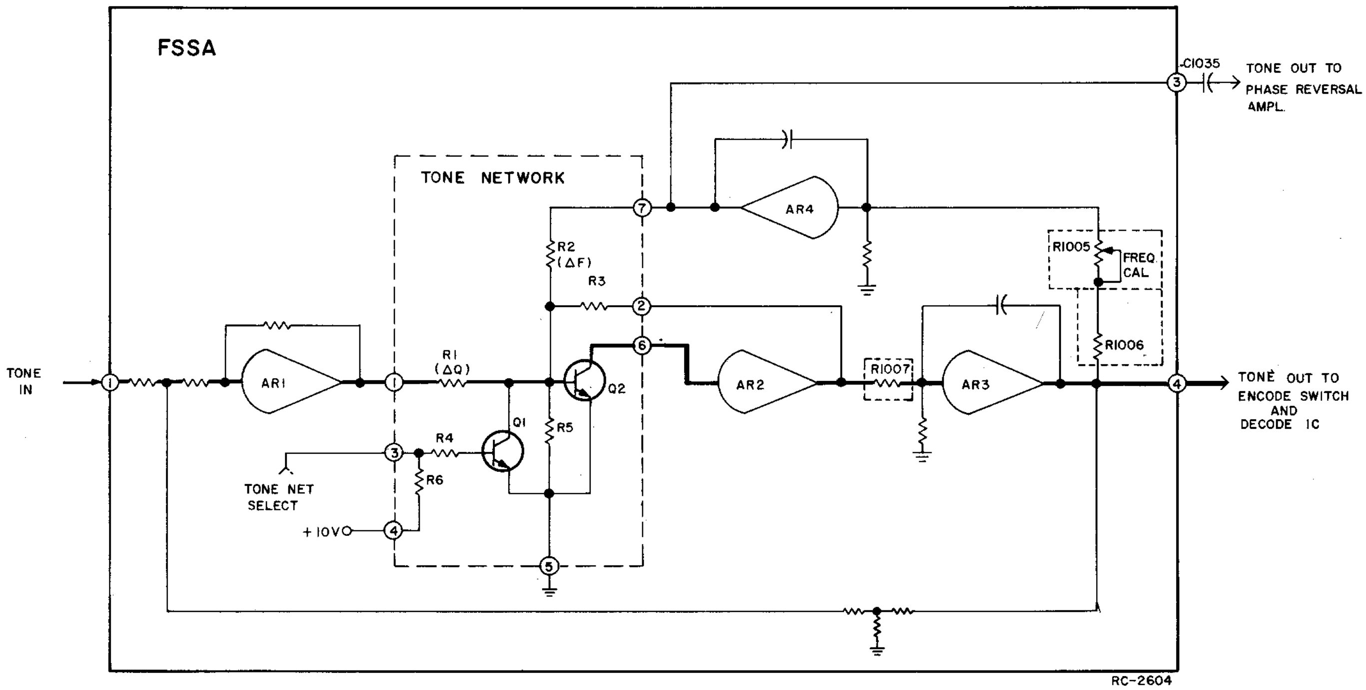


Figure 2 - Typical FSSA Functional Diagram

Decode IC

The Decode IC controls receiver operation and insures squelch tail elimination. When a valid tone is received, the two inputs to the decoder (one from Filter/Limiter and one from the FSSA) are out-of-phase with each other. The received tone from the Filter/Limiter is coupled directly to the decode comparator while the tone from the FSSA is coupled through peak detector circuits that conduct only during the tone peaks. The peak detection also provides the necessary phase shift that results in an in phase comparison at Q4 when the correct channel guard tone is received.

When the channel guard tones received from the Filter/Limiter and the FSSA are 180° out-of-phase at the inputs (pin 1 and 9) of Decode IC, the receiver is unmuted by receiver mute switch Q7.

Comparator Q4 compares the phase of the Filter/Limiter output tone with the output of the FSSA. Since the FSSA amplifies only the selected channel guard tone and inverts it, both the absence of a tone or a phase change away from 180° will result in an out-of-phase condition at the base of comparator Q4. During the absence of an input signal from the FSSA, Q3 will turn on and hold the base of Q4 at A- preventing a positive phase comparison. Under these conditions, the receiver is muted.

Peak Detector

The tone signal from the FSSA is coupled to the base of peak detector Q1 in the Decode IC through pin 1. Q1 determines the threshold level at which the receiver is unmuted. The threshold level is determined by the emitter voltage of Q1 which is controlled by the conduction of Q5. In the decode condition when channel guard tones are not being received Q5 is turned on. The collector current for Q5 is drawn through R2 in the emitter circuit of Q1 causing the emitter voltage of Q1 to drop and therefore require a more negative pulse at the base of Q1 to turn it on. This, in effect, increases the operating threshold. Conversely, when a valid tone is received Q5 is turned off and the operating threshold of Q1 is lowered. The change in operating threshold level is approximately 3 dB.

Q1 conducts only during the negative peaks of the input signal to generate a narrow positive pulse at the collector. This positive pulse is coupled to the base of a second peak detector Q2 which conducts only during the positive peaks. This results in a narrow negative pulse at the collector of Q2 which is then DC coupled to the base of Q3. (Q3 functions as a switch that is normally on, holding the base of Q4 at A- to keep the receiver muted.) Q3 is turned off only during the negative peaks appearing at the collector of Q2 and supplies

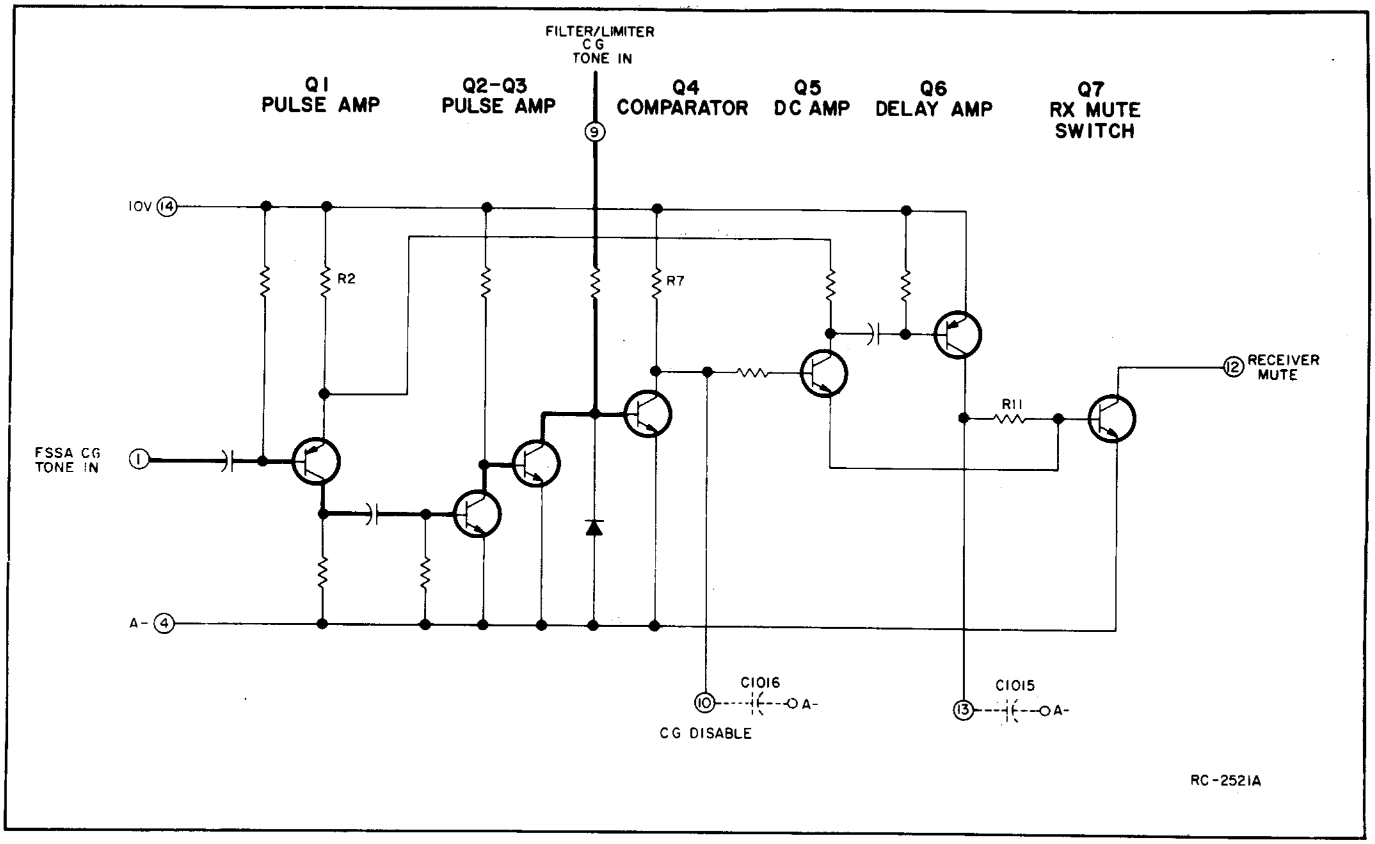


Figure 3 - Typical Decode IC

a positive pulse to the base of Q4. The positive pulse appearing at the base of Q4, when coincident (in phase) with the tone from the Filter/Limiter IC, turns on Q4.

The narrow pulse provided by the peak detectors permits in-phase comparison for nearly all of the positive half cycle of the received channel guard tone. This positive comparison, at the base of Q4, can occur only when Q1 is turned on (input signal exceeds threshold) and the input signals at pins 1 and 9 of the Decode IC are 180° out of phase. With Q4 turned on, Q5 and Q7 are turned off and the receiver is unmuted. Conversely, when Q4 is turned off Q5 and Q7 are turned on and the receiver is muted.

Receiver Mute

During the negative half cycles of the input tone from the Filter/Limiter when Q4 is turned off, capacitor C1016 begins to charge through resistor R7. The RC time constant of R7 and C1016 is sufficient to prevent Q5 from conducting during the negative half cycles, thereby keeping the receiver unmuted.

After the transmission is completed and the push-to-talk switch is released at the transmitter, the tone signals at the base of comparator Q4 are out of phase. Q4 turns off, Q5 and Q7 turn on muting the receiver and a negative pulse is coupled to the base of Q6 turning it on for the duration of the pulse and charging C1015. C1015 then discharges through R11 and the base-emitter junction of Q7. The RC time constant of R11 and C1015 holds Q7 on for approximately 300 milliseconds to keep the receiver muted and insure that the transmit carrier is off before the Channel Guard is enabled again.

SERVICE NOTE

J908-5 on the Channel Guard board provides an indication of the Channel Guard operating status.

- When J908-5 is high--receiver is unmuted
- When J908-5 is low--receiver is muted

ENCODE MODE

Keying the transmitter activates the encode circuits and at the same time interrupts the receiver channel guard frequency path through the Filter/Limiter IC. It also disables the Decode IC. When the transmitter is keyed, A- is applied to the push-to-talk delay, encode switch, encode start, STE and phase reversal circuits in the Encode IC. The push-to-talk delay circuit in turn applies A- to the CG tone switch in the Filter/Limiter IC turning it off and blocking incoming tones. It also disables the local decoder and where the Different Tone Encode/Decode option is used, selects the operating tone network. Additionally, A- is also supplied to the System Board to complete the PTT circuit.

The Encode IC also completes a positive feedback path from the FSSA to the Filter/Limiter amplifier and generates an encode start pulse. This pulse is applied to the FSSA output causing the FSSA to rapidly generate the encode tone frequency. In addition, the Encode IC controls the phase of the transmitted channel guard encode tone.

Encode Control Circuits

With the PTT switch depressed, A- from the PTT circuit in the Encode IC is coupled through pin 9 of the Filter/Limiter to the base of CG tone switch Q5, turning it off and interrupting the receive signal path.

A- from the delayed PTT circuit is also coupled through diode CR1009 to the input of the decoder to disable it and prevent the encoder tone from turning on the local receiver.

Encode Switch

The encode switch, Q7, in the Encode IC controls the positive feedback path from the FSSA to the Filter/Limiter amplifier by applying A- to the signal path at the junction of R19 and R20.

When the PTT switch is operated A- is applied to the base of Q7 through diodes CR1 and CR3. Q7 immediately turns off removing A- from the junction of R19 and R20 and completing the positive feedback path to allow the FSSA to oscillate. The circuit remains in this state until the PTT switch is released and Q4 turns off. Q1002 is controlled by the PTT delay circuit and holds encode switch Q7 off for approximately 160 milliseconds to allow the STE circuit to function.

When operating in the decode mode, Q7 is turned on and applies A- to the positive feedback path to prevent the FSSA from generating the encode tone.

Encode Start

The encode start circuit provides a means of instantaneously shock exciting the FSSA into oscillation as soon as the PTT switch is operated. When the PTT switch is operated Q5 turns on. The instant Q5 turns on a positive pulse is coupled to the base of Q6. Q6 pulses on, momentarily pulling the output of the FSSA to ground causing it to rapidly initiate oscillations at the channel guard frequency.

ENCODE TONE PHASE REVERSAL

The PTT switch through diode CR4 and transistor switch Q2 controls the phase of the encode tone to be transmitted. By controlling conduction of Q2 the tone is taken from either the collector or emitter of Q1.

When the PTT switch is operated the FSSA generates the encode tone appearing at the base of phase reversal amplifier Q1. Diode CR4 is forward biased applying A- to the base of Q2, turning Q2 off. Under this condition the encode tone is coupled from the emitter of Q1 through R7 to the base of emitter follower Q3. The encode tone output is in phase with the input tone at the base of Q1.

When the PTT switch is released diode CR4 is biased off and the base of Q2 rises toward +10 V turning Q2 on. With Q2 turned on the encode tone is coupled from the collector and emitter of Q1 and summed at the base of emitter follower Q3. The encode tone output is taken from the emitter of Q3 and applied to the transmitter exciter through pin 3 of the encoder, C1019, and J908-7. The encode tone output with the PTT switch released is out-of-phase with the input tone at the base of Q1. The phase difference between the transmitted tone when the PTT switch is operated and then released is a nominal 235° at a level greater than 250 millivolts rms.

Channel Guard Encode Disable

The Channel Guard encode function can be disabled from an externally controlled source by applying A- to J908-2. When disabled A- is applied to the base of emitter follower Q3 turning it off. With Q3 turned off, the channel guard tone is not presented to the transmitter.

PTT DELAY

The transmit carrier is transmitted for approximately 160 milliseconds after the PTT switch is released to allow sufficient time for the receiver to detect the phase reversal in the transmitted tone and to mute, thereby eliminating the squelch tail. The delay in transmit carrier drop out is determined by the RC time constant of C1017, RT1001 and R9-R11.

Initially, when the PTT switch was operated, C1017 charged to 10 V through CR1 and A- applied through CR3 turned on encode switch Q7. At this time Q4 also turned on and, in turn, turned on Q1002 which applied A- to the base of encode switch Q7.

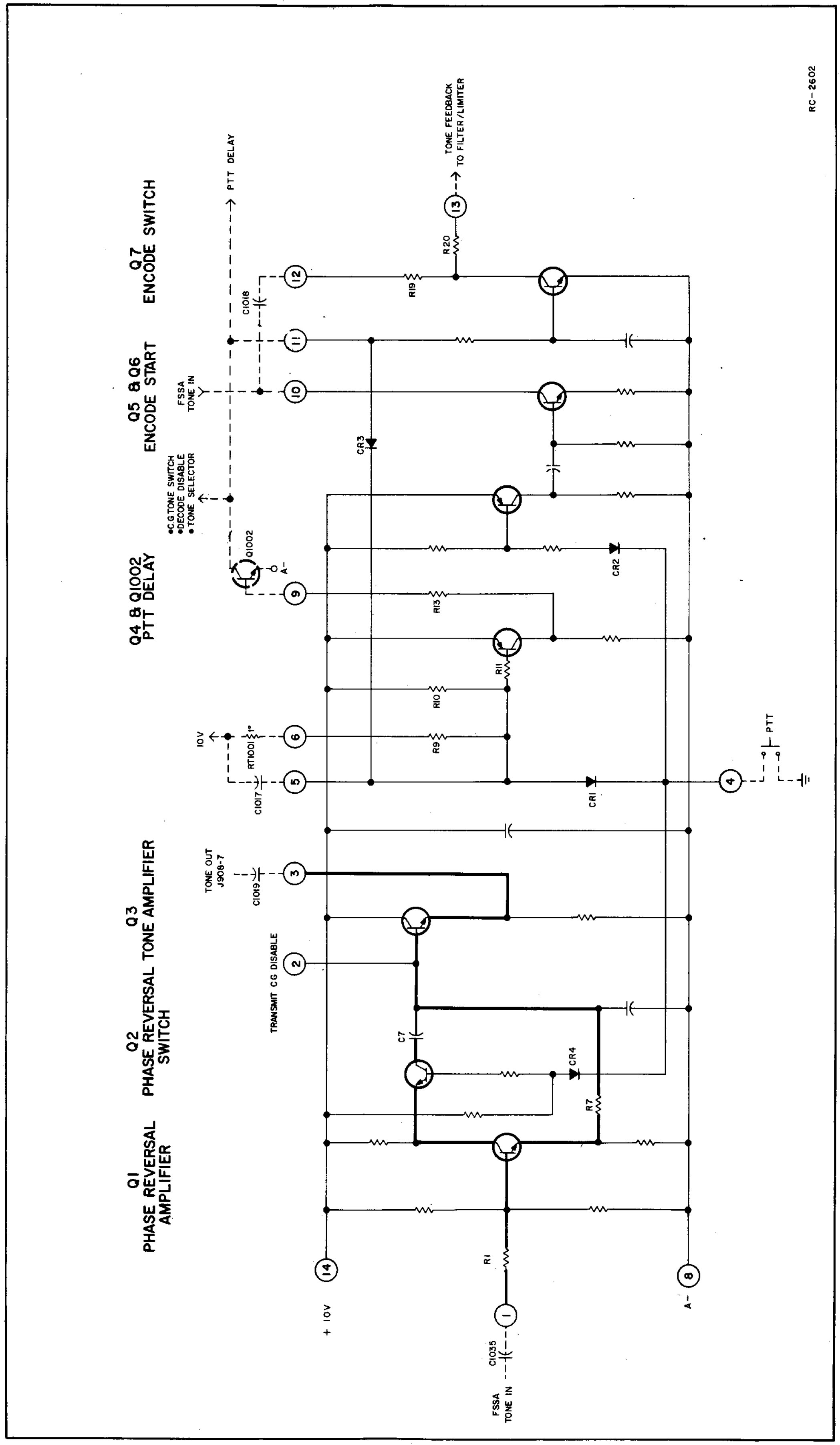


Figure 4 - Typical Encode IC

The turn off time of Q7 is controlled by the charge on C1017. It cannot turn off until the charge on C1017 falls below the threshold of Q4.

In addition Q1002 controls the operation of the CG tone switch in the Filter/ Limiter and the Decoder IC. When the Different Tone Encode/Decode option is employed, Q1002 controls the frequency of the channel guard tone by selecting the appropriate tone network.

When the PTT switch is released, A- is removed from the phase reversal amplifiers, encode start and the PTT delay circuit. Phase reversal of the transmitter tone occurs immediately; the encode start circuit sees no change. Circuits controlled by the PTT delay remain active until the delay time has elapsed. With A- removed from CR1, C1017 begins to discharge through RT1001, R9-R11, and the base-emitter junction of Q4. During this delay encode switch Q7 and CG tone switch Q5 in the Filter/Limiter are held off and the local decoder remains disabled. The channel guard encode tone, although different in phase is still transmitted.

After approximately 160 milliseconds, when the charge on C1017 falls below the threshold of Q4, Q4 turns off. Q4 turns off Q1002 which removes A- from the base of encode switch Q7, the CG tone switch in the Filter/Limiter, and the decoder. Q7 immediately turns on and grounds the positive feedback path to the FSSA causing it to stop generating the channel guard tone. The CG tone switch is turned on and the decoder is active in the decode mode.

SQUELCH TAIL ELIMINATION (STE)

STE is accomplished by reversing the phase of the modulating tone at the transmitter when the push-to-talk switch is released and simultaneously delaying the transmitter-carrier dropout for approximately 160 milliseconds.

Detection of the phase reversal in the received channel guard tone and the resulting temporary drop in the output level of the FSSA causes the decoder to mute the receiver within approximately 70 milliseconds. This overlap of time between the receiver turn-off and transmit carrier drop-out mutes the squelch tail.

MULTI-TONE ENCODE/DECODE TONE SELECTION - (Groups 2 and 4)

Depending on the option used, up to eight Channel Guard tone networks may be supplied to operate up to eight carrier frequencies. The control lines from pin 3 of each tone network are hard wired to the frequency selector switch on the control unit so that when the operating frequency is changed the tone network is changed also. For example, when frequency F1 is selected A- is applied from the frequency selector switch through J909-8 to pin 3 of Tone Network FL1001 (Tone A). Control transistor Q1 within the Tone Network then turns off and turns on Q2. Q2 completes all interconnections with the FSSA to enable it to operate on tone A frequency. All other tone networks are turned off. Similarly when F8 is selected, tone network FL1008 is active providing encode and decode functions for its assigned frequency. The correlation chart below identifies the tone network associated with each operating frequency.

TONE NETWORK CORRELATION CHART			
Frequency	Tone	Tone Network	Control Lead
F1	A	FL1001	J909-8
F2	B	FL1002	J909-7
F3	C	FL1003	J909-6
F4	D	FL1004	J909-5
F5	E	FL1005	J909-4
F6	F	FL1006	J909-3
F7	G	FL1007	J909-2
F8	H	FL1008	J909-1

CHANNEL GUARD DECODE DISABLE (Groups 1, 2, 5 and 6)

In those instances where Channel Guard is not used with an operating frequency the decode function within the Channel Guard is disabled to permit normal noise squelch operation. A diode network connected from the frequency select lead to the Channel Guard Disable lead at H22 applies control A- from the frequency selector switch to the Channel Guard decoder each time an "open" channel is selected. (An "open" channel is one on which normal noise squelch operation is desired.)

TONE SELECTOR (Group 5 only)

Tone selector switches Q1003 and Q1004, provide automatic tone selection when using different channel guard frequencies to encode and decode transmissions. The presence or absence of A- from the PTT delay circuit is used to select the operating tone network. When the PTT switch is operated A- is applied to the base of Q1003 causing tone network FL1002 to become active. Figure 5 illustrates the operation and control of the Tone Selector.

In the decode mode the base of Q1003 rises toward +10 V turning it on and applying A- to pin 3 of tone network FL1001 and to the base of Q1004. Q1004 turns off disconnecting Tone Network FL1002 from the FSSA. Q1 in Tone Network FL1001 upon application of A- from Q1003, immediately turns off removing A- from the base of Q2. Q2 turns on to complete circuit connections

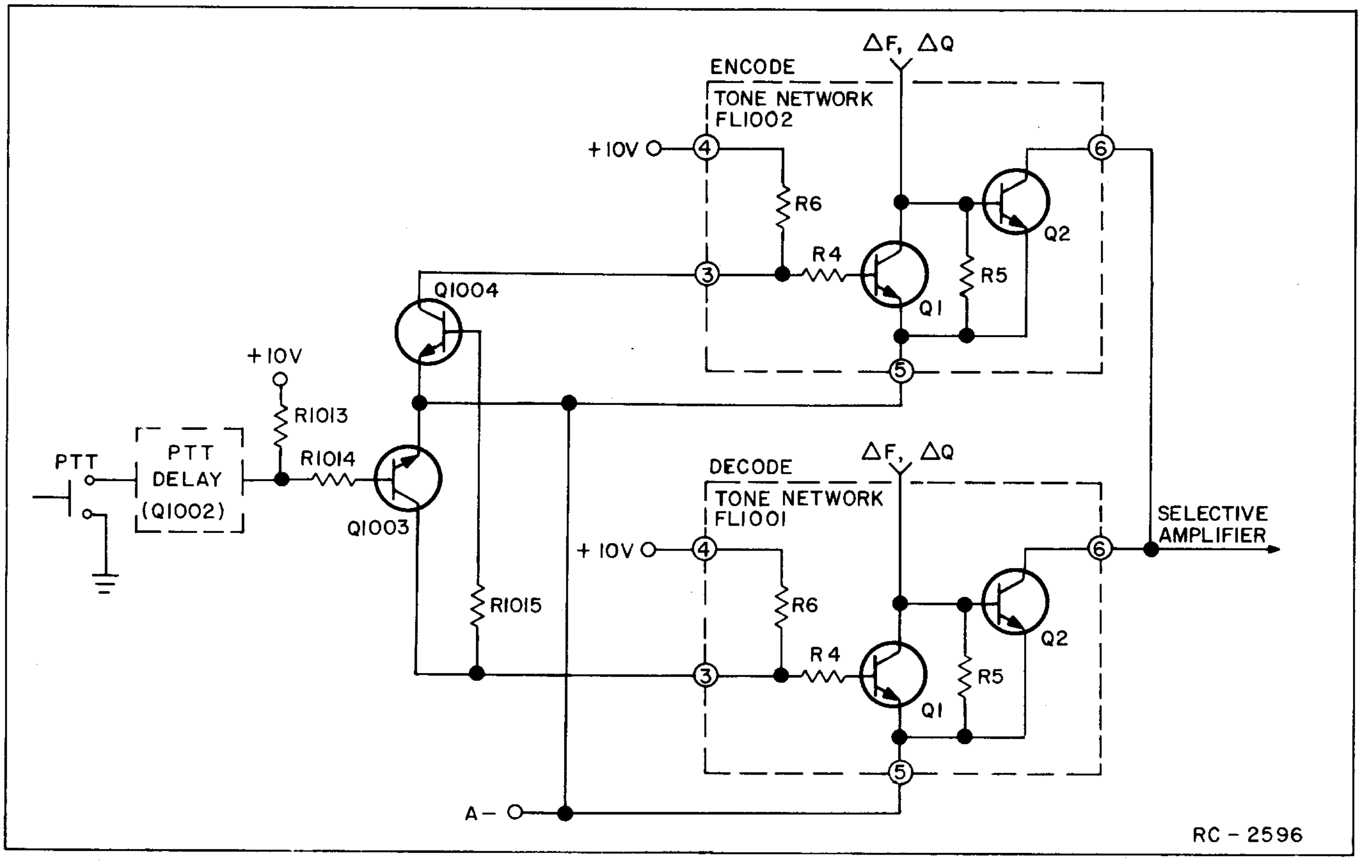


Figure 5 - Tone Selector Switch

with the Selective Amplifier. The FSSA circuits are now complete and the FSSA responds to the operating frequency of tone network FL1001.

Conversely, in the encode mode when the PTT switch is operated A- is applied to the base of Q1003 turning it off. With Q1003 turned off A- is removed from the base of Q1004 and pin 3 of tone network FL1001. Q1 in FL1001 turns on grounding the base of Q2. Q2 turns off disconnecting FL1001 from the circuit. The base of Q1004 rises toward 10 V being supplied through pin 4, R6 and pin 3 of FL1001. Q1004 turns on and applies A- to pin 3 of tone network FL1002. Tone network FL1002 now becomes operational causing all transmissions to be encoded with the operating frequency of FL1002. Except for the operating frequency, the operation of FL1002 is identical to that of FL1001 described above.

INSTALLATION

DUPLICATING TONE NETWORKS

A diode matrix may be constructed on the multi-frequency Channel Guard units (19D417261G2-G4) to eliminate the need for more than one tone network operating on the same frequency. To construct the diode matrix proceed as follows:

1. Complete a channel arrangement chart similar to the example below. Draw an (X) on wire runs associated with duplicated tone frequencies.

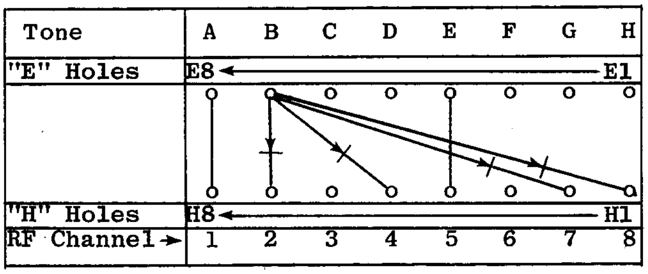
Radio Channel	Wire Run H		Wire Run E	CG Tone Frequencies
1	1	---	1	A - 103.5
2	2	-X-	2	B - 114.8
3	3	-X-	3	C - 85.4
4	4	-X-	4	B - 114.8
5	5	---	5	D - 156.7
6	6	-X-	6	C - 85.4
7	7	-X-	7	B - 114.8
8	8	-X-	8	B - 114.8

Channel Arrangement Chart

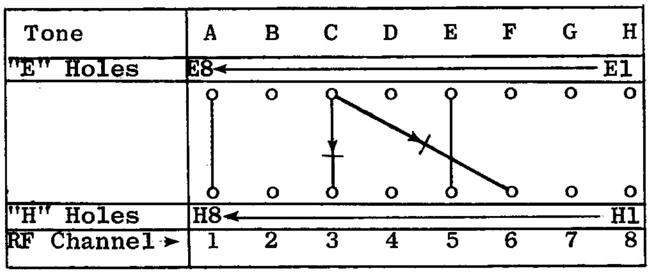
2. Refer to the Outline Diagram and cut the wire runs indicated by an "X" in the Channel Arrangement Chart.

3. Complete a diode matrix chart similar to the example below. Draw an arrow from repeated Channel Guard tone fre-

quencies to each radio channel using that tone frequency. In the examples below channels 2, 4, 7 and 8 use Tone B. Channels 3 and 6 use tone C.



Tone B Duplicating Diode Matrix



Tone C Duplicating Diode Matrix

4. Each arrow drawn for step 3 indicates a diode. Solder diodes in circuit as shown with cathodes connected to "H" holes and anodes to "E" holes. NOTE: Use only General Electric 19A116052P2 silicon (hot carrier) diodes. Standard silicon diodes are not compatible with this modification due to their higher voltage drop.

CHANNEL GUARD DISABLE STRAPPING
(Groups 1, 2, 5 & 6)

When an "open" channel is required on a multi-frequency radio, the decode function on the Channel Guard board must be disabled for each "open" channel. This modification may be incorporated into any Channel Guard containing the decode function i.e., single tone Encode/Decode (Group 1), Multi tone Encode/Decode (Group 2), Different Tone Encode/Decode (Group 5) or Decode only (Group 6).

Refer to the Outline Diagram for Strapping instructions.

IN MOBILE RADIOS

To install Channel Guard in radios not previously equipped with this feature, proceed as follows:

1. Gain access to System Board and clip out the DA jumper wire between H71 and H72 on the System Board (Refer to the MASTR II Maintenance Manual for the Front Panel and System Board.)

2. Plug the Channel Guard unit into J908 and J909 on the System Board.

3. Install the hookswitch to the control unit as directed in the Control Unit Maintenance Manual.

4. Adjust transmitter deviation in accordance with the Alignment Procedures in the Transmitter Maintenance Manual. No other adjustments are required.

IN STATIONS

Refer to the Station Combination Maintenance Manual for installation instructions.

MAINTENANCE

Troubleshooting the Channel Guard assembly is facilitated when using the Channel Guard extender board (19C320966G1). The extender board contains three slide switches which disable the decode and encode circuitry, and also bridges the PTT input to the delayed PTT output when the CG board is removed. In addition, "test points" are provided for all pins on J908.

PTT Bridge - Allows the transmitter to be keyed when the channel guard board is removed. Note: If transmitter is keyed with Channel Guard installed and PTT bridge closed the channel guard PTT delay will lock up until PTT bridge is opened.

Encode Disable - Applies A- to pin 2 of J908 and Pin 2 of Encode IC to prevent transmitting the Channel Guard Tone.

Rx CG Disable - Applies A- to J908-3 and pin 10 of Decode IC to disable the decoder. Under this condition the receiver is not muted.

A troubleshooting diagram (Figure 6) and associated procedures contain typical voltage and waveform data taken at selected points on the Channel Guard assembly.

ADJUSTMENTS

Normally, field adjustments to the Channel Guard assembly are not required. A single adjustment, "Frequency Calibration" is preset at the factory using an extremely accurate Reference Tone Network to permit direct field interchange of the Versatone networks.

However, should it become necessary in the field to replace one or more of the frequency determining components excluding the tone network, (Selective Amplifier IC, R1005, R1006, or R1007), readjustment of the Frequency Calibration control R1005 may be required. In addition, if R1005 or R1007 has been replaced, it may be necessary to select a new value for R1006 in order to recalibrate the tone network.

The Frequency Calibration control may be set using an existing tone network to establish operation on that frequency, as instructed in the Procedure below. In multi-frequency applications, use the tone network nearest the center operating frequency.

1. Install Channel Guard on Extender Board and set all switches to "TEST" position.

2. Connect A- to J908-6 to simulate keying transmitter.

3. Using a frequency counter calculate the exact period by determining the reciprocal of the frequency. Adjust R1005 so that the period monitored equals the period of the tone network and stake with epoxy.

4. Remove Extender board and reinsert Channel Guard in radio.

REMOVING INTEGRATED CIRCUITS

Removing IC's (and all other soldered-in components) can be easily accomplished by using a de-soldering tool such as a SOLDA-PULLT® or equivalent. To remove an IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

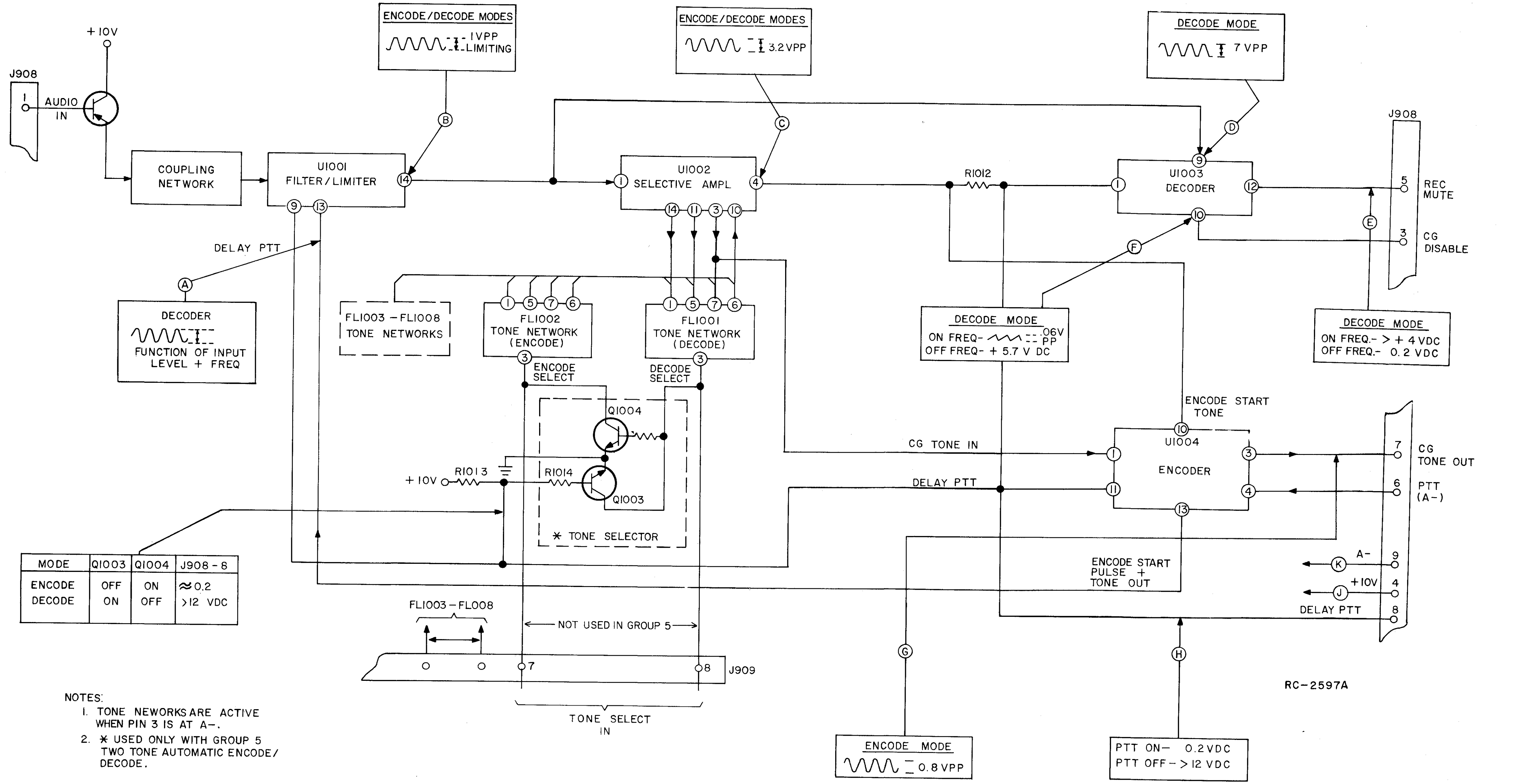
An alternate method is to use a special soldering tip that heats all of the pins simultaneously.

TROUBLESHOOTING

SYMPTOM	STEP	SWITCH	TEST POINT	ACTION
Unit does not Decode (NOTE 2)	1			Disable CG at hookswitch or remove CG board and check receiver for proper operation.
	2		TP4 M	Check for +10 Vdc
	3		TP9 L	Check for A-
	4	NOTE 1	B	Place Channel Guard assembly on extender board. Apply correct frequency CG tone to J908-1 at a level sufficient to cause limiting at B . (approximately 100 mV).
	5		TP5 E	Check for DC voltage 4.0 Volts minimum.
	6	S3: Disable	TP5 E	Check for DC voltage 4.0 Volts minimum. If voltage is not correct replace Decode IC.
	7		TP3 F	Check for presence of sawtooth waveform at F .
	8		C , D	Check for proper inputs to decoder. If input waveforms are correct (out of phase with each other) and output not present, replace Decode IC.
	9		A	Check for presence of proper waveform at A . Note: Verify that TP6 is not at A-.
Unit does not Encode (NOTE 2)	1		TP7 G	Key transmitter with the test set for the following tests. Check for presence of correct waveform at G : If waveform is correct, check for failure in the exciter.
	2		TP4 J	Check for presence of +10 Vdc
	3		TP9 K	Check for A-
	4	S1: Bridge	TP7 G	Check for proper waveform at G . If waveform is present, failure exists in Encode IC or Q1002 and associated circuitry.
	5			Isolate defective component by verifying proper waveforms at A B C .
CG does not mute Receiver	1			Check hookswitch at control unit or other ground on Receiver CG Disable input.
	2		TP5 E	Verify that receiver mute is clamped near A-. If not clamped near A-, replace Decode IC. Check Q7 in Encode IC.

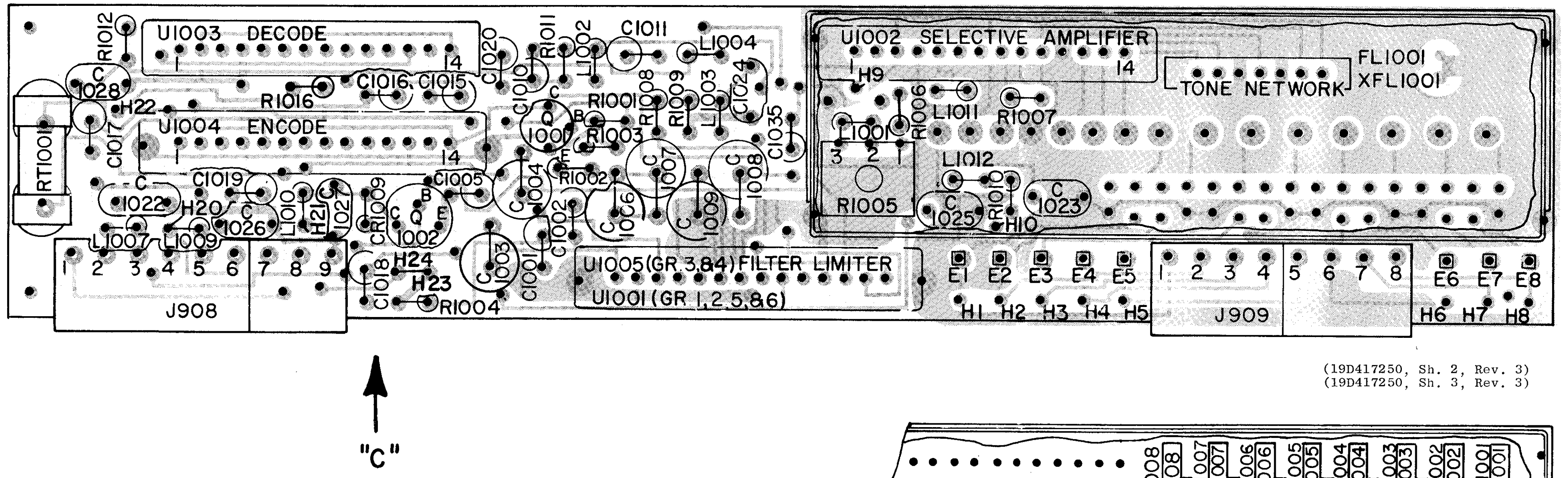
NOTE 1: S1, S2 and S3 are in the normal (Test) position unless otherwise noted.

NOTE 2: The Tone Network can be checked by substitution of a known good network.

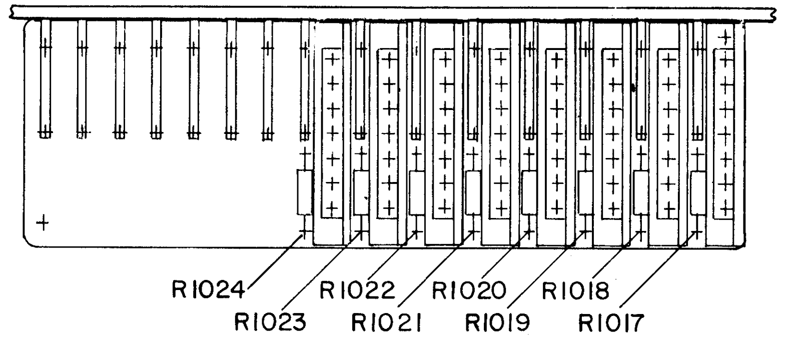


TROUBLESHOOTING PROCEDURE

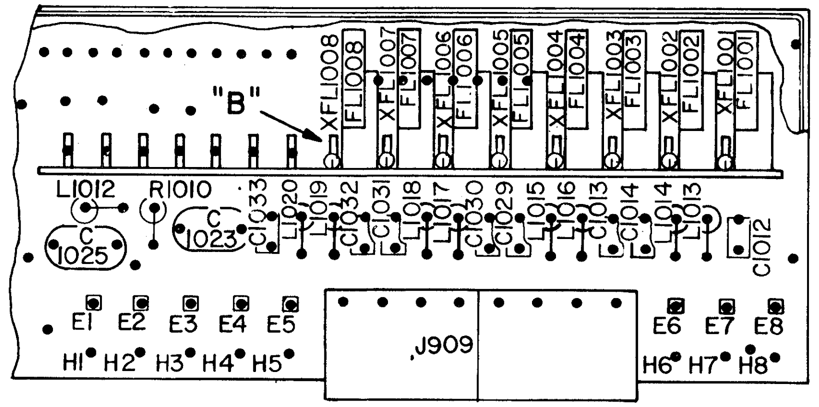
CHANNEL GUARD ENCODER/DECODER
19D417261G1-G6



(19D417250, Sh. 2, Rev. 3)
(19D417250, Sh. 3, Rev. 3)

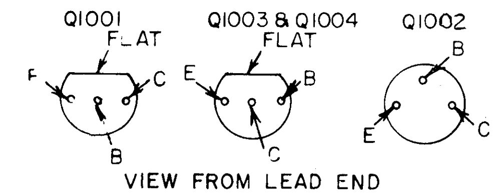


VIEW "B"



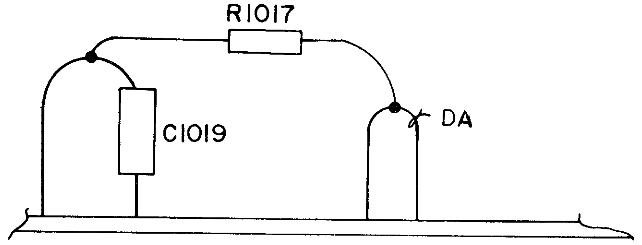
GROUPS 2 & 4

LEAD IDENTIFICATION

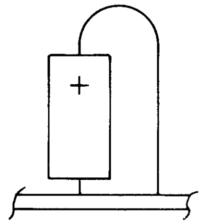


VIEW FROM LEAD END

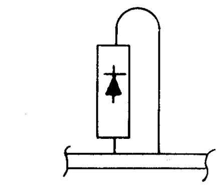
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION



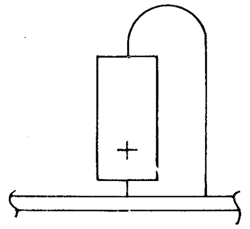
VIEW "C"
(PARTIAL FOR CLARITY)



POLARITY FOR ALL STAND-UP CAPACITORS EXCEPT C1005

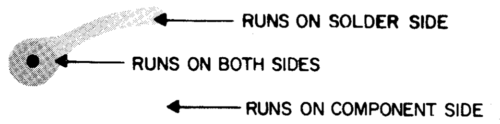


POLARITY FOR ALL STAND-UP DIODES



POLARITY FOR C1005

CONNECTION CHART			
FROM	TO	WIRE	ALL GROUPS
H9	H10	ITEM 3	
H20	H21	CR1010 CATHODE TO H20	GR.6 ONLY
H24	H23	DA	GROUPS 1 — 5



(19D417980, Rev. 12)

OUTLINE DIAGRAM

CHANNEL GUARD ENCODER/DECODER
19D417261G1-G6

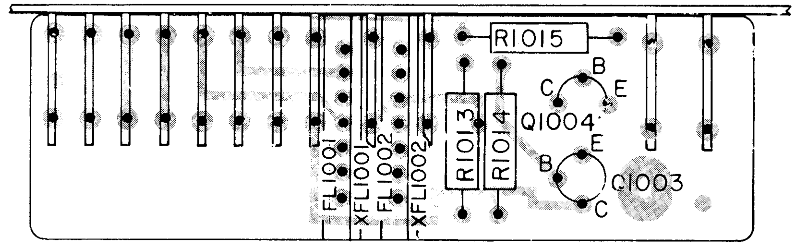
CHANNEL GUARD STRAPPING (19D417261G1, 5 & 6)

1. REMOVE CHANNEL GUARD BOARD FROM RADIO.
2. SELECT THE FREQUENCY POSITIONS FROM COLUMN A WHERE CHANNEL GUARD IS TO BE DISABLED. (CORRESPONDING TO "OPEN" CHANNELS.)
3. CUT CORRESPONDING RUNS FROM COLUMN "B" REPLACING EACH CUT RUN WITH A DIODE FROM HOLE TO TERMINAL. USE DIODE 19A115250P1.
4. CONNECT ANODES OF ALL DIODES TOGETHER WITH SLEEVED DM WIRE AT TERMINAL CONNECTION AND THEN CONNECT COMMON ANODE BUS TO H22 WITH SF24-W WIRE.
5. REPLACE CHANNEL GUARD BOARD.

"A" FREQUENCY - VERSATONE SOCKET	"B" CUT RUN BETWEEN HOLE AND TERMINAL ADD DIODE CATHODE	ANODE
F1	H8	E8
F2	H7	E7
F3	H6	E6
F4	H5	E5
F5	H4	E4
F6	H3	E3
F7	H2	E2
F8	H1	E1

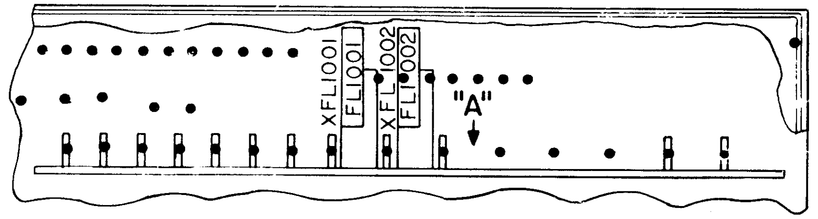
EXAMPLE: F2, F4 AND F7 CHANNELS ARE "OPEN".

1. COLUMN "A" SEE F2, F4, F7.
2. CUT RUNS BETWEEN H7, E7, H5-E5, H2-E2.
3. ADD DIODES BETWEEN H7-E7, H5-E5, H2-E2.
4. ADD DM JUMPERS BETWEEN E7, E5 AND E2.
5. ADD SF24-W WIRE BETWEEN E2 AND H22.



VIEW "A"

(19C320764, Sh. 2, Rev. 0)
(19C320764, Sh. 3, Rev. 0)



GROUP 5

CHANNEL GUARD STRAPPING (19D417261G2)

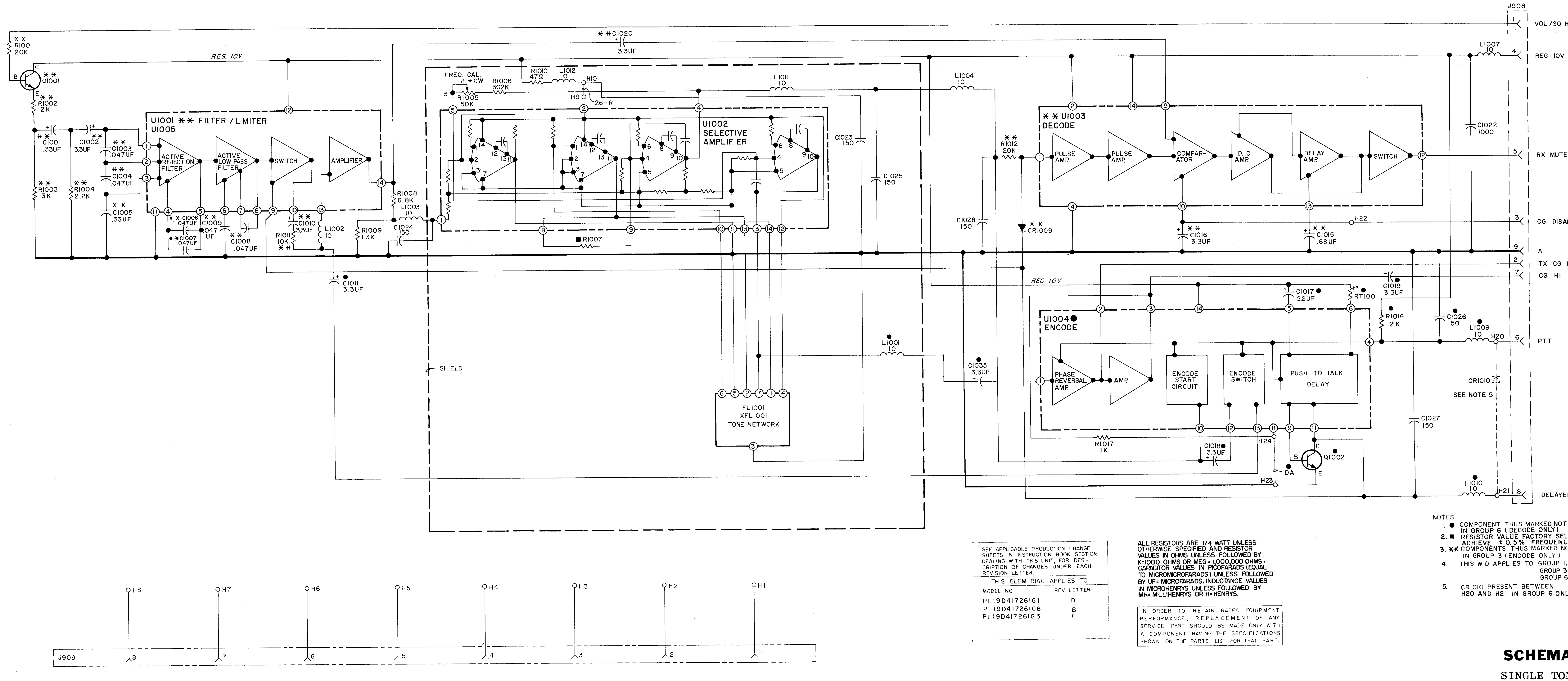
1. REMOVE CHANNEL GUARD BOARD FROM RADIO.
2. SELECT THE FREQUENCY POSITIONS CORRESPONDING TO "OPEN" CHANNELS OR UNUSED VERSATONE SOCKETS FROM COLUMN "A".
3. CUT CORRESPONDING RUNS FROM COLUMN "B" REPLACING EACH CUT RUN WITH A DIODE FROM HOLE TO TERMINAL. USE DIODE 19A115250P1.
4. CONNECT ANODES OF ALL DIODES TOGETHER WITH SLEEVED DM WIRE AT TERMINAL CONNECTION AND THEN CONNECT COMMON ANODE BUS TO H22 WITH SF24-W WIRE.
5. REMOVE CORRESPONDING INDUCTOR FROM COLUMN "C".
6. REPLACE CHANNEL GUARD BOARD IN RADIO.

"A" FREQUENCY	"B" CUT RUN BETWEEN HOLE AND TERMINAL ADD DIODE CATHODE	ANODE	"C" REMOVE INDUCTOR
F1-XFL1001	H8	E8	L1013
F2-XFL1002	H7	E7	L1014
F3-XFL1003	H6	E6	L1015
F4-XFL1004	H5	E5	L1016
F5-XFL1005	H4	E4	L1017
F6-XFL1006	H3	E3	L1018
F7-XFL1007	H2	E2	L1019
F8-XFL1008	H1	E1	L1020

EXAMPLE: IF VERSATONE SOCKETS XFL1002, XFL1004, XFL1007 ARE UNUSED:

1. COLUMN "A" SEE F2, F4, F7
2. CUT RUNS BETWEEN H7-E7, H5-E5, H2-E2
3. ADD DIODES BETWEEN H7-E7, H5-E5, H2-E2
4. ADD DM JUMPERS BETWEEN E7, E5 AND E2
5. ADD SF24-W WIRE BETWEEN E2 AND H22
6. REMOVE INDUCTORS L1014, L1016, AND L1019

(19C321875, 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
PL19D417261G1	D
PL19D417261G6	B
PL19D417261G3	C

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.

NOTES:

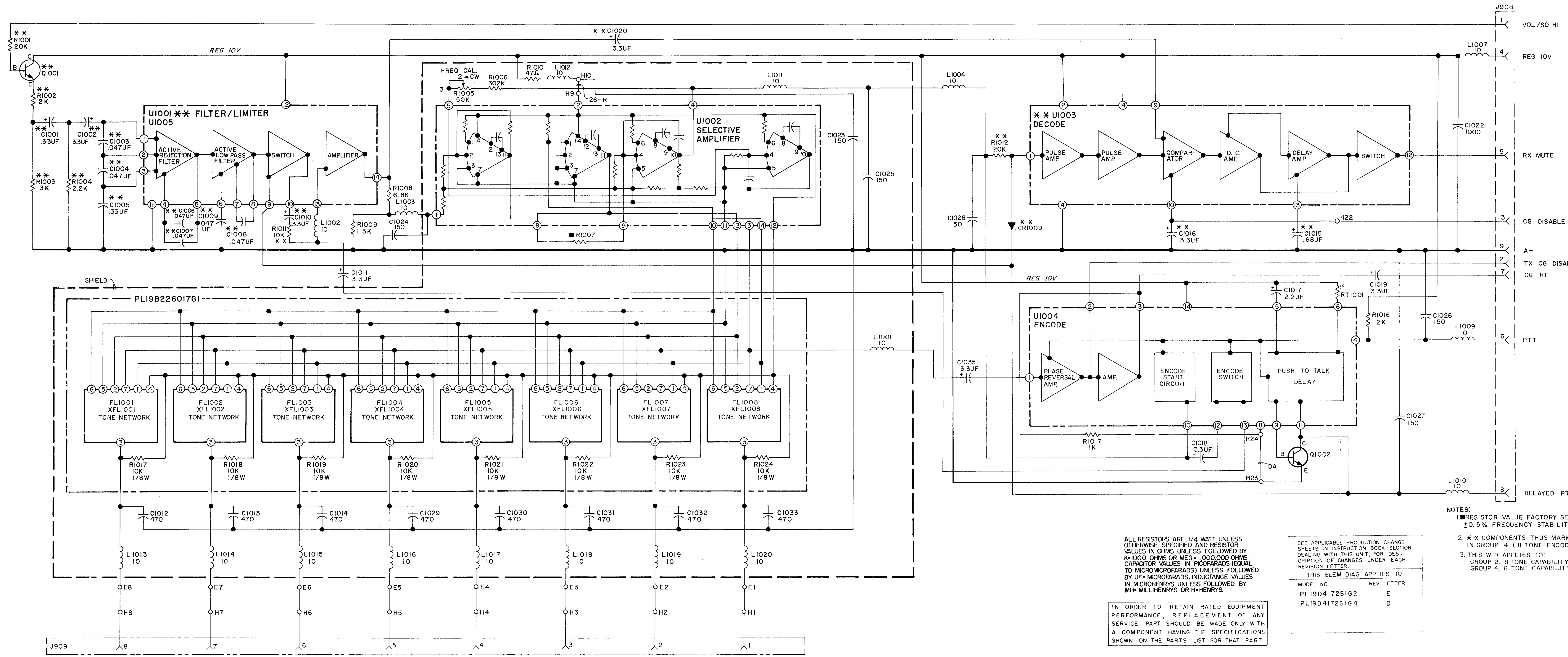
1. ● COMPONENT THUS MARKED NOT PRESENT IN GROUP 6 (DECODE ONLY)
2. ■ RESISTOR VALUE FACTORY SELECTED TO ACHIEVE ± 0.5% FREQUENCY STABILITY.
3. ** COMPONENTS THUS MARKED NOT PRESENT IN GROUP 3 (ENCODE ONLY)
4. THIS W.D. APPLIES TO: GROUP 1, SINGLE TONE ENCODE/DECODE. GROUP 3, SINGLE TONE ENCODE. GROUP 6, SINGLE TONE DECODE.
5. CR1010 PRESENT BETWEEN H20 AND H21 IN GROUP 6 ONLY.

SCHEMATIC DIAGRAM

SINGLE TONE ENCODE/DECODE

Issue 5

(19R622025, Rev. 14)



NOTES:

1. ■ RESISTOR VALUE FACTORY SELECTED TO ACHIEVE ±0.5% FREQUENCY STABILITY.
2. ** COMPONENTS THUS MARKED NOT PRESENT IN GROUP 4 (8 TONE ENCODE)
3. THIS W. D. APPLIES TO:
   GROUP 2, 8 TONE CAPABILITY ENCODE/DECODE
   GROUP 4, 8 TONE CAPABILITY ENCODE

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.

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

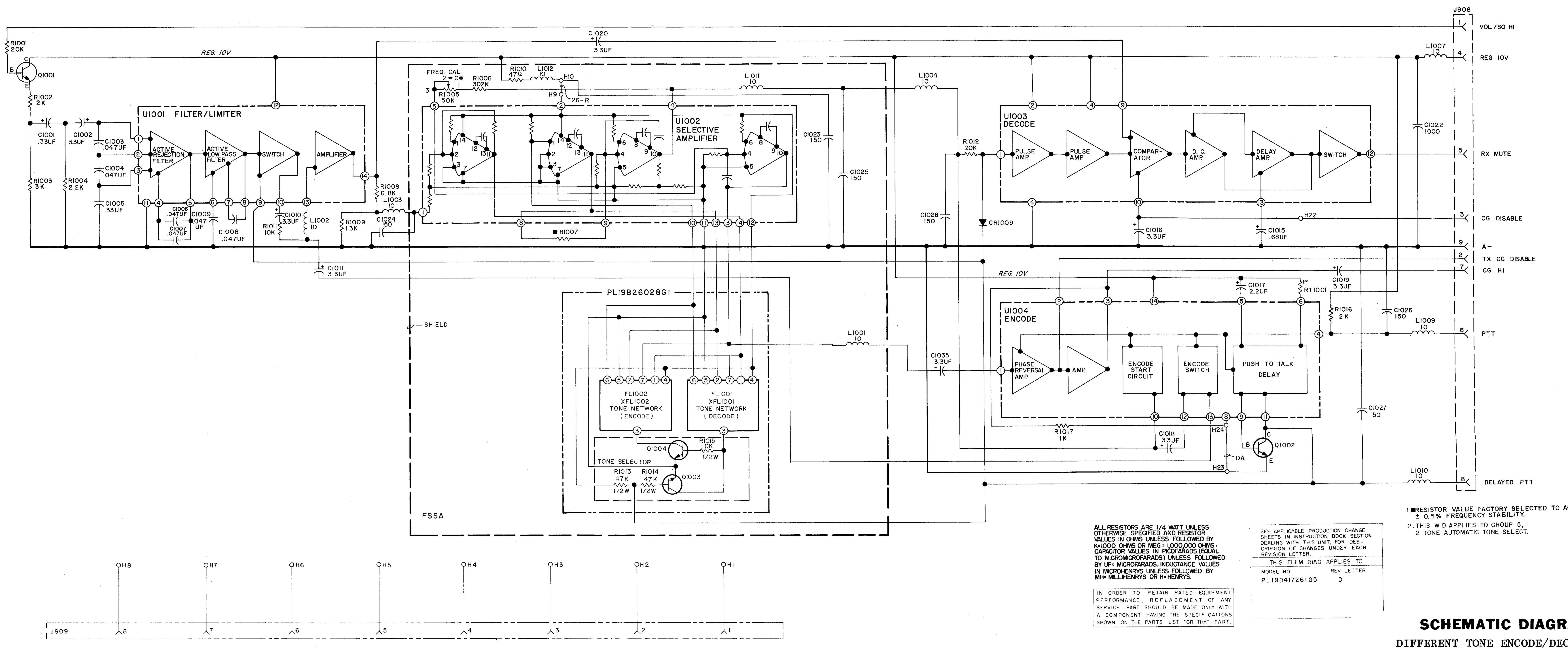
THIS ELEM DIAG APPLIES TO

MODEL NO	REV LETTER
PL19D417261G2	E
PL19D417261G4	D

(19R621999, Rev. 12)

SCHEMATIC DIAGRAM

MULTI-TONE ENCODE/DECODE



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.

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
PL19D417261G5	D

1. ■RESISTOR VALUE FACTORY SELECTED TO ACHIEVE ± 0.5% FREQUENCY STABILITY.
2. THIS W.D. APPLIES TO GROUP 5, 2 TONE AUTOMATIC TONE SELECT.

(19B622026, Rev. 11)

SCHEMATIC DIAGRAM

DIFFERENT TONE ENCODE/DECODE

Issue 5

PARTS LIST

LBI-4667C

CHANNEL GUARD ENCODER/DECODER
19D417261G1-G6

SYMBOL	GE PART NO.	DESCRIPTION
		19D417261G1 SINGLE TONE ENCODE/DECODE 19D417261G2 8 TONE ENCODE/DECODE 19D417261G3 SINGLE TONE ENCODE 19D417261G4 8 TONE ENCODE 19D417261G5 2 TONE AUTOMATIC ENCODE/DECODE 19D417261G6 SINGLE TONE DECODE
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1001	5496267P27	Tantalum: 0.33 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C1002	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C1003 and C1004	19C300075P47001F	Polyester: 47,000 pf ±1%, 100 VDCW; sim to GE Type 61F.
C1005	5496267P427	Tantalum: 0.33 µf ±5%, 35 VDCW; sim to Sprague Type 150D.
C1006 thru C1009	19C300075P47001F	Polyester: 47,000 pf ±1%, 100 VDCW; sim to GE Type 61F.
C1010 and C1011	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C1012 thru C1014	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C1015	5496267P229	Tantalum: 0.68 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C1016	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C1017*	5496267P213	Tantalum: 2.2 µf ±10%, 20 VDCW; sim to Sprague Type 150D.
		Earlier than REV A:
	5496267P13	Tantalum: 2.2 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C1018 thru C1020	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C1022	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1023 thru C1028	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C1029 thru C1033	19A116192P2	Ceramic: 470 pf ±20%, 50 VDCW; sim to Erie 8111-050-W5R.
C1034*	5494481P1	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap. Deleted in 19D417261G1, G4, G5 by REV D. Deleted in 19D417261G2 by REV E. Deleted in 19D417261G3 by REV C. Deleted in 19D417261G6 by REV B.
C1035	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1009	19A115250P1	Silicon.
CR1010	4037822P1	Silicon.
		- - - - - - - - - - - TERMINALS - - - - - - - - - -
E1 thru E8	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
		- - - - - - - - - - TONE NETWORKS - - - - - - - - -
		NOTE: When reordering, give GE Part Number and specify exact frequency needed.
FL1001 thru FL1008	19C320291G1	Hybrid.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J908		Includes:
	19A116659P5	Connector, printed wiring: sim to Molex 09-52-3031.
	19A116659P6	Connector, printed wiring: sim to Molex 09-52-3061.
J909	19A116659P7	Connector, printed wiring: sim to Molex 09-52-3041. (order Quantity 2).
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1001 thru L1004	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L1006*	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4. Deleted in G1,4,5 by REV C. Deleted in G2 by REV D. Deleted in G3 by REV B.
L1007	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L1009 thru L1020	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1001	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q1002	19A115300P4	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1001	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R1002*	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R1003*	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P301J	Composition: 300 ohms ±5%, 1/4 w.
R1004	3R152P222J	Composition: 2200 ohms ±5%, 1/4 w.
R1005	19A116559P114	Variable, cermet: 50,000 ohms ±20%, .5 w; sim to CTS Series 360.
R1006	19A116793P3023	Metal film: 302,000 ohms ±1%, .25 w; sim to IRC/TRW Style AR7.
R1007A	19A116793P1803	Metal film: 180,000 ohms ±1%, .25 w; sim to IRC/TRW Style AR7.
R1007B	19A116793P1913	Metal film: 191,000 ohms ±1%, .25 w; sim to IRC/TRW Style AR7.
R1007C	19A116793P1693	Metal film: 169,000 ohms ±1%, .25 w; sim to IRC/TRW Style AR7.
R1008	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R1009	3R152P132J	Composition: 1300 ohms ±5%, 1/4 w.
R1010	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R1011	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R1012	3R152P203J	Composition: 20,000 ohms ±5%, 1/4 w.
R1016*	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w. Added by REV A.
R1017*	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w. Added to G1,4,5 by REV B. Added to G2 by REV C. Added to G3 by REV A.
		- - - - - - - - - THERMISTORS - - - - - - - - -
RT1001	5490828P12	Thermistor: 25,000 ohms ±10%, color code red; sim to Globar Type 783H-2.
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - -
U1001	19D416741G3	Filter/Limiter Hybrid. (Used in G1,2,5 and 6).
U1002	19D417186G1	Hybrid Amplifier.
U1003	19D416730G1	Decoder Hybrid.
U1004	19D416740G2	Encoder Hybrid.
U1005	19D416741G4	Filter/Limiter Hybrid. (Used in G3 and G4).
		- - - - - - - - - - SOCKETS - - - - - - - - -
XFL1001	19C320299G1	Socket: 7 contact.
		TONE SELECTOR BOARD 19B226028G1
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1003 and Q1004	19A115889P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1013 and R1014	3R77P473J	Composition: 47,000 ohms ±5%, 1/2 w.
R1015	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
		- - - - - - - - - - SOCKETS - - - - - - - - -
XFL1001 and XFL1002	19C320299G1	Socket: 7 contact.
		COMPONENT BOARD 19B226017G1
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1017* thru R1024*	3R151P103J	Composition: 10,000 ohms ±5%, 1/8 w. Added to 19D417261G2 by REV B. Added to 19D417261G4 by REV A.
		- - - - - - - - - - SOCKETS - - - - - - - - -
XF1001 thru XF1008	19C320299G1	Socket: 7 contact.
		- - - - - - - - - - MISCELLANEOUS - - - - - - -
	4036555P1	Insulator, disc. (Used with Q1002).
	19A129434P1	Washer, fiber. (Used with RT1001).
	19B219892P3	Terminal. (Used with Component boards).

*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 - Channel Guard Encoder/Decoders 19D417261G1-2,5-6

To reduce loading on +10 Volt line. Changed R1002 and R1003.

REV. A - Channel Guard Encode Only 19D417261G4

To permit multi-tone operation when repeating ICOMs. Added R1017 thru R1024.

REV. B - Channel Guard Encode/Decode 19D417261G2

To permit multi-tone operation when repeating ICOMs. Added R1017 thru R1024.

REV. B - Channel Guard 19D417261G1, 4, 5

REV. A - Channel Guard 19D417261G3

REV. C - Channel Guard 19D417261G2

To reduce Channel Guard distortion at low frequencies. Added R1017.

REV. C - Channel Guard 19D417261G1, 4, 5

REV. B - Channel Guard 19D417261G3

REV. D - Channel Guard 19D417261G2

To improve encoder operation. Delete L1006 and replace with sleeved jumper.

REV. B - Channel Guard 19D417261G6

REV. D - Channel Guard 19D417261G1, 4, 5

REV. C - Channel Guard 19D417261G3

REV. E - Channel Guard 19D417261G2

To improve performance in cold climates. Deleted C1034.

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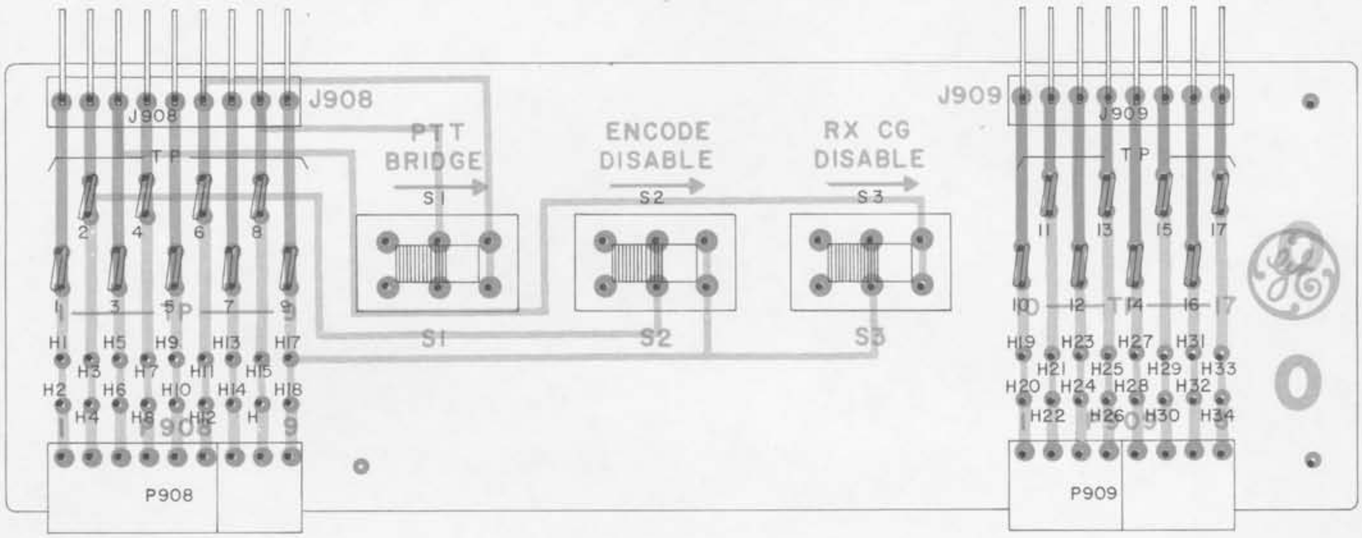
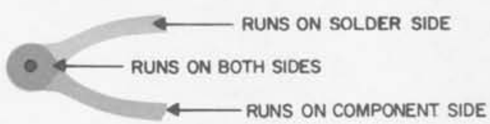
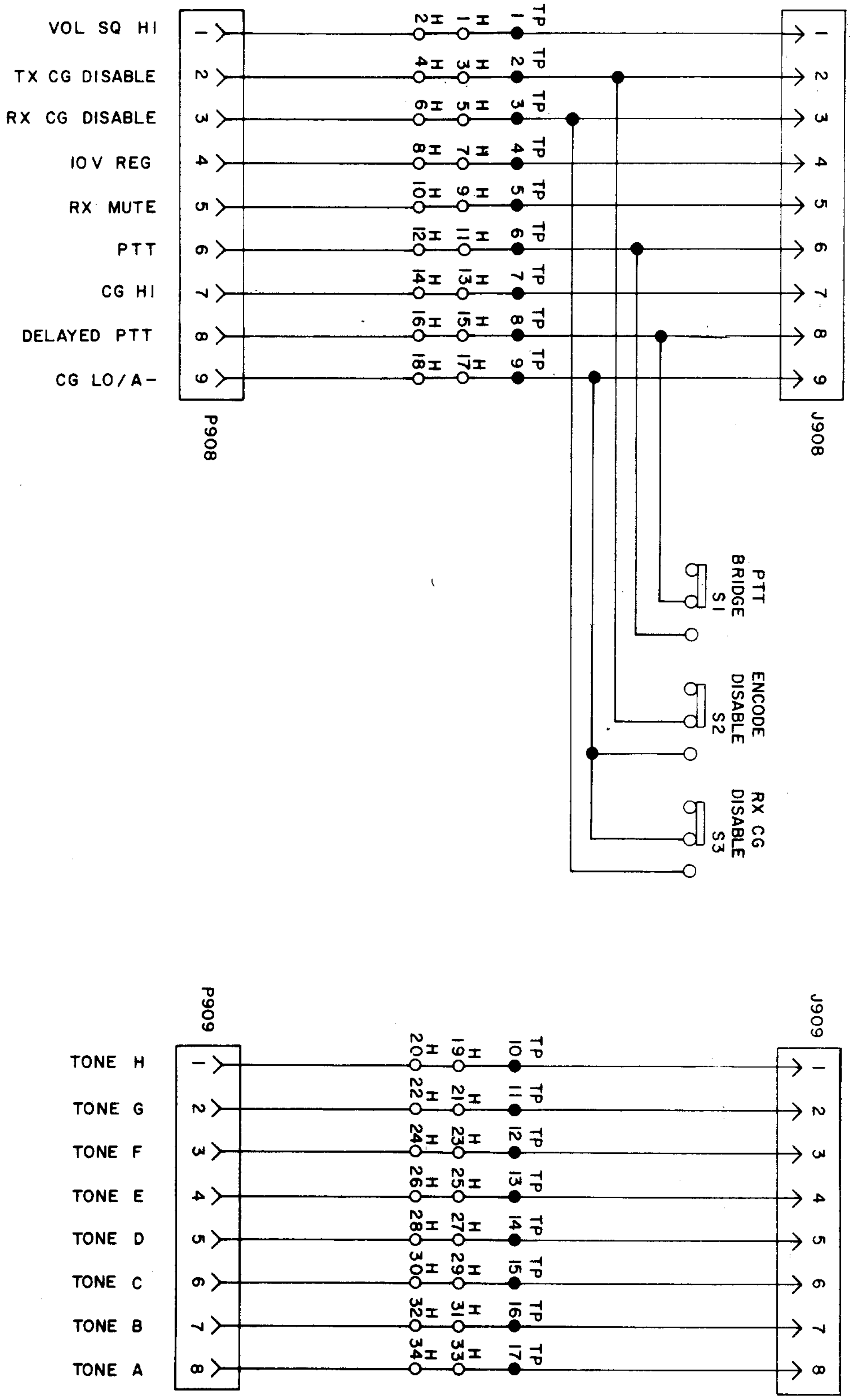


(19C321121, Rev. 0)
(19C320968, Sh. 2, Rev. 0)
(19C320968, Sh. 3, Rev. 0)



OUTLINE DIAGRAM

CHANNEL GUARD EXTENDER BOARD
19C320966G1



(19C321026, Rev. 1)

SCHEMATIC DIAGRAM

CHANNEL GUARD EXTENDER BOARD
19C320966G1

Issue 1

PARTS LIST

LBI-4626

CHANNEL GUARD EXTENDER BOARD
19C320966G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - -
J908	19A116659P31	Connector, printed wiring: 9 contacts; sim to Molex 2373-9A.
J909	19A116659P30	Connector, printed wiring: 8 contacts; sim to Molex 2373-8A.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P908		Includes:
	19A116659P5	Connector, printed wiring: 3 contacts; sim to Molex 09-52-3031.
	19A116659P6	Connector, printed wiring: 6 contacts; sim to Molex 09-52-3061.
P909	19A116659P7	Connector, printed wiring: 4 contacts; sim to Molex 09-52-3041. (Quantity 2).
		- - - - - - - - - - - SWITCHES - - - - - - - - - - -
S1 thru S3	19B209261P14	Slide: DPDT, 2 poles, 2 positions, .5 amp VDC or 3 amps VAC at 125 v; sim to Switchcraft XW-1468.
		- - - - - - - - - - TEST POINTS - - - - - - - - - -
TP1 thru TP17	19B211379P1	Spring (Test Point).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES