

MAINTENANCE MANUAL

SYNTHESIZER/INTERCONNECT BOARD 19D900241G1-G14

TABLE OF CONTENTS

DESCRIPTION	Page
DESCRIPTION	1
CIRCUIT ANALYSIS	1
OUTLINE DIAGRAM	7
SCHEMATIC DIAGRAM	8 & 9
PARTS LIST AND PRODUCTION CHANGES	10 - 12

DESCRIPTION

The system interconnect and frequency synthesizer board generates the synthesized RF frequency and the injection frequency. In addition it provides the interface with the various control and display functions on the control panel (or control unit), the transmit-receive board, the microprocessor on the logic board, and external functions such as the microphone, speaker and power cables. Also, a system test jack J2506 is provided to connect the GE-MARC V™ Micro-processor Control Set to the radio. A block diagram is shown in Figure 1.

The synthesizer/interconnect board is provided in 14 groups to accommodate the various frequency plans available for use in the trunked communication system. Application information for the synthesizer/interconnect board and the differing ICOM's are identified on the schematic diagram or parts list. More detailed application data is provided in the Service Section of this manual.

The synthesizer/interconnect board is mounted to the top side of the "H" frame chassis using 14 thread forming screws.

CIRCUIT ANALYSIS

I/O Interface (Input/Output)

I/O interface circuit consists of I/O expanders U2503 and U2504. These expanders provide the interface between the microprocessor on the logic board and the operator controlled functions on the control panel/control unit, and transfers the frequency address codes from the logic board to the RF frequency PROM, located on the RF PROM interface board. Data for the test functions monitored on test jack J2506 also pass through the I/O circuits.

Each I/O expander contains four 4-bit bi-directional static I/O ports and one 4-bit port to interface with the microprocessor. The 4-bit microprocessor interface

ports consisting of P20-23 are paralleled to allow a maximum interchange of data. The function of data appearing on the microprocessor interface ports is identified by the status off the PROG lead. A high to low transition signifies that address and control information is available. A low to high transition signifies data is available.

Only one expander is active at any given time and is selected by the logic board, under control of the I/O select line. An inverter U2502F ensures that opposite levels are simultaneously applied to the CS leads (chip select). The expander is active when CS is low.

On U2504 interface ports P50-52 and P72 complete the interface to the RF PROM interface board and allow manual selection of group tone (or operating area if selected). P60-62 and P73 interface the area select function through J2503.

Ports P70 and P71 provide for an electronically controlled audio level adjustment using two pushbutton switches (volume UP/down) on the control unit. P53 controls the operation of the mode indicator and P63 provides the RX mute interface to the radio. P40-43, and P71-73 on U2503, permit operational testing using the test jack. Interface ports U2503 P40-43 and P50 transfer the 5-bit address code to the RF frequency PROM located on the RF PROM interface board through J2509.

The RF frequency PROM contains the binary frequency codes representing the user operating frequencies. These frequency codes are addressed by the logic board and applied to the frequency synthesizer to control the RF frequency.

FREQUENCY SYNTHESIZER

The frequency synthesizer consists of reference oscillator Y2601, synthesizer U2601, acquisition and filtering circuit Q2601 and Q2602, voltage controlled oscillator (VCO) Q2603 and Q2604, low pass filter L2605-L2607 and associated circuitry, dual

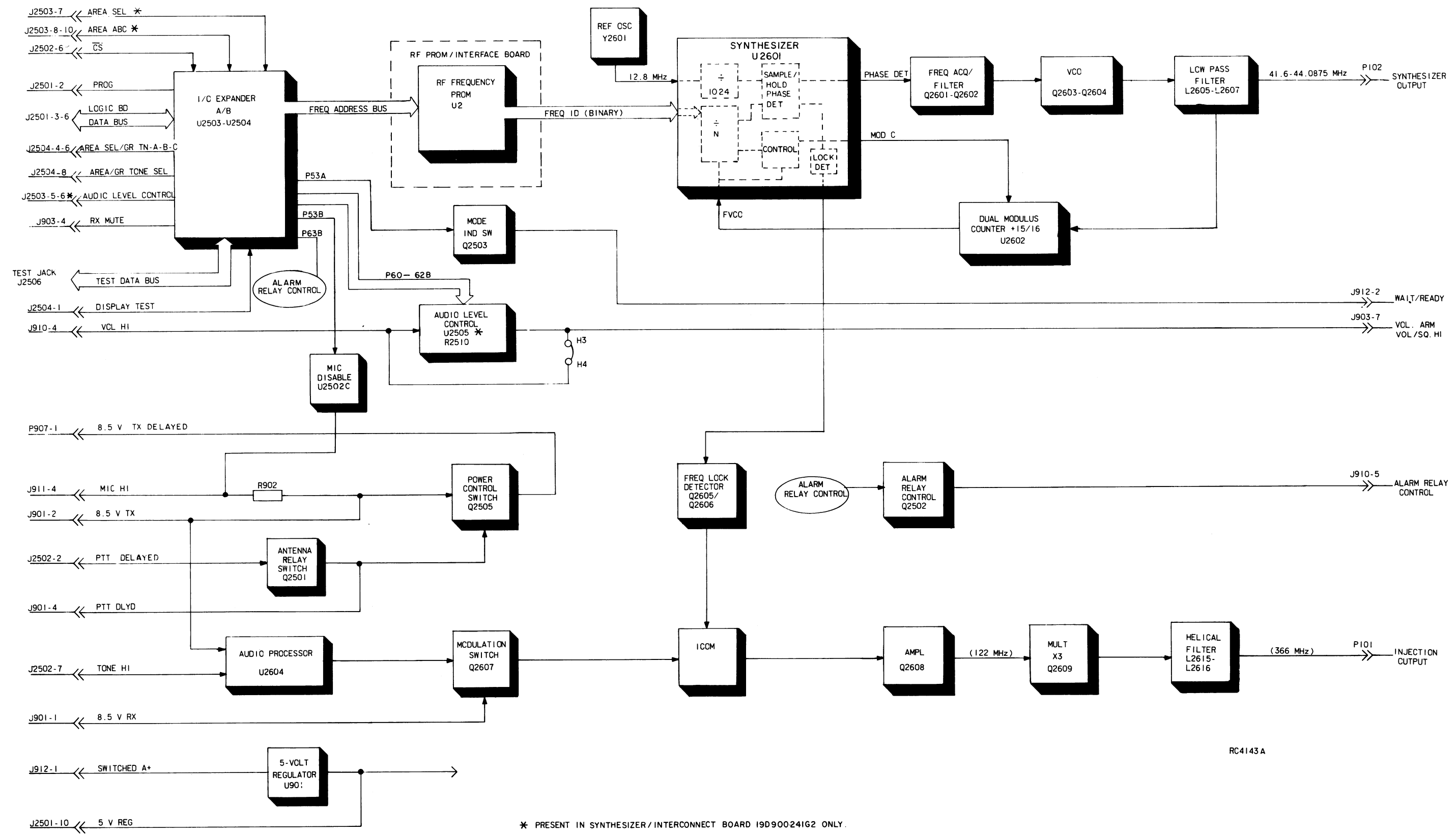


Figure 1 - Block Diagram

modulus counter U2602 and lock detector Q2605 and Q2606. The synthesizer loop operates at frequencies between 41.6 and 44.0875 MHz and provides a minimum output signal of -4.5 dBm to the transmit/receive board.

Reference Oscillator

The 5 PPM reference oscillator operates at a frequency of 12.8 MHz. Voltage for the oscillator compensator is obtained from the 8.5 V continuous supply and is regulated down to 5.4 Volts by zener diode D2601. Frequency compensation is provided by varactor D2603. Frequency is adjusted by C2607 while monitoring the synthesizer output at TP2602. The 12.8 MHz output signal is fed into the synthesizer IC on pin 27.

Synthesizer

The synthesizer U2601 contains a 1024 divider, phase detector, and a $\div N$ counter. The reference input frequency is divided by 1024 to obtain a 12.5 kHz channel spacing reference for the synthesizer. U2601-23 is the sample and hold phase detector output. The phase detector compares the 12.5 kHz signal from the $\div 1024$ counter and the output of the internal $\div N$ counter.

This comparison results in an \pm error voltage when the phases differ and a constant output voltage when operating in phase. If a phase error is detected an error voltage is supplied to the VCO through the acquisition circuit to set the VCO frequency. The count of the internal $\div N$ counter is controlled by the frequency code received from the frequency PROM. Thus, when a different channel is selected an error voltage appears at the phase detector output, causing the phase lock loop to acquire the new frequency.

Acquisition and Notch Filter

Q2601, Q2602 and associated circuitry comprise a twin TEE notch filter, low pass filter, and acquisition speed up circuit. The twin TEE notch filter (base side and emitter side of Q2601) remove the 12.5 kHz and 25 kHz reference spurs that are a product of the sample and hold phase detector output of the synthesizer. The low pass filter consists of R2620, R2621, C2623 and C2624 and controls the stability of the synthesizer loop.

The acquisition circuit consists of Q2601, Q2602, D2604-D2607, R2611 and C2616. During frequency acquisition the sample and hold and FS (frequency sense) outputs of the synthesizer generate an error voltage representative of the frequency change required of the VCO to achieve phase lock. The FS output provides corrections for large frequency changes while the sample and hold output is a sort of vernier control to correct for small phase differences to achieve phase lock. The FS error voltage is integrated by R2611 and C2616 and summed with the sample

and hold output to permit rapid frequency acquisition.

Rapid acquisition is achieved by changing the charge on the VCO varicap D2608 as swiftly as possible. This is the function of D2604-D2607. When D2604 is conducting, it effectively shorts out R2620, Q2602 and all the components of the 2nd twin TEE filter. This permits a fast change in the DC level on the varicap. When D2605 is conducting it shorts out R2620 and allows a rapid discharge of the varicap through Q2602. When D2606 or D2607 are conducting, they allow for rapid charge or discharge of C2624.

When R2620 is shorted the closed loop bandwidth is greatly increased and permits frequency switching times of less than 25 milliseconds.

After phase lock is achieved no acquisition (error voltage) information is received from the FS output.

Test point TP2601 monitors the voltage applied to the varicap.

NOTE

When adjusting the VCO voltage, always be sure to use a high impedance meter (10 megohm input impedance minimum).

The voltage at TP2601 varies directly with frequency in the locked condition (as voltage increases the frequency increases) and typically may range from 4.0 to 6.0 volts.

VCO (Voltage Controlled Oscillator)

The VCO consists of two FET's, Q2603 and Q2604, L2602, D2608, C2629, C2625, R2661 and C2628. The free running frequency of the VCO is adjusted by L2602 and operates over the range of 41.6 MHz to 44.0875 MHz. The tuned circuit consists of L2602, D2608 and C2625. The capacitance of D2608 varies in proportion to the DC voltage applied to it from the acquisition circuit, thus controlling the operating frequency of the VCO. The output of the VCO is taken from the drain of Q2603 and routed to the transmit/receive board through a low pass filter and P102. The low pass filter removes the 2nd and 3rd harmonics of the VCO frequency.

Dual Modulus Counter

The VCO frequency is fed back to the dual modulus counter U2602 through R2629 and C2638. The counter divides the VCO frequency by 15 or by 16 under control of MOD C (modulus control) from the synthesizer. When MOD C is high the VCO is divided by 15 and is divided by 16 when MOD C is low. The output of the dual modulus counter is applied

to the synthesizer where it is divided down to 12.5 kHz by an internal $\div N$ counter and compared in frequency and phase with the divided down frequency from the reference oscillator. The divide by N counter is controlled by the 8-bit binary frequency code received from the RF frequency PROM. When the PROG lead on the I/O expander is all zeros the VCO frequency should be 41.6 MHz at TP2602 and the voltage at TP2601 should be 4.1 ± 0.1 VDC.

Lock Control

The lock control circuit consisting of Q2605 and Q2606 in conjunction with LD (lock detect) control the operation of the 2 PPM ICOM by switching its control line. Should the synthesizer become unlocked, negative pulses will be present on the LD lead which will turn Q2605 on, discharging C2645 and turning Q2606 off. The incoming negative pulses increase in frequency with an increase in the difference between the divided down VCO frequency and the divided down reference frequency. With Q2606 turned off the ICOM ENABLE lead is opened and the ICOM ceases operation.

Audio Processor

The audio processor provides audio pre-emphasis with amplitude limiting and post limiter filtering. A total gain of approximately 24 dB is realized through the audio processor. 20 dB is provided by U2601B and 4 dB by U2601A.

The 8.5 Volt regulator on the transmit/receive board powers the audio processor and applies regulated +8.5 V through J901-3 to a voltage divider consisting of R2639, R2640, R2641 and R2643. The +4.25 V output from the voltage divider establishes the operating reference point for both operational amplifiers. C2649 provides an AC ground at the summing input of both operational amplifiers.

Audio from the microphone is coupled to the audio processor through C928 and R904 on the interconnect board to the input of operational amplifier U2604B-6.

When the input signal to U2604B-6 is of a magnitude such that the amplifier output at U2604B-7 does not exceed 4 volts P-P, the amplifier provides a nominal 20 dB gain. When the audio signal level exceeds 4 volts peak-to-peak, diodes D2611 and D2612 conduct on the positive and negative half cycles providing 100% negative feedback to reduce the amplifier gain to 1. This limits the audio amplitude at U2604B-7 to 5 volts peak-to-peak.

Resistors R2644, R2645, R2646 and C2648 comprise the audio pre-emphasis network that enhances the signal to noise ratio. R2607 and C2610 control the pre-emphasis curve below limiting. R2646 and C2648 control the

cut-off point for high frequency pre-emphasis. As high frequencies are attenuated, the gain of U2604 is increased.

The amplified output of U2604B is coupled through audio MOD ADJUST control R2636 to a second operational amplifier U2604A. Audio MOD ADJUST control is set for a deviation of 3.75 kHz (refer to the Transmitter Alignment Procedure).

The tone input from the logic board is applied to U2604A through J2502-7 and combined with the microphone audio when in the ready mode. U2604A provides a signal gain of approximately 4 dB. Tone deviation adjustment is accomplished on the logic board and is set for 1 kHz.

A post limiter filter consisting of R2642, R2647, R2648, C2655 and C2654 provides 12 dB per octave roll-off. R2637 and C2652 provide an additional 6 dB per octave roll-off for a total of 18 dB.

SERVICE NOTE

R2642 and R2647 are 1% resistors. This tolerance must be maintained to assure proper operation of the post limiter filter. Use exact replacements.

The audio processor output is coupled through C2656 and R2650 to FM ICOM U2603.

MODULATION SWITCH

The output of the audio processor is also applied to the collector of modulation switch Q2607. In the transmit mode, Q2607 is turned off. This permits the audio output of the processor to be applied to the ICOM through receive frequency adjust control R2663.

In the receive mode, 8.5 volts is applied to the base of Q2607, turning the transistor on. When turned on, Q2607 shunts any audio or tone from the audio processor to ground, preventing modulation of the oscillator in the receive condition. R2663 is adjusted to offset the receive IF frequency by 6.25K Hz.

FM ICOM

FM ICOM U2603 is a crystal controlled Colpitts oscillator that operates in the third overtone mode. A simplified ICOM diagram is shown in Figure 2.

Frequency modulation is accomplished by applying an audio signal (from the audio processor) to varicap D2. The audio varies the voltage at D2 which also varies its capacitance. This produces a changing resonant frequency at or near the oscillator's resonant frequency to provide direct frequency modulation.

The ICOM contains two tunable coils. The coil labeled FREQ is tuned to the desired.

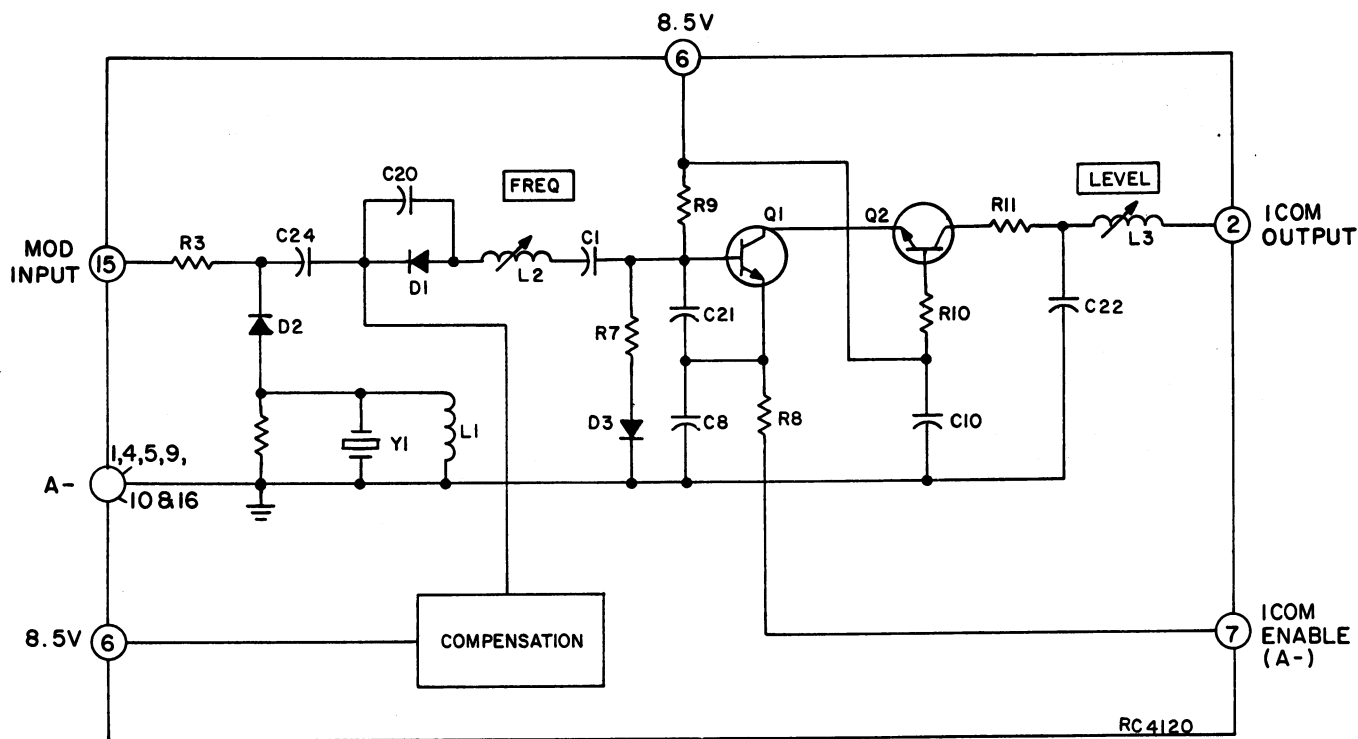


Figure 2 - FM ICOM

output frequency. The coil labeled LEVEL is tuned for maximum output power at the desired frequency. The output level is monitored at TP2603.

CAUTION

All ICOMs are individually frequency compensated at the factory and cannot be repaired in the field. Any attempt to repair or change an ICOM frequency will void the warranty.

Buffer Amplifier/Multiplier

The oscillator output frequency, approximately 122 MHz, is applied to buffer-amplifier Q2608 for isolation, and then through a tuned circuit consisting of L2611 and C2667 to multiplier stage Q2609. L2611 is tuned to the ICOM frequency of approximately 122 MHz.

The output of multiplier Q2609 is tuned to the 3rd harmonic of the ICOM frequency, passed through three poles of filtering to remove spurious harmonics, and then applied to the transmit/receive board through P101. TP2604 is the monitoring point (typically 0.5 volts) when tuning the multiplier and filters of the injection chain. RF output applied to the Tx/Rx board is 1.0 dBm minimum.

AUDIO LEVEL CONTROL (GE-MARC V CLASSIC ONLY)

The audio level control circuitry consisting of R2510 and electronic attenuator U2505 is electronically controlled by the microprocessor through the I/O expanders and VOLUME UP/DOWN pushbuttons on the control unit. The pushbuttons instruct the microprocessor to increment or decrement the audio level. Actual control of the level is implemented by resistor network R2510, which converts the digital information from the microprocessor to a DC control voltage, and by electronic attenuator U2505, which attenuates the level in proportion to the control voltage.

R2516 controls the audio range and sets the reference level for the electronic attenuator.

ANTENNA RELAY/POWER CONTROL SWITCH

Antenna relay switch Q2501 is turned off by PTT DLYD from the logic board when the radio is in the receive mode. PTT DLYD is inverted by U2502-A. When the PTT switch is operated, PTT DLYD turns on Q2501 and applies A- to the antenna relay through J901-4 and to power control switch Q2505. The antenna relay in the Tx/Rx board picks up and applies 8.5 V Tx to the emitter of Q2505 and to the microphone pre-amplifier through J911-4.

Power control switch Q2505 is held off for approximately 25 milliseconds by C2508 and R2501 before applying power to the control circuit, to provide a transmitter attack time compatible with GE-MARC V signalling. Power control voltage is applied through P907-1.

ALARM RELAY CONTROL

Alarm relay control transistor Q2502 is controlled by the microprocessor through U2503-17. When an alarm condition exists, Q2502 is turned on and A- is applied to the customer supplied alarm relay through J910-5. Current required to operate the relay should not exceed 400 milliamperes.

5 VOLT REGULATOR

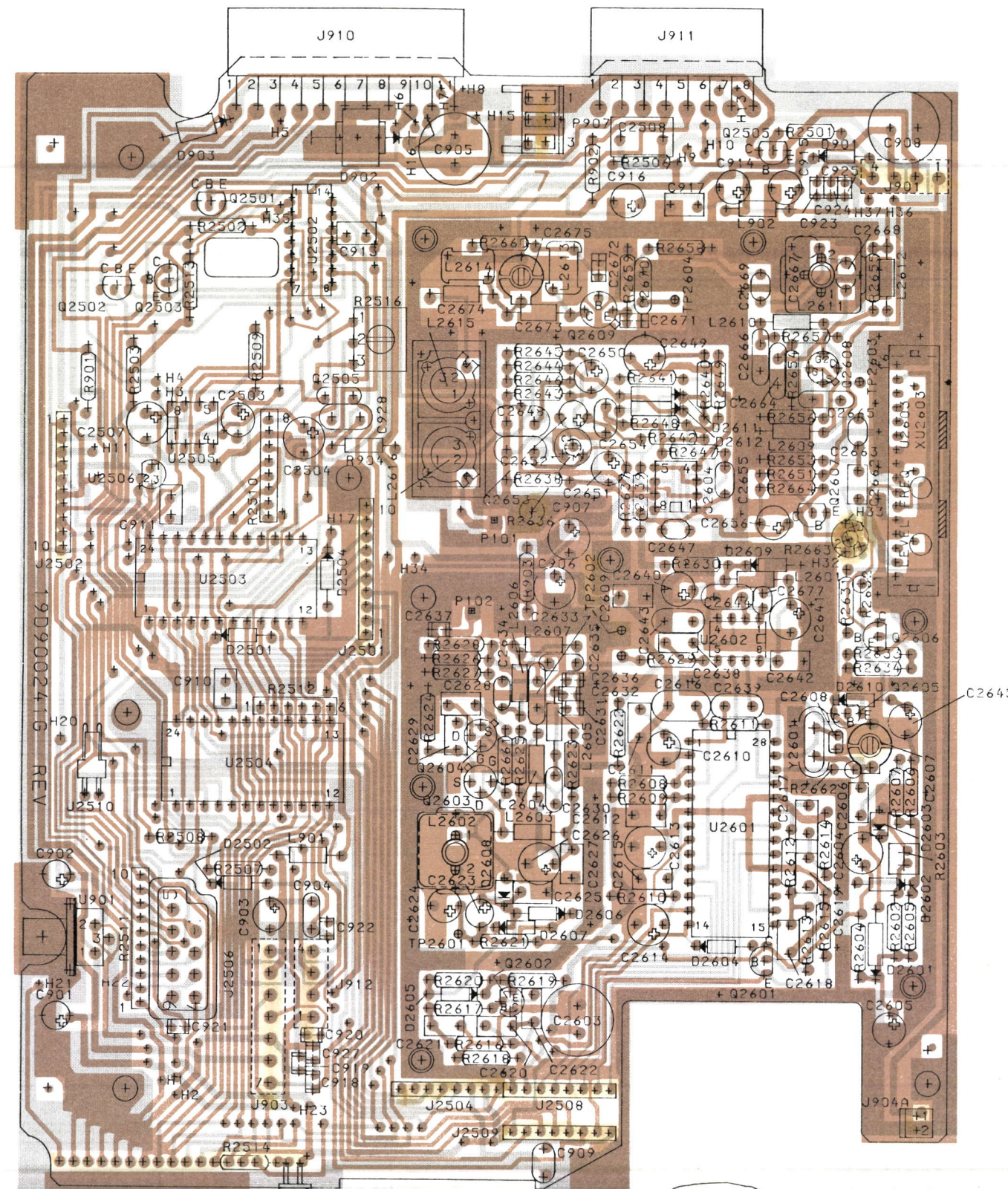
The 5 Volt regulator receives switched A+ through J912-1 and supplied +5 volt regulated to the logic and synthesizer/interconnect boards and the control panel. Diodes D902 and D903 provide reverse polarity protection for A+.

MODE INDICATOR

Mode indicator switch Q2503 operates under control of the microprocessor on the logic board. It indicates the WAIT Mode by flashing and the READY Mode by illuminating continuously. The Idle Mode is indicated by no light. It provides A- to the control panel/control unit through J912-2.

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

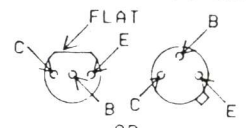




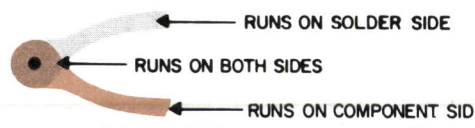
CONNECTION CHART			
FROM	TO	WIRE	REMARKS
H1	H2	DA	GROUP 1,3,5,7,9,11,13 ONLY
H2	H4	DA	GROUP 1,3,5,7,9,11,13 ONLY
H5	H6	STD.60-9	GROUP 1,3,5,7,9,11,13 ONLY
H9	H10	DA	GROUP 2,4,6,8,10,12,14 ONLY
H21	H22	DA SLEEFED	GROUP 2,4,6,8,10,12,14 ONLY
H11	H20	STD.60-9	
H32	H33+	C2676	C2676 REPLACES R2663 IN GROUP 1,2 ONLY

R-2636-Modulation
R-2663-R offset

LEAD IDENTIFICATION
FOR Q2601,Q2602,Q2605,
Q2606,Q2607,Q2609,Q2501,
Q2502,Q2504 AND Q2505



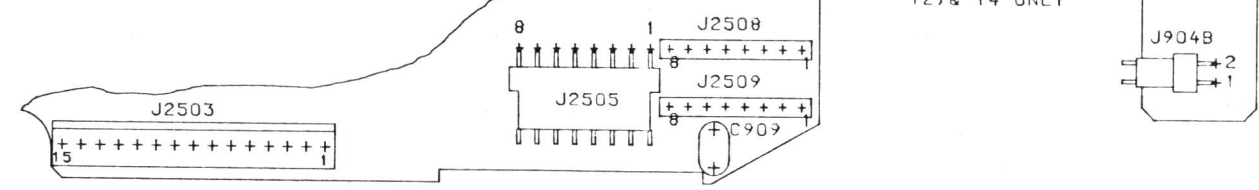
IN-LINE OR TRIANGULAR
TOP VIEW
NOTE: LEAD ARRANGEMENT, AND NOT
CASE SHAPE, IS DETERMINING
FACTOR FOR LEAD IDENTIFICATION.

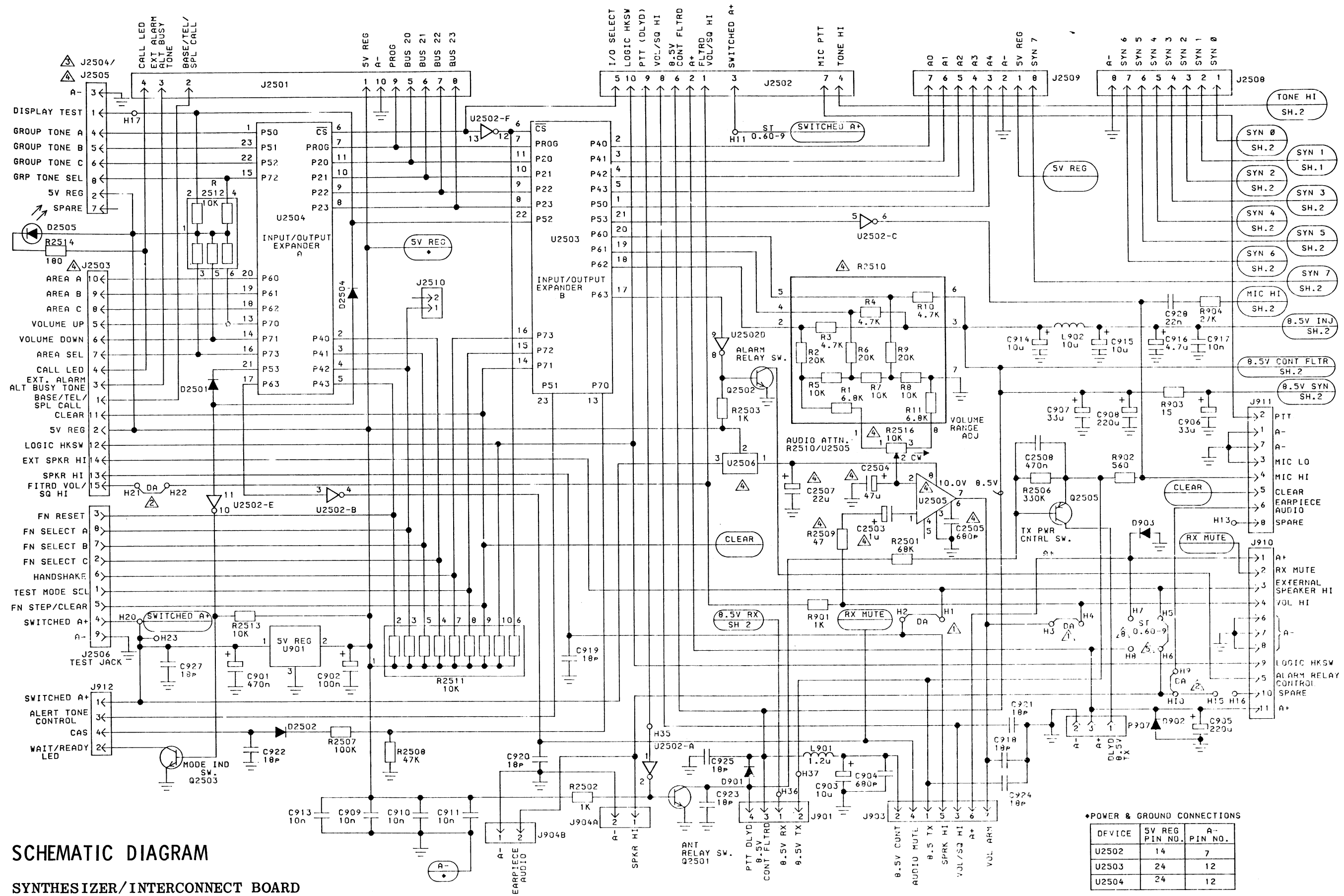


(19D900242, Rev. 11)
(19A701541, Sh. 1, Rev. 7)
(19A701541, Sh. 2, Rev. 7)

FLAT DENOTES CATHODE

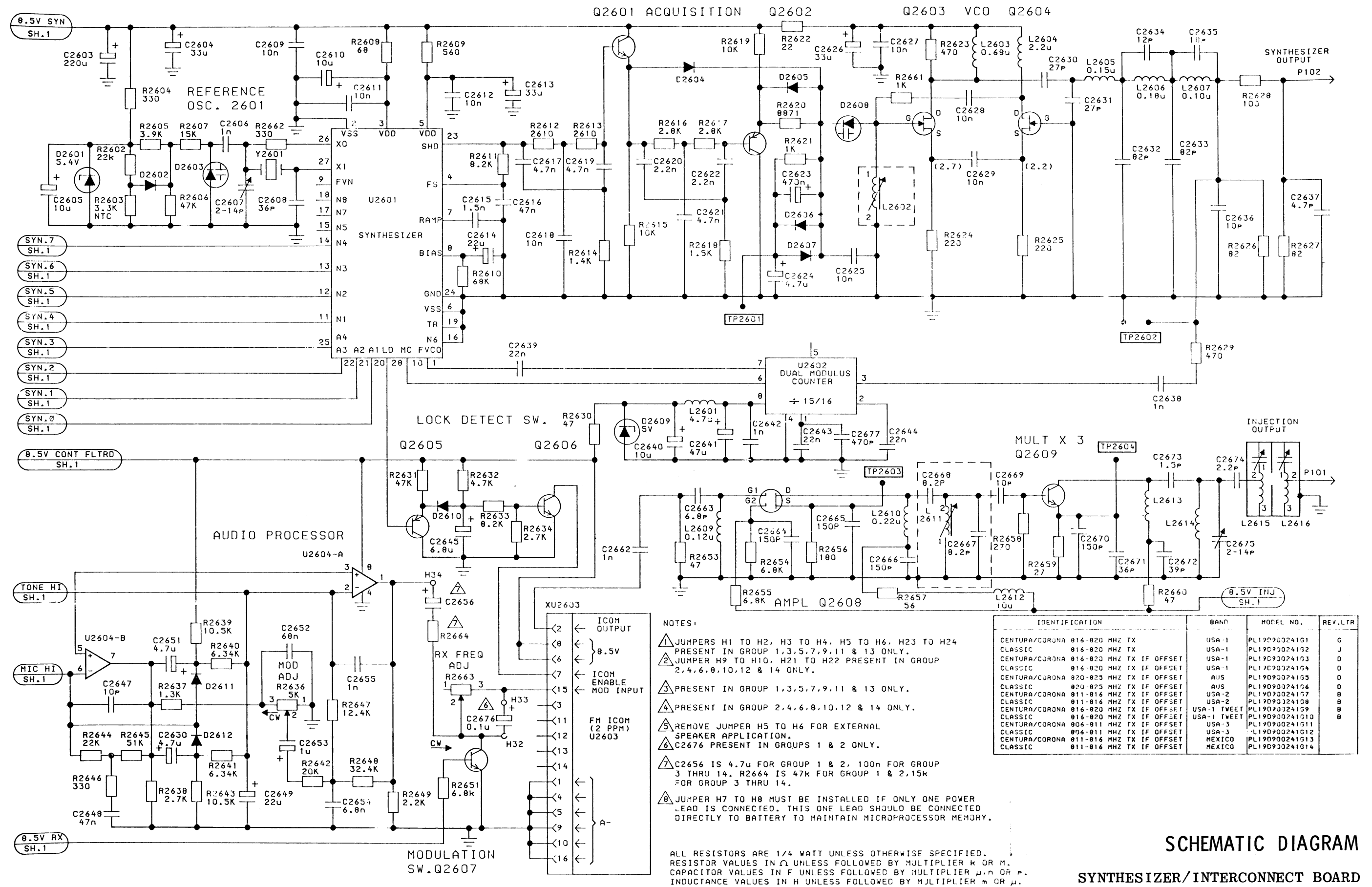
GROUP 2,4,6,8,10,
12, & 14 ONLY





SCHEMATIC DIAGRAM

SYNTHESIZER/INTERCONNECT BOARD



PARTS LIST

SYSTEM SYNTHESIZER/INTERCONNECT BOARD
19D900241G1 - G14

ISSUE 4

SYMBOL	GE PART NO.	DESCRIPTION
		G1 CENTURA/CORONA 816-820 MHz - REV G G2 CLASSIC 816-820 MHz - REV J G3 CENTURA/CORONA 816-820 MHz IF OFFSET USA-1 - REV D G4 CLASSIC 816-820 MHz IF OFFSET USA-1 - REV D G5 CENTURA/CORONA 820-825 MHz IF OFFSET AUS - REV D G6 CLASSIC 820-825 MHz IF OFFSET AUS - REV D G7 CENTURA/CORONA 811-816 MHz IF OFFSET USA-2 - REV B G8 CLASSIC 811-816 MHz IF OFFSET USA-2 - REV B G9 CENTURA/CORONA 816-820 MHz IF OFFSET USA-1 ZT - REV B G10 CLASSIC 816-820 MHz IF OFFSET USA-1 ZT - REV B G11 CENTURA/CORONA 806-811 MHz IF OFFSET USA-3 G12 CLASSIC 806-811 MHz IF OFFSET USA-3 G13 CENTURA/CORONA 811-816 MHz IF OFFSET MEXICO G14 CLASSIC 811-816 MHz IF OFFSET MEXICO
		- - - - - CAPACITORS - - - - -
C901	19A701534P3	Tantalum: 0.47 uF ±20%, 35 VDCW.
C902	19A701534P1	Tantalum: 0.1 uF ±20%, 35 VDCW.
C903	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C904	19A700233P6	Ceramic: 680 pF ±20%, 50 VDCW.
C905	19A134730P2	Electrolytic: 220 uF +100 -10%, 25 VDCW.
C906 and C907	19A143486P5	Tantalum: 33 uF ±20%, 10 VDCW.
C908	19A134730P2	Electrolytic: 220 uF +100 -10%, 25 VDCW.
C909	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C910 and C911	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C913	19A700005P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C914 and C915	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C916	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C917	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C918 thru C925	19A700219P38	Ceramic: 18 pF ±10%, 100 VDCW, temp coef 0 PPM.
C927	19A700219P38	Ceramic: 18 pF ±10%, 100 VDCW, temp coef 0 PPM.
C928	19A700005P9	Polyester: 0.022 uF ±10%, 50 VDCW.
C2503	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C2504	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C2505	19A700233P6	Ceramic: 680 pF ±20%, 50 VDCW.
C2507	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C2508	19A700004P6	Metallized polyester: 0.47 uF ±10%, 63 VDCW.
C2603	19A134730P2	Electrolytic: 220 uF +100 -10%, 25 VDCW.
C2604	19A143486P5	Tantalum: 33 uF ±20%, 10 VDCW.
C2605	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C2606	19A700234P1	Polyester: 1000 pF ±10%, 50 VDCW.
C2607	19A700008P2	Variable: 2.28 to 14.13 pF; sim to EF Johnson 187-0109-005.
C2608	19A700225P48	Ceramic: 36 pF ±5%, 100 VDCW, temp coef -470 PPM.
C2609	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C2610	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C2611 and C2612	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C2613	19A143486P5	Tantalum: 33 uF ±20%, 10 VDCW.
C2614	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C2615	19A700234P2	Polyester: 1500 pF ±10%, 50 VDCW.
C2616	19A700234P11	Polyester: 0.047 uF ±10%, 50 VDCW.
C2617	19A700234P5	Polyester: 4700 pF ±10%, 50 VDCW.
C2618	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C2619	19A700234P5	Polyester: 4700 pF ±10%, 50 VDCW.
C2620	19A700234P3	Polyester: 2200 pF ±10%, 50 VDCW.
C2621	19A700234P5	Polyester: 4700 pF ±10%, 50 VDCW.
C2622	19A700234P3	Polyester: 2200 pF ±10%, 50 VDCW.
C2623	19A701534P3	Tantalum: 0.47 uF ±20%, 35 VDCW.
C2624	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C2625	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C2626	19A143486P5	Tantalum: 33 uF ±20%, 10 VDCW.
C2627 thru C2629	19A700234P7	Polyester: 0.01 uF ±10%, 50 VDCW.
C2630	19A700235P18	Ceramic, disc: 27 pF ±5%, 50 VDCW.
C2631	19A700224P44	Ceramic: 27 pF ±5%, 100 VDCW.
C2632	19A700224P62	Ceramic: 82 pF ±5%, 100 VDCW.
C2633	19A700235P24	Ceramic: 82 pF ±5%, 50 VDCW.
C2634	19A700235P14	Ceramic, disc: 12 pF ±5%, 50 VDCW.
C2635	19A700235P16	Ceramic: 18 pF ±5%, 50 VDCW.
C2636	19A700219P26	Ceramic: 10 pF ±5%, 100 VDCW, temp coef 0 PPM.
C2637	19A700219P18	Ceramic: 4.7 pF ±5%, 100 VDCW, temp coef 0 PPM.
C2638	19A700234P1	Polyester: 1000 pF ±10%, 50 VDCW.
C2639	19A700234P9	Polyester: 0.022 uF ±10%, 50 VDCW.
C2640	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C2641	19A701534P9	Tantalum: 47 uF ±20%, 6.3 VDCW.
C2642	19A700234P1	Polyester: 1000 pF ±10%, 50 VDCW.
C2643 and C2644	19A700234P9	Polyester: 0.022 uF ±10%, 50 VDCW.
C2645	19A701534P16	Tantalum: 6.8 uF ±20%, 35 VDCW.
C2647	19A700235P13	Ceramic: 10 pF ±5%, 50 VDCW.
C2648	19A702059P11	Polyester: 0.047 uF ±5%, 50 VDCW.
C2649	19A701534P8	Tantalum: 0.47 uF ±20%, 35 VDCW.
C2650 and C2651	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C2652	19A702059P12	Polyester: 0.068 uF ±5%, 50 VDCW.
C2653	19A701534P4	Tantalum: 1 uF ±20%, 35 VDCW.
C2654	19A702059P6	Polyester: 6800 pF ±5%, 50 VDCW.
C2655	19A702059P1	Polyester: 1000 pF ±5%, 50 VDCW.
C2656A	19A701534P6	Tantalum: 4.7 uF ±20%, 35 VDCW.
C2656B	19A701534P1	Tantalum: 0.1 uF ±20%, 35 VDCW.
C2662	19A700234P1	Polyester: 1000 pF ±10%, 50 VDCW.
C2663	19A700235P11	Ceramic: 6.8 pF ±5%, 50 VDCW.
C2664 thru C2666	19A700235P27	Ceramic: 150 pF ±5%, 50 VDCW.
C2667 and C2668	19A700235P12	Ceramic: 8.2 pF ±0.25 pF, 50 VDCW.
C2669	19A700235P13	Ceramic: 10 pF ±5%, 50 VDCW.
C2670	19A700235P27	Ceramic: 150 pF ±5%, 50 VDCW.
C2671	19A700219P48	Ceramic: 36 pF ±5%, 100 VDCW.
C2672	19A700219P50	Ceramic: 39 pF ±5%, 100 VDCW, temp coef 0 PPM.

SYMBOL	GE PART NO.	DESCRIPTION
C2673	19A700013P15	Phenolic: 1.50 pF ±5%, 500 VDCW.
C2674	19A700013P17	Phenolic: 2.2 pF ±5%, 500 VDCW.
C2675	19A700008P2	Variable: 2.28 to 14.13 pF; sim to EF Johnson 187-0109-005.
C2676	19A701534P1	Tantalum: 0.1 uF ±20%, 35 VDCW.
C2677	19A700121P7	Ceramic: 470 pF ±20%, 50 VDCW.
		- - - - - DIODES - - - - -
D901	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D902	19A116783P1	Rectifier, silicon: 100 VDC blocking, 6 amp; sim to MR751.
D903	4037822P1	Silicon, 1000 mA, 400 PIV.
D2501 and D2502	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D2504	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D2505	19A134354P1	Diode, optoelectronic: red; sim to Hew. Packard 5082-4655.
D2601	4036887P5	Zener: 500 mW, 5.4 v. nominal.
D2602	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D2603	19A134208P1	Silicon; sim to MV 109.
D2604	19A700047P2	Silicon, 0.410 volt max.
D2605	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D2606 and D2607	19A700047P2	Silicon, 0.410 volt max.
D2608	19A134208P1	Silicon; sim to MV 109.
D2609	19A700025P6	Silicon, zener: 400 mW max; sim to BZX55-C5V1.
D2610	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
D2611 and D2612	19A115100P1	Silicon: sim to Type 1N458A.
		- - - - - JACKS AND RECEPTACLES - - - - -
J901	19J706214P4	Connector: 4 contacts rated @ 7 amps; sim to Molex 09-67-1042.
J903	19J706214P7	Flat wafer: 7 contacts rated @ 7 amps; sim to Molex 09-67-1072.
J904A	19A700072P28	Printed wire: 2 contacts rated @ 2.5 amps; sim to Molex 22-27-2021.
J904B	19A700072P132	Printed wire: 2 contacts rated at 2.5 amps; sim to Molex 22-05-3021.
J910	19A116659P151	Connector, printed wiring: sim to Molex 09-75-1111.
J911	19A116659P145	Connector, printed wiring: sim to Molex 09-75-1081.
J912	19J706214P4	Connector: 4 contacts rated @ 7 amps; sim to Molex 09-67-1042.
J2501 and J2502	19A700072P9	Printed wire: 10 contacts; sim to Molex 22-03-2101.
J2503	19A700072P41	Printed wire: 15 contacts rated at 2.5 amps; sim to Molex 22-27-2151.
J2504	19A700072P7	Printed wire: 8 contacts; sim to Molex 22-03-2081.
J2505	19A700072P138	Printed wire: 8 contacts rated at 2.5 amps; sim to Molex 22-05-3081.
J2506	19B219374G1	Connector, 9 contacts.
J2508 and J2509	19A700072P7	Printed wire: 8 contacts; sim to Molex 22-03-2081.
J2510	19A700072P132	Printed wire: 2 contacts rated @ 2.5 amps; sim to Molex 22-05-3021.

SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - INDUCTORS - - - - -						
L901	19A700024P14	Coil, RF: 1.2 uH \pm 10%.	R2512	19A134673P1	Network: 5 DC res rated @ 10K ohms \pm 2%; sim to Bourns 4306R-101-103.	R2654 and R2655	19A700019P47	Deposited carbon: 6.8K ohms \pm 5%, 1/4 w.
L902	19A700024P25	Coil, RF: 10.0 uH \pm 10%, 3.70 ohms DC res max.	R2513	19A700019P49	Deposited carbon: 10K ohms \pm 5%, 1/4 w.	R2656	19A700019P28	Deposited carbon: 180 ohms \pm 5%, 1/4 w.
L2601	19A700024P21	Coil, RF: 4.7 uH \pm 10%.	R2514	19A700019P28	Deposited carbon: 180 ohms \pm 5%, 1/4 w.	R2657	19A700019P22	Deposited carbon: 56 ohms \pm 5%, 1/4 w.
L2602	19A134729P3	Coil, RF: Freq, variable, wire size 24 SP AWG.	R2516	19A116559P106	Variable cermet: 10K ohms \pm 20%, 1/2 w; sim to CTS Series 360.	R2658	19A700019P30	Deposited carbon: 270 ohms \pm 5%, 1/4 w.
L2603	19A700024P11	Coil, RF: 680 nH \pm 10%.	R2602	19A700019P53	Deposited carbon: 22K ohms \pm 5%, 1/4 w.	R2659	19A700019P18	Deposited carbon: 27 ohms \pm 5%, 1/4 w.
L2604	19A700024P17	Coil, RF: 2.2 uH \pm 10%.	R2603	19A701828P1	Thermistor: 3.3K ohms \pm 5%; sim to Phillips 2322-642-63332.	R2660	19A700019P21	Deposited carbon: 47 ohms \pm 5%, 1/4 w.
L2605	19A700024P3	Coil, RF: 150 nH \pm 10%.	R2604	19A700019P31	Deposited carbon: 330 ohms \pm 5%, 1/4 w.	R2661	19A700019P37	Deposited carbon: 1K ohms \pm 5%, 1/4 w.
L2606	19A700024P4	Coil, RF: 180 nH \pm 10%.	R2605	19A700019P56	Deposited carbon: 39K ohms \pm 5%, 1/4 w.	R2662	19A700019P31	Deposited carbon: 330 ohms \pm 5%, 1/4 w.
L2607	19A700024P1	Coil, RF: 100 nH \pm 10%, 0.08 ohms DC res max, 100 v.	R2606	19A700019P57	Deposited carbon: 47K ohms \pm 5%, 1/4 w.	R2663	19A700016P7	Variable, cermet: 10K to 100K ohms \pm 10%, 1/2 w.
L2609	19A700024P2	Coil, RF: 120 nH \pm 10%.	R2607	19A700019P51	Deposited carbon: 15K ohms \pm 5%, 1/4 w.	R2664A	19A700019P57	Deposited carbon: 47K ohms \pm 5%, 1/4 w.
L2610	19A700024P5	Coil, RF: 220 nH \pm 10%.	R2608	19A700019P23	Deposited carbon: 68 ohms \pm 5%, 1/4 w.	R2664B	19A700019P51	Deposited carbon: 15K ohms \pm 5%, 1/4 w.
L2611	19J706083P22	Coil, RF: freq, variable.	R2609	19A700019P34	Deposited carbon: 560 ohms \pm 5%, 1/4 w.			- - - - - TEST POINTS - - - - -
L2612	19A700024P25	Coil, RF: 10.0 uH \pm 10%, 3.70 ohms DC res max.	R2610	19A700019P59	Deposited carbon: 68K ohms \pm 5%, 1/4 w.	TP2601	19A700152P1	Contact.
L2613	19J706085P2	Coil, RF: sim to Paul Smith LM-2.	R2611	19A700019P48	Deposited carbon: 8.2K ohms \pm 5%, 1/4 w.	TP2602	19A700152P1	Contact. (Quantity 2).
L2614	19J706085P7	Coil, choke: 0.018 uH \pm 30%; sim to Paul Smith LM2.	R2612 and R2613	19A701250P241	Metal film: 2610 ohms \pm 1%, 1/4 w.	TP2603 and TP2604	19A700152P1	Contact.
L2615 and L2616	19J706154P11	RF Coil: sim to Paul Smith SK802-1.	R2614	19A701250P215	Metal film: 1400 ohms \pm 1%, 1/4 w.			- - - - - INTEGRATED CIRCUITS - - - - -
		- - - - - PLUGS - - - - -	R2615	19A700019P49	Deposited carbon: 10K ohms \pm 5%, 1/4 w.	U901	19A134717P1	Linear, Positive Voltage Regulator.
P101 and P102	19A701785P3	Contact, electrical.	R2616 and R2617	19A701250P244	Metal film: 2.8K ohms \pm 1%, 1/4 w.	U2502	19A116180P75	Digital: HEX BUFFER INVERTER (OPEN COLLECTOR).
P907	19A700102P10	Printed wire: 3 contacts; sim to Molex 09-52-3032.	R2618	19A701250P218	Metal film: 1.5K ohms \pm 1%, 1/4 w.	U2503 and U2504	19A703862P1	Digital, I/O Expander.
		- - - - - TRANSISTORS - - - - -	R2619	19A700019P49	Deposited carbon: 10K ohms \pm 5%, 1/4 w.	U2505	19A134609P1	Linear. ELECTRONIC ATTENUATOR.
Q2501 and Q2502	19A134959P1	Silicon, NPN; sim to Type 2N4401.	R2620	19A701250P292	Metal film: 8870 ohms \pm 1%, 1/4 w.	U2506	19J706031P1	Linear: POSITIVE VOLTAGE REGULATOR.
Q2503	19A700023P1	Silicon, NPN; sim to Type 2N3904.	R2621	19A700019P37	Deposited carbon: 1K ohms \pm 5%, 1/4 w.	U2601	19B800726P1	Custom CMOS Synthesizer.
Q2505	19A700022P1	Silicon, PNP; sim to Type 2N3906.	R2622	19A700019P17	Deposited carbon: 22 ohms \pm 5%, 1/4 w.	U2602	19A700107P1	Custom, Dual In-Line 8-Pin Mini-Dip Package.
Q2601	19A700023P1	Silicon, NPN; sim to Type 2N3904.	R2623	19A700019P33	Deposited carbon: 470 ohms \pm 5%, 1/4 w.	U2603	19A701712G9	Oscillator. 816-820 MHz. 2 PPM. (USA-1).
Q2602	19A700022P1	Silicon, PNP; sim to Type 2N3906.	R2624 and R2625	19A700019P29	Deposited carbon: 220 ohms \pm 5%, 1/4 w.		19A701712G10	Oscillator. 820-825 MHz. 2 PPM. (AUSTRALIA)
Q2603 and Q2604	19A700060P1	N-Type, field effect.	R2626 and R2627	19A700019P24	Deposited carbon: 82 ohms \pm 5%, 1/4 w.		19A701712G11	Oscillator. 811-816 MHz. 2 PPM. (USA-2).
Q2605	19A700022P1	Silicon, PNP; sim to Type 2N3906.	R2628	19A700019P25	Deposited carbon: 100 ohms \pm 5%, 1/4 w.		19A701712G12	Oscillator. 816-820 MHz. 2 PPM. (USA-3).
Q2606 and Q2607	19A700023P1	Silicon, NPN; sim to Type 2N3904.	R2629	19A700019P33	Deposited carbon: 470 ohms \pm 5%, 1/4 w.		19A701712G13	Oscillator. 811-816 MHz. 2 PPM. (MEXICO).
Q2608	19A700075P1	N-Channel, field effect. (MOS DUAL GATE).	R2630	19A700019P21	Deposited carbon: 47 ohms \pm 5%, 1/4 w.		19A701712G14	Oscillator. 811-816 MHz. 2 PPM. (MEXICO).
Q2609	19A116201P3	Silicon, NPN.	R2631	19A700019P57	Deposited carbon: 47K ohms \pm 5%, 1/4 w.	U2604	19A116297P6	Linear, Dual OP Amp, 8 Pin Minidip Package; sim to Raytheon.
		- - - - - RESISTORS - - - - -	R2632	19A700C19P45	Deposited carbon: 4.7K ohms \pm 5%, 1/4 w.			- - - - - SOCKETS - - - - -
R901	19A700019P37	Deposited carbon: 1K ohms \pm 5%, 1/4 w.	R2633	19A700019P48	Deposited carbon: 8.2K ohms \pm 5%, 1/4 w.	XU2603	19D900097P1	Connector: 16 terminals.
R902	19A700019P34	Deposited carbon: 560 ohms \pm 5%, 1/4 w.	R2634	19A700019P42	Deposited carbon: 2.7K ohms \pm 5%, 1/4 w.			- - - - - CRYSTALS - - - - -
R903	19A700019P15	Deposited carbon: 15 ohms \pm 5%, 1/4 w.	R2636	19A700016P3	Variable, cermet: 4.7K ohms \pm 10%, 1/2 w.	Y2601	19A701565G1	Crystal unit, Quartz: 12.800 MHz at 25°C, temp range -30°C to +75 °C.
R904	19A700019P54	Deposited carbon: 27K ohms \pm 5%, 1/4 w.	R2637	3R152P132J	Composition: 1.3K ohms \pm 5%, 1/4 w.			- - - - - MISCELLANEOUS - - - - -
R2501	19A700019P59	Deposited carbon: 68K ohms \pm 5%, 1/4 w.	R2638	19A700106P73	Composition: 2.7K ohms \pm 5%, 1/4 w.		19C850619G2	Casting.
R2502 and R2503	19A700019P37	Deposited carbon: 1K ohms \pm 5%, 1/4 w.	R2639	19A701250P303	Metal film: 10.5K ohms \pm 1%, 1/4 w.		19A700069P1	Can. (Used with L2602 & L2611).
R2506	19A700019P67	Deposited carbon: 0.33M ohms \pm 5%, 1/4 w.	R2640 and R2641	19A701250P278	Metal film: 6.34K ohms \pm 1%, 1/4 w.		19A701516P1	Insulator, plate. (Used with Y2601).
R2507	19A700019P61	Deposited carbon: 0.1M ohms \pm 5%, 1/4 w.	R2642	19A701250P330	Metal film: 20K ohms \pm 1%, 1/4 w.		19A701538P1	Gasket. (Located under L2602).
R2508	19A700019P57	Deposited carbon: 47K ohms \pm 5%, 1/4 w.	R2643	19A701250P303	Metal film: 10.5K ohms \pm 1%, 1/4 w.		19A701400P1	Insulated spacer. (Used with P101 & P102).
R2509	19A700019P21	Deposited carbon: 47 ohms \pm 5%, 1/4 w.	R2644	19A700106P95	Composition: 22K ohms \pm 5%, 1/4 w.		19A138451P1	Tuning slug. (Used with L2615 & L2616).
R2510	19C850670G1	Resistor, Network.	R2645	19A143400P57	Deposited carbon: 51K ohms \pm 5%, 1/4 w.		19A701886P1	Spring. (Used with L2615 & L2616).
R2511	19A134673P2	Network: 9 DC res rated @ 100K ohms \pm 2%; sim to Bourns 4310R-101-104.	R2646	19A700106P51	Composition: 330 ohms \pm 5%, 1/4 w.		19A702364P106	Machine screw: TORX® DRIVE, No. M2 - 0.4 x 6 . (Secures L2615, L2616 casting).
			R2647	19A701250P310	Metal film: 12.4K ohms \pm 1%, 1/4 w.		19B232901P1	Support. (Mounts U901).
			R2648	19A701250P350	Metal film: 32.4K ohms \pm 1%, 1/4 w.		19A702364P208	Machine screw, metric: 2.5-.45 x 10MM. (Secures U901).
			R2649	19A700106P71	Composition: 2.2K ohms \pm 5%, 1/4 w.		19A700034P3	Hex nut, metric: M2.5 x 0.45. (Secures U901).
			R2651	19A700019P47	Deposited carbon: 6.8K ohms \pm 5%, 1/4 w.		19A700032P3	Lockwasher, tooth, steel, metric: 2.5. (Secures U901).
			R2653	19A700019P21	Deposited carbon: 47 ohms \pm 5%, 1/4 w.			

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 & B - Synthesizer/Interconnect Board 19D900241G1 & G2
Incorporated in initial shipment.
- REV. C - Synthesizer/Interconnect Board 19D900241G2
To increase volume adjustment range. Changed R2516.
R2516 was: 19A116559P102, variable cermet, 5000
ohms $\pm 20\%$, 0.5 Watt. Sim to CTS Series 360.
- REV. C - Synthesizer/Interconnect Board 19D900241G1
- REV. D - Synthesizer/Interconnect Board 19D900241G2
To improve synthesizer tuning. Added R2662.
Changed C2608.
C2608 was: 5496218P552, Ceramic disc: 36 pf $\pm 5\%$,
500 VDCW, temp coef -330 ppm.
- REV. E - Synthesizer/Interconnect Board 19D900241G2
To reduce alternator whine. Added U2506. Deleted
R2519, C2506 and D2503.
R2519 was: 19A700019P28, Deposited carbon; 180 ohms
 $\pm 5\%$, 0.25 W.
C2506 was: 19A700003P8, Tanzalum: 22 uf $\pm 20\%$,
16 VDCW.
D2503 was: 4036887P1, Zener: 500 mw, 2.3 V
nominal.
- REV. D - Synthesizer/Interconnect Board 19D900241G1
- REV. F - Synthesizer/Interconnect Board 19D900241G2
To facilitate serviceman during initial
installation. Delete jumper H7 - H8.
- REV. E - Synthesizer/Interconnect Board 19D900241G1
- REV. G - Synthesizer/Interconnect Board 19D900241G2
To improve tuning of Synthesizer Oscillator
injection chain. Changed C2671.
C2671 was: 19A700219P44, Ceramic: 27 pf $\pm 5\%$,
100 VDCW.
- REV. A - Synthesizer/Interconnect Board 19D900241G3-G6
To increase audio modulation capability. Delete
R2650.
R2650 was: 19A700019P57, Deposited carbon: 47K
ohms $\pm 5\%$, 1/4 W.
Change DA jumper connection from H26-H28 to H28-H29.
- REV. B - To improve deviation by increasing drive to ICOM.
Added R2664.
- REV. F - Synthesizer/Interconnect Board 19D900241G1
- REV. H - Synthesizer/Interconnect Board 19D900241G2
- REV. C - Synthesizer/Interconnect Board 19D900241G3-6
- REV. A - Synthesizer/Interconnect Board 19D900241G7-10
To improve operation of reference Oscillator.
Changed R2602 from 12K ohms to 22K ohms. The old
part number for R2602 was:
19A700019P50 - Deposited carbon: 12K ohms $\pm 5\%$,
1/4 w.
- REV. G - Synthesizer/Interconnect Board 19D900241G1
- REV. J - Synthesizer/Interconnect Board 19D900241G2
- REV. D - Synthesizer/Interconnect Board 19D900241G3-6
- REV. B - Synthesizer/Interconnect Board 19D900241G7-10
To improve operation at low temperatures and to
facilate manufacturing. Added C2676 (Groups 1 & 2)
C2677, and U2603B to Groups 1-4. Deleted U2603A.
Changed L2609 from 150nH to 120nH and R2651 from 18K
ohms to 6.8K ohms and decreased the length of inter-
connecting pins J2504, J2508, and J2509 to avoid a
short to the display board. C2676 is connected from
H33(+) to H32(-) and C2677 is connected in parallel
across C2643. Old component part numbers are:
L2609 was: 19A700024P3, Coil, RF: 150 nH $\pm 10\%$.
R2651 was: 19A700019P52, Deposited carbon: 18K
ohms $\pm 5\%$, 1/4 w.

ADDENDUM NO. 1 TO LBI30994C
PCM1

This addendum incorporates a new heavy duty regulator to replace existing regulator U2506.

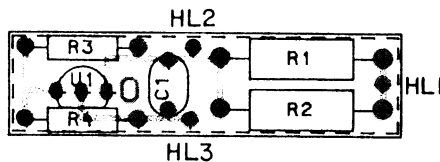
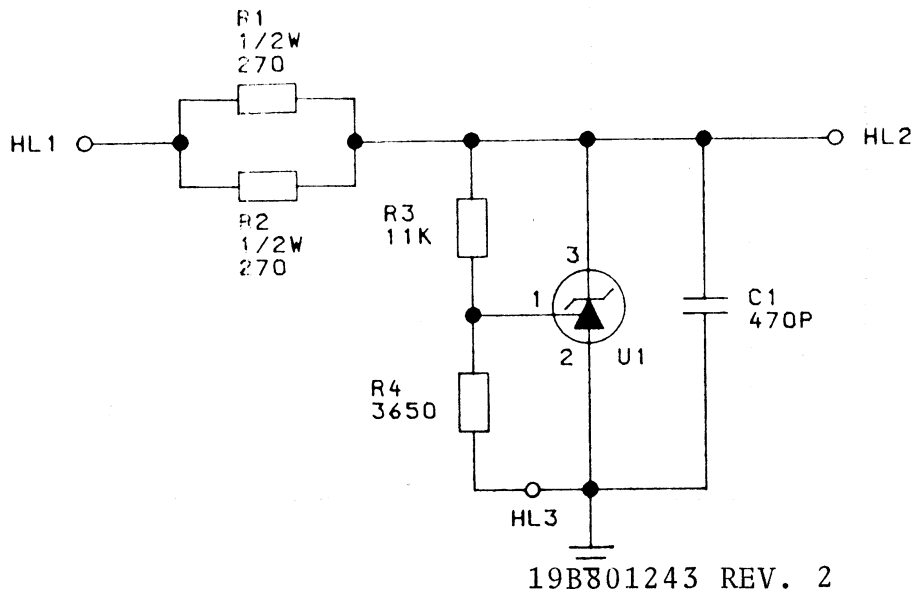
The replacement shunt regulator consists of U1 biased by R3 and R4. A+ is provided to HL1 and referenced to ground at HL3. The 10-volt output may be monitored across C1.

HL1 is connected to HL23

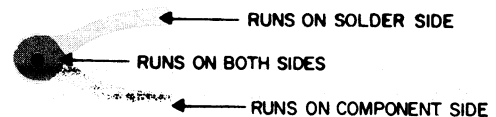
HL3 is connected to A-

HL2 is connected to U2505-8

10 VOLT REGULATOR



CONNECTIONS CHART		
FROM	TO	WIRE
HL1	LET HANG	DA SLEEVED
HL2	LET HANG	DA SLEEVED
HL3	LET HANG	DA SLEEVED



(19B801242, Rev. 0)
(19A704087, Sh. 1, Rev. 0)
(19A704087, Sh. 2, Rev. 0)

OUTLINE & SCHEMATIC DIAGRAM
10 VOLT REGULATOR

PARTS LIST

10 VOLT REGULATOR
19B801241G1

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
C1	19A700233P5	----- CAPACITORS -----
		Ceramic: 470 pF $\pm 20\%$, 50 VDCW.
		----- RESISTORS -----
		Composition: 100 ohms $\pm 5\%$, 1/2 w.
R1 and R2	19A700113P39	
R3	19A701250P305	Metal film: 11K ohms $\pm 1\%$, 250 VDCW, 1/4 w.
R4	19A701250P255	Metal film: 3650 ohms $\pm 1\%$, 250 VDCW, 1/4 w.
U1	19A702939P1	----- INTEGRATED CIRCUITS -----
		Linear: sim to TI TL431CLP.
		----- MISCELLANEOUS -----
		Insulator. (Located on printed wire board).
	19A704090P1	
	19A704090P2	Insulator. (Located on 19A704090P1 insulator).

ADDENDUM NO.2 TO LBI30994C PCN5

This addendum describes Revision Letter changes that are not yet included in the publication.

REV.H- SYNTHESIZER/INTERCONNECT BOARD 19D900241G1
 REV.K- SYNTHESIZER/INTERCONNECT BOARD 19D900241G2
 REV.E- SYNTHESIZER/INTERCONNECT BOARD 19D900241G3-6
 REV.C- SYNTHESIZER/INTERCONNECT BOARD 19D900241G7-10
 REV.A- SYNTHESIZER/INTERCONNECT BOARD 19D900241G11-14

To correct tuning of L2611. Changed L2610. New part number is:

19A700024P7- Coil, RF: 330 nH $\pm 10\%$.