The Future of Mobile Radio

Voice Guard/Aegis Module VGE-9600

MASTR® II & MASTR® III Stations, Controllers, Auxiliary Receivers, Console Interface Units and PST Console Interface Units

tyco Electronics

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SPECIFICATIONS

Cryptographic

Encryption Technique:	Non-linear product/block transformation.
Key Permutations:	1.8 x 1019. User selected using Keyloader.
CUE Code:	Additional 64-bit customer unique encryption (CUE) code. Customer programmable.

System

Guarded Mode Performance:	Assured acquisition at 12 dB SINAD (SINAD measured in clear mode).
Speech Digitization:	9600 baud Sub-Band Coding.
Automatic Clear/Guarded Switching:	Automatically accepts clear or guarded signals based on presence of digital sync data.
Signalling:	Continual digital signalling in guarded mode.
Programming:	Externally programmable using Universal Radio Programmer (TQ-2310); or an IBM PC compatible computer with software (TQ-3344), RDI & Cable (TQ-3330) and Cable (TQ-3345).
Power Requirement:	+10.8 to +16 Vdc, 200 milliamperes nominal during quiescent state, 500 milliamperes nominal during GUARDED TX or RX.

Mechanical

Height:	51.6 mm (2.03 in.)
Width:	175 mm (6.9 in.)
Depth:	206 mm (8.1 in.)
Weight (with mounting bracket)	9.5 kg (4.3 Ib.)

Environmental

Temperature Range:	-30°C to +60°C (-22°F to +140°F)
Altitude:	5 km (16,500 ft.)
Shock:	EIA
Vibration:	EIA, USFS

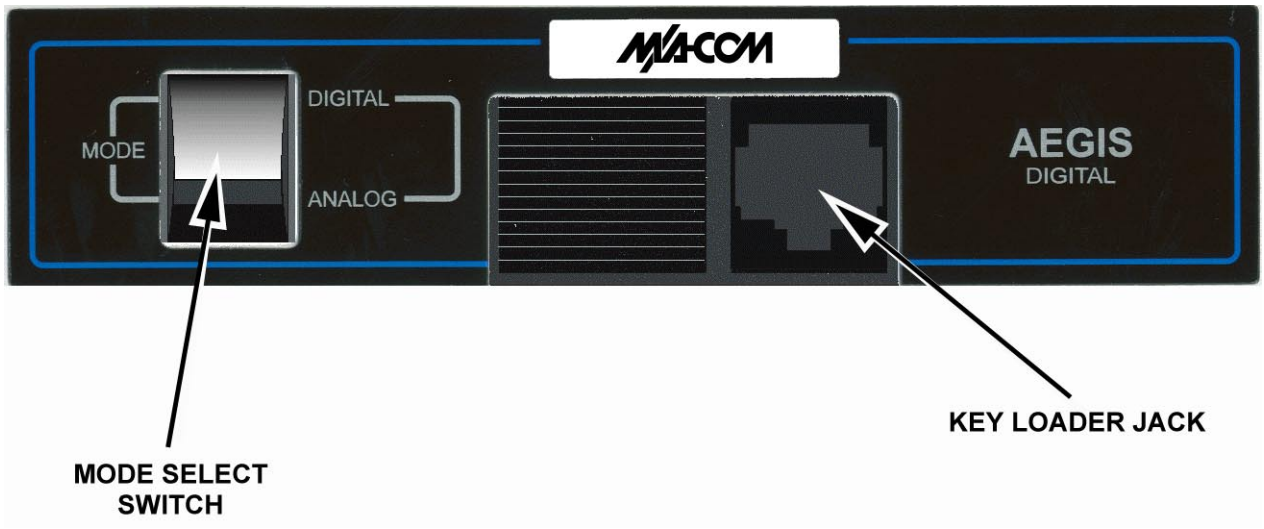

Figure 1 – VGE-9600

DESCRIPTION

The VGE-9600 Voice Guard™ module is a digital speech encryption/decryption unit used with MASTR II Stations, Controllers, Auxiliary Receivers, Console Interface Units and PST CIUs. The Voice Guard module provides digital speech encryption/decryption with no reduction in radio range.

The VGE-9600 module permits the operator to switch between the CLEAR (not encrypted) or GUARDED (encrypted) mode, and provides GUARDED mode frequency selection in multi-frequency remote control station applications.

The VGE module may be used in end-to-end Voice Guard stations, in Encrypt/Decrypt (E/D) station applications, CIUs, or in auxiliary receiver locations in receiver voting systems.

End-to-end encryption provides encrypted audio from the remote controller through telephone lines, microwave link or other link to the remote or repeater station, and then to a portable or mobile radio.

Also, in end-to-end voting systems, encrypted audio from a portable radio or mobile unit is applied to the auxiliary receiver. There it is decrypted, and applied to the Voting Selector.

In E/D applications, unencrypted (clear) audio is applied to the E/D station where it is encrypted and transmitted. Voice encryption is provided only over the RF path.

The model number, GE Part Number and application of the different VGE modules is shown in Table I.

Table I - VGE-9600 MODULE CONFIGURATION

MODEL NUMBER	PART NUMBER	APPLICATION
VGE-9600-SW	19A148909P21	Auxiliary Receiver
VGE-9600-CW	19A148909P22	MASTR Controller
VGE-9600-SRW	19A148909P23	MASTR II E/D Station, CIU
VGE-9600-PRW	19A148909P32	PST-CIU
VGE-9600-DRW	19A148909P42	DVIU - VGE Ageis
VGE-9600-DURW	19A148909P43	DVIU-unencrypted Aegis
VGE-9600-ARW	19A148909P62	MASTR III E/D Station - VGE Aegis
VGE-9600-AURW	19A148909P63	MASTR III E/D Station - unencrypted Aegis

VGE-9600-DRW & DURW MODULES

The VGE-9600-DRW & VGE-9600-DURW modules are utilized in **D**igital **V**oice **I**nterface **U**nit (**DVIU**) applications. These modules are Aegis compatible and are referred to as "Aegis Modules."

Electronically, Aegis Modules VGE-9600-DRW and VGE-9600-DURW are similar to the Voice Guard Module as described in this manual with the following exceptions:

Analog Board 19D437979G1

- Rev. A thru G: resistors R8, R15 and R16 are changed
- Rev. H or later: resistors R2, R8, R15 and R16 are changed
- Rev. H or later: capacitor C42 is removed.

Logic Board 19D437827G1

- EPROM integrated U2 is changed
- DSP integrated circuit U10 is changed
- Personality programming is changed and EEPROM integrated circuit U12 is re-labeled *(See Table II)*
- Transistor Q9 is removed and replaced with a jumper (between collector and emitter holes).

FIELD MODIFICATION KIT SPK-9207

An upgrade kit is available that includes the necessary parts and instruction to convert a VGE-9600-PRW (19A148909P32) Voice Guard Module to a VGE-9600-DRW or VGE-9600-DURW Aegis Module. This kit, part number SPK-9207, can be ordered from M/A-COM Customer Service. Converting any other VGE Voice Guard Module to a DVIU Aegis Module will require jumper/plug changes according to Table III.

VGE-9600-ARW & AURW

The VGE-9600-ARW & VGE-9600-AURW modules are utilized in MASTR III Station applications. These modules are Aegis compatible and are referred to as "Aegis Modules."

Electronically, Aegis Modules VGE-9600-ARW and VGE-9600-AURW are similar to the Voice Guard Module and described in this manual with the following exceptions:

Logic Board 19D437827G1

- EPROM integrated circuit U2 is different
- Personality programming is different and EEPROM integrated circuit U12 is re-labeled *(See Table II)*
- Transistor Q8 is removed and replaced with a jumper *(between collector and emitter holes)*

VGE ALGORITHM

The VGE algorithm uses a 64-bit binary number as a cryptographic code or "key". There are 1.8 x 10l9 possible keys. This electronic key is used for encryption and decryption of any digitized voice data transmitted or received in the system, and prevents unauthorized monitoring of voice communications.

A second level of security is provided by an additional 64-bit CUE (Customer Unique Encryption) code selected by the user. This CUE code is entered into the VGE module with a TQ-2310 programmer, or the PC programming software and accessories.

CRYPTOGRAPHIC KEY

The term "cryptographic key" refers to an electronic code inserted through the keyloader jack on the front of the VG module.

If no valid cryptographic key has been loaded into the VGE module when an encrypted message is received, the radio will remain muted. In the event of an invalid check-sum associated with the cryptographic key, a GUARDED mode transmission will be inhibited, and a two-tone alert signal will be heard at the speaker.

NOTE

For any communications in the GUARDED mode, the cryptographic key and CUE code must be the same in both the transmitting and receiving units.

KEYLOADER

Cryptographic Keyloader 19A148910P4 (Option V4028) is a small, handheld calculator-type keyboard display unit that permits easy entry, storage and transfer of the cryptographic key. The Keyloader connects into the keyloader jack located on the front of the VGE module through a coil-cord cable.

In the VGE-9600 module, simply inserting the cable from the Keyloader into the keyloader jack enables the keyloading circuit in the VGE module. The cable is disconnected after the key is loaded.

Complete operating instructions for the Keyloader are contained in LBI-31685.

VGE-9600 ASSEMBLY

The VGE module is contained in a metal housing. A metal frame assembly provides mounting support for the logic and analog printed boards and the front panel. The front panel contains the single operating control. All interface connections are made to connectors at the rear of the VGE module.

OPERATION

The VGE module has only one operating control: a CLEAR or GUARDED transmit mode switch on the front panel. The operator simply selects the desired transmit operating mode and sends and receives messages similar to a standard non-Voice Guard radio. GUARDED or CLEAR mode reception is automatically selected, regardless of the front panel switch position.

CIRCUIT ANALYSIS

The Voice Guard (VG) circuitry consists of two printed wiring boards: an analog board and a digital logic board.

The analog board consists of a CODEC integrated circuit (IC), audio filtering, transmit data filtering, receive data filtering, analog signal switching, CODEC timing, I/O buffering and power supply and voltage regulation circuitry. The CODEC IC provides "anti-aliasing" filtering, analog-to-digital (A/D) and digital-to-analog (D/A) conversion and output reconstruction filtering.

The digital logic board consists of a control microprocessor, a Digital Signal Processing (DSP) IC for speech bandwidth compression, a modem IC for NRZ (non-return to zero) data transmission and reception, a key EEPROM to store the cryptographic key, and input and output signal conditioning circuits. A block diagram of the VGE module is shown in Figure 2.

In the transmit mode, the CODEC circuitry converts the analog voice to a digital bit stream. Then a bandwidth compression is performed using a sub-band coding algorithm programmed into the Digital Signal Processor. This reduces the digital voice data rate from about 46 kb/s to about 9.2 kb/s. This bit stream of data is then encrypted and synchronization and overhead bits are added to form a 9600 baud data signal. This signal is then filtered and passed on to the radio transmitter modulator circuit.

When the VGE module is in the receive mode, the process is reversed. Synchronization and overhead bits are removed from the incoming 9600 baud signal. The signal is decrypted, a bandwidth expansion is performed, and the CODEC converts the digital bit stream to an analog signal which is passed on to the receive audio circuit.

When operating in the encrypted mode, the function of a multi-tone Channel Guard encode/decode in the clear mode can be duplicated by using the eight unencrypted bits in the recurring synchronization header (see Figures 3 and 4).

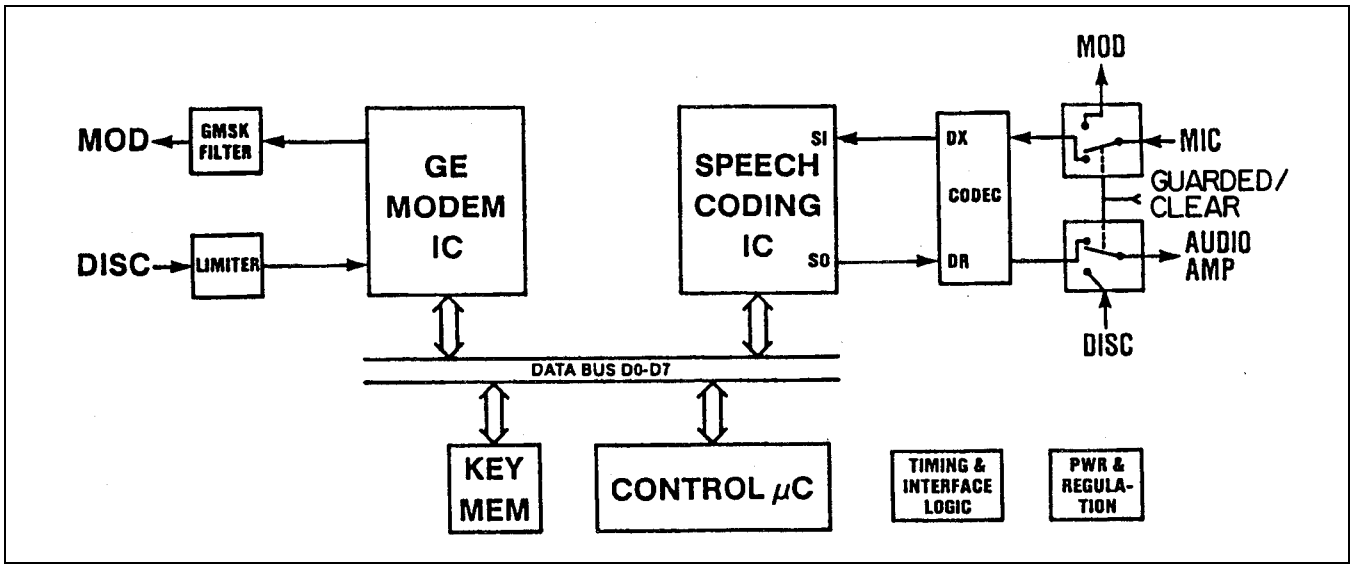

Figure 2 – VGE Module Block Diagram

These eight bits comprise the Outside Address(es) (OA). They are assigned to individual channels when programmed into the radio's EEPROM using the TQ-2310 Programmer and the Voice Guard EPROM Kit TQ-2344, or the PC programming software and accessories. The OA can be used for selective unit or group calling, or selective repeater activation.

POWER SUPPLY & VOLTAGE REGULATOR

Switched power is supplied to the analog board regulators, switching inverter circuit, and to the digital board regulator circuits. Regulators U10 and U12 sup-ply +8 and +5 volts respectively to the analog board. The inverter circuit made up of Q10-Q12, U11 and associated components is driven from TX Clock. This inverter supplies -5 volts to the analog board. On the digital board, U17 provides constant +5 volts and U18 supplies switched +5 volts to the DSP chip.

CONTROL MICROCOMPUTER

Control microprocessor U1 controls the data flow between the DSP IC (U10) and the Modem IC (U6). Ul also provides interfacing to the Keyloader and the key storage EEPROM (U11). In addition, the control processor monitors VG and radio controls (e.g. PTT, Guarded/Clear...etc.) to determine the proper mode of operation. This microprocessor also performs the encryption and decryption processes.

DIGITAL SIGNAL PROCESSOR

The digital signal processor (U10) receives A/D converted voice data from CODEC IC U4. It is programmed with a proprietary Sub-Band Coder bandwidth compression algorithm, which reduces the digitized voice data rate from 46.4 kb/s to about 9.2 kb/s. The Sub-Band Coder compressed voice data is then passed to the control processor through the 8-bit wide parallel data bus.

To conserve power, the DSP is powered down when not needed. The Power Switch signal from the processor appearing at U14, when high, turns on Q8 and Q9. Transistor Q8 supplies power to regulator U18.

A/D AND D/A CONVERSION

In GUARDED transmit mode, the microphone audio is filtered by bandpass filter UlC and applied to CODEC U4. The CODEC integrated circuit performs input anti-alias filtering, A/D conversion and output reconstruction filtering of the mic audio. The digitized output from the A/D converter is an 8 bit u-law representation of the mic audio sampled at 172.4 uSec intervals. This 8 bit sample is then serially transferred to the DSP integrated circuit for compression.

In GUARDED receive mode, the decrypted data is transferred serially from the DSP to the CODEC integrated circuit for D/A conversion and filtering. Next, this audio signal is routed to RX bandpass filter and pre-emphasis circuits made up of UlB and UlA respectively. The audio signal is then passed through UlD and U5A to the appropriate external audio amplifier circuits.

KEY STORAGE

In VGE applications, U11 is an EEPROM with a 2K x 8 bit capacity. When a key is loaded into the VGE module, it is stored in this non-volatile EEPROM.

Whenever a new key is stored, the previous key is overwritten. Otherwise, the cryptographic key remains stored in EEPROM U11 during power down periods. (No keep-alive circuitry is required.) In addition, the VGE module has no key-dump capability other than loading a new key over a previously stored key.

MODEM IC

The radio receiver discriminator output (DVG AUDIO HI) is presented to the limiter circuitry composed of U3C and associated components. This non- inverting comparator input uses the low-pass filtered data stream (on pin 8) as an estimate of the average dc level of the received signal. The discriminator output is then compared to this voltage to produce the 0 to 5 volt NRZ (non-return to zero) data stream which is the input to modem U6.

Modem U6 contains a digital phase-locked loop, which provides bit sync on the incoming 9600b/sec data. The modem also contains a hardware correlator circuit which can be enabled to look for the 11-bit Barker Code sequence (11100010010) which is used to establish frame synchronization. Upon reception of the ll-bit Barker code, the modem IC interrupts the control processor. The control processor then reads succeeding bytes of received data from the modem over the data bus.

TIMING AND CLOCK GENERATION

The required clocks for control microprocessor Ul and modem U6 are derived by a crystal oscillator, running at 11.0592 MHz. The DSP and CODEC clocks are provided by an 8.0 MHz crystal oscillator, located on the analog board. Timing and control signals for the CODEC IC are derived from the 8.0 MHz clock using U6 and U7 dividers.

ANALOG SWITCHES

The audio signals on the Analog Board are routed by various analog switches. These switches are microprocessor controlled via U14 and U15 on the Logic Board.

Switch U5A routes the receiver audio (VOL/SQ HI IN) to the audio amplifier (VOL/SQ HI OUT) when the radio is receiving clear audio. This switch is controlled by the RX SWITCH line. This line is low when the radio is receiving clear audio (no 9600 bps data).

Switch U5B routes the encrypted data from the TX Data filter to the radio modulator via the DVG AUDIO HI line. The DVG AUDIO HI line is also used in guarded receive mode to send the 9600 bps encrypted data from the radio to the VGE unit RX Data Demodulator, U3C.

I/O EXPANDERS AND BUFFERS

The control processor's data bus is connected to two input port ICs (U13 and U16) and two output port ICs (U14 and U15). IC U13 buffers the mode switch and frequency select lines. Power switching and radio controls are output by U14 and U15.

TRANSMIT DATA FILTER

The TX data filter is composed of U2 (sections A, B and D). It filters the sharp transitions of the NRZ logic level data stream to reduce the frequency spectrum of the transmitted data. Jumper P14 permits the third stage to be bypassed when used in different applications.

ALERT TONE GENERATION

Alert tones are generated by the processor and are applied to output port U14 pin 15 as square waves. The tones are attenuated on the analog board by R81, R37 and R38. The PA KEY signal from U14 turns the tones on and off via Q3 and U5C.

JUMPERS

Jumpers are located throughout the VGE-9600 to configure the unit for the particular application. See the tables for details on the configuration of these jumpers.

PREAMBLE FORMAT

At the start of a transmission (PTT), a preamble consisting of repeated sync, initialization vector (IV) and addressing information is sent before voice encryption begins. The preamble provides a high probability of correct reception of sync, IV and repeater address (see Figure 3).

In PST applications, a shortened form of the preamble, consisting of a sync word, a message type byte and the repeated IV sequence is sent at the start of each transmission. The sync sequence is not sent as it can be repeated by the main site repeater.

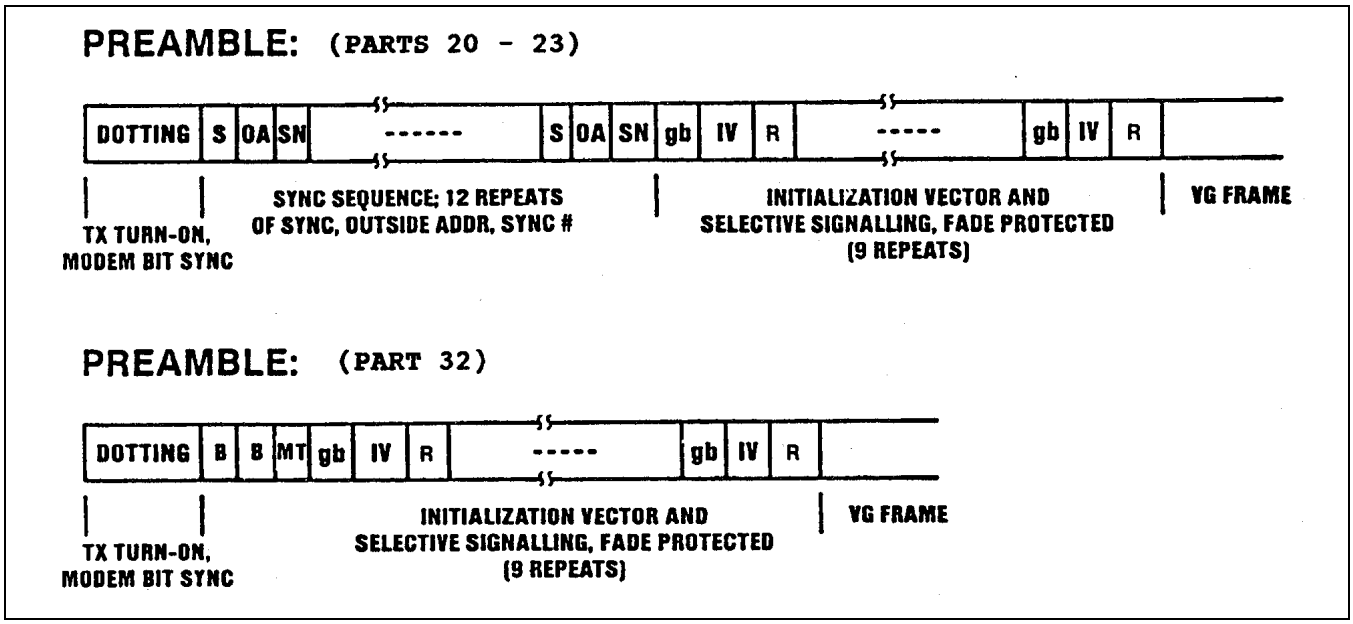

Figure 3 – Preamble Format

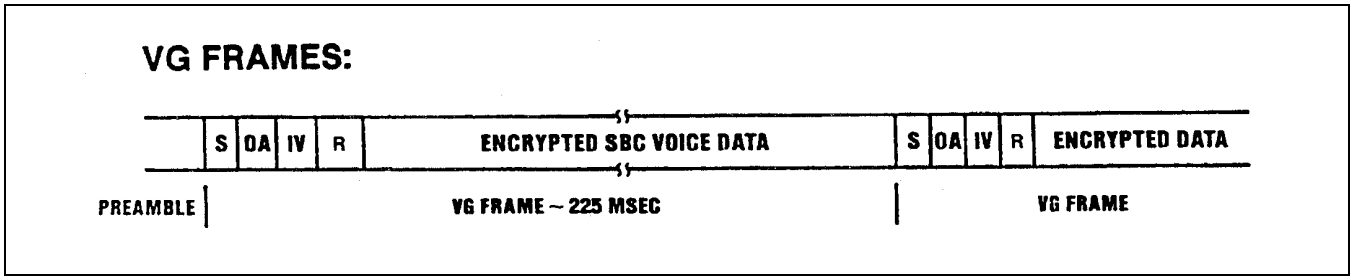

Figure 4 – Frame Header Format

FRAME HEADER FORMAT

The encrypted voice data frame header is shown expanded in Figure 4. Information is provided at the beginning of a frame to insure maintenance of data and cryptographic sync and to allow late entry into a conversation during private receive. Following the 112 bits of the VG frame header are 2040 bits of encrypted SBC voice data. The VG frame header is then repeated with a new initialization vector(IV).

END OF MESSAGE (EOM)

In order to signal the end of a transmission, an inverted sync-plus-dotting sequence is transmitted for about 50 msecs. This allows for a long fade in the signal and still ensures that the receiver decodes the EOM correctly.

MAINTENANCE

This section contains maintenance and troubleshooting information required to service the VGE-9600 module. Included in this section are the Set-Up and VGE module Configuration Procedures, Disassembly Procedures, and two levels of troubleshooting for the VGE module. This section also includes Mechanical Layout Diagrams, Outline and Schematic Diagrams, and Parts Lists for the VGE module.

The Set-Up and Adjustment procedure includes an introduction to the test program called SIMON (SImple MONitor). Instructions for using SIMON are contained in LBI-31593.

SET-UP AND ADJUSTMENTS

Configuration Jumpers

Voice Guard modules must be configured by positioning jumpers on the VG Analog Board as shown in Table III.

NOTE

In all VGE applications, a jumper is connected from H15 to H16 on the Logic Board.

In addition, the module also must be configured for front panel mode select or remote mode select (Table IV).

Adjustments

Several adjustments are normally required in the initial system set-up. The adjustments may include the radio deviation adjustment, transmitter digital deviation and local receive audio level adjustments. In addition, the receiver IF stages may require re-alignment for optimum performance in data systems. Refer to the applicable combination manual for the required procedures.

DATA POLARITY

The data polarity is selected so as to satisfy the criteria that a data "O" is a decreasing (or lower) transmitted RF frequency and a data "l" is an increasing (or higher) transmitted RF frequency. A data "O" is a nominal zero volts while a data "l" is a nominal +5 volts.

Different transmitters and receivers may or may not invert the data as it passes through. Since VG data is NRZ (non-return to zero), it cannot be inverted and retain its original information content. The data inversion characteristics of the 138-174 MHz and 406-512 MHz MASTR II VG stations are shown in Figure 5.

138-174 MHz:

Transmitter = no inversion

Receiver = inverted

406-512 MHz:

Transmitter = no inversion

Receiver = inverted

Figure 5 – Transmit and Receive Data Polarity

PERSONALITY PROGRAMMING

In the VGE-9600, personality information is stored in EEPROM U12. This information can be altered for a specific application with the TQ-2310 Universal Radio Programmer (with TQ-2365 PROM) or the PC programming software and accessories. Table II lists factory programmed personality data for the various applications.

Table IIA - VGE-9600 Personality Data

	VGE-9600-SW 19A148909P21	**VGE-9600-CW 19A148909P22**	**VGE-9600-SRW 19A148909P23**	**VGE-9600-PRW 19A148909P32**
U12=344A3000P_*	60	70	80/100	90
UNIT TYPE	Delta	Controller	Delta/Cont.	Controller
CLEAR TX ALERT	Yes	Yes	Yes/Yes	Yes
SYSTEM ALARM	Yes	Yes	Yes/Yes	Yes
TX ATTACK DELAY	10 msec	175 msec	10/20 msec	10 msec
ADDNL DATA DELAY	30 msec	250 msec	30/50 msec	0 msec
CHAN 1-22 TX OA	55	55	55/55	55***
CHAN 23-32 TX OA	**	55	55/55	55
CHAN 1-22 RX OA	55	55	55/55	55
CHAN 23-32 RX OA	**	55	55/55	55
TX DATA POLARITY	invert	invert	normal/inv.	normal
RX DATA POLARITY	invert	invert	inv./inv.	invert

NOTES:

* Non-programmed EEPROM is l9A703072P2
** Special programming for factory use only
*** Channel 1 TX OA = 3F, Channel 2 TX OA = FF

PST Application Notes:

1. When the Programmer asks for Type S, R or C; enter C.
2. When the Programmer asks for Options, set as per VGE-9600-PRW in Table II.
3. When the Programmer asks for Channels, program:

   Channel 1 TX Address = 3F (hex)

   Channel 2 TX Address = FF (hex)

This will result in an ID of 16,383 being inserted into the PST VG stream. If a different ID is desired, program the hex equivalent into the above address locations.

Channel 1 TX Data inverted = No

Channel 2 TX Data inverted = No

Table IIB - VGE-9600 Personality Data

PARAMETER NAME	VGE-9600-DRW (19A148909P42)	VGE-9600-DURW| (19A148909P43)
U12 PART NUMBER	344A3000P290	344A3000P490
UNIT TYPE	CONSOLE	
VG OPTION	VG AME	UNC, AEGIS
CLEAR TX ALERT	Yes (Enabled)	
SYSTEM ALARM	Yes (enabled)	
TX ATTACK DELAY	10 Milliseconds	
ADDITIONAL DATA DELAY	0 Milliseconds	
TX OUTSIDE ADDRESS*	55 (hex)	
RX OUTSIDE ADDRESS	55 (hex)	
TX DATA POLARITY	Inverted	
RX DATA POLARITY	Inverted	
CUE MASK (VGE units only)	AAAAAAAAAAAAAAAA	

* Channel 1 Outside Address is 3F and channel 2 TX Outside Address is FF. All other channels are 55.

Jumper/plug setting for the DVIU Aegis Modules are identical to the jumper/plug setting for MASRT II E/D station and CIU as shown in Table III.

Table IIC - VGE-9600 Personality Data

PARAMETER NAME	VGE-9600-ARW (19A148909P62)	VGE-9600-AURW| (19A148909P63)
U12 PART NUMBER	344A3000P280	344A3000P480
UNIT TYPE	CONSOLE	
VG OPTION	VG AME	UNC, AEGIS
CLEAR TX ALERT	Yes (Enabled)	
SYSTEM ALARM	Yes (Enabled)	
TX ATTACK DELAY	10 Milliseconds	
ADDITIONAL DATA DELAY	0 Milliseconds	
TX OUTSIDE ADDRESS*	55 (hex)	
RX OUTSIDE ADDRESS	55 (hex)	
TX DATA POLARITY	Inverted	
RX DATA POLARITY	Inverted	
CUE MASK (VGE units only)	AAAAAAAAAAAAAAAA	

* Channel TX Outside Address is 3F and channel 2 TX Outside Address is FF. All other channels are 55.

Jumper/plug settings for E/D station Aegis Modules are identical to the jumper/plug settings for MASTR II E/D station and CIU as shown in Table III.

Table III – Analog Board Jumper-Plug Chart

	POSITION 1-2	POSITION 2-3	MASTR CONTROLLER	MASTR II E/D STATION & CIU	AUXILIARY RECEIVER
P10	FLAT RX AUDIO	PRE-EMPHASIZED RX AUDIO	1-2	1-2	2-3
Pll	LOW LVL RX AUDIO	HIGH LVL RX AUDIO	2-3	2-3	1-2
P13	REMOTE CONTROLLER	MOBILE	1-2	2-3	2-3
P14	1 STAGE TX DATA FILTER	2 STAGE TX DATA FILTER	1-2	1-2	1-2
P15	CONTROL OUTPUTS TO GROUND	CONTROL OUTPUTS TO CONTROL A-	1-2	1-2	1-2
P17	HIGH LVL ALERT TONE	LOW LVL ALERT TONE	1-2	1-2	2-3
P18	HIGH GAIN MIC INPUT	LOW GAIN MIC INPUT	1-2	2-3	2-3
Pl9	6dB/OCTAVE PRE-EMPHASIS	12 dB/OCTAVE PRE-EMPHASIS	2-3	2-3	2-3
P20	NO MIC BIAS	MIC BIAS	1-2	1-2	2-3
P21	UNSWITCHED TX DATA	SWITCHED TX DATA	1-2	1-2	2-3
P22	UNSW A+ NOT REGULATED	UNSW A+ REGULATED TO 3.9V	NOT USED IN VGE		
P23	RX DATA FROM DVG AUD HI	TX DATA FROM DVG RX AUDIO	1-2	2-3	1-2

Table IV – Remote Mode Selection

FUNCTION	E/D STATION CONFIGURATION REMOTE MODE SELECT	ALL OTHER CONFIGURATIONS FRONT PANEL MODE SELECT
REMOTE MODE SELECTION	DISCONNECT FRONT PANEL MODE SELECTOR SWITCH CABLE FROM J9 ON LOGIC BOARD, THEN CONNECT CABLE l9B234849Gl TO J25 ON ANALOG BOARD AND J9 ON LOGIC BOARD	CONNECT CABLE FROM FRONT PANEL MODE SELECTOR SWITCH TO J9 ON LOGIC BOARD. J25 ON ANALOG BOARD IS OPEN.

Table V – Logic Board Jumper Chart

LOGIC BOARD JACKS	STANDARD CONNECTIONS	EXCEPTIONS
J11/P11 (Hl & H2)	J11/P11 connected. (Hl to H2 connected in earlier boards).	Jumper-plug removed when using 8751 SIMON EPROM.
H3, H4 & H5	Jumper-plug connected from H4 to H5. (H3 not used).	Jumper-plug may be removed for field test.
H6, H7 & H8	Jumper-plug connected from H7 to H8 when using standard 2764 EPROM.	Jumper-plug connected from H6 to H7 if using 2732 EPROM.
H9, H10 & H11	Jumper-plug connected from H9 to Hll. H10 not used.	Jumper-plug may be removed for field test. Removes 80C31 clock signal.
H15 & H16	Jumper-plug connected from H15 to H16 in VGE applications.	Jumper-plug may be removed for field test. Removes EEPROM Vcc.
H18 & Hl9	Jumper-plug connected from H18 to Hl9.	Jumper-plug may be removed for field test.

VGE-9600 DISASSEMBLY PROCEDURE

This Disassembly Procedure provides instructions for gaining access to the logic and analog boards for servicing and removal if required. (Refer to the Applicable Mechanical Parts Breakdown listed in the Table of Contents.)

To remove the VGE module from the station shelf mounting bracket:

1. Unplug the connectors from the rear of the VGE module.
2. Remove the two #8-32 x 1/2-inch washer-head screws and lock-washers securing the VGE module to the shelf mounting bracket.

To remove the VGE cover:

1. Remove the two pan-head screws located on each side of the cover, and the flat-head screw located at the back of the top cover.
2. While holding the VGE unit, push on the back of the VG chassis and slide the chassis forward and out of the cover.

To remove the logic board:

1. Remove the chassis from the cover.
2. Remove the 11 pan-head screws securing the board to the chassis, and the two 4-40 nuts securing the back supporting plate to the chassis assembly. These are located on the outside edges of the heatsink.

NOTE

There are two screw sizes used to secure the board (4-40 x 1/4 and 4-40 x 7/16). Remember the sizes and locations for reassembly.

3. Unplug the toggle switch connector.
4. Remove the five flat head screws located on the side of the chassis assembly.
5. The logic board and attached metal shield can now be lifted free of the chassis assembly. Be careful not to damage connectors when removing and replacing the logic board.

To service or remove the analog board:

1. Remove logic board. The analog board is now accessible for servicing.
2. Remove the six 4-40 x 1/4" pan-head screws from the bottom of the analog board. Remove the analog board.

VGE-9600 MAINTENANCE

Two levels of maintenance and troubleshooting are provided for servicing the VGE module. The first level checks will result in a complete functional system checkout. This will permit isolation of a problem to a particular printed wire board for board substitution.

The second level of maintenance requires Service Kit SPK-8611 that includes a PROM containing a test program called SIMON, for SImple MONitor. The kit also contains an adaptor for connecting an RS-232, 2400 baud data terminal to the suspected VG unit. After a few simple checks are made to the logic board of the VG unit, the test PROM can be plugged

into the logic board in place of the VGE operating program residing in the EPROM U2. The 2400-baud terminal can now communicate with SIMON, and a number of specific tests can be run to isolate the problem to a specific area of circuitry, and possibly to a specific component.

The Service Kit contains:

- 8751 Microprocessor with SIMON in residence.
- 27C64 EPROM with an expanded version of SIMON in residence.
- SIMON level adaptor cable l9A149116Pl to interconnect an RS-232 terminal to a Voice Guard unit. Instructions for the level adaptor cable are contained in LBI-31700.
- Instructions for use of SIMON are contained in LBI-31550.

LEVEL ONE MAINTENANCE

In order to evaluate the functional operation of a Voice Guard installation, the following sequence of tests can be performed with the VG unit installed:

1. Using another radio or a Service Monitor, verify that the module (and the complete radio system) will receive a clear transmission directed to it. The position of the Mode Select switch is irrelevant since the module should automatically select clear reception.
2. With the Mode Select switch in the CLEAR position, verify the system will transmit clear audio. A short warning tone should be heard each time the PTT switch is pressed. This tone warns the operator of a clear transmission.
3. With an invalid (or nonexistent) key in the VGE module and the unit in GUARDED mode, key the transmitter and listen for a distinctive two-tone alert from the speaker. This warns the operator of an invalid key. The system should not transmit.
4. With identical keys and outside addresses in a companion VGE module, and both units in GUARDED mode, verify that the system under test will receive and decrypt an encrypted transmission. Now verify the system under test will transmit an encrypted voice message.
5. If multiple outside addresses are being employed, confirm proper channel tracking by attempting communication on another channel having a different OA.

At the successful completion of the above sequence of functional tests, the VGE unit should be considered as operational. Refer to the Level Two maintenance for common problems that could cause failure of the above tests.

If substituting a known good VGE unit into an installation being examined still results in either no digital or clear modulation with the other being present, the Controller VG Interface module or the VG repeater shelf should be considered as the most probable failed item.

VGE Failure

Should the failure be determined to be the VGE module, the following preliminary checks can be performed.

1. Remove the VGE module from its base mounting plate or bracket, and remove the three retaining screws from the sides and top of the case.
2. Attach the VGE module with cover removed to a test mobile, or station on a service bench.
3. Apply power to the test system and confirm that U1-40 and U11-24 on the logic board have +5 volts present. Press the PTT and confirm presence of +5 volts on U10-1. Release the PTT button.
4. Confirm presence of the following voltages on the bottom side of the analog board:

   U4-16 +5 volts

   U4-1 -5 volts

   U3-3 +8 volts
5. With these voltages all present, then confirm presence of 11.0592 MHz clock signal at U1-18 on the logic board using an oscilloscope.
6. Then confirm the presence of 8.00 MHz æ100 PPM at J8-5 on the logic board.
7. Confirm that the microprocessor RESET line Ul-9 is not in the reset (high) state. This pin should be low for normal operation.
8. If the reset line is pulsing high for a few microseconds approximately every two seconds, or failure of steps 3, 5 or 7, would indicate a most probable logic board problem. If the reset line is continuously held high, or failure of steps 4 or 6 or step 7, would indicate a most probable analog board problem.
9. Substitution of a known working logic or analog board into a VG unit being examined is a valid board level test after the above voltages and signals have been checked.

LEVEL TWO MAINTENANCE

Level Two maintenance on a failed VG unit requires the use of Service Kit SPK-8611. The examination of the VG unit should continue with the test program called SIMON (supplied in the Service Kit).

In order to use SIMON (meaning SImple MONitor), an additional 2400 baud RS-232 serial ASCII computer terminal (not supplied in the Service Kit) is required. SIMON Level Adaptor Cable 19A149116P1 is supplied to interface from logic board connector J10 to provide the RS-232 terminations for the 2400 baud terminal.

The procedure for setting up for SIMON operation is as follows:

1. Assure that the supply voltage and signal tests described in the Level One maintenance section are satisfactory.
2. Remove all power from the unit and replace VGE EPROM U2 with the SIMON test EPROM. Connect the level adaptor to logic board J10 and connect the power lead to +5 v at H37. Connect the 2400 baud terminal to the level adaptor. Also see the Logic Board Jumper Chart.
3. Reapply power and continue with the test instructions for SIMON supplied in the Service Kit.
4. If SIMON does not run, there is a possibility that the microprocessor address or data bus may be latched. In order to troubleshoot this circuitry, remove power and replace microprocessor U1 with the microprocessor supplied in the kit and proceed with Step 3. The 8751 is a UV PROM version of microprocessor Ul that has a limited version of the SIMON program in residence. (This is due to the limited PROM space in the 8751.) Once the 8751 has successfully verified the address and data bus condition, operation should be moved back to microprocessor Ul, and the 27C64 SIMON EPROM.
5. At completion of the SIMON testing, be sure to replace the SIMON EPROM with the VG operational code EPROM and return any jumpers to their proper position.

TROUBLESHOOTING PROCEDURE

This troubleshooting procedure provides a series of symptoms and checks for tracing the path through a VG System. Before starting the procedure, make the following checks:

1. The regulators are operating properly.
2. Both 8 MHz and 11.0592 MHz clocks are running.
3. Reset is low and not watchdogging.
4. The ALE and PSEN signals out of the processor are pulsing.

A VGE module has no chance of operating unless these conditions are met. Typically, such units may receive clear, will not receive private, will not transmit, will not accept a key from the Keyloader, and will not give the usual alert and warning tones. It is and will appear to be dead. Troubleshoot the logic board and the regulators on the analog board until these conditions are met. Remember the TX clock at J5 pin 7 of the logic board must be running to get -5 v.

SYMPTOM I: REDUCTION IN RANGE COMPARED TO OTHER UNITS

If the range reduction is in both private and clear, then the problem is probably in the RF sections of the radio. Check the radio for the usual power, frequency, sensitivity, and deviation. This is probably not a VG unit problem.

If the reduction in range is in guarded mode only, check the guarded transmission by looking at recovered audio on a deviation monitor. The eye pattern will probably be distorted. The most common cause of this is for the deviation on the radio, VG Control Shelf or repeater control shelf to be improperly adjusted. Refer to the appropriate Alignment Procedure for instructions.

- If the deviation seems to be adjusted correctly, refer to SYMPTOM III (DOES NOT TRANSMIT GUARDED).
- Check to see that the waveform at receive data J8 pin 3 of the logic board seems right. If not, refer to SYMPTOM VI (DOES NOT RECEIVE GUARDED).

SYMPTOM II: RADIO DOES NOT KEY

Typically, the transmit light will light on the control shelf but the radio will not transmit.

Check to see that J6 pin 28 on the logic board follows the Fill key. The radio will not transmit if it thinks it is in the keyfill mode.

Check to see that the PTT (low) is getting to the VG unit on Jl pin 6 on the analog board. This says that the PTT IN signal is getting to the VG unit. If not, the problem is in the interconnect cable.

Check to see that the PTT IN signal is getting to the logic board on J6 pin 21. If not, trace the PTT IN line through the analog board.

Note that PTT IN is really just a request to key. The radio is keyed through the PTT OUT line. Verify that the PTT OUT signal is getting off the logic board on J6 pin 5. If not, troubleshoot the logic board to see if PTT IN is being recognized and PTT OUT is indeed being generated.

Check to see if PTT is getting to J2 pin 14 of the analog board. If not, the signal is not getting through the analog board.

SYMPTOM III: RADIO DOES NOT TRANSMIT GUARDED

The radio will key, but there is no data modulation. The radio will probably transmit clear. It is assumed that a key has been successfully loaded and that the mode select switch is in the private position.

There are three main areas to check when a radio does not transmit in the private mode. They are:

1. Make sure the radio is in fact in the GUARDED mode.
2. That data is getting out of the VG unit (J3 pin 6 of Analog Board.)
3. That data is getting to the modulator.

If it does not receive GUARDED, then one should pay attention to what happens when MIC PTT is pressed. If there is a clear transmission alert tone, then the mode switch is not connected to the logic board (J9) If connected, then the switch may be open. If there is a two-tone warning, then the mode switch has the private and clear TX lines shorted together. Note that there is a valid key. If there is silence, then the VGE module does in fact see itself as in the GUARDED mode and should be transmitting data.

The next area to check is if the data getting out of the VGE unit. If it is not, the first step would be to see if data is getting to the analog board. If TTL level data is not present on J8 pin 1 of the logic board, then troubleshoot the logic board. The problem will probably be in modem U6 or DSP Ul0. It is a good idea to isolate the pin from the jack with a toothpick to make sure something on the analog board is not killing the signal so as to make it appear to be a logic board problem.

Digital data is converted to analog data and switched onto the radio control cable on the analog board. One should be able to follow the data through the filter sections of U2. The dc level should be at 4.5 volts. There should be around 2.5 Vpp of data at the last section of the filter. The data will appear to have its edges rounded off.

The output of the filter goes to a switch section in U5. It should go in on pin 5 and out on pin 4. The control line is pin 9 and the controlling signal is Data PTT. Pin 9 of U5 should be low for GUARDED transmit. If not, the switch will be open and no data will get through. If high, check Ql and Data PTT.

Data seen at the output of the switch should go to the back connector. If it does not, one problem could be with the protection diodes. A level of close to 8 v or close to ground indicates one of the diodes is shorted out.

SYMPTOM IV: RADIO TRANSMITS DATA, COMPANION RECEIVER SYNCS UP, BUT THERE IS NO RECOVERED MODULATION

If a 600 ohm microphone is not used, make sure there is a 600 ohm dc resistance to ground on the mic path. If this resistance does not exist, then amplifier UlC will have its input biased near 8 v. It will not work under this condition.

If this is not a problem, then the next step would be to look at pin 15 of CODEC U4. This is the output of an internal operational amplifier. No modulation here indicates a problem around U4. If there is no audio here, verify the Analog +5 and especially -5 v supplies. If these are OK, then the problem is probably internal to the CODEC.

Transmit audio is also looped through DSP U10 and regenerated on pin 2 of the CODEC. The presence of audio here verifies the operation of the CODEC and DSP circuits.

SYMPTOM V: RADIO DOES NOT TRANSMIT CLEAR

Clear audio requires a 600 ohm microphone or an appropriate loaded source. Mic audio is applied to Jl pin 4 to U2C buffer. Under normal operation U2C's output will appear on J2 pin 16. If the mic audio is not present, U9A or Ql3 should be suspected. Inverter U9A and Q13 are controlled by the Mic Switch line from the output port at U15. This line goes low when a guarded transmission is occurring to prevent clear audio from passing to the radio (J2 pin 16).

SYMPTOM VI: RADIO DOES NOT RECEIVE GUARDED

The first step is to determine if the VG unit is enabled for GUARDED mode. If the radio can transmit GUARDED, then it is already answered. If it does not transmit GUARDED, then one should pay attention to what happens when MIC PTT is pressed. If PTT is pressed and there is a clear

transmission alert tone, then the mode switch is not connected to the logic board (J9.) If connected, then the mode switch must be open. If there is a two-tone warning, then the mode switch has the private and clear TX lines shorted together. Note that there is a valid key. If so, the EEPROM U11 IC is working. If there is no tone, then the VG unit does see itself as in the GUARDED mode and should be transmitting data.

Receive GUARDED requires that the receiving radio's key and outside address match that of the transmitting radio. It may be a good idea to verify the Personality EEPROM (U12) program. Also verify that the logic board can in fact correctly read the EEPROM.

TTL level data should be on J8 pin 3 of the logic board. There will be a jitter on the trace that is not too clear on the photograph. This is normal. The 9600 bit pattern should be apparent. If it is, then there is probably a problem with the logic board.

If it is not, then the problem is in the analog board. The data coming into J3 pin 6 should be on the common side of Rl9 and R20. Pin 9 of the comparator should have an attenuated version of the data. Pin 8 should be almost a dc level. If there is data on pin 8, then there is a problem with C7. Data on U3 pin 9 should show up on pin 14 as TTL levels. If not, the problem is probably the comparator.

Decrypted audio comes out of pin 2 of the CODEC (U4) on the analog board. It goes through two or three filter sections before going through switch U5A. This switch switches the decrypted audio or the clear audio onto the VOLUME/SQUELCH high line to the control head. It is controlled by the RX Switch. During private receive, the control pin of this switch (pin 10), will be low.

If audio is getting out of Jl pin 16, then it will either be a controller problem or a radio problem.

SYMPTOM VII: RADIO DOES NOT RECEIVE CLEAR

The VG unit will normally want to receive CLEAR. If it does not, the problem will usually be in the radio. However, there are some items in the VG unit that should be checked.

The first is switch U5A on the analog board. It switches VOLUME/SQUELCH high between clear audio from the radio and decrypted VGE audio from the CODEC.

Next, the logic board controls the signal RX Mute. This could keep a radio quiet if it is in the wrong state.

Finally, there are numerous protection diodes along the various boards on the audio lines. If one of these shorts, the line will be tied to ground or 8 v. Either way, there will not be any audio getting through the system.

SYMPTOM VIII: VOICE GUARD UNIT DOES NOT ACCEPT A VALID KEY

There are two main reasons why a VG unit will not accept a key. First, a working VG unit will give an alert tone if a keyfill that is turned off is inserted into its jack while in the fill mode. If there is silence, then the keyloader jack, cable or Keyloader are defective.

Second, there are many protection diodes on the keyfill lines. A loss of any of them could cause some lines to behave erratically. That result would probably cause a transfer error.

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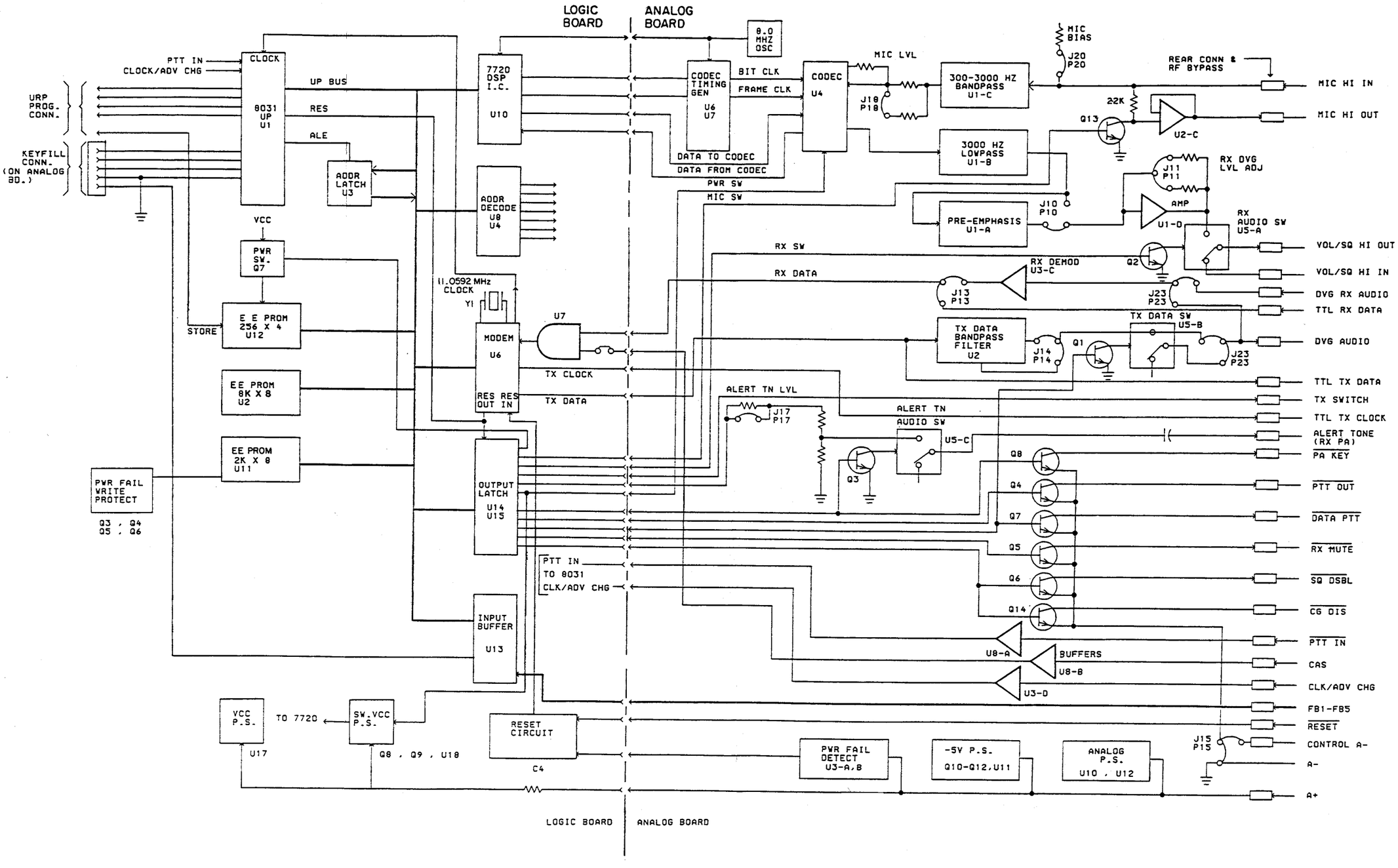
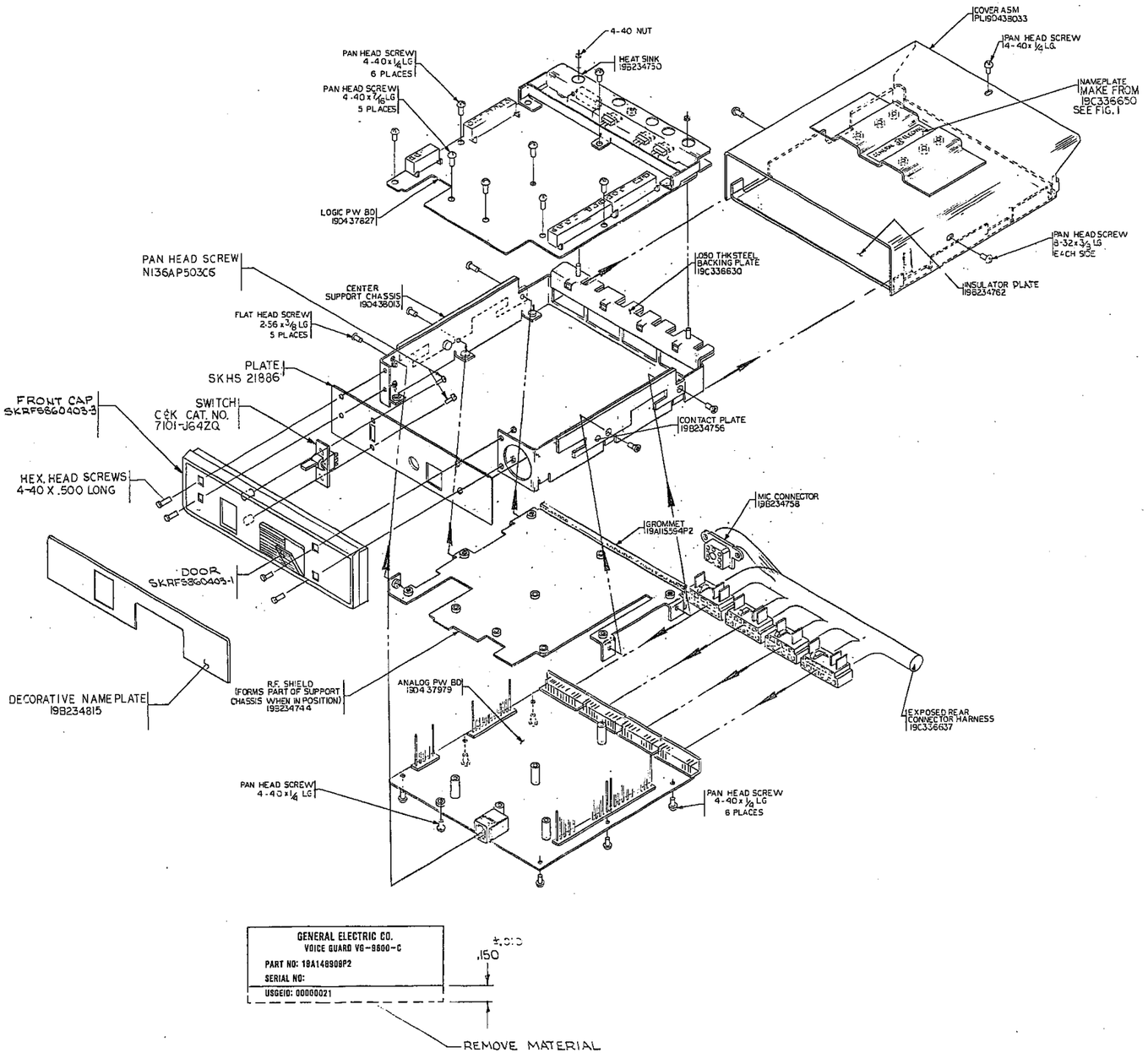
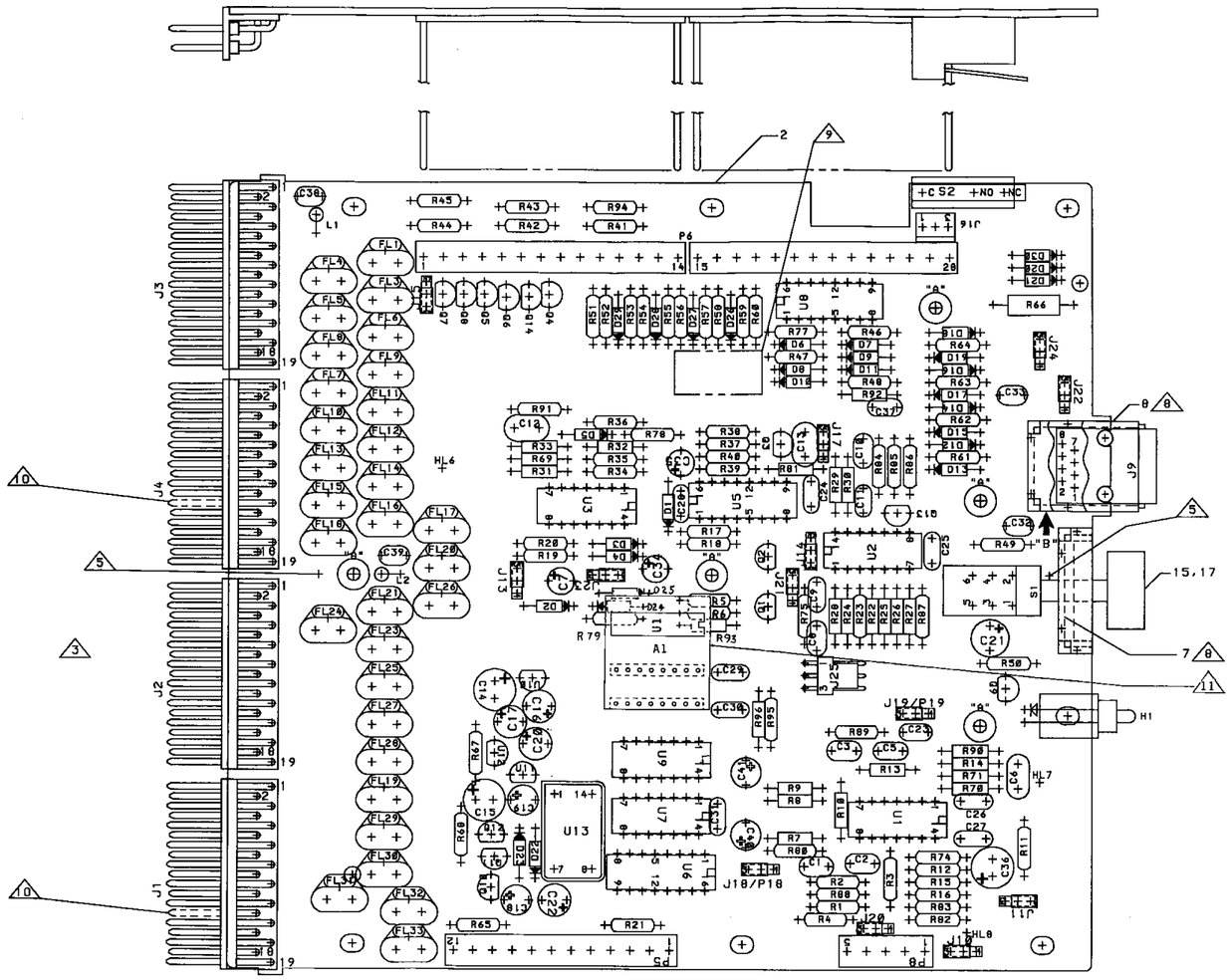


Figure 6 - VGE-9600 Voice Guard Module

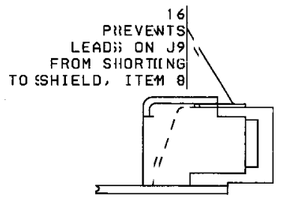


VGE-9600 Voice Guard Module

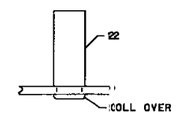
(19D38166, Sh. 1, Rev. 0)



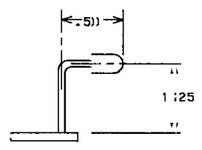
(1) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. COMPONENT LEADS TO PROTRUDE .06 MAX. BELOW SOLDER SIDE OF BOARD.
3. INDICATES FRONT OF COMPONENT AUTO-INSERTION MACHINES.
4. THE FOLLOWING ITEMS ARE MOS DEVICES REQUIRING SPECIAL CARE PER 19A701294, U4 THRU U9.
5. BOARD ERROR CORRECTION HOLES
6. CLEAN PER 19A701294
7. A SILICONE BASE MATERIAL SOLDER MASK IS NOT PERMISSIBLE.
8. SOLDER ITEMS 7 & 8 IN POSITIONS SHOWN
9. VENDOR TO MARK A UNIQUE SERIAL NUMBER IN THIS BOX.
10. CUT PINS J1-14 AND J4-13 FLUSH TO .02 MAX FROM CONNECTOR BODY.
11. INSURE COMPONENTS UNDER A1 ARE FLUSH TO PWB. ITEM 2. ITEM 3 OF A1 SHOULD BE FLUSH WITH ITEM 2 PWB.



VIEW AT "B"



VIEW AT "A"
TYP. 5 PLACES @ "A"



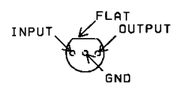
VIEW AT "C"
TYP. DS1, DS2, & DS3

LEAD IDENTIFICATION FOR Q1 THRU Q14

IN-LINE
TOP VIEW

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

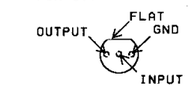
LEAD IDENTIFICATION FOR U10 AND U12



IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR U11



IN-LINE
TOP VIEW

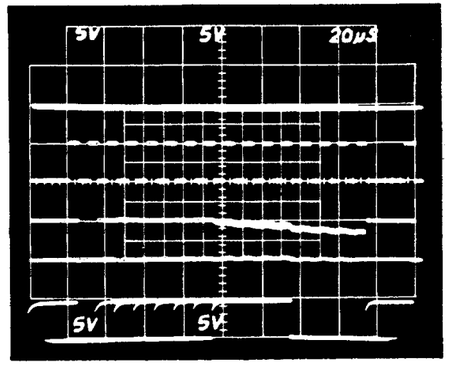
NOTE: LEAD ARRANGEMENT IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

"C"

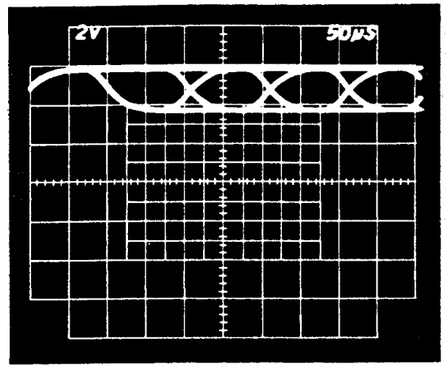
Analog Board
19D437979G1

(19D38166, Sh. 1, Rev. 0)

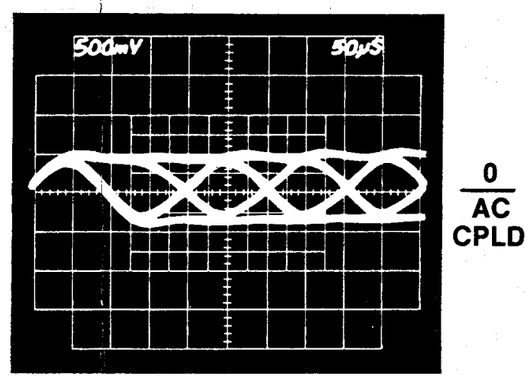
CODEC - GUARDED TX (P5-2, P5-4, P5-3, & P5-5)



SECOND STAGE TX FILTER (U2-14)

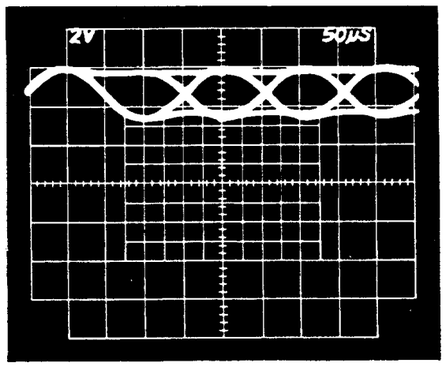


TYPICAL RCVD VG DATA (DVG AUDIO HI)

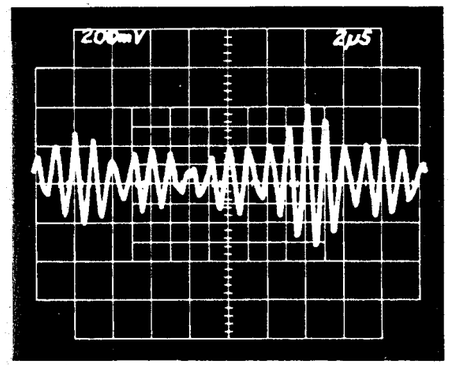


TRANSMITTING UNIT DATA MODULATION SET TO 3 KHz DEVIATION

FIRST STAGE TX FILTER (U2-2)



RCVD GUARDED AUDIO (VOL/SQ HI OUT)



TRANSMITTING UNIT HAD 1 KHz, 300 mV P-P INTO MIC HI

VOLTAGE READINGS (SHEET 3)
(DC,NOMINAL)

OPERATING CONDITION	MEASUREMENT POINT			
	V2(B)-5	U5(A)-10	U5(B)-5	U5(B)-9
GUARDED RX	2.5V	0.5V	4.5V	8V
CLEAR RX	2.5V	8V	4.5V	8V
GUARDED TX	—	8V	—	0.5V
CLEAR TX	2.5V	8V	4.5V	8V

SIGNAL LEVELS (SHEET 3)
(P-P,NOMINAL)

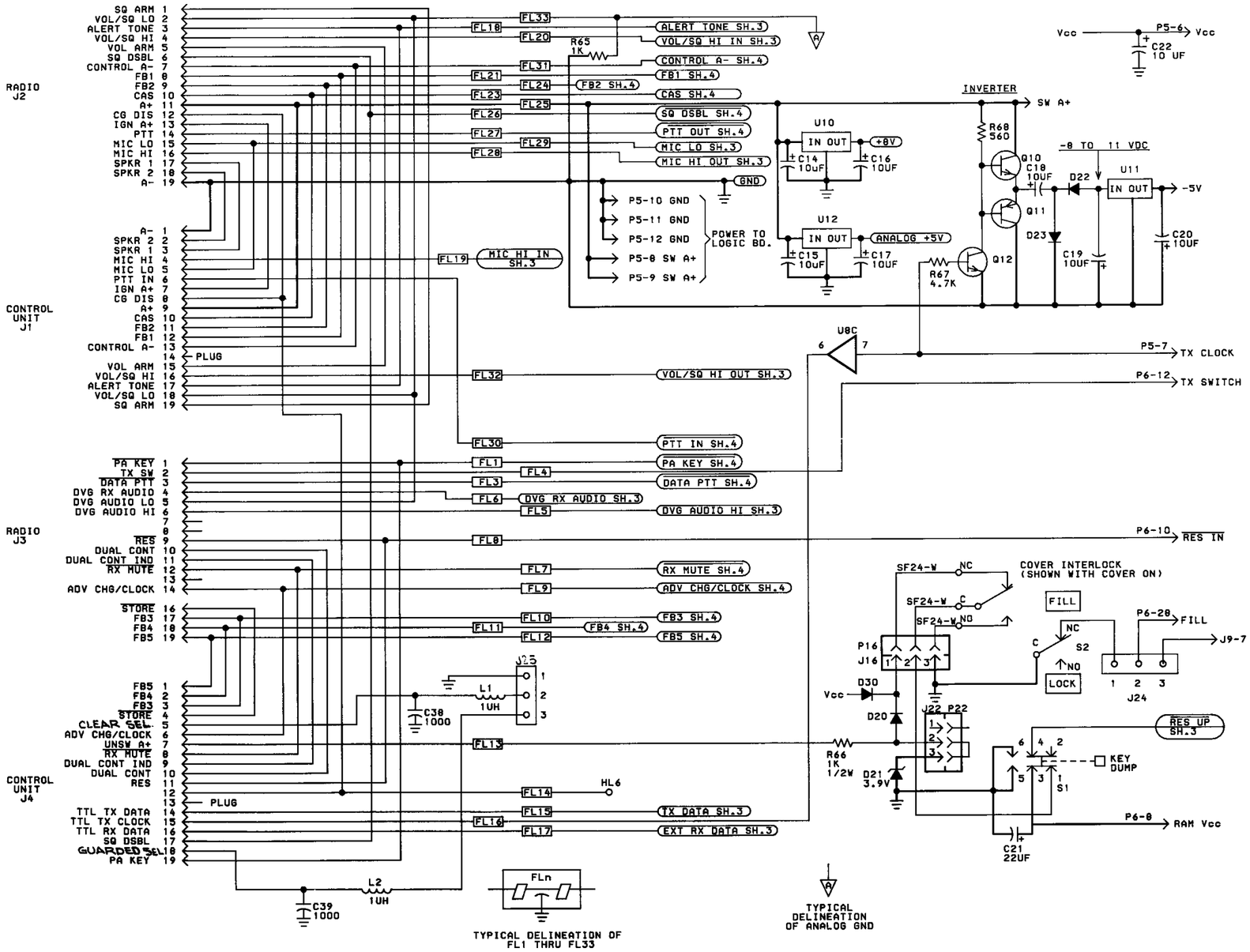
WITH 300 uV P-P @ 1 KHZ SINUSOID SIGNAL INPUT AT J1-4 AND UNIT IN GUARDED TX MODE THE FOLLOWING SIGNAL LEVELS, NOMINAL, SHOULD BE PRESENT.

OPERATING CONDITION	MEASUREMENT POINT				
	U1(A)-1	U1(B)-7	U1(C)-8	U1(D)-14	U4-15
—	—	—	300uV	—	—
P18 ON J18-2&3	100uV	200uV	—	450uV	700uV
P18 ON J18-1&2	—	—	—	—	2.2V
P11 ON J11-2&3	—	—	—	450uV	—

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.

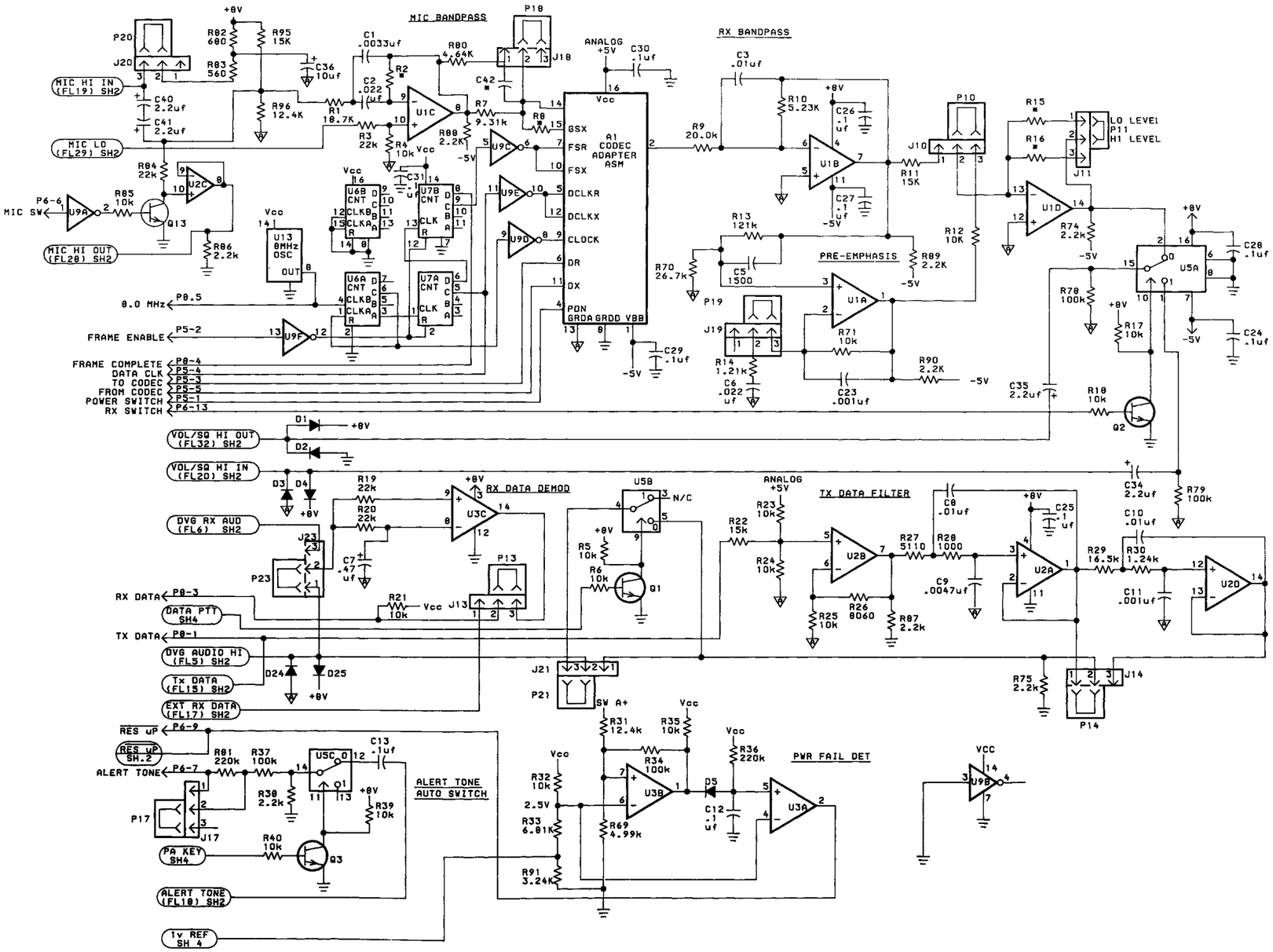
Analog Board
19D437979G1
Sheet 1 of 4

(19D437976, Sh. 1, Rev. 7)



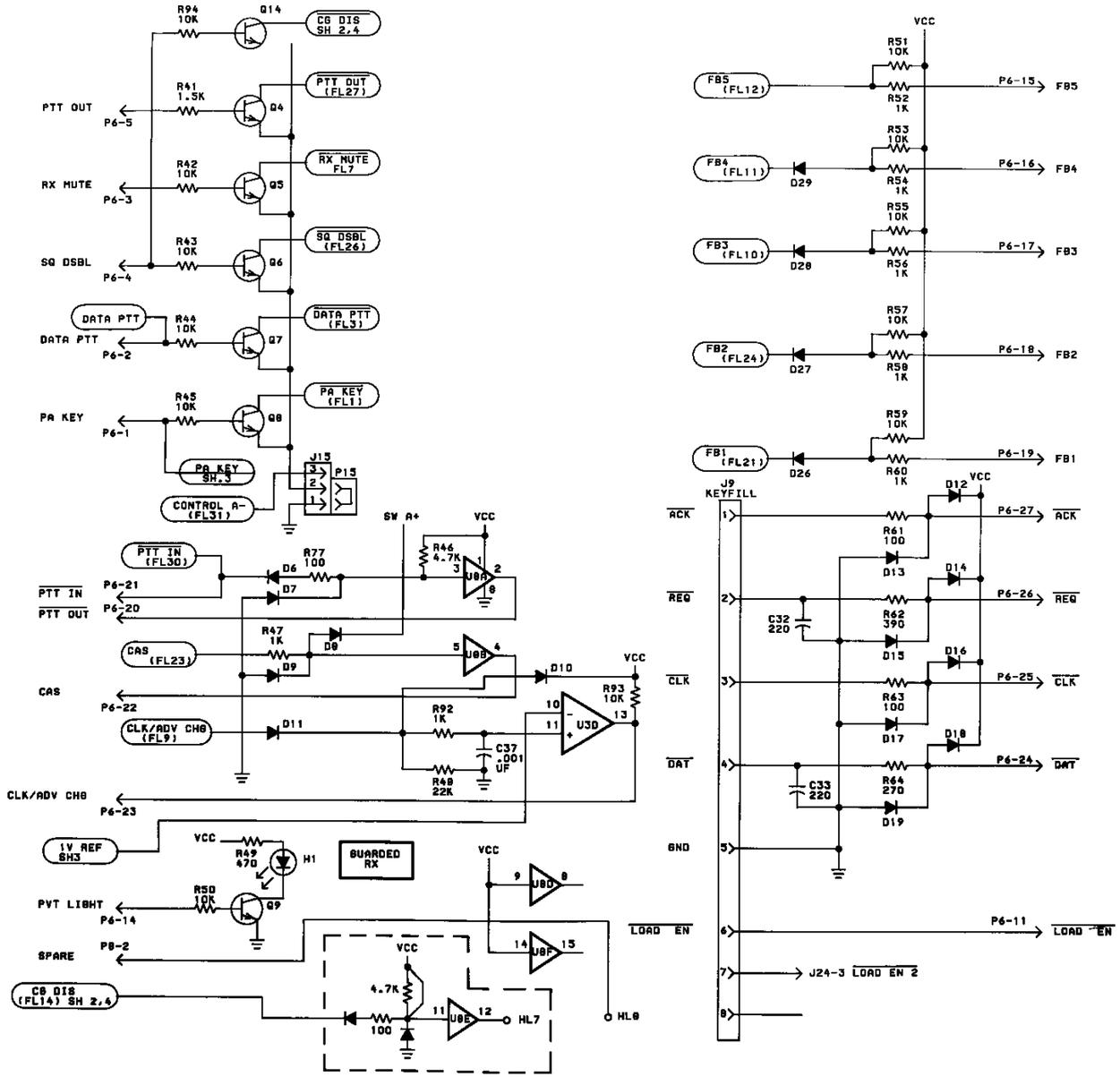
Analog Board
19D437979G1
Sheet 2 of 4

(19D437976, Sh. 2, Rev. 7)



Analog Board
19D437979G1
Sheet 3 of 4

(19D437976, Sh. 3, Rev. 7)



Analog Board
19D437979G1
Sheet 4 of 4

(19D437976, Sh. 4, Rev. 7)

ANALOG BOARD
19D437979G1
(A19/B300101)

ISSUE 9

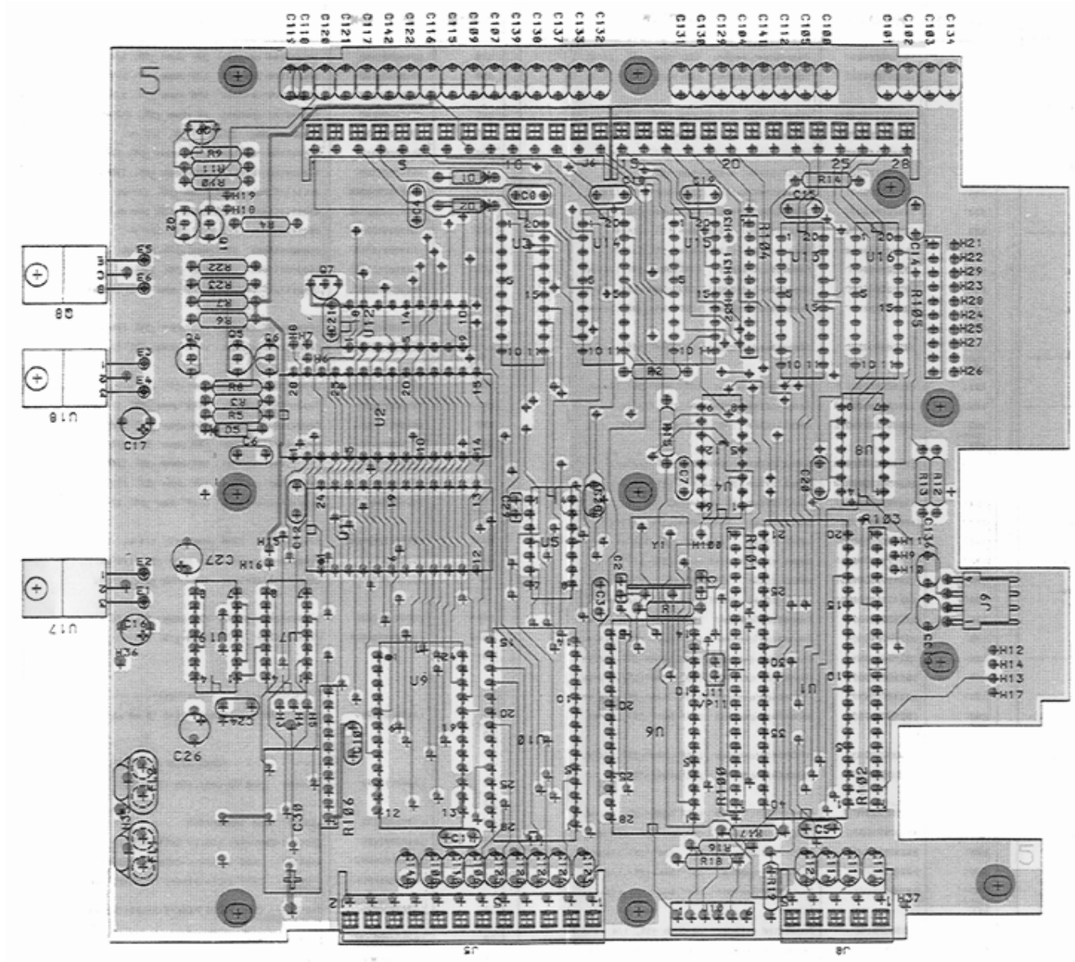
SYMBOL	PART NUMBER	DESCRIPTION
		- - - - - - - - CAPACITORS - - - - - - -
C1	T644ACP233J	Polyester: .0033 uF ±5%, 50 VDCW.
C2	T644ACP322J	Polyester: .022 uF ±5%, 50 VDCW.
C3	T644ACP310J	Polyester: .010 uF ±5%, 50 VDCW.
C5	T644ACP215J	Polyester: .0015 uF ±5%, 50 VDCW.
C6	T644ACP322J	Polyester: .022 uF ±5%, 50 VDCW.
C7	19A701534P3	Tantalum: 0.47 uF ±20%, 35 VDCW.
C8	T644ACP310J	Polyester: .010 uF ±5%, 50 VDCW.
C9	T644ACP247J	Polyester: .0047 uF ±5%, 50 VDCW.
C10	T644ACP310J	Polyester: .010 uF ±5%, 50 VDCW.
C11	T644ACP210J	Polyester: .0010 uF ±5%, 50 VDCW.
C12 and C13	19A702250P113	Polyester: 0.1 uF ±10%, so VDCW.
C14 and C15	19A701225P1	Electrolytic: 15 uF-10 +75%, 25 VDCW.
C16 and C17	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C18	19A701534P10	Tantalum: 10 uf ±20%, 25 VDCW.
C19 and C20	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C21	19A701534P8	Tantalum: 22 uF ±20%, 16 VDCW.
C22	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C23	T644ACP210J	Polyester: .0010 uF ±5%, 50 VDCW.
C24 thru C31	19A116192P14	Ceramic : 0.1 uF ±20%, 50 VDCW.
C32 and C33	19A700233P3	Ceramic : 220 pF ±10%, 50 VDCW.
C34 and C35	19A701534P5	Tantalum: 2.2 UP ±20%, 35 VDCW.
C36	19A701534P7	Tantalum: 10 uF ±20%, 16 VDCW.
C37	T644ACP210J	Polyester: .0010 UP ±5%, 50 VDCW.
C38 and C39	19A700233P7	Ceramic : 1000 pF ±20%, 50 VDCW.
C40* and C41	315A6047P225U	Tantalum: 2.2 uF ±20%, 35 VDCW.
C42*	T644ACP233K	Polyester: 0.0033µF ±10%, 50 VDCW *(Used in VGE-9600-SW, VEG-9600-SRW and VGE-9600-PRW).*
		- - - - - - - - - - DIODES - - - - - - - - -
D1 thru D11	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV.
D12	19A700047P2	Silicon, 100 mW, continuous dissipation.
D13	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV.
D14	19A700047P2	Silicon, 100 mW, continuous dissipation.
D15	19A700028PI	Silicon, fast recovery: fwd current 75 mA, 75 PIV.
D16	19A700047P2	Silicon, 100 mW,continuous dissapation.
D17	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV.
D18	19A700047P2	Silicon, 100 mW, continuous dissipation.
D19 and D20	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NUMBER	DESCRIPTION
D21	19A700025P4	Silicon, zener: 400 mW max.
D22 thu D29	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV.
D30	19A700047P2	Silicon, 100 mW, continuous dissipation
		- - - - - - -FILTERS - - - - - - -
FL1		Filter, MFG: MURATA ERIE, DSS310-55Y271M.
FL3 thru FL21		Filter, MPG: MURATA ERIE, DSS310-55Y271M.
FL23 thru FL33		Filter, MFG: MURATA BRIE, DSS310-55Y271M.
		- - - - - - -LEDS - - - - - - -
H1	19A703595P2	Optoelectronic: yellow.
		- - - - - - - JACKS & RECEPTICLES- - - - - - -
J1 thru J4	19823477161	Connector.
J5	19J706197P3	Connector: 8 contacts; sim to AMP Type 520251-4
J10 and J11	19A700072P2	Printed wire: 3 contacts rated at 2.5 amps.
J13 thru J15	19A700072P2	Printed wire: 3 contacts rated at 2.5 amps.
J16	19A700072P29	Printed wire: 3 contacts rated at 2.5 amps.
J17 thru J24	19A700072P2	Printed wire: 3 contacts rated at 2.5 amps.
J25*		MFG: Molex #22-05-3031.
		- - - - - - - - INDUCTORS- - - - - - - -
L1 and L2	19A700024P15	Coil.
		- - - - - - - - - PLUGS - - - - - - - - - -
P5		Connector, MFG : MOLEX, 2461-12AK.
P6		Connector, MFG: MOLEX, AX-40187-A-YA14AAF102.
P8		Connector, MFG: MOLEX, 2461-05AK.
P10 and P11	19A702104P1	Receptacle: 2 position, shorting, rated at 3 amps.
P13 thru P15	19A702104PI	Receptacle: 2 position, shorting, rated at 3 amps.
P17 thru P24	19A702104PI	Receptacle: 2 position, shorting, rated at 3 amps.
		- - - - - - - - TRANSISTORS- - - - - - - -
Q1 thru Q10	19A700023P1	Silicon, NPN.
Q11	19A700022P1	Silicon, PNP.
Q12 thru Q14	19A700023P1	Silicon. NPN.
		- - - - - - - - RESISTORS - - - - - - - -
R1	19A701250P327	Metal film: 18.7K ohms ±1%, 1/4 w.
R2*	19A701250P319	Metal film: 15.4k ohms ±1%, 1/4 w.
R2*	19A701250P336	Metal film: 23.2k ohms ±1%, 1/4 w. *(Used in VGE-9600-DRW and VGE-9600-DURW).*
R3	H212CRP322C	Deposited carbon : 22K ohms ±5%, 1/4 w.
R4 thu R6	H212CRP310C	10K ohms ±5%, 1/4 w. Deposited carbon :

SYMBOL	PART NUMBER	DESCRIPTION
R7	19A701250P294	Metal film: 9.3lK ohms ±1%, 1/4 w.
R8*	19A701250P307	Metal film: Il.5K ohms ±1%, 1/4 w.
R8*	19A701250P309	Metal film: 12.1k ohms ±1%, 1/4 w. (Used in *VGE-9600-DRW and VGE-9600-DURW).*
R9	19A701250P337	Metal film: 23.7K ohms ±1%, 1/4 w.
R9*	19A701250P330	Metal film: 20k ohms ±1%, 1/4 w. (Used in *VGE-9600-DRW and VGE-9600-DURW).*
R10	19A701250P270	Metal film: 5.23K ohms ±1%, 1/4 w.
R11	H212CRP3l5C	Deposited carbon: 15K ohms ±5%, 1/4 w.
R12	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R13	19A701230P409	Metal film: 121K ohms ±1%, 1/4 w.
R14	19A701250P209	Metal film: 1.2lK ohms ±1%, 1/4 w.
R15	H212CRP347C	Deposited carbon: 47K ohms ±5%, 1/4 w.
R15*	19A701250P403	Metal film: 105k ohms ±1%, 1/4 w. (Used in *VGE-9600-DRW and VGE-9600-DURW).*
R16	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R16*	19A701250P432	Metal film: 210k ohms ±1%, 1/4 w. (Used in *VGE-9600-DRW and VGE-9600-DURW).*
R17 and R18	H212CRP310C	Deposited carbon : 10K ohms ±5%, 1/4 w.
R19 And R20	H212CRP322C	Deposited carbon: 22K ohms ±5%, 1/4 w.
R21	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R22	19A701250P318	Meta1 film: 15K ohms ±1%, 1/4 w.
R23 thru R25	19A701250P301	Metal film: 10K ohms ±1%, 1/4 w.
R26	19A701250P288	Metal film: 8060 ohms ±1%, 1/4 w.
R27	19A701250P269	Meta1 film: 5.llK ohms ±1%, 1/4 w.
R28	19A701250P201	Meta1 film: 1K ohms ±1%, 1/4 w.
R29	19A7012503322	Metal film: 16.5K ohms ±1%, 1/4 w.
R30	19A701250P210	Metal film: 1240 ohms ±1%, 1/4 w.
R31	19A701250P310	Metal film: 12.4K ohms ±1%, 1/4 w.
R32	19A701250P301	Metal film: 10K ohms ±1%, 1/4 w.
R33	19A701250P281	Meta1 film: 6.8lK ohms ±1%, 1/4 w.
R34	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R35	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R36	H212CRP422C	Deposited carbon: 220K ohms ±5%, 1/4 w.
R37	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R38	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R39 and R40	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R41	H212CRP2l5C	Deposited carbon : 1.5K ohms ±5%, 1/4 w.
R42 thru R45	H212CRP3lOC	Deposited carbon : 10K ohms ±5%, 1/4 w.
R46	H212CRP247C	Deposited carbon: rbon 4.7K ohms ±5%, 1/4 w.
R47	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R48	H212CRP322C	Deposi ted carbon : 22K ohms ±5%, 1/4 w.
R49	H212CRP147C	Deposited carbon: 470 ohms ±5%, 1/4 w.
R50 and R51	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R52	H212CRP210C	Deposited carbon : 1K ohms ±5%, 1/4 w.
R53	H212CRP310C	Deposited carbon: 10k ohms ±5%, 1/4 w.
R54	H212CRP210C	Deposited carbon 1K ohms ±5%, 1/4 w.
R55	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R56	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R57	H212CRP310C	Deposited carbon: 10K ohms ±5 %, 1/4 w.
R58	H212CRP210C	Deposited carbon: 1K ohms ±5 %, 1/4 w.
R59	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R60	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R61	H212CRP110C	Deposited carbon: 100 ohms ±5%, 1/4 w.
R62	H212CRP139C	Depoeited carbon: 390 ohms ±5%, 1/4 w.
R63	H212CRP110C	Deposited carbon: 100 ohms ±5%, 1/4 w.
R64	H212CRP127C	Deposited carbon: 270 ohms ±5%, 1/4 w.
R65	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R66	19A700113P63	Composition: 1K ohms ±5%, 1/2 w.
R67	H212CRP247C	Deposited carbon: 4.7x ohms ±5%, 1/4 w.
R68	H212CRP156C	Deposited carbon: 560 ohms ±5%, 1/4 w.
R69	19A701250P268	Metal film: 4.99K ohms ±1%, 1/4 w.
R70	19A701250P341	Metal film: 26.1K ohms ±1%, 1/4 w.
R71	19A701250P301	Metal film: 10K ohms ±1%, 1/4 w.
R72	19A700113P57	Composition: 560 ohms ±5%, 1/2 w.
R73	19A700113P55	Composition: 470 ohms ±5%, 1/2 w.

SYMBOL	PART NUMBER	DESCRIPTION
R74 and R75	H212CRP222C	Deposited carbon: 2.2s ohms ±5%, 1/4 w.
R77	H212CRP110C	Deposited carbon: 100 ohms ±5%, 1/4 w.
R78 and R79	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R80	19A701250P265	Metal film: 4.6K ohms ±1%, 1/4 w.
R81	H212CRP422C	Deposited carbon 220K ohms ±5%, 1/4 w.
R82	H212CRP168C	Deposited carbon: 680 ohms ±5%, 1/4 w.
R83	H212CRP156C	Deposited carbon : 560 ohms ±5%, 1/4 w.
R84	H212CRP322C	Deposited carbon : 22K ohms ±5%, 1/4 w.
R85	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R86 thru R90	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R91	19A701250P250	Meta1 film: 3240 ohms ±1%, 1/4 w.
R92	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R93 and R94	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R95*	H212CRP315C	Deposited carbon : 15K ohms ±5%, 1/4 w.
R96*	19A701250P310	Metal film: 12.4K ohms ±1%, 1/4 w.
R97		- - - - - - - - SWITCHES - - - - - - - -
S1 and S2	19B600563P3	Push : DPDT, contacts rated 15 mA at 130 VDC.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U1 and U2	19A701789P3	Linear: Quad Op Amp; sim to LM224.
U3	19J70601892	Linear: Quad Comparator.
A1	19C852714G1	Encoder-Decoder; sim to Intel 2916. (Replaced by U4).
U5	19A700029P38	Digital : CMOS Triple 2-Channel Multiplexer.
U6	19A703987P13	Digital : CM0S 4-Bit Binary Counter; sim to 74HC390.
U7	19A703987P14	Digital: CM0S 4-Bit Binary Ripple Counter; sim to 74HC393.
U8	19A700029P35	Digital : Hex Non-Inverting Buffer; sim to 4050B
U9	19A703483P4	Digital : Hex Inverter.
U10	19J70603lP2	Linear: +8 volt Regulator; sim to LM7808.
U11	19A704013P1	Linear: -5 volt Regulator; sim to MC790SCP.
U12	19J706031P1	Linear : +S volt Regulator; sim to LM7805.
U13		Oscillator, 8.0 MHz, MPG: CTS, MXO-559A-2I.
		- - - - - - - - MISCELLANEOUS - - - - - - - -
	19C336648P1	Shield.
	19C336647P1	Shield.
		Standoff; MPG: R.A.F. Electronics Hardware Inc., 3045-B-440-S-I-MOD. L = .600.
	19C850640P1	Knob for S1.
	19A701699P22	Nameplate for S1.
	19A121175P44	Insulator plate. (Deed with J9).

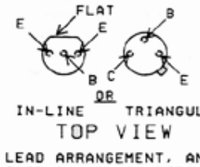


(19D437828, Sh. 1, Rev. 0)
(19A148718, Sh. 1, Rev. 5)
(19A148718, Sh. 2, Rev. 5)

RUNS ON SECOND LAYER

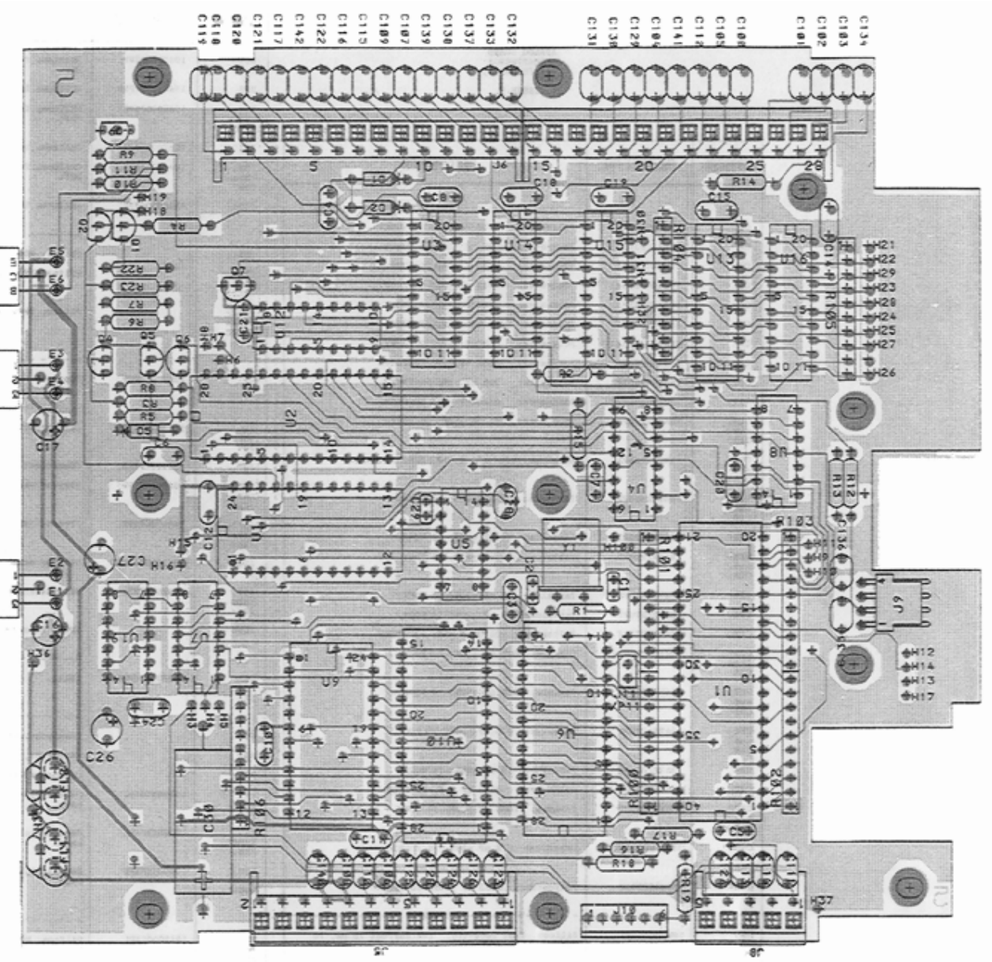
RUNS ON FIRST LAYER

LEAD IDENTIFICATION
FOR Q1,Q2,Q4-Q7,& Q9



TOP VIEW

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

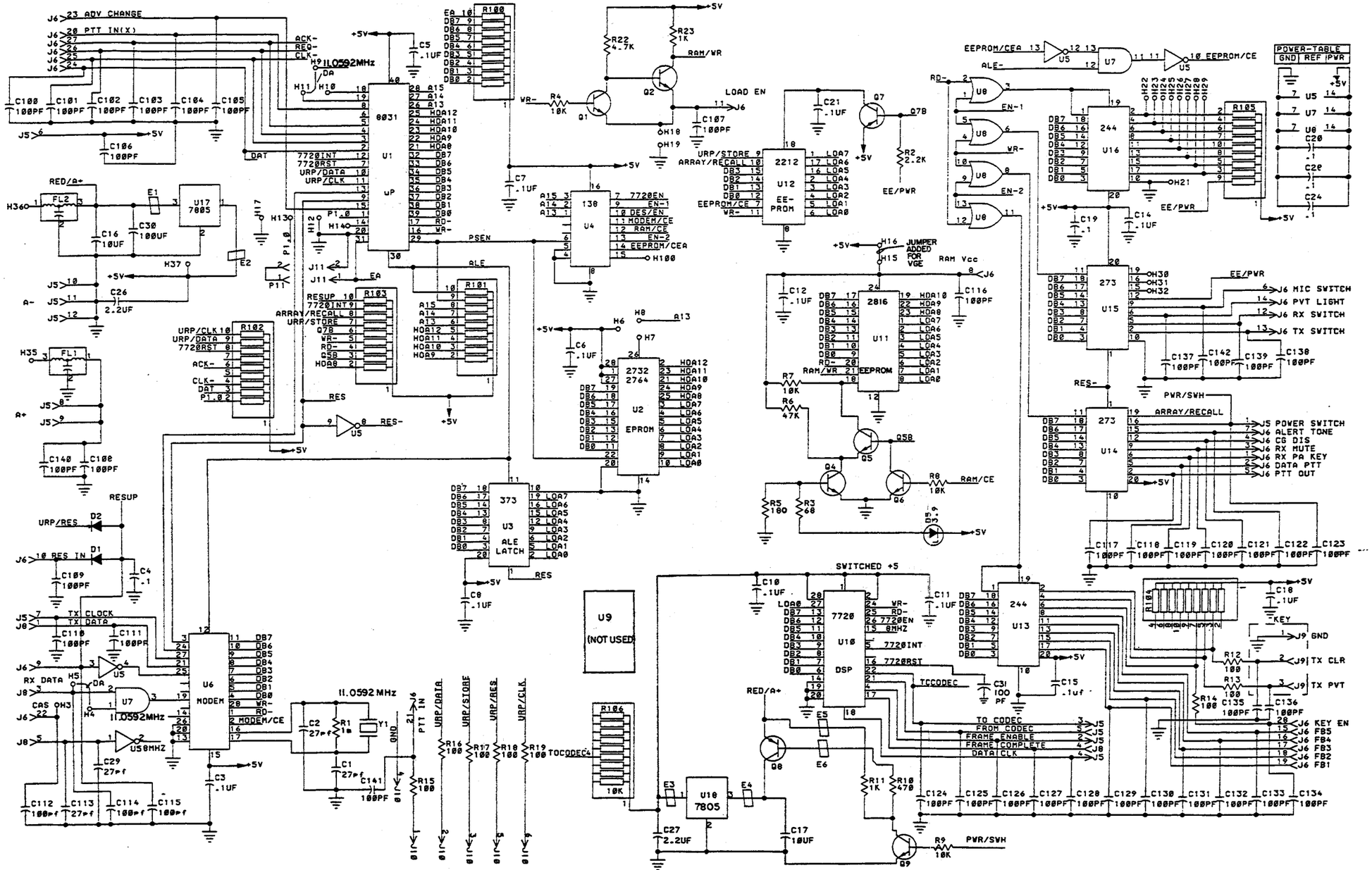


(19D437828, Sh. 1, Rev. 0)
(19A148718, Sh. 3, Rev. 5)
(19A148718, Sh. 4, Rev. 5)

RUNS ON THIRD LAYER

RUNS ON FOURTH LAYER

LOGIC BOARD
19D437827G1



LOGIC BOARD
19D437827G1
Sheet 1 of 1

LBI-31732
VGE LOGIC BOARD
19D437827G1
ISSUE 4

SYMBOL	PART NUMBER	DESCRIPTION
		---------- CAPACITORS- ----------
C1 and C2	19A700219P44	Ceramic: 27 pF ±5%, 100 VDCW.
C3 thru C8	19A116192P14	Ceramic: 0.1 uFF ±20%, 50 VDCW.
C10 thru C15	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW.
C16 and C17	19A703314P10	Electrolytic: 10 uF -10+50%, 50 VDCW.
C18 thru C21	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW.
C24 and C25	19A116192P14	Ceramic: 0 .1 uF ±20%, 50 VDCW.
C26 and C27	19A701534P5	Tantalum: 2.2 uF ±20%, 35 VDCW.
C28	19A116192P14	Ceramic: 0.1 uF ±20%, 50 VDCW.
C30	19A700064P4	Electrolytic: 100 uF, -10+150%, 250 VDCW.
C31	19A700219P64	Ceramic: 100 pF ±5%.
C100* thru C142	19A700233P1	Ceramic: 100 pF ±20%. 50 VDCW.
		---------- DIODES- ----------
D1 and D2	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV.
D5	19A700025P3	Silicon: 3.9 Volt zener. 400 mW.
		---------- JACKS-- ----------
J5		Connector. Sim to: MOLEX 26-11-6125.
J6		Connector. Sim to: MOLEX 26-11-6145.
J8		Connector. Sim to: MOLEX 26-11-6055.
J9		Connector. Sim to: MOLEX 22-05-3041.
J10	19A700072P32	Printed wire: 6 contacts rated at 2.5 amps.
P11 thru P15	19A702104P1	Receptacle: 2 position. shorting, rated at 3 amps.
		---------- RESISTORS ----------
R1	19A701537P1	Composition: 1M ohms ±5%, 1/4 w.
R2	H212CRP222C	Deposited carbon: 2.2K ohms ±5%, 1/4 w.
R3	H212CRP068	Deposi ted carbon: 68 o h m s ±5%. 1/4 w.
R4	H212CRP310C	Deposited carbon: 10K ohms ±5%. 1/4 w.
R5	H212CRP118	Deposited carbon: 180 ohms ±5%. 1/4 w.
R6	H21 2CRP347C	Deposi ted carbon: 47K ohms ±5%. 1/4 w.
R7 thru R9	H212CRP310C	Deposited carbon: 10K ±5%. 1/4 w.
R11	H212CRP210C	Deposited carbon: 1K ohms ±5%. 1/4 w.
R12 thru R19	H212CRP110C	Deposited carbon: 100 ohms ±5%,1/4 w.
R20	5493035P1	Wireround : 5 ohms ±5% 5 watt.
R22	H212CRP247C	Deposited carbon: 4.7K ohms ±5%,5%, 1/4 w.
R23	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R24 thru R27	H212CRP127C	Deposited carbon: 270 ohms ±5%, 1/4 W.
R100 thru R106	19A701630P2	Resistor , network: 9 resistors rated 10K ohms ±2% , 50 VDCW.
		---------- TRANSISTORS- ----------
Q1 and Q2	19A700084P1	Silicon. NPN.
Q4	19A700023P1	Silicon, NPN.
Q5 and Q6	19A70008P1	Silicon, NPN.
Q7	19A700022P1	Silicon. PNP.
Q8	19A116942P1	Silicon, PNP.
Q8*	19A116942P1	Silicon, PNP *(Used in VGE-9600-SW, VGE-9600-CW, VGE-9600-SRW, VGE-9600-PRW, VGE-9600-DRW, VGE-9600-DURW).*
Q9	19A700023P1	Silicon, NPN.
Q9*	19A700023P1	Silicon, NPN *(Used in VGE-9600-SW, VGE-9600-CW, VGE-9600-SRW and VGE-9600-PRW).*
		----- --- INTEGRATED CIRCUITS- -------
U1	19A703104P1	Microcomputer: NMOS 8 bit; sim t o P8031AH.
U2*	19A705160G7	Digital: 8K x 8-bit CMOS EPROM: sim to 2764 *(Programmed. Used in VGE-9600-SW, VGE-9600-CW and VGE-9600-SRW).*
U2*	19A705869G2	Digital: 8K x 8 CMOS EPROM; sim to 27C64. (Programmed. Used in VGE-9600-PRW.)
U2*	344A4516G3	Digital: 8K x 8-bit CMOS EPROM: sim to 2764 *(Programmed. Used in VGE-9600-PRW, VGE-9600-DRW and VGE-9600-DURW).*
U2*	344A4514G3	Digital: 8K x 8-bit CMOS EPROM: sim to 2764 *(Programmed. Used in VGE-9600-ARW and VGE-9600-AURW).*
U3	19A703471P2	Digital: Octal Data Latch; sim to 74HC373.
U4	19A704445P1	Digital: 3-to-8 Line Decoder; sim to 74HC138.
U5	19A703483P4	Digital: Hex Inverter; sim to 74HC04.
U6	19B80113662	Digital: Modem.
U7	19A703483P5	Digital: Quad 2-Input AND Gate; sim to 74 HC08.
U8	19A703483P11	Digital: Quad 2-Input OR Gate; sim to 74HC32.
U10	19A703984P40	Digital: Digital Signal Processor; slm to 7720.
U10*	344A4452P3	Digital: Digital Signal Prodcessor: sim to 77C25 *(Used in VGE-9600-DRW and VGE-9600-DURW).*
U11	19A703952P1	Digital: 2K x 8 EEPROM; sim to 2816.
U12	19A703072P2	Digital: EEPROM. (Not Programmed).
U12	344A3000P60	Digital: EEPROM. (Programed. used in VGE-9600-SW.)
U12	344A3000P70	Digital: EEPROM. (Programmed. Used in VGE-9600-CW.)
U12	344A3000P80	Digital: EEPROM. (Programmed. used i n VGE-9600-SW.)
U12*	344A3000P91	Digital: EEPROM. (Programmed. Used in VGE-9600-PRW.)
U12	344A3000P100	Digital: EEPROM. (Programed. used in VCE-9600-SRW CIU.)
U12*	344A3000P290	Digital: EEPROM *(Programmed. Used in VGE-9600-DRW).*
U12*	344A3000P490	Digital: EEPROM *(Programmed. Used in VGE-9600-DURW).*
U12*	344A3000P220	Digital: EEPROM *(Programmed. Used in VGE-9600-ARW).*
U12*	344A3000P480	Digital: EEPROM *(Programmed. Used in VGE-9600-AURW).*
U13	19A703471P1	Digital: Octal Data Latch; sim to 74HC244.
U14 and U15	19A704380P11	Digital: Octal Data Flip-Flop; sim to 74HC273.
U16	19A703471P1	Digital: Octal Data Latch; sim to 74HC44.
U17 and U18	299A6459P8685	Linear: +5 volt Regulator.
		---------- SOCKETS- ----------
XU1		Sim t o : C .A . CA-40SDL-1T
XU2		Sim to: C.A. CA-28SDL-1T
XU6		Sim to: C.A. CA-28SDL-1T
XU9		Sim to: C.A. CA-24SDL-1T
XU10		Sim to: C.A. CA-28SDL-1T
XU11		Sim to: C.A. CA-24SDL-1T
XU12		Sim to: C.A. CA-18SDL-1T
		---------- CRYSTALS- ----------
Y1	19A702511G15	11.0592 MHz.

*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 the descriptions of parts affected by these revisions.

REV. A - VGE-9600 (19A148909P21 – 23)
To improve Voice Guard compatibility with T90, T99, DTMP and GE-STAR when signalling is inititiated by other than a microphone PTT, added C40, C41, R95 and R96 to the Analog Board. Also changed J25 on the analog Board from a vertical jack to a horrtontal jack. Jack J25 was 19A700072P2.

REV. B - VGE-9600 (19A148909P21 - 23)
To improve operation, changed U1 Old part was: 19A704345P1 Microcomputer: sim t o 80C31.

REV. C - VGE-9600 (19A148909P21 - 23)
To improve RFI characteristics, added 100 pF decoupling capacitors C111, C114, C115, C120, C121 and C122.

REV. D - VGE-9600 (19A148909P21 - 23)
To improve PSLM operation, updated firmware. New U2 EPROM is 19A705160C2.

REV. E - VGE-9600 (19A148909P21 - 23)
To support two-frequency operation in CIU, updated firmware. New U2 EPROM is 19A705160G3.

REV. F - VGE-9600 (19A148909P21 - 23)
To improve PLSM hangtime and GE-STAR operation, updated firmware. New EPROM is19A705160G4.

REV. G - VGE-9600 (19A48909P21 - 23)
To support "Start Data" timer for CIU, updated firmware. New EPROM is 19A705160G5.

REV. H – VGE-9600 (19A148909P21 –23 and P32)
To improve VG intelligibility, the following components were changed on the Analog Board in the microphone input bandpass circuit. Resistor R2 was changed from 23.2K to 15.4K ohms and resistor R8 was changed form 20.0K to 11.5K ohms. Also, capacitor C48 was added.

REV. J - VGE-9600 (19A148909P21 - 23)
Updated firmware. New EPROM is 19A705160G6.

REV. K - VGE-9600 (19A148909P32)
To improve PST CIU operation, changed EPROX (U2) to 19A705869G2 and EEPROM (U12) to 344A3000P91.

REV. L - VGE-9600 (19A148909P21-P23)
Upgraded VGE-9600-SW, -CW and -SRW firmware to improve voice quality, correct IV creation problem and correct key verification problems. Changed EPROM (U2) from 19A705160G6 to 19A705160G7.

REV. M - VGE-9600 (19A148909P42 and P43)
Added DVIU Aegis Modules VGE-9600-DRW and -DURW. Both modules use EPROM (U2) part number 344A4516G2. Personality EEPROM (U12) is 344A3000P290 for VGE-9600-DRW and 344A3000P490 for VGE-9600-DURW. In addition, on the Logic Board DSP U10 is changed to a 77C25 device and Q9 is removed and replaced with a jumper (collector to emitter). Also, on the Analog Board, C42 is removed, and R2, R8, R15 and R16 are changed.

REV. N - VGE-9600 (19A148909P42 and P43)
To improve VGE-9600-DRW and -DURW operation. Changed firmware EPROM (U2) to 344A4516G3.

REV. O - (Not Used)

REV. P - VGE-9600 (19A148909P62 and P63)
Added E/D station Aegis Modules VGE-9600-ARW and -AURW. Both modules use EPROM (U2) part number 344A4514G3. Personality EEPROM (U12) is 344A3000P280 for VGE-9600-ARW and 344A3000P480 for VGE-9600-AURW. In addition, on the Logic Board, Q8 is removed and replaced with a jumper (collector to emitter).

REV. P - VG-9600- (19A148909P40 thru P43)

REV. Q - VG-9600- (19A148909P60 thru P63)

REV. M - VG-9600- (19A148909P1 thru P33)
Obsolete part for U4 (19A703924P1) and changed R8 from 10k ohms (19A701250P301) and R9 frm 23.7k ohms (19A701250P337).

REV. N - VG-9600- (19A148909P1 thru P32)

REV. Q - VG-9600- (19A148909P40 thru P43)

REV. R - VG-9600- (19A148909P60 thru P63)
To eliminate a clock slip problem. U6 was changed to ROP 101 688/3A.

MODIFICATION INSTRUCTIONS FOR MASTR III Voice Guard

(Modification Kit 350A1558)

The following information provides detailed instructions to modify the VG-9600 (19A148909P60-P63) when used with the MASTR III Base Station for conventional Voice Guard options SXVG3D, SXVW1J & SXVV1N.

REASON FOR MODIFICATION

There are two diodes on the **VOL SQ HI** line from the MASTR III station, one connected to +8 Vdc and one connected to ground *(Figure 7)*. This works for radios providing audio on a 4 Vdc bias. The MASTR III is AC coupled and provides no DC bias for the **VOL SQ HI** signal. The Data slicer in the VG-9600 box has a 22k Ohms resistor and uses a 0.47µF capacitor for a 15.4 Hz low pass filter. This is effectively 22k Ohms to ground in parallel with the M3 15k Ohms Squelch potentiometer. This configuration loads down the squelch arm signal and reduces the ME squelch range

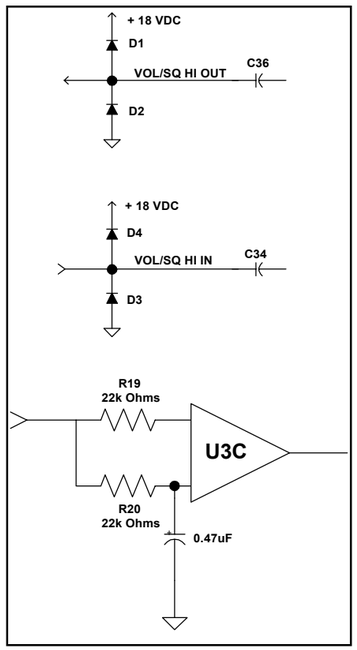


Figure 7 - Current VG-9600 Data Slicer Circuit

SOLUTION

To return the squelch performance to normal, it is necessary to remove the diodes to ground from the circuit and change the data slicer as shown in Figure 8. This new circuit configuration provides the necessary DC bias to pass through the amplifier (supply +8Vdc and ground) regardless of the DC bias on the input signal. The higher values on the series resistors in the data slicer will increase the input impedance of the data slicer. The input impedance shown here is high enough that it will not significantly load the output of the station and degrade the squelch arm signal.

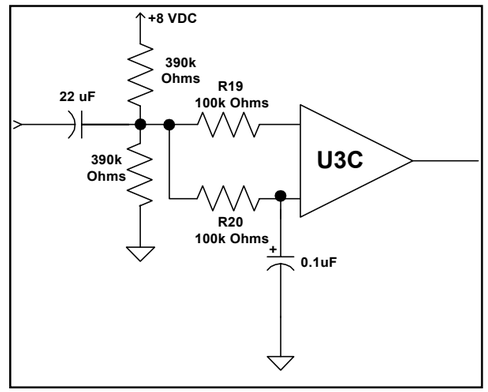


Figure 8 - New Data Slicer Circuit

PROCEDURE

1. Following the Disassembly Procedures provided in this manual gain access to the VG-9600 module Analog *(Audio)* Board 19D437979 by:
   a) Remove outside cover assembly 19D423033.
   b) Remove Logic Board Assembly 19D437827.
2. Replace resistor R19 with a 100k Ohms resistor (H212CRP410C).
3. Replace resistor R20 with a 100 Ohms resistor (H212CRP410C).
4. Replace capacitor C7 with a 0.1 µF capacitor (19A701534P1).
5. Replace diode D3 with a 390k Ohms resistor (H212CRP439C).
6. Replace diode D4 with a 390k Ohms resistor (H212CRP439C).
7. Remove and discard diode D2.
8. Cut printed wire pattern as shown in Figure 9.
9. Cut printed wire pattern as shown in Figure 9.
10. Install a 22µF capacitor (19A701534P8) in the location shown in Figure 9 by:
    a) Remove the solder from two holes on the printed wire board (10).
    b) Insert the 22µF capacitor into the clear holes, being careful to place positive lead "+" nearest resistor R20.
    c) Solder the part into place.
    d) Trim the leads so that there is no protrusion more than 0.060 inches from the bottom of the printed wire board.
11. Install a wire jumper (AWG 30) between the junction of resistors R19 and R20 (Steps 5 and 6 above) and the positive "+" lead of the 22µF capacitor installed in Step 10. Route the jumper with straight lines and smooth bends as shown in Figure 9.
12. Re-assemble the VG-9600 module by reversing the Disassembly Procedure.
13. Apply a black on yellow label "Modified per 350A1557", adjacent to the nameplate on the cover.

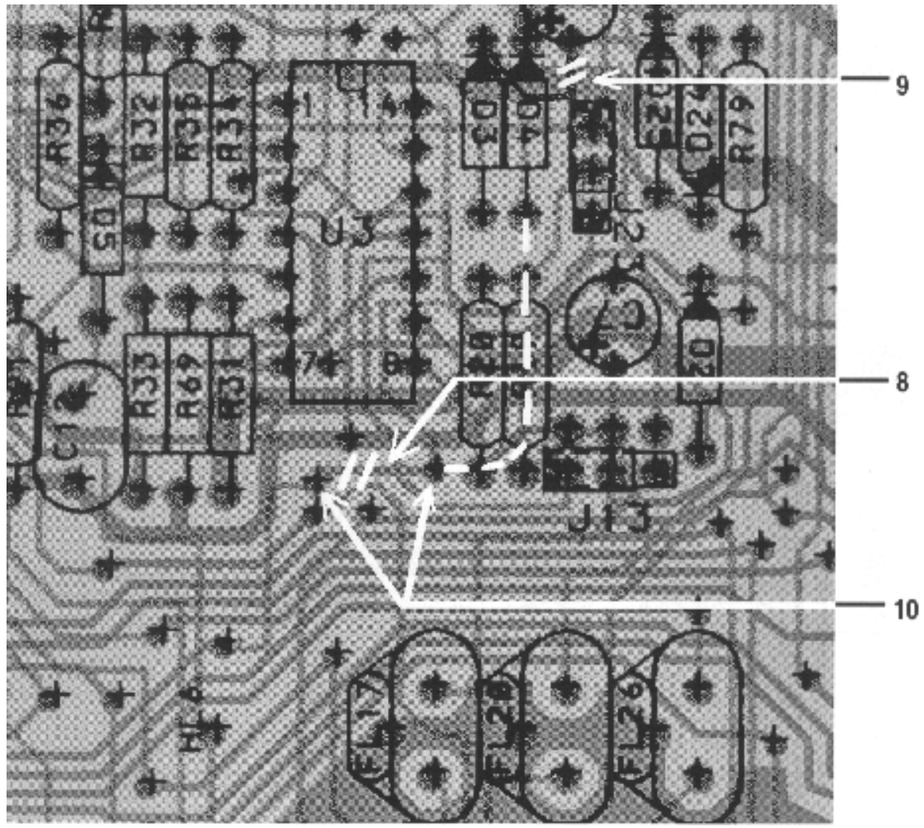


Figure 9 - Analog (Audio) Board 19D437979

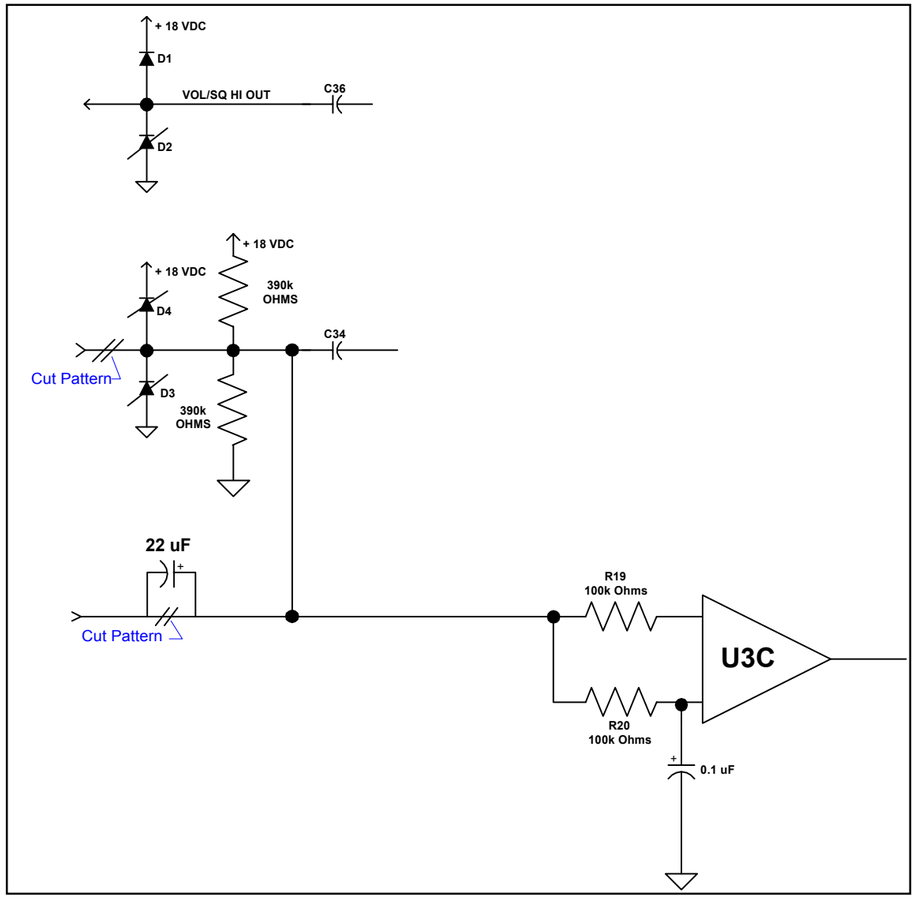


Figure 10 – Schematic Diagram of Modifications

4-PIN CONNECTOR CONNECT TO J9 ON LOGIC BOARD

3-PIN CONNECTOR CONNECTS TO J25 ON ANALOG BOARD

NOTE: CONNECTORS ARE NOT KEYED.
CONNECT PIN 1 TO PIN 1 ON JACKS.

PARTS LIST

REMOTE MODE SELECT CABLE
19B234849G1

ISSUE 2

SYMBOL	GE PART NO.	DESCRIPTION
	19A700041P30	Connector Shell.
	19A700041P29	Connector Shell.
	19A700041P25	Contacts (Quantity 6).
	19A115871P30	Black Wire, 24 Ga.
	19A115871P22	White Wire, 24 Ga.
	19A115871P32	Blue Wire, 24 Ga.

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