MAINTENANCE MANUAL

VOICE GUARD® INTERFACE BOARD 19C852304G1

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DESCRIPTION

Voice Guard® interface board 19C852304G1 is used with the MASTR® III encrypt/decrypt Voice Guard stations. This board is installed on Voice Guard E/D shelf 19C336763G2 and connected to the Voice Guard module and the MASTR III backplane by harness 19B802402P1. Connector J5 on the VG interface board plugs mates with connector P501 on the harness. The board includes the following circuitry:

- high-speed transmit data filter
- high-speed transmit data path switch
- clear and guarded mode indicator lights
- local mode select switch
- keep-alive power supply
- low battery indicator circuit for the keep-alive power supply

CIRCUIT ANALYSIS

HIGH-SPEED TRANSMIT DATA FILTER

The Voice Guard module contains several stages of filtering for the sharp logic transitions of the transmit data from its modem circuits. However, additional filtering is provided by the high-speed data filter on the VG interface board. When the station is transmitting in guarded mode (remote or local), transmit high-speed data from the Voice Guard module is applied to the VG AUDIO HI input at J5 pin 5.

The high-speed data filter circuit is made from op amp stages U1.2, U1.3 and the associated components. Op amp U1.2 forms a unity-gain low-pass filter stage. Capacitor C6 couples the output of this stage (U1.2 pin 7) to the transmit data adjustment potentiometer R8 (labeled "DATA ADJ" on the front panel). Potentiometer R8 is adjusted for ±3.0 kHz digital deviation when the station is transmitting in guarded mode.

The attenuated data signal from the wiper of R8 is applied to buffer stage U1.3. The output of this buffer

stage (U1.3 pin 8) is applied to the high-speed transmit data path switch at U2 pin 2.

HIGH-SPEED TRANSMIT DATA PATH SWITCH

The high-speed transmit data path switch circuit is essentially a digitally-controlled single-pole double-throw switch. This switch allows the MASTR III system module to switch between the Voice Guard module's filtered transmit data during remote and local operation, and the GETC panel's repeat transmit data.

Integrated circuit U2 is a CMOS 4053 triple two-channel analog multiplexer. One multiplexer section of this device is used to provide the SPDT switch action. The Voice Guard module's data is applied to U2 pin 2 and the GETC's data is applied to U2 pin 1 via the GETC DATA line (J5 pin 4).

The REP PTT IN (repeat PTT input) line on J5 pin 8 of the VG interface board is connected to the open-collector REPEAT PTT OUT (repeat PTT output) line of the MASTR III system module. When the station is transmitting in guarded mode (remote or local) the MASTR III system module "floats" this line and no current flows through D3. This action allows R30 and R31 to turn Q1 on, thus pulling the digital input on U2 pin 10 low. With pin 10 low, pin 15 is switched to pin 2 and the Voice Guard module's transmit data is applied to the EXT HSD (external high-speed data) line on J5 pin 6. The data on EXT HSD is routed to the transmit audio processing circuits in the system module and then to station's modulating circuits.

When the station is repeating a Voice Guard signal, the MASTR III system module pulls the REP PTT IN line low (typically less than 0.1 Vdc). This action turns Q1 off and allows R11 to pull U2 pin 10 high (12 Vdc). With pin 10 high, pin 15 is switched to pin 1 and repeat transmit data from the GETC on the GETC DATA line is applied to the EXT HSD line on J5 pin 6. The repeat data on EXT HSD is routed to the transmit audio processing circuits in the system module and then to station's modulating circuits.

MODE INDICATOR LIGHTS

Mode indicator lights labeled "CLEAR" and "GUARD" on the front panel light to indicate the station's transmit mode. Two (2) out-of-phase mode select outputs (open-collector) from the system module drive the Voice Guard module's mode select inputs and the VG interface board's mode select inputs. On the VG interface board, these lines are only used to turn the indicator lights on and off. The selected local mode will be indicated by the mode indicator lights until the station is keyed from the remote controller. During remote keys, the mode indicator lights indicate the selected remote mode.

When the station is in guarded transmit mode, the GRD SEL (guarded select) line on J5 pin 11 is low and the CLR SEL (clear select) line on J5 pin 10 "floats". In this state, transistor Q2 is off and Q3 is on; the "GUARD" indicator LED D11 lights.

When the station is in clear transmit mode, the GRD SEL line "floats" and the CLR SEL line is low. Transistor Q2 is on and Q3 is off; the "CLEAR" indicator LED D10 lights.

LOCAL MODE SELECT SWITCH

Switch S1 on the board is used to select the station's transmit mode (clear or guarded) for local operations. The system module uses its 1950 DIS (1950 Hz disable) input to monitor the position of S1. This momentary-type switch toggles the local mode (clear or guarded) of the station each time it is activated. The selected local mode will be indicated by the mode indicator lights until the station is keyed from the remote controller. During remote keys, the mode indicator lights indicate the selected remote mode.

When the switch is in the normal position (contacts 2 and 3 shorted), a resistor in the system module pulls the 1950 DIS line high. When S1 is switched to the momentary position (contacts 1 and 2 shorted) the 1950 DIS line is pulled low and the system module toggles the local transmit mode of the station. Capacitor C8 provides switch debounce.

KEEP-ALIVE POWER SUPPLY

Two 1.5 volt AA alkaline batteries on the VG interface board form the keep-alive power supply for Voice Guard modules that store the cryptographic key in random-access memory (RAM). This keep-alive power (3.0 Vdc) is applied to J4 pin 7 of the Voice Guard module by J5 pin 3 and the interconnecting harness. Fresh batteries provide up to 1500 hours of memory backup.

LOW BATTERY INDICATOR

The low battery indicator circuit on the board lights LED indicator D1 when the batteries' charge becomes low and replacement is needed. Op amp U1.1 forms a comparator circuit that continuously monitors the batteries' voltage. The voltage divider formed by R2 and R3 applies a 2.1 Vdc reference voltage to the non-inverting (+) input of U1.1 and the op amp samples the voltage of the batteries by R4 and its inverting (-) input. If the sampled voltage falls below the 2.1 Vdc reference voltage, U1.1 pin 1 will transition high (12 Vdc) and LED D1 will turn on.

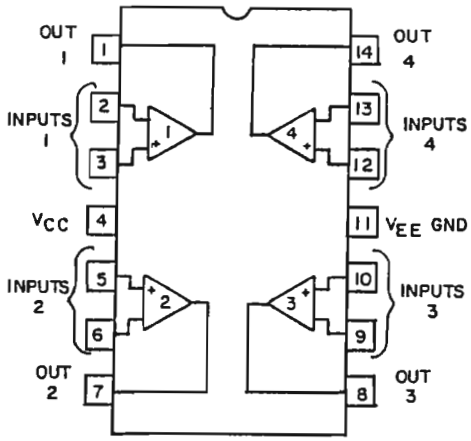
VG INTERFACE BOARD
19C852304G1

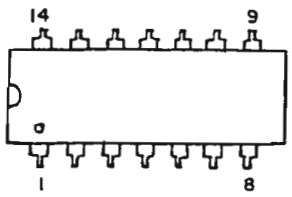
ISSUE 1

SYMBOL	PART NUMBER	DESCRIPTION
		——— CAPACITORS ———
C1 and C2	T644ACP347K	Polyester: .047 µF ±10%, 50 VDCW.
C3	T644ACP210J	Polyester: .001 µF ±5%, 50 VDCW.
C4	T644ACP310J	Polyester: .01 µF ±5%, 50 VDCW.
C6	19A701534P7	Tantalum: 10 µF ±20%, 16 VDCW.
C7	T644ACP210J	Polyester: .001 µF ±5%, 50 VDCW.
C8	19A701534P7	Tantalum: 10 µF ±20%, 16 VDCW.
C20 and C21	T644ACP210J	Polyester: .001 µF ±5%, 50 VDCW.
		——— DIODES ———
D1	19A703595P10	Optoelectric: Red LED; sim to HP HLMP-1301-010.
D2 and D3	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D5 and D6	19A700028P1	Silicon: 75 mA, 75 PIV; sim to 1N4148.
D10 and D11	19A703595P10	Optoelectric: Red, LED; sim to HP HLMP-1301-010.
		——— JACKS ———
J5	19A704852P146	Connector, header: 16-pin, right-angle mount; sim to Molex 22-12-2164.
		——— TRANSISTORS ———
Q1 thru Q3	19A700023P2	Silicon, NPN: sim to 2N3904.
		——— RESISTORS ———
R1	H212CRP168C	Deposited carbon: 680 ohms ±5%, 1/4 w.
R2	H212CRP339C	Deposited carbon: 39K ohms ±5%, 1/4 w.
R3	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R4	H212CRP347C	Deposited carbon: 47K ohms ±5%, 1/4 w.
R5	19A701537P1	Composition: 10M ohms ±5%, 1/4 w.
R6	19A701250P322	Metal film: 16.5K ohms ±1%, 1/4 w.
R7	19A701250P210	Metal film: 1240 ohms ±1%, 1/4 w.
R8	19A700109P8	Variable: 10K ohms ±20%, 1/4 w.
R9	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R11	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R12	H212CRP410C	Deposited carbon: 100K ohms ±5%, 1/4 w.
R22 and R23	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R30 and R31	H212CRP318C	Deposited carbon: 18K ohms ±5%, 1/4 w.
R32	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
R40 thru R43	H212CRP318C	Deposited carbon: 18K ohms ±5%, 1/4 w.
R44 and R45	H212CRP310C	Deposited carbon: 10K ohms ±5%, 1/4 w.
		——— SWITCHES ———
S1	19A705959P2	Toggle, SPDT: right-angle mount; sim to C&K T108-M-H9-AV-B-E.
		—— INTEGRATED CIRCUITS ——
U1	19A704883P1	Linear: Quad Op Amp; sim to MC3303P.
U2	19A700029P38	Digital: CMOS Triple 2-Channel Multiplexer.
		—— BATTERY HOLDERS ———
XBT1	19A703247P2	Holder, battery: two "AA" style; sim to Keystone 2223.

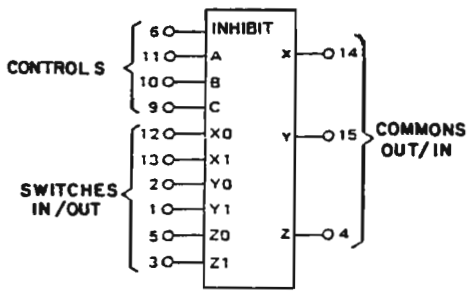
★ COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

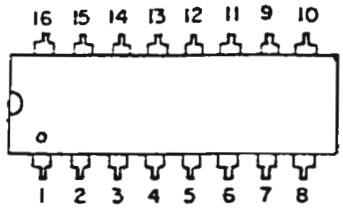
U1
QUAD OPERATIONAL AMPLIFIER
19A704883P1





U2
TRIPLE 2-CHANNEL MULTIPLEXER
19A700029P38



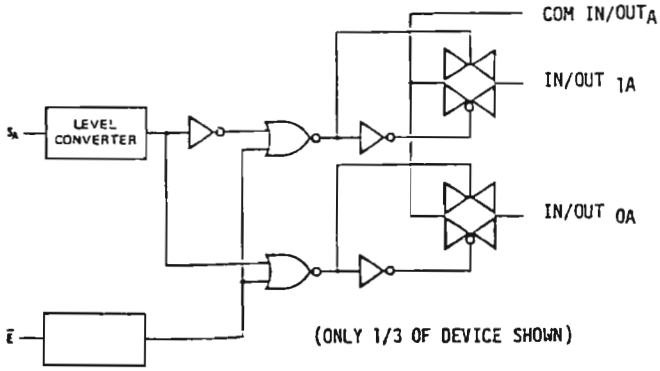


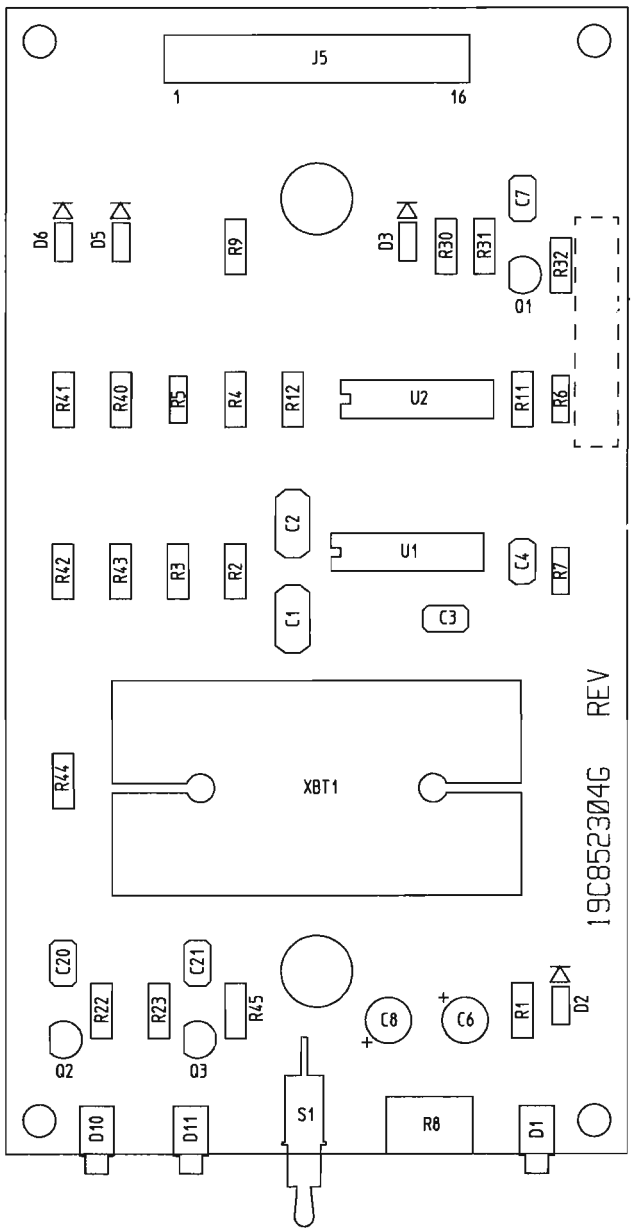
TRUTH TABLE

CONTROL INPUTS				ON-SWITCHES		
	SELECT					
INHIBIT	C	B	A			
0	0	0	0	Z0	Y0	X0
0	0	0	1	Z0	Y0	X1
0	0	1	0	Z0	Y1	X0
0	0	1	1	Z0	Y1	X1
0	1	0	0	Z1	Y0	X0
0	1	0	1	Z1	Y0	X1
0	1	1	0	Z1	Y1	X0
0	1	1	1	Z1	Y1	X1
1	x	x	x	NONE		

X = DON'T CARE

BLOCK DIAGRAM

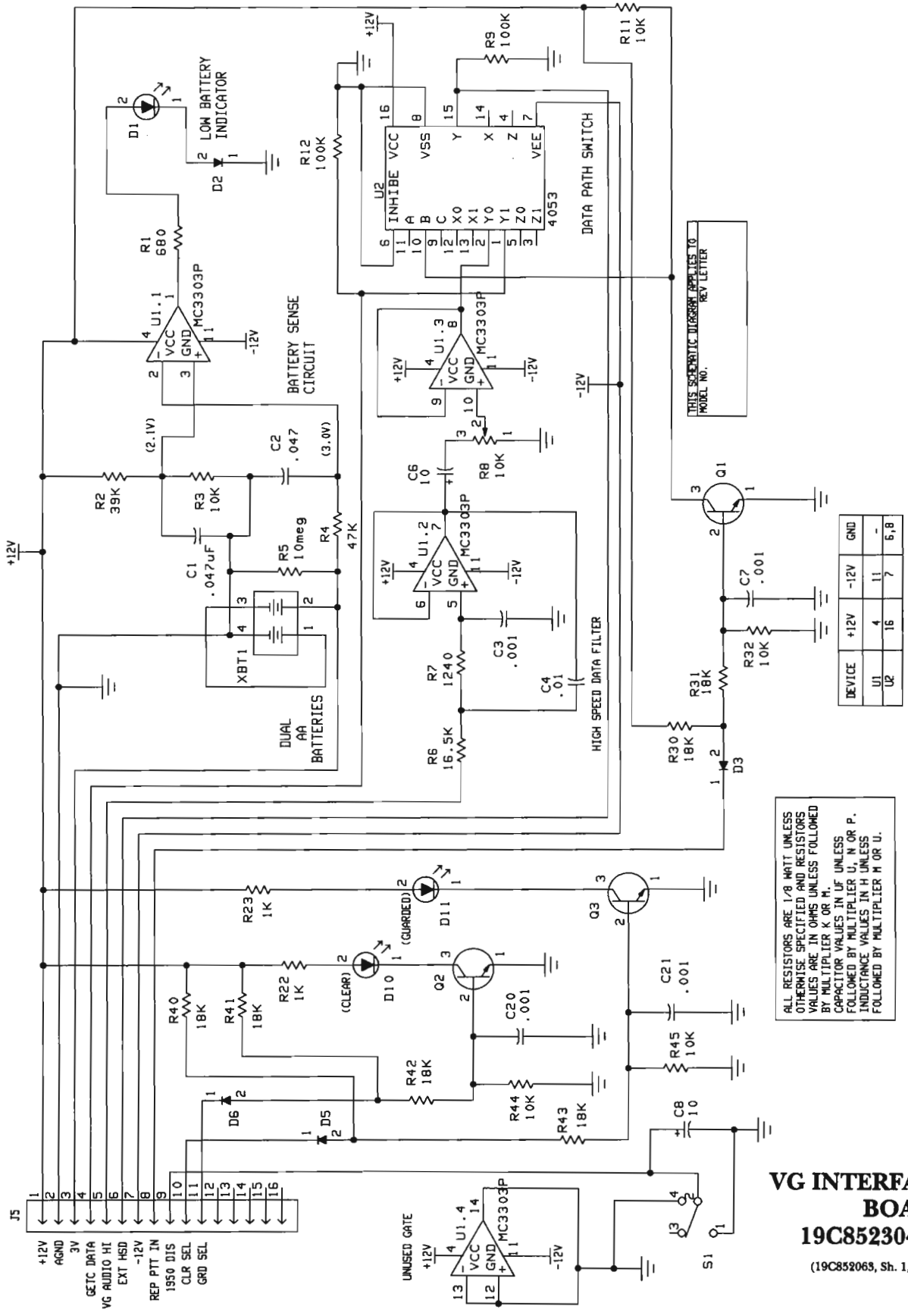




VG INTERFACE BOARD
19C852304G1

(19C852304, Sh. 1, Rev. 2)
(19D905162, Sh. 1, Rev. 2)
(19D905162, Sh. 2, Rev. 2)

CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES


VG INTERFACE BOARD
19C852304G1
(19C852063, Sh. 1, Rev. 2)
LOW BATTERY INDICATOR
BATTERY SENSE CIRCUIT
DUAL AA BATTERIES
DATA PATH SWITCH
HIGH SPEED DATA FILTER
UNUSED GATE
ALL RESISTORS ARE 1/8 WATT UNLESS OTHERWISE SPECIFIED AND RESISTORS VALUES ARE IN OHMS UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN UF UNLESS FOLLOWED BY MULTIPLIER U, N OR P.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M OR U.
THIS SCHEMATIC DIAGRAM APPLIES TO MODEL NO. REV LETTER
DEVICE | +12V | -12V | GND
U1 | 4 | 11 | -
U2 | 16 | 7 | 6,8
+12V
AGND
3V
GETC DATA
VG AUDIO HI
EXT HSD
-12V
REP PTT IN
1950 DIS
CLR SEL
GRD SEL
(GUARDED)
(CLEAR)
(2.1V)
(3.0V)

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