MAINTENANCE MANUAL

LOGIC BOARD 19D900253G1-4

## DESCRIPTION

The logic board controls the operation of the radio. It generates all timing functions, selects and generates all tones, selects operating frequencies and controls display data as well as certain maintenance functions. It contains the microprocessor, personality PROM, tone encoder/decoder and voice/tone reject filter.

The logic board is mounted in the top section of the chassis just above the synthesizer/interconnect board.

## CIRCUIT ANALYSIS

### MICROPROCESSOR INITIALIZATION/RESET

The microprocessor initialization and reset circuitry consists of D2453 and D2454, Q2453-Q2455, Q2451 and the watchdog timer U2452. It is reset during initial power up, under low voltage conditions and by the watchdog timer if the microprocessor does not generate programmed resets for any reason.

When the radio is turned on, Q2454 and Q2453 turn on, preventing thyristor Q2455 from firing. Reset capacitor C2453 charges through R2486, biasing reset transistor Q2451 on and resetting the microprocessor. When C2453 is sufficiently charged, Q2451 turns off, thereby terminating the reset pulse.

When the battery voltage falls below a predetermined level (as it might when starting the vehicle) D2454 ceases conduction, turning Q2453 off, allowing thyristor Q2455 to fire and quickly discharge C2453. So long as Q2453 is off, thyristor Q2455 is effectively a forward biased diode which prevents C2453 from charging and allows Q2451 to turn on. Q2451 applies a continuous reset pulse to the microprocessor during the low voltage condition. When the voltage rises above the predetermined level Q2453 again conducts, turning Q2455 off and allowing C2453 to charge. The reset pulse persists for a short time after full power is restored.

### WATCHDOG TIMER

The watchdog timer, U2452, is a digital counter which monitors microprocessor operation and generates a reset pulse in the abnormal condition that the microprocessor gets "lost" or does not execute the software properly. Inputs to the watchdog timer consist of the ALE (crystal frequency 15) clock and programmed reset pulses from the microprocessor. If the watchdog timer does not receive programmed reset pulses at specified intervals, it times out and applies a 34 millisecond pulse to the base of reset transistor Q2451. The watchdog reset will normally restore the processor to proper operation so that only one pulse will occur. In the event that watchdog reset pulses do not reach the timer, a square wave of approximately 14.6 Hz will appear at the microprocessor $\overline{\text{RESET}}$ line.

### MICROPROCESSOR

The microprocessor controls the operation of the radio by performing the following major functions:

- System Timing
- Frequency Selection
- Mode Selection
- Tone Selection and Sequencing
- Transmit/Receive Control
- Alert Tone Sequencing
- Status Display
- Audio Routing and Mute Control
- Volume Control (CLASSIC Models Only)
- Response to Operator Controls
- Integration of Tone Detector Output
- Maintenance Functions

Communication with the radio is through a 4-bit I/O expander bus P20-P23.

**GENERAL ELECTRIC**

This bus interchanges data with the I/O expanders on the system/interconnect board through P2401. Data presented to the I/O expanders are identified by the microprocessor PROM output. A high to low transition indicates address and control information is present. A low to high transition indicates data are present. The I/O bus also addresses the personality PROM when data stored in the PROM is needed for processing.

The microprocessor is sequenced through its program by an internal oscillator whose frequency is set by crystal Y2451. The oscillator frequency is 3.579545 MHz.

The call monitor (incorporated by software) option allows the operator to replace his MIC on-hook during a call and monitor the remaining conversation. Replacing the MIC on-hook will not disconnect or clear the radio off the channel.

The area select receiver scan option (incorporated by software) allows the radio to search only those channels that are contained within the area selected for receiving calls. THIS OPTION IS MANDATORY IF MORE THAN 20 CHANNELS ARE ORDERED.

TONE ENCODER/DECODER

Tone encoder/decoder AR1 generates all signaling and alert tones as well as detecting incoming tones from the VOL/SQ HI input. It receives serial digital data from the microprocessor to set the frequency and Q of the internal tone detector. The encoder/decoder is a specialized custom microprocessor which uses the output of clock shaper U2456 to generate and detect the desired tones. A 15-bit data word which determines tone frequency and tone detector Q is transferred by the microprocessor from the PROM to the tone encoder/decoder in less than 1 millisecond.

The tone output is applied to alert tone select switch U2455-A and to the transmitter audio processor through tone deviation adjust potentiometer R2471 and P2402-4. Tone deviation is set for 1 kHz for the attenuated busy tone. All other tone deviations are 2-5 kHz deviation. A burst of unattenuated busy tone is transmitted on an idle channel to acquire the repeater.* When the channel is acquired, signaling tones are transmitted through the repeater to other radios. After the call initialization sequence, the radio transmits attenuated busy tone in accompaniment to each transmission, to hold the repeater up. Between transmissions, the radio monitors the channel for busy tone for assurance that the channel is still active.

The repeater transmits busy tone continuously when it is active, indicating that the channel is in use.

Busy tone transmitted in accompaniment to voice traffic is attenuated by tone attenuation switch U2453-C and voltage divider R2466 and R2467 under control of the microprocessor. A low applied to Pin 15 (tone attenuator output) and thus to U2453-C. This inserts R2467 into the circuit reducing the deviation of the transmitted busy tone to 1 kHz.

Alert tones are applied to the Filtered VOL/SQ HI line through alert tone select switch U2455-A and audio mute switch U2455-B under microprocessor control.

VOICE/TONE REJECT FILTER

The voice/tone reject filter, AR2, forms a part of the received audio path. The function of the voice/tone reject filter is to remove the busy tone from the recovered audio, allowing only the voice frequencies to be heard on the speaker, and to attenuate voice frequencies in the signal applied to the tone decoder to keep voice energy from interfering with detection of busy tone.

One of two voice/tone reject filters may be used. The Group 1 filter is used in radios operating with the standard busy tone of 3051.9 Hz. The Group 2 filter is used when radios operating with the alternate busy tone of 2918.7 Hz.

Voice frequencies pass through the tone reject filter and are applied to alert tone select switch U2455-A through AR2 pin 5. The busy tone frequency passes through the voice reject filter and is applied to filter select switch U2455-C through AR2 pin 3.

TONE/AUDIO CONTROL SWITCH

Tone/audio control switch U2455 is a triple bilateral switch with each station operating independently of the others, under control of the microprocessor.

Filter select switch U2455-C selects the tone path for the decoder. When the microprocessor is looking for signaling tones (collect, group, acquisition, etc) the tone path is completed through U2455-C pins 13 and 14. The select lead (pin 11) is high. Any time the microprocessor is looking for a busy tone (during channel acquisition or between voice transmissions after a channel has been acquired), the tone path is completed from the voice/tone reject filter through pins 12 and 14. The select lead is low.

The alert tone select switch U2455-A selects received audio or alert tones from the tone encoder. To sound alert tones,

* The repeater, in response transmits acquisition tone back to the mobile.

the select line (pin 10) is high and the tone path is completed through pins 1 and 15 of U2455-A. During voice communications (ready mode), the select lead is low and the received audio path through the voice/tone reject filter is completed through U2455-A pins 2 and 15.

Audio mute switch U2455-B completes the audio path from switch U2455-A to the audio amplifier on the transmit/receive board. The select lead (pin 9) is high when the audio is muted.

## VOLTAGE TRANSLATION

Voltage translation between the 8.5 VDC used by IC U2455 and the microprocessor is provided by Q2456-Q2458. When the transistors are turned on, the voltage applied to the microprocessor is limited by the 5 VDC present at the base of the transistor. The transitors act as non-inverting buffers between the microprocessor and the analog switches of U2455.

## CLOCK SHAPER

Clock shaper U2456 is a monostable multivibrator that receives an asymmetric clock input from ALE of the microprocessor, and provides a square wave with a duty cycle of approximately 50% to the tone encoder/decoder.

## CALL INDICATOR

The call indicator is controlled by the microprocessor and is turned on when selected calls are received. A separate output is provided by P2401-7 for use in the GE-MARC V™ CLASSIC model radio.

## OPTION SELECT SWITCHES

The Option Select switches cause the microprocessor to select the desired function. Alternate input lines used in some radios are provided through J2401-8 and 9.

## MEMORY SUPPLY

The memory supply U2457 provides continuous +5 volts to the microprocessor U2451-26. This allows the radio to remember group, area, or volume settings when the radio is turned off. Should the supply be interrupted, the radio will revert to group 1, area 1, and the volume will be set to level 4. The typical current drain for this feature is 20 mA continuous.

## PERSONALITY PROM

The 32X8 personality PROM U2454 contains 32 eight bit locations in which are stored information that identify the system operating parameters, tones, options, etc., present in the radio. The selection or non-selection of options and pertinent timing cannot be changed without replacing the personality PROM with a new one programmed with the desired options. Information stored in the personality PROM consist of:
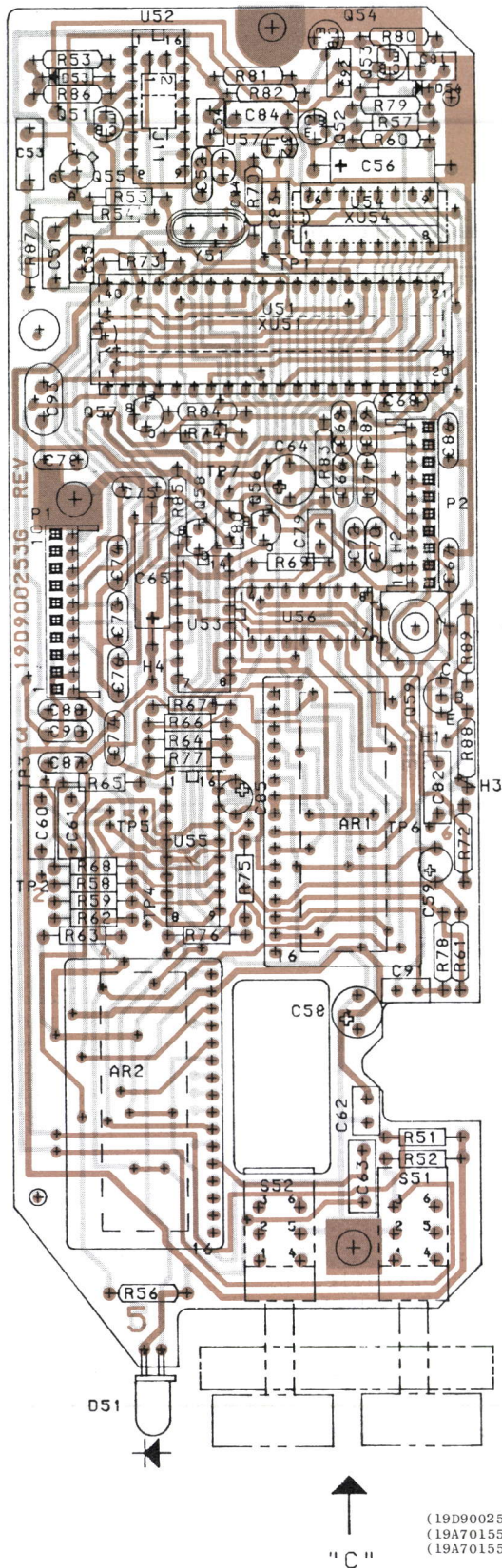
- Tone Signaling Frequencies
- Main System Timing
- Fade Margin Timing
- External Alarm Option (all Tones Called or Individual Call)
- Call Light Option
- Alert Tone Format Option
- Group Selection Option Format
- Area Select Option Format
- Call Monitor Option
- RF Channel Addresses
- Carrier Control Timer
- Model Identification
- Voter Compatibility Option
- Control Station Operation

When data stored in the PROM is required, the microprocessor addresses the PROM via the I/O data bus on address inputs A0-A4. The 8-bit binary code stored in the addressed location is then presented in parallel to the microprocessor. Data from the PROM is identified as data bits DB0-DB7 and is entered through pins 12-19 of the microprocessor.

The personality PROM is turned on only when information is requested. Power to the PROM is controlled by the microprocessor from the RD output. When $\overline{RD}$ is high, PROM select transistor Q2452 is turned on applying +5 VDC to the VCC input of the PROM. When the $\overline{RD}$ output is low, Q2452 is turned off and the power is removed.
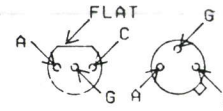
LEAD IDENTIFICATION
FOR Q55

OR

IN-LINE    TRIANGULAR
TOP VIEW

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

LEAD IDENTIFICATION
FOR Q51 THRU Q54,Q56,Q57&Q58
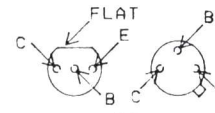
OR

IN-LINE    TRIANGULAR
TOP VIEW

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

LEAD IDENTIFICATION
FOR Q59
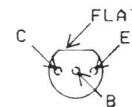
IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING
FACTOR FOR LEAD IDENTIFICATION.

### CAUTION
**OBSERVE PRECAUTIONS
FOR HANDLING**
**ELECTROSTATIC
SENSITIVE
DEVICES**
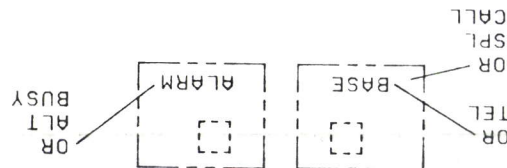
VIEW IN DIRECTION OF ARROW "C"

"C"

(19D900254, Rev. 7)
(19A701553, Sh. 1, Rev. 5)
(19A701553, Sh. 2, Rev. 5)
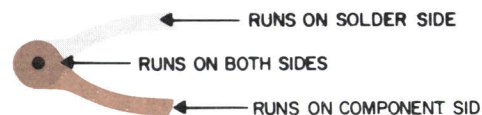
# OUTLINE DIAGRAM

## LOGIC BOARD

4          Issue 4

RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

RUNS ON COMPONENT SID

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER k OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ,n OR P.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.

NOTES:

⚠1 PRESENT IN GROUP 1 AND 3 ONLY.

⚠2 CMOS ANALOG SWITCHES
SHOWN WITH CONTROL LEAD
IN HIGH STATE.

**POWER & GROUND CONNECTIONS**

| DEVICE | +5V PIN NO. | +8.5V PIN NO. | GROUND PIN NO. |
|--------|-------------|---------------|----------------|
| U2453 | 14 | | 7 |
| U2455 | | 16 | 6,7,8 |
| U2456 | 14 | | 3,4,7 |

| MODEL NO. | IDENTIFICATION | REV. LETTER |
|-----------|----------------|-------------|
| PL19D900253G1 | CENTURA/CORONA | G |
| PL19D900253G2 | CLASSIC | G |
| PL19D900253G3 | CENTURA/CORONA | C |
| PL19D900253G4 | CLASSIC | C |

SCHEMATIC DIAGRAM

LOGIC BOARD

**PARTS LIST**

LOGIC BOARD
19D900253G1 - REV H
19D900253G2 - REV H
19D900253G3 - REV D
19D900253G4 - REV D
ISSUE 5

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| AR1 | 19D900246G3 | Integrated circuit: Tone Encoder/Decoder Hybrid. |
| AR2A | 19D900244G1 | Integrated circuit: Voice/Tone Reject Filter: 3051.9 Hz. |
| AR2B | 19D900244G2 | Integrated circuit: Voice/Tone Reject Filter: 2918.7 Hz. |
| | | - - - - - - - - CAPACITORS - - - - - - - - - |
| C2451 | 19A700004P2 | Metallized polyester: 0.1 uF ±10%, 63 VDCW. |
| C2452 | 19A700002P17 | Ceramic disc: 22 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2453 | 19A700004P2 | Metallized polyester: 0.1 uF ±10%, 63 VDCW. |
| C2454 | 19A700005P7 | Polyester: 0.01 uF ±10%, 50 VDCW. |
| C2455 | 19A700005P1 | Polyester: 1000 pF ±10%, 50 VDCW. |
| C2456 | 19B200240P19 | Tantalum: 100 uF ±20%, 6 VDCW. |
| C2458 | 19A701534P8 | Tantalum: 0.47 uF ±20%, 35 VDCW. |
| C2459 | 19A701534P4 | Tantalum: 1 uF ±20%, 35 VDCW. |
| C2460 and C2461 | 19A700004P2 | Metallized polyester: 0.1 uF ±10%, 63 VDCW. |
| C2462 | 19A700005P7 | Polyester: 0.01 uF ±10%, 50 VDCW. |
| C2463 | 19A700004P2 | Metallized polyester: 0.1 uF ±10%, 63 VDCW. |
| C2464 | 19A701534P8 | Tantalum: 0.47 uF ±20%, 35 VDCW. |
| C2465 | 19B200240P19 | Tantalum: 100 uF ±20%, 6 VDCW. |
| C2466 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2467 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2468 and C2469 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2470 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2471 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2472 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2473 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2474 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2475 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2476 and C2477 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2478 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2479 | 19A700005P1 | Polyester: 1000 pF ±10%, 50 VDCW. |
| C2480 and C2481 | 19A700005P7 | Polyester: 0.01 uF ±10%, 50 VDCW. |
| C2482 thru C2484 | 19A700004P2 | Metallized polyester: 0.1 uF ±10%, 63 VDCW. |
| C2485 | 19A701534P4 | Tantalum: 1 uF ±20%, 35 VDCW. |
| C2486 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2487 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2488 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |
| C2489 | 19A700002P16 | Ceramic disc: 18 pF ±5%, 50 VDCW, temp coef -150 +60 PPM. |
| C2490 | 19A700235P16 | Ceramic: 18 pF ±5%, 50 VDCW. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| C2491 and C2492 | 19A700005P1 | Polyester: 1000 pF ±10%, 50 VDCW. |
| C2493 | 19A700005P11 | Polyester: 0.047 uF ±10%, 50 VDCW. |
| C2494 | 19A700002P13 | Ceramic disc: 10 pF ±5%, 50 VDCW, temp coef -150+60 PPM. |
| | | - - - - - - - - - - DIODES - - - - - - - - - - |
| D2451 | 19A134354P1 | Diode, optoelectronic: red; sim to Hew. Packard 5082-4655. |
| D2453 | 19A700028P1 | Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148. |
| D2454 | 19A700025P6 | Silicon, zener: 400 mW max; sim to BZX55-C5V1. |
| | | - - - - - - - - - - - PLUGS - - - - - - - - - - - |
| P2401 and P2402 | 19A700041P59 | Connector, printed wiring: sim to Molex 22-02-2101. |
| | | - - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q2451 | 19A700023P1 | Silicon, NPN; sim to Type 2N3904. |
| Q2452 | 19A134960P1 | Silicon, PNP; sim to Type 2N4403. |
| Q2453 and Q2454 | 19A700023P1 | Silicon, NPN; sim to Type 2N3904. |
| Q2455 | 19A116642P1 | Thyristor, silicon controlled; sim to Type 2N5064. |
| Q2456 thru Q2459 | 19A700023P1 | Silicon, NPN; sim to Type 2N3904. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R2451 and R2452 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2453 and R2454 | 19A700019P61 | Deposited carbon: 0.1M ohms ±5%, 1/4 w. |
| R2455 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2456 | 19A700019P33 | Deposited carbon: 470 ohms ±5%, 1/4 w. |
| R2457 | 19A700019P41 | Deposited carbon: 2.2K ohms ±5%, 1/4 w. |
| R2458 and R2459 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2460 | 19A700019P33 | Deposited carbon: 470 ohms ±5%, 1/4 w. |
| R2461 thru R2463 | 19A700019P61 | Deposited carbon: 0.1M ohms ±5%, 1/4 w. |
| R2464 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2465 | 19A700019P42 | Deposited carbon: 2.7K ohms ±5%, 1/4 w. |
| R2466 and R2467 | 19A700019P43 | Deposited carbon: 3.3K ohms ±5%, 1/4 w. |
| R2468 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2469 | 19A701250P249 | Metal film: 3.16K ohms ±1%, 1/4 w. |
| R2470 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2471 | 19A800784P208 | Variable: 10K ohms ±20%, 1/2 w; sim to Murata Type RVG0911V328. |
| R2472 thru R2474 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2475 and R2476 | 19A700019P37 | Deposited carbon: 1K ohms ±5%, 1/4 w. |
| R2477 | 19A700019P42 | Deposited carbon: 2.7K ohms ±5%, 1/4 w. |
| R2478 | 19A700019P61 | Deposited carbon: 0.1M ohms ±5%, 1/4 w. |
| R2479 | 19A700019P34 | Deposited carbon: 560 ohms ±5%, 1/4 w. |
| R2480 | 19A700019P29 | Deposited carbon: 220 ohms ±5%, 1/4 w. |
| R2481 | 19A700019P57 | Deposited carbon: 47K ohms ±5%, 1/4 w. |
| R2482 | 19A700019P51 | Deposited carbon: 15K ohms ±5%, 1/4 w. |
| R2483 thru R2485 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| R2486 | 19A700019P61 | Deposited carbon: 0.1M ohms ±5%, 1/4 w. |
| R2487 | 19A700019P51 | Deposited carbon: 15K ohms ±5%, 1/4 w. |
| R2488 | 19A700019P49 | Deposited carbon: 10K ohms ±5%, 1/4 w. |
| R2489 | 19A700019P48 | Deposited carbon: 8.2K ohms ±5%, 1/4 w. |
| | | - - - - - - - - - TEST POINTS - - - - - - - - |
| TP2401 thru TP2407 | 19A701622P1 | Cotter pin. |
| | | - - - - - - - INTEGRATED CIRCUITS - - - - - - - |
| U2451 | 19J706206P5 | Digital: SINGLE CHIP 8-BIT MICROCOMPUTER; sim to Intel D 8049H. |
| U2452 | 19A700029P14 | Digital: 14-STAGE BINARY RIPPLE COUNTER. |
| U2453 | 19A116180P256 | Digital: HEX BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH VOLTAGE OUTPUT. |
| U2455 | 19A700029P38 | DIGITAL: TRIPLE 2-CHANNEL MULTIPLEXER. |
| U2456 | 19A116180P30 | DIGITAL: MONOSTABLE MULTIVIBRATOR. |
| U2457 | 19J706031P1 | LINEAR: POSITIVE VOLTAGE REGULATOR. |
| | | - - - - - - - - - - SOCKETS - - - - - - - - - - |
| XU2451 | 19A700156P5 | Socket, integrated circuit: 40 contacts; sim to Augat 340-AG39D. |
| XU2454 | 19A700156P9 | Socket, integrated circuit: 16 contacts; sim to Burndy DILB14-P108. |
| | | - - - - - - - - - - CRYSTALS - - - - - - - - - - |
| Y2451 | 19A702511G1 | Quartz: Frequency 3.579545 MHz. |
| | | ASSOCIATED PARTS |
| S2451 | 19A143490G3 | Switch Kit: (BASE/TEL). |
| S2451 | 19A143490G2 | Switch Kit: (EXTERNAL ALARM). |
| | | - - - - - - - - INTEGRATED CIRCUITS - - - - - - - |

NOTE: When reordering Personality PROM include complete combination number, structured options, and the Personality PROM worksheet.

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| U2454 | 19A701923G2 | Integrated circuit: (PERSONALITY PROM). |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - - |
| | 19A701516P1 | Insulator, plate. (Used with Y2451). |
| | 19A701235P2 | Spacer. (Quantity 2). |

## 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 - Logic Board 19D900253G1, G2, G3, G4
To reduce level of alert tones. Changed R2464. R2464 was: 19A700019P45, Deposited carbon: 4.7K ohms ±5%, 0.25W.

REV. B - To improve operation by reducing level of GE-MARC V tones. Changed R2467. R2467 Was: 19A700019P39, Deposited carbon: 1.5K ohms ±5%, 0.25 W.

REV. C - To stop self falsing under strong RF Carrier conditions. Added Q2459, R2488 and R2489.

REV. D - Logic Board 19D900252G1, G2
To increase the deviation to provide compatibility with GE-MARC V MASTR Executive II Radios. Changed R2467. R2467 was: 19A700019P43, Deposited carbon: 3.3 ohms ±5%, 0.25 W.

REV. E - To center the duty cycle of the clock shaper circuit around 50%. Changed R2469. R2469 was: 19A701250P253 Metal film: 3.48 ohms ±1% 1/4W.

REV. F - To improve random channel access. Change microcomputer U2451. U2451 was: 19A706206P4 Digital: SINGLE CHIP 8-BIT MICROCOMPUTER.

REV. G - To make clock circuit compatable with new processor. Added C2494.

REV. H - Logic Board 19D900253G1, G2

REV. D - Logic Board 19D900253G3, G4
To improve operation. Changed R2467 from 2.7K ohms to 3.3K ohms and deleted R2456 and D2451. Old part number was: R2467 - 19A700019P43 Deposited carbon: 2.7K ohms ± 5%, ¼ W.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES