



MAINTENANCE MANUAL
LOGIC BOARD 19D901690G4
FOR MVS

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DESCRIPTION

The Logic Board (A1) controls the main operation of the MVS radio.

It is located in the bottom of the frame assembly underneath the Audio Board. Refer to the combination manual for a complete mechanical layout of the board. Figure 1 provides a Block Diagram of the Logic Board. Refer to the Table of Contents in this publication for IC data sheets with pinout information on integrated circuits and modules.

The Logic Board contains a microprocessor and associated memory circuits which include an EPROM for controlling the processor and a programmable "personality" EEPROM to store customer frequencies, tones and options. Programmable data is entered using an IBM compatible personal computer and a RS-232 interface. Refer to the programming manual for programming instructions.

CIRCUIT ANALYSIS

MICROPROCESSOR

Microprocessor U701 is an 8-bit processor that performs the logic functions to provide the control signals required in the radio. An external 11.0592 MHz crystal (Y701)

is used for the clock. The microprocessor controls the following:

- Synthesizer
- Transmit circuit
- Decoding of Channel Guard (tone or digital) and Type 99 tones
- Generation of Channel Guard (tone or digital)
- Transmitter and receiver audio mute gates.

Serial data at a 300 baud rate is used for communication between the microprocessor and the Front Cap Assembly. U701 uses the KEYPAD SERIAL line to receive Control Panel commands from the microprocessor in the Front Cap Assembly. U701 sends data back on the DISPLAY SERIAL line to update the LCD. Both serial lines normally rest at 5 volts with the data causing the lines to go low.

Diodes D701-D708 on $\overline{\text{PTT}}$, the serial lines, and AUDIO MUTE protect the microprocessor from static discharges. These lines are pulled high to +5 volts through 50K ohm resistors inside the microprocessor.

ERASABLE PROM (EPROM)

EPROM U703 is a CMOS 8K byte device with an internal address latch. All information required by the microprocessor for system operation resides in this EPROM.

ELECTRICALLY ERASABLE PROM (EEPROM)

EEPROM U704 is a 512 x 8-bit memory device, designated the "personality" PROM. This personality PROM stores all required customer information which includes: Frequencies, Tones, and Options. The EEPROM also retains the status of all radio functions (channel selection, volume setting, scan channel list, and scan on-off function) to return the radio to the same mode of operation after power is turned off or removed from the radio.

The EEPROM can be conveniently programmed without any need for opening up the radio. This is accomplished through the microphone jack (J725). The serial data is routed through the Control Board to the EEPROM on the Logic Board.

For an optional 128 channel radio, U704 is replaced with a larger memory (2048 x 8-bit) EEPROM device (19A705553P1).

LATCH

Latch U702 is a CMOS, 3-state, non-inverting, D type flip-flop with the following functions.

- To activate the band switch on the RF Board (if used).
- To function as a digital-to-analog converter (DAC) by generating sine wave signalling tones using resistor network R704.
- To activate the FAST SQUELCH on the Audio Board.
- To activate the low pass filter bypass on the Audio Board when Type 99 tone signalling is used.

RELAY

The relay circuit consists of NPN buffer transistor Q701 and NPN relay driver transistor Q702. The relay is activated by the microprocessor when a Type 99 call is received, or when the public address option is enabled and the mic PTT is keyed. The circuit is capable of handling up to 150 milliamperes from an externally connected relay coil.

VOLTAGE REGULATOR

Voltage regulator U705 supplies a regulated +5 VDC to the microprocessor, the EPROM, the EEPROM and the latch circuit. A reset circuit is built into U705 to provide the microprocessor with a reset signal required during its power-up routine. A +8 volts regulated DC is supplied to regulator U705 from the 8 volt regulator U102, located on the RF Board.

BATTERY VOLTAGE FILTER

Transistor Q703 is a filter circuit for the switched A+ battery voltage. This circuit is used to reduce "alternator whine" interference. SW A+ filtered (13 volts) is used on the Audio Board.

CAUTION

The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, the serviceman should discharge himself by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering iron should also have a 3-prong power cord connected to an outlet with a known good earth ground. A battery operated soldering iron may be used in place of the regular soldering iron.

SERVICE NOTES

If a faulty Logic Board is suspected it may be useful to confirm this by substitution of a known good board.

DC CHECKS

Power for the Logic Board is supplied by the 8 volts on J702, Pin 3. This comes from the transmitter regulator U102.

1. Check for +5 volts ± 0.25 volts on U705, Pin 5.
2. Check Power-On Reset on U701, Pin 9 (see Figure 2). If not present, check regulator U705, Pin 2 and transistor Q704.

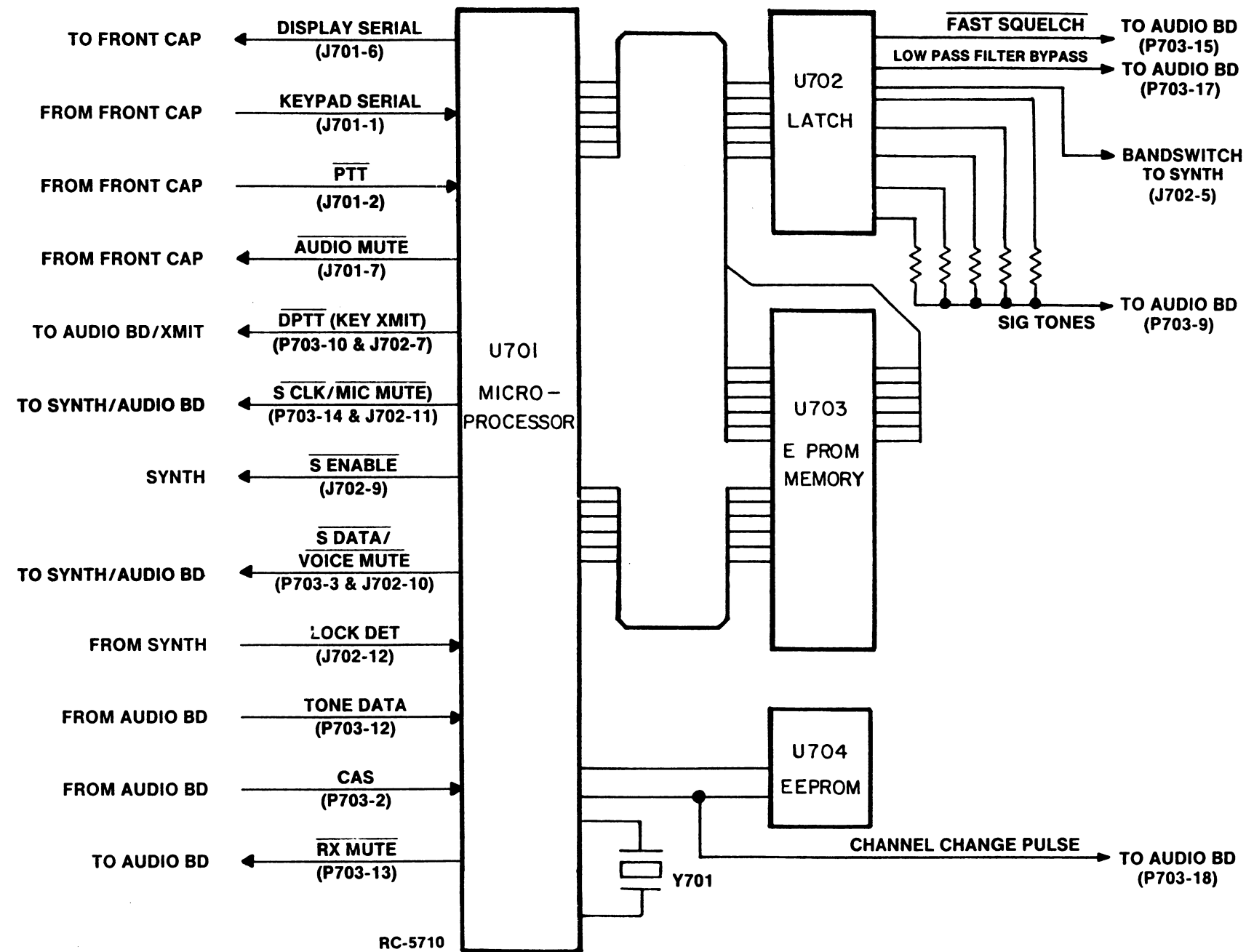


FIGURE 1 - BLOCK DIAGRAM

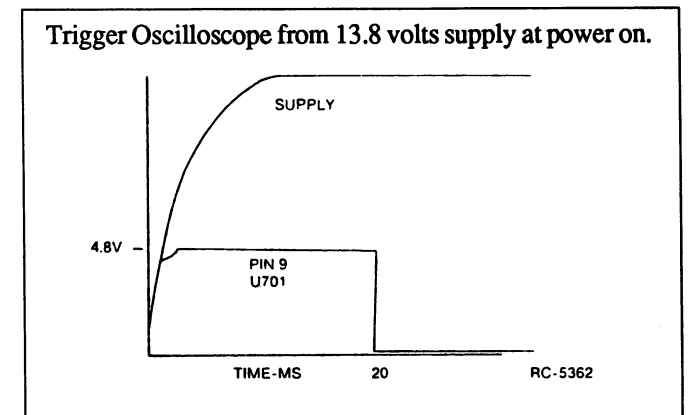


FIGURE 2 - RESET WAVEFORM

3. Check for oscillator activity by examining the ALE clock on U701, Pin 30 (see Figure 3). If not present, examine the system clock on U701, Pin 18 (5 volts pp at 11.059 MHz). The presence of the system clock, but no ALE may indicate a bad U701. If the system clock is not present, suspect Y701 and related components.

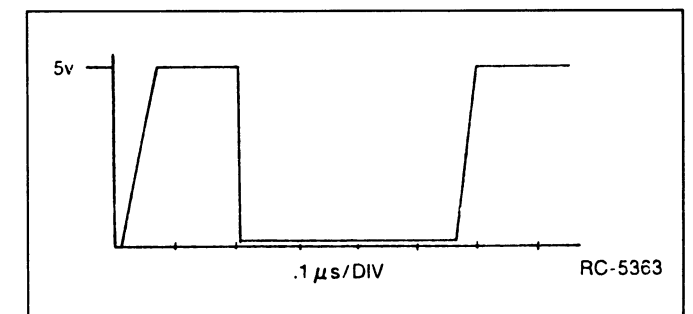
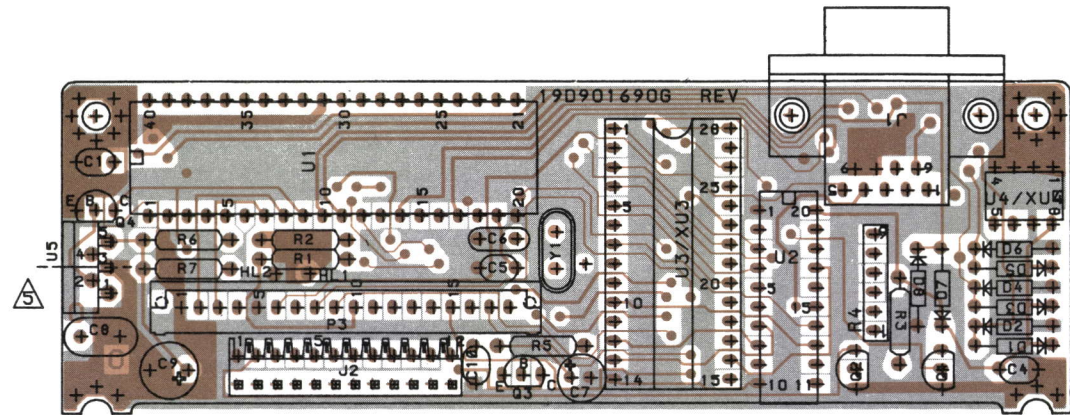


FIGURE 3 - ALE CLOCK

4. All output lines from the microprocessor are pulled high to +5 volts through 50K ohm resistors inside the microprocessor. If a line is high, you may ground that pin and monitor the results. However, if a line is low, the line may not be forced to +5 volts.

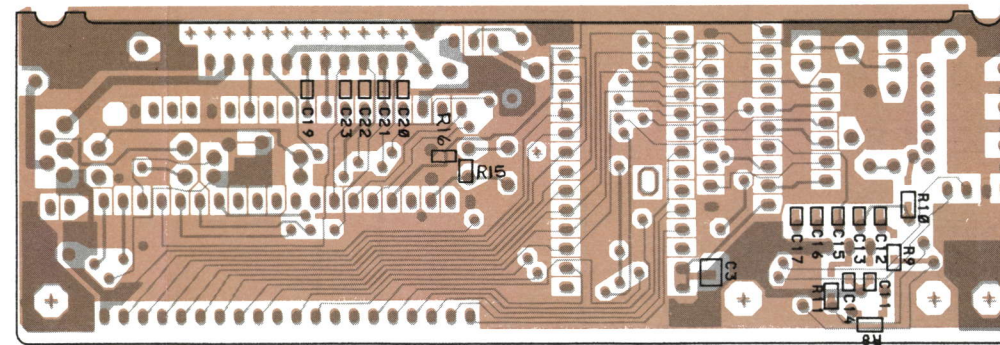


TOP VIEW



(19D901690, Sh. 2, Rev. 1)
 (19A705378, Sh. 1, Rev. 0)
 (19A705378, Sh. 2, Rev. 0)

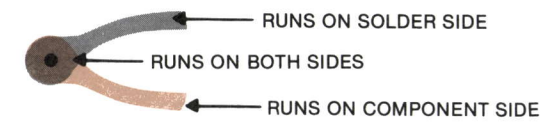
BOTTOM VIEW



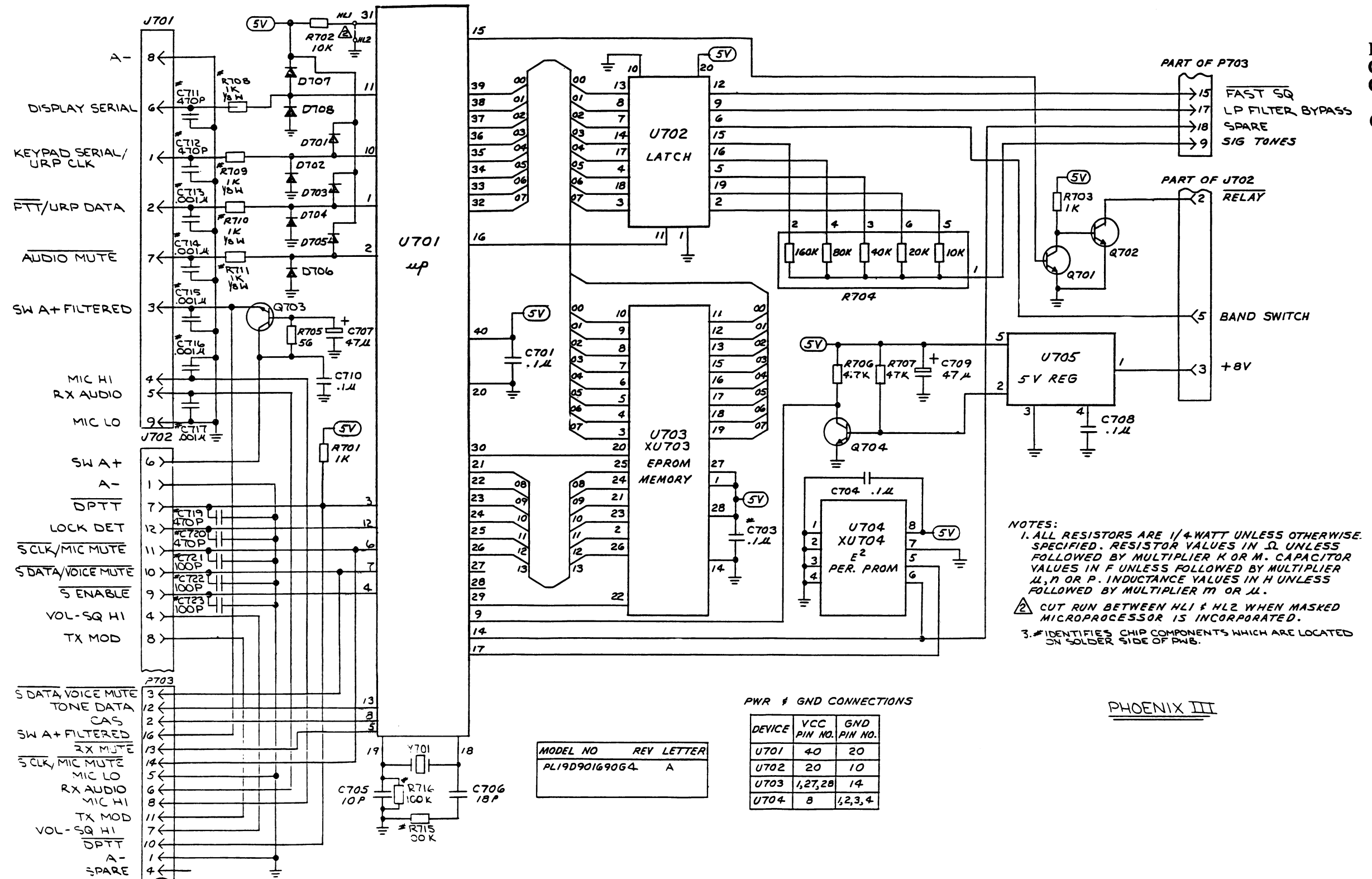
VIEW FROM BACK OF BOARD

(19D901690, Sh. 2, Rev. 1)
 (19A705378, Sh. 3, Rev. 0)
 (19A705378, Sh. 4, Rev. 0)

- △ U5 SHALL NOT OVERHANG EDGE OF PWB.
 6. P3 SHALL BE FLUSH TO PWB WITHIN 0.25.
 7.
 8. REFERENCE DESIGNATIONS SHOWN ARE ABBREVIATED; FOR COMPLETE DESIGNATION ADD 700 TO NO. SHOWN, ETC J1-J701.
 9. THE FOLLOWING ITEMS ARE ELECTROSTATIC SENSITIVE DEVICES REQUIRING SPECIAL CARE PER 19A701294: U1, U2, U3 AND U4.
 10. THE MAX. HEIGHT ABOVE THE PWB OF ALL PARTS IN THE AI GROUP (ITEM 9) MUST BE MAINTAINED WHEN THOSE PARTS ARE NOT AI'D.
 △ THE (+) LEAD OF C7 IS THE LONGEST OF THE TWO.
 12. PIN 1 OF R4 IDENTIFIED BY DOT, COLOR STRIPE, VENDOR'S LOGO OR NOTCH.

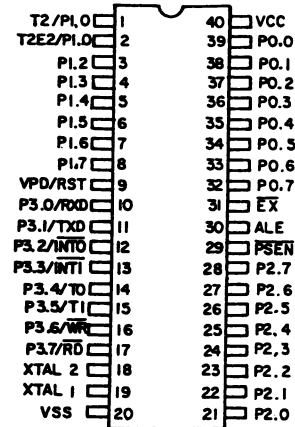


LOGIC

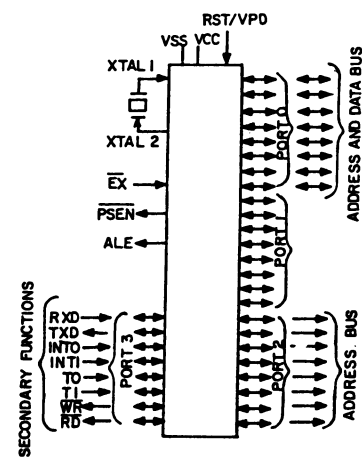


**HMOS 8-BIT MICROPROCESSOR (U701)
19A703714PI**

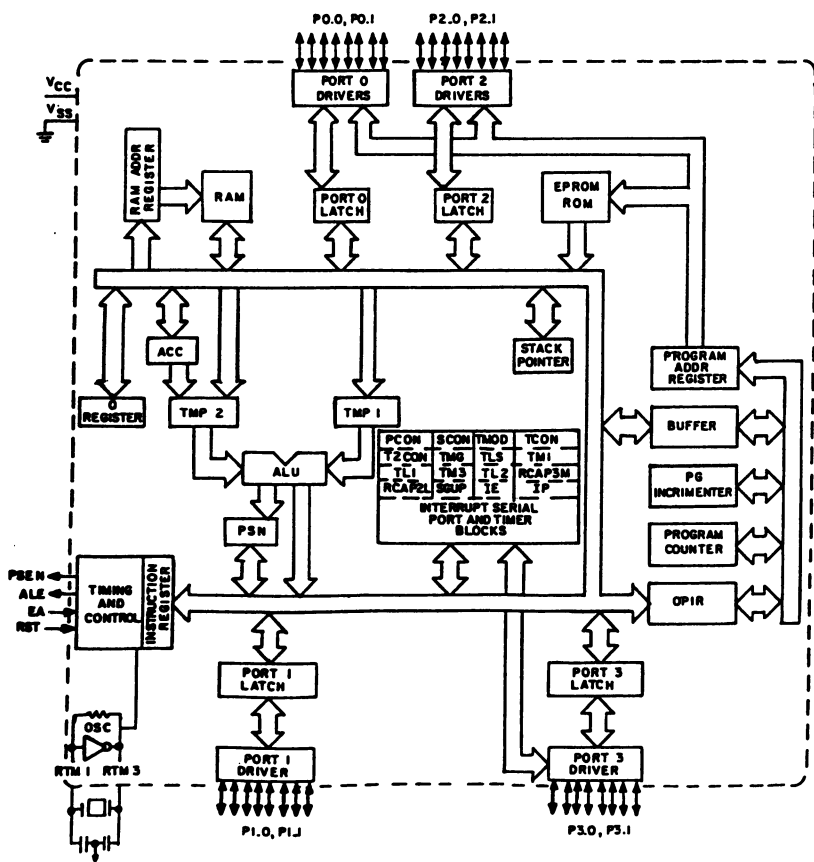
PIN CONFIGURATION



LOGIC SYMBOL

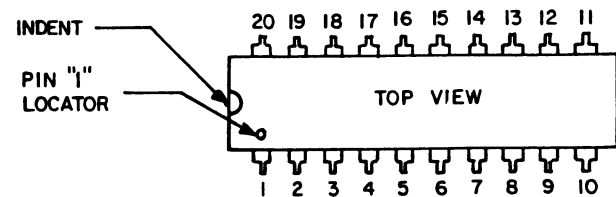


FUNCTION DIAGRAM

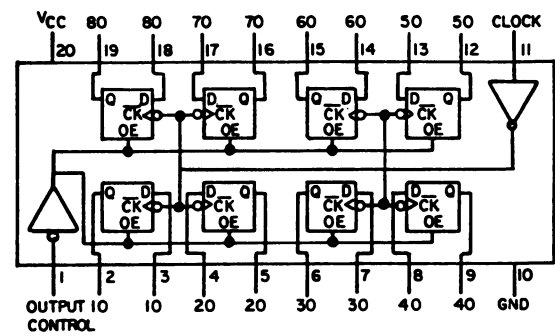


**OCTAL 3-STATE D FLIP FLOP (U702)
19A704380PI2 (74HC374)**

PIN CONFIGURATION



FUNCTION DIAGRAM



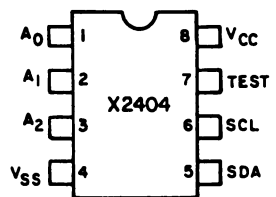
TRUTH TABLE

| OUTPUT CONTROL | CLOCK | DATA | OUTPUT |
|----------------|-------|------|----------------|
| L | ↑ | H | H |
| L | ↑ | L | L |
| L | L | X | Q ₀ |
| H | X | X | Z |

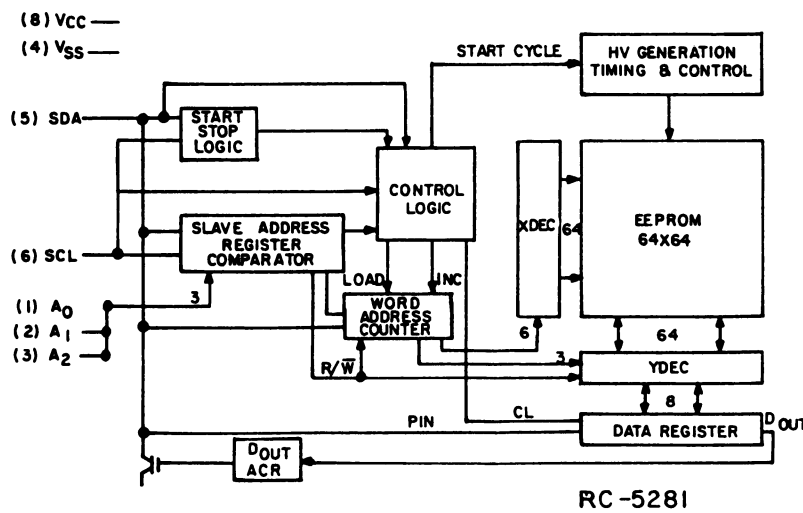
H = HIGH LEVEL, L = LOW LEVEL
X = DON'T CARE
↑ = TRANSITION FROM LOW-TO-HIGH
Z = HIGH IMPEDANCE STATE
Q₀ = THE LEVEL OF THE OUTPUT BEFORE STEADY STATE INPUT CONDITIONS WERE ESTABLISHED.

**DIGITAL 512X8 EEPROM (U704)
19A704724PI**

PIN CONFIGURATION



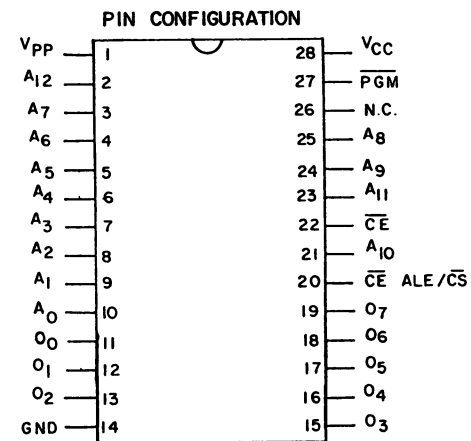
FUNCTION DIAGRAM



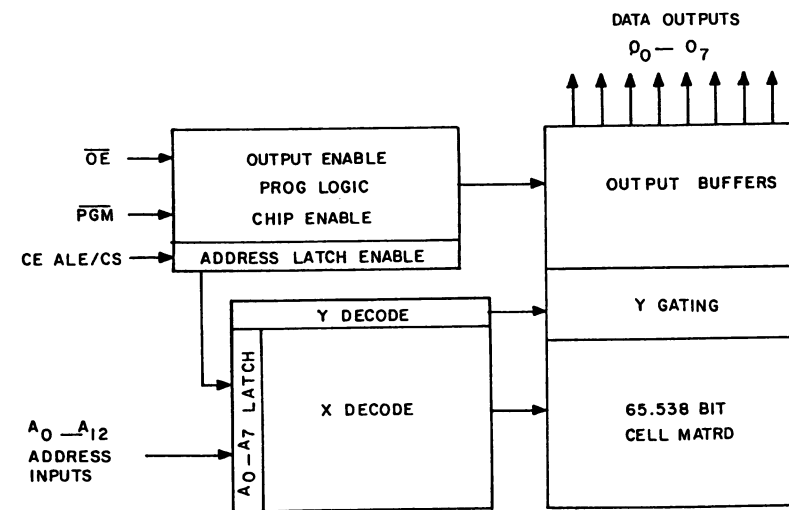
- 1 A₀ → TO V_{SS}
- 2 AND 3 A AND A ADDRESS INPUTS
- 4 V_{SS}
- 5 SDA SERIAL DATA — I²C
- 6 SCL SERIAL CLOCK — BUS
- 7 TEST INPUT — TO V_{SS}
- 8 V_{CC}

EPROM (U703)

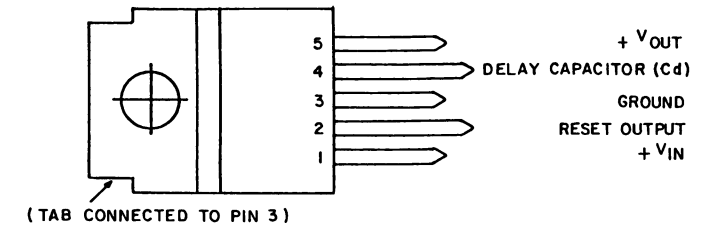
SEE PART LIST



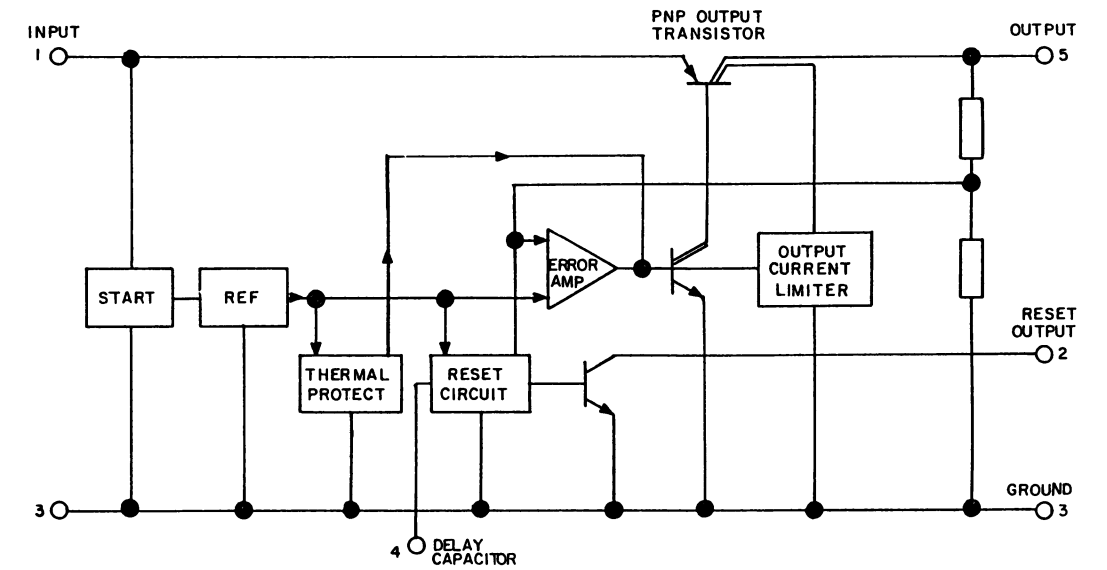
FUNCTION DIAGRAM



**VOLTAGE REGULATOR (U705)
(WITH RESET)
I9A704970PI
PIN CONFIGURATION**



FUNCTION DIAGRAM



RC-5286

PARTS LIST

MVS LOGIC BOARD
19D901690G4
ISSUE 3

| SYMBOL | GE PART NO. | DESCRIPTION |
|-------------------------|---------------|--|
| ----- CAPACITORS ----- | | |
| C701 | 19A700121P106 | Ceramic: 0.1 uF + or -20%, 50 VDCW. |
| C703 | 19A702052P26 | Ceramic: 0.1 uF + or - 10%, 50 VDCW. |
| C704 | 19A700121P106 | Ceramic: 0.1 uF + or -20%, 50 VDCW. |
| C705 | 19A700235P13 | Ceramic: 10 pF + or -5%, 50 VDCW. |
| C706 | 19A700235P16 | Ceramic: 18 pF + or -5%, 50 VDCW. |
| C707 | 19A704879P2 | Electrolytic: 47 uF + or -20%, 16 VDCW. |
| C708 | T644ACP410K | Polyester: 0.1 uF + or -10%, 50 VDCW. |
| C709 | 19A701534P9 | Tantalum: 47 uF + or -20%, 6.3 VDCW. |
| C710 | 19A700121P106 | Ceramic: 0.1 uF + or -20%, 50 VDCW. |
| C711 and C712 | 19A702052P3 | Ceramic: 470 pF + or - 10%, 50 VDCW. |
| C713 thru C717 | 19A702052P5 | Ceramic: 1000 pF + or -10%, 50 VDCW. |
| C719 and C720 | 19A702052P3 | Ceramic: 470 pF + or - 10%, 50 VDCW. |
| C721 thru C723 | 19A702061P61 | Ceramic: 100 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM. |
| ----- DIODES ----- | | |
| D701 thru D708 | 19A700028P1 | Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148. |
| ----- JACKS ----- | | |
| J701 | 19B209727P29 | Connector. |
| J702 | 19A704779P11 | Connector; sim to Molex 22-17-2122. |
| ----- PLUGS ----- | | |
| P703 | 19A704874P1 | Connector: sim to: Elco 00-9021-18-12-00-339. |
| ----- TRANSISTORS ----- | | |
| Q701 | 19A700023P2 | Silicon, NPN: sim to 2N3904. |
| Q702 and Q703 | 19A702503P2 | Silicon, NPN. |
| Q704 | 19A700023P2 | Silicon, NPN: sim to 2N3904. |
| ----- RESISTORS ----- | | |
| R701 | H212CRP210C | Deposited carbon: 1K ohms + or -5%, 1/4 w. |
| R702 | H212CRP310C | Deposited carbon: 10K ohms + or - 5%, 1/4 w. |
| R703 | H212CRP210C | Deposited carbon: 1K ohms + or -5%, 1/4 w. |
| R704 | 19A704885P5 | Resistive Network: + or -2%, 1/8 w. |
| R705 | H212CRP056C | Deposited carbon: 56 ohms + or -5%, 1/4 w. |
| R706 | H212CRP247C | Deposited carbon: 4.7K ohms + or -5%, 1/4 w. |
| R707 | H212CRP347C | Deposited carbon: 47K ohms + or -5%, 1/4 w. |
| R708 thru R711 | 19B800607P102 | Metal film: 1K ohms + or - 5%, 200 VDCW, 1/8 w. |
| R715 and R716 | 19B800607P104 | Metal film: 100K ohms + or - 5%, 200 VDCW, 1/8 w. |

| SYMBOL | GE PART NO. | DESCRIPTION |
|---------------------------------|--------------|---|
| ----- INTEGRATED CIRCUITS ----- | | |
| U701 | 19A703714P1 | Microcomputer: HMOS, 8-BIT. |
| U702 | 19A704380P12 | Digital: sim to: 74HC374. |
| U704 | 19A704724P1 | Digital: EE PROM; sim to XICOR X2404P. |
| U705 | 19A704970P1 | Voltage Regulator, 5 volts; sim to: SGS L387. |
| ----- SOCKETS ----- | | |
| XU703 | 19A700156P3 | Integrated circuit: 28 contacts; sim to AMP 640362P3. |
| XU704 | 19A700156P15 | Integrated circuit: 8 positions; sim to Burndy DILB 8P-108. |
| ----- CRYSTALS ----- | | |
| Y701 | 19A702511G15 | Quartz: 11.059200 MHZ. |

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES