MAINTENANCE MANUAL
LOGIC BOARD 19D901690G4
FOR MCS

TABLE OF CONTENTS

DESCRIPTION

The Logic Board (A1) controls the main operations of the MCS 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.

The Logic Board also contains a +5 VDC regulator (U705) for the integrated circuits on the board.

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)
- Generation of Channel guard (tone or digital)
- Transmitter and receiver audio mute gates.

The input lines, PTT, CH SEL 0, CH SEL 1, and MONITOR, are pulled high to +5 volts through 50K ohm resistors inside the microprocessor. The lines are grounded by the switches in the control head. Diodes D701-D708 on these lines protect the microprocessor from static discharges.

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 the EPROM.

ELECTRICALLY ERASABLE PROM (EEPROM)

EEPROM U704 is a 512 x 8-bit memory device, designated the "personality" PROM. This personaity PROM stores all customer channel frequencies and tones.

The EEPROM can be conveniently programmed without any need for opening up the radio. This is accomplished through J701 on the Logic board

LATCH

Latch U702 is a CMOS, 3-state, noninverting, 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 provide a continuous logic high (+5 volts) to the FAST SQUELCH on the Audio board (unused function).
- To provide a continuous logic low to the low pass filter bypass on the Audio Board (unused function).

RELAY

The relay circuit (Q701 and Q702) is not used in the MCS radio.

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 micrprocessor 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). It not present, check regulator U705, Pin 2 and transistor Q704.

Trigger Oscilloscope from 13.8 volts supply at power on.

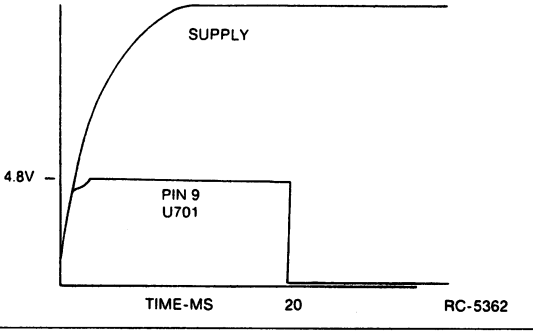
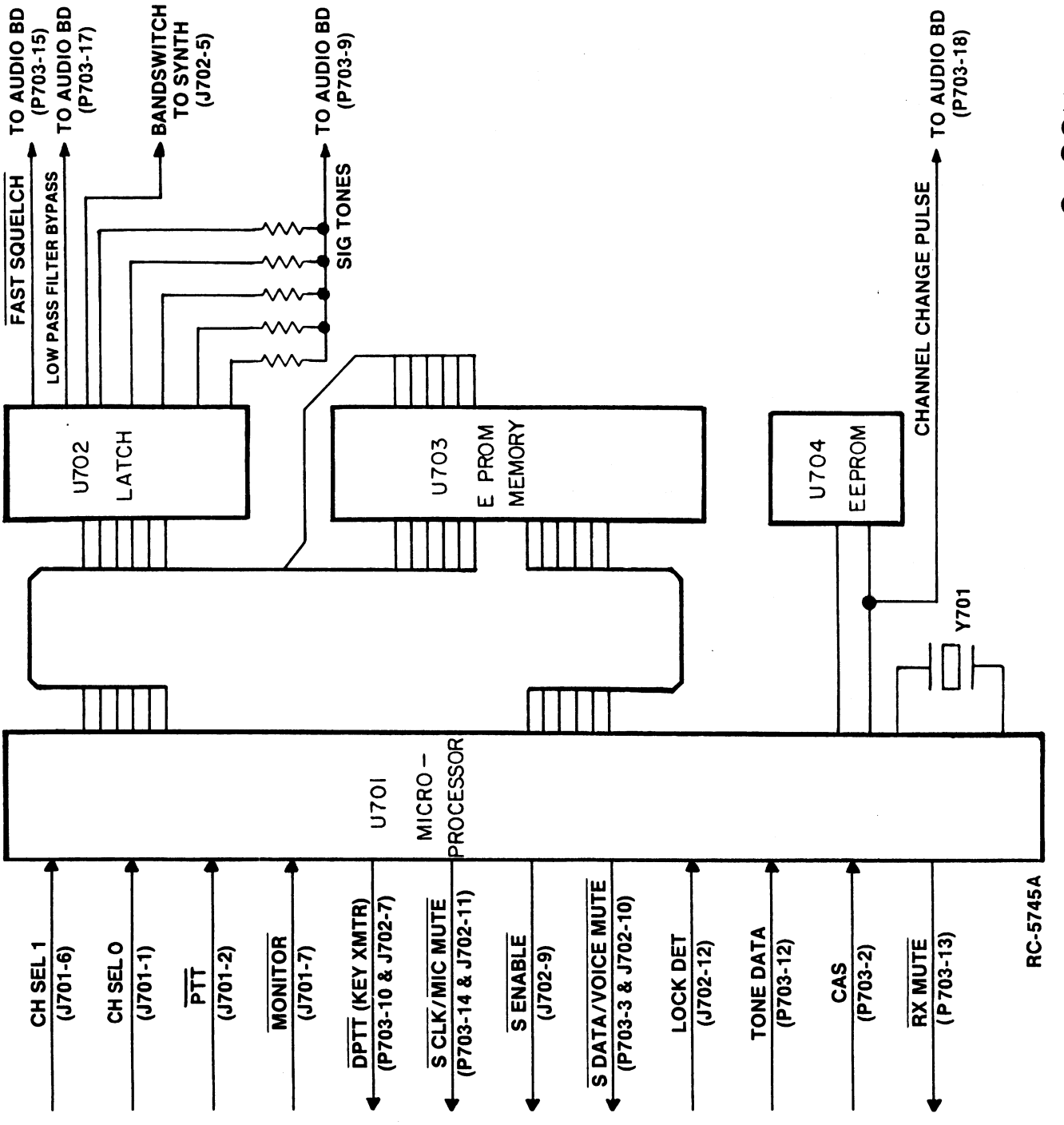


Figure 2 - Reset Waveform


FAST SQUELCH
TO AUDIO BD (P703-15)
LOW PASS FILTER BYPASS
TO AUDIO BD (P703-17)
BANDSWITCH TO SYNTH (J702-5)
SIG TONES
TO AUDIO BD (P703-9)
U702 LATCH
U703 E PROM MEMORY
U704 EEPROM
CHANNEL CHANGE PULSE
TO AUDIO BD (P703-18)
Y701
U701 MICRO-PROCESSOR
CH SEL 1 (J701-6)
CH SEL 0 (J701-1)
PTT (J701-2)
MONITOR (J701-7)
DPTT (KEY XMTR) (P703-10 & J702-7)
S CLK/MIC MUTE (P703-14 & J702-11)
S ENABLE (J702-9)
S DATA/VOICE MUTE (P703-3 & J702-10)
LOCK DET (J702-12)
TONE DATA (P703-12)
CAS (P703-2)
RX MUTE (P703-13)
FROM CONTROL HEAD
FROM CONTROL HEAD
FROM CONTROL HEAD
FROM CONTROL HEAD
TO AUDIO BD/XMTR
TO AUDIO/SYNTH BD
SYNTH
TO AUDIO/SYNTH BD
FROM SYNTH
FROM AUDIO BD
FROM AUDIO BD
TO AUDIO BD
RC-5745A

LOGIC

3. Check for oscillator activity by examing 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).

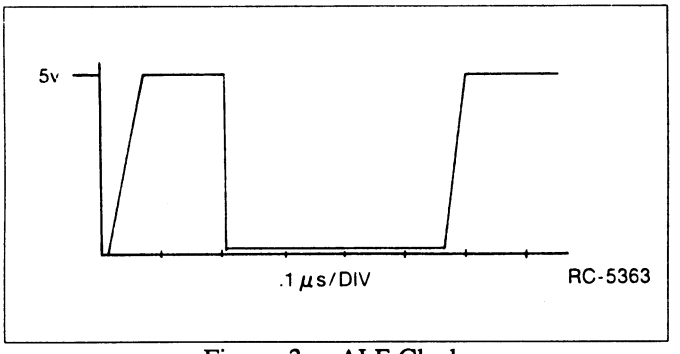
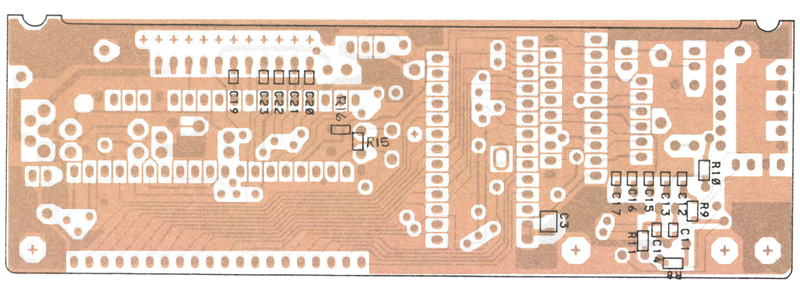


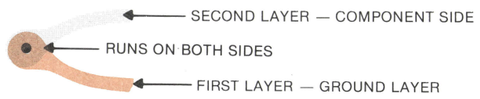
Figure 3 - ALE Clock

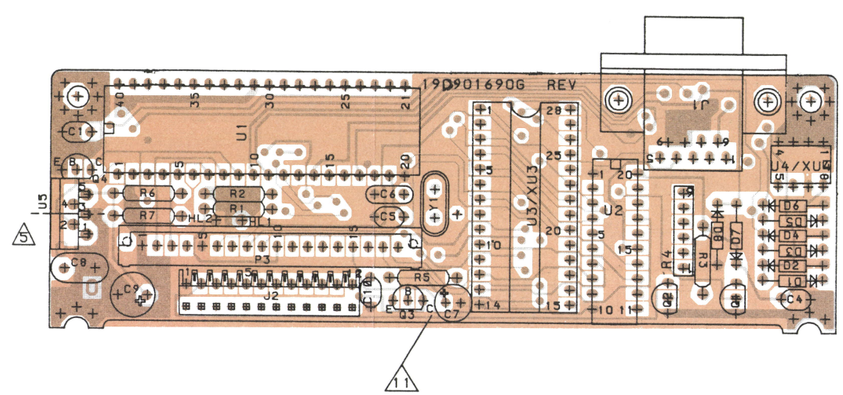
4. All output lines from the microprocessor are pulled high to +5 volts through 50K ohm resistors inside the microprocessor. If a line is high, you may ground that pin and monitor the results. However, if a line is low, the line may not be forced to +5 volts.



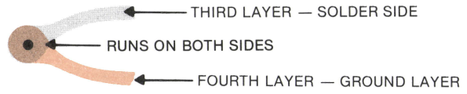
VIEW FROM BACK OF BOARD

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





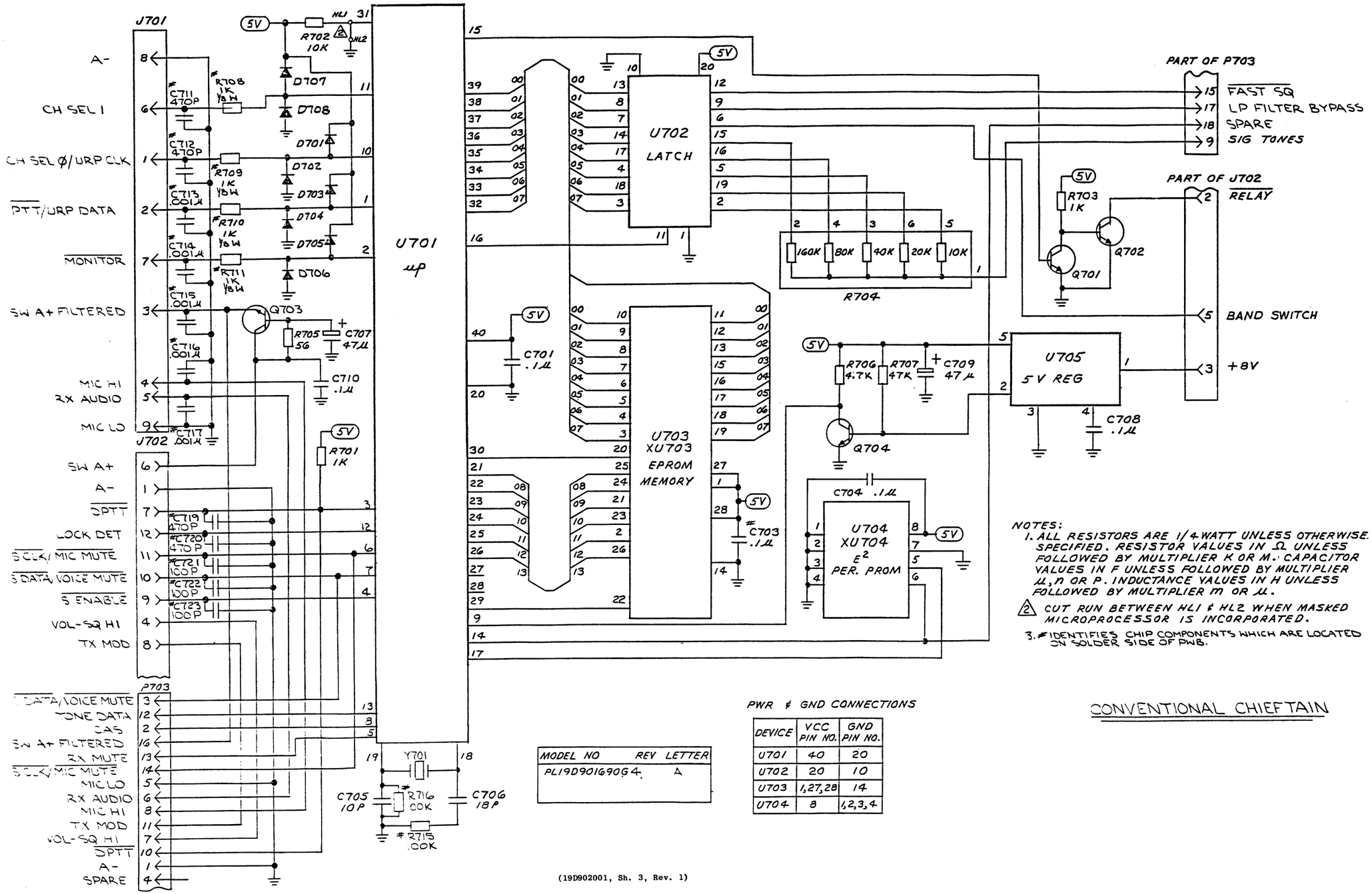
(19D901690, Sh. 2, Rev. 2)
(19A705378, Sh. 1, Rev. 0)
(19A705378, Sh. 2, Rev. 0)



5 U5 SHALL NOT OVERHANG EDGE OF PWB.

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.

11 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.



MODEL NO	REV LETTER
PL19D901G90G4	A

PWR & GND CONNECTIONS

DEVICE	VCC PIN NO.	GND PIN NO.
U701	40	20
U702	20	10
U703	1,27,28	14
U704	8	1,2,3,4

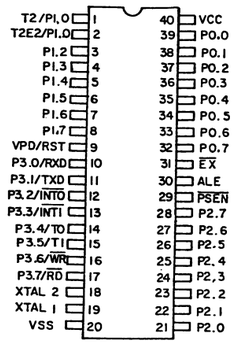
NOTES:
1. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED. RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M. CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ, n OR P. INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m OR μ.
2. CUT RUN BETWEEN HL1 & HL2 WHEN MASKED MICROPROCESSOR IS INCORPORATED.
3. # IDENTIFIES CHIP COMPONENTS WHICH ARE LOCATED ON SOLDER SIDE OF PWB.

CONVENTIONAL CHIEFTAIN

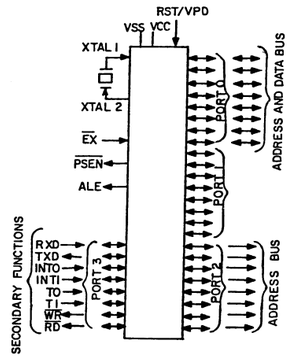
(19D902001, Sh. 3, Rev. 1)

HMOS 8-BIT MICROPROCESSOR (U701)
19A703714P1

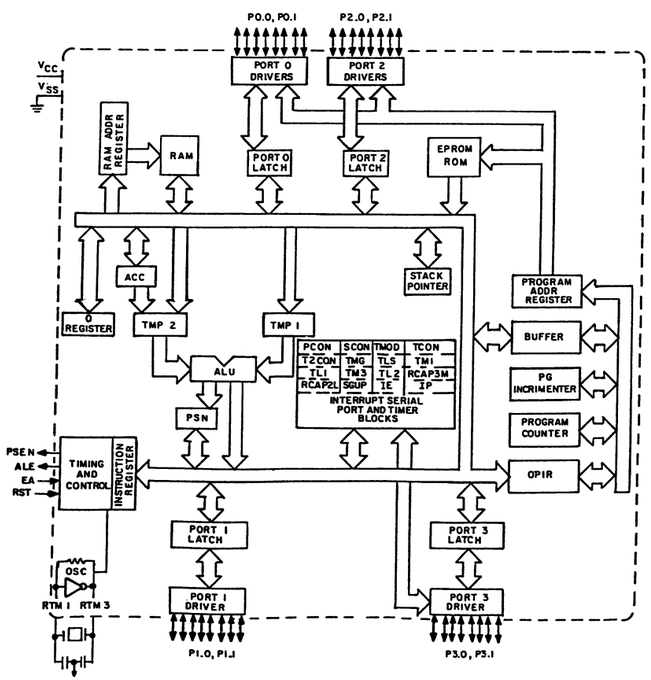
PIN CONFIGURATION



LOGIC SYMBOL

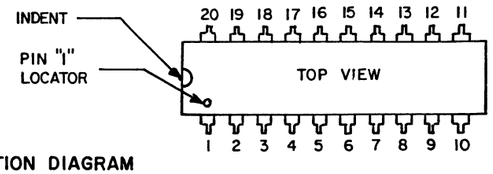


FUNCTION DIAGRAM

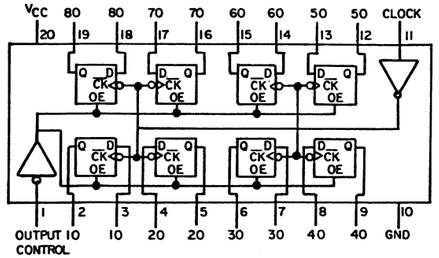


OCTAL 3- STATE D FLIP FLOP (U702)
19A704380P12 (74HC374)

PIN CONFIGURATION



FUNCTION DIAGRAM



TL/F/5336–1

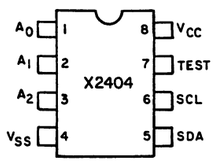
TRUTH TABLE

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
Q_0 = THE LEVEL OF THE OUTPUT BEFORE STEADY STATE INPUT CONDITIONS WERE ESTABLISHED.

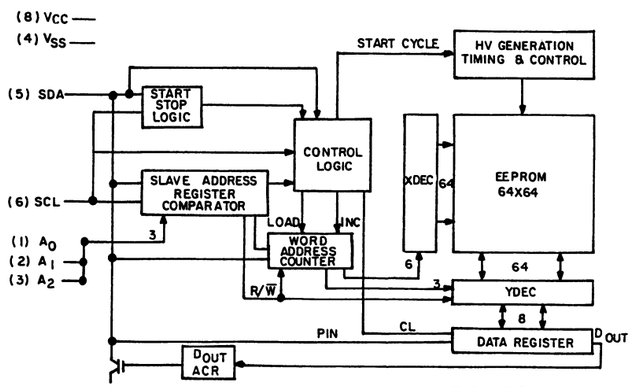
DIGITAL 512X8 EEPROM (U704)
19A704724P1

PIN CONFIGURATION



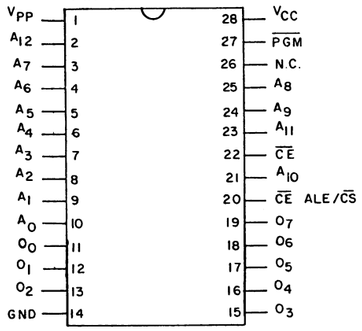
1 A_0 → TO V_{SS}
2 AND 3 A AND A ADDRESS INPUTS
4 V_{SS}
5 SDA SERIAL DATA — I^2C BUS
6 SCL SERIAL CLOCK — I^2C BUS
7 TEST INPUT — TO V_{SS}
8 V_{CC}

FUNCTION DIAGRAM

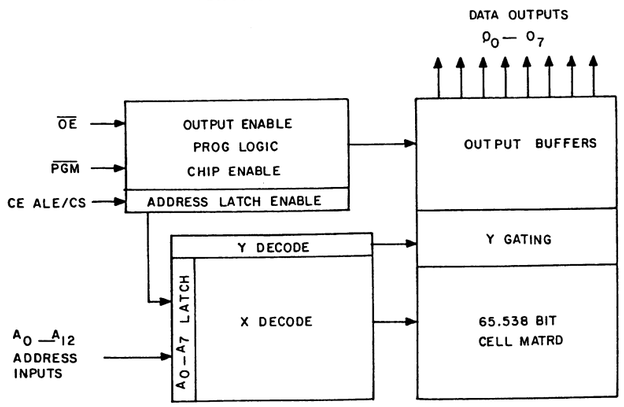


EPROM (U703)

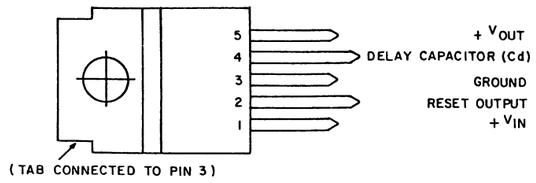
PIN CONFIGURATION



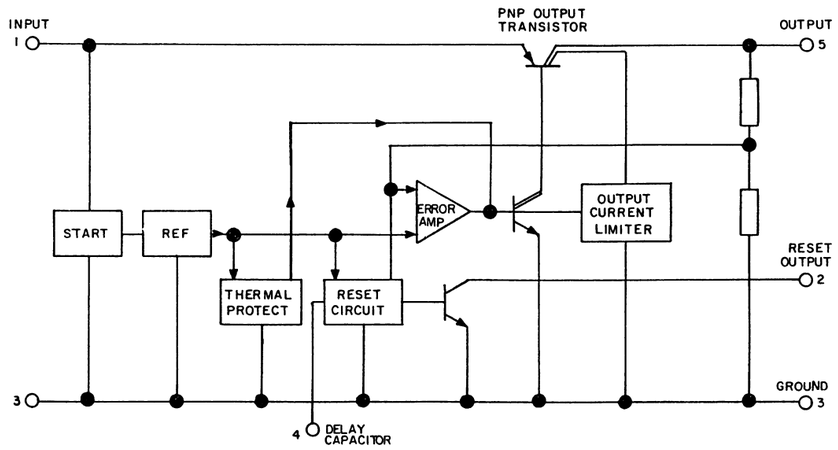
FUNCTION DIAGRAM



VOLTAGE REGULATOR (U705)
(WITH RESET)
19A704970P1
PIN CONFIGURATION



FUNCTION DIAGRAM



RC — 5286

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circiuts are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all pervious revisions. Refer to the Parts List for the descriptions of parts affected by these revisions.

REV. A - LOGIC BOARD 19D901690G4

To improve the operation of the Clock Oscillator. Added R715 and R716.

PARTS LIST

MCS LOGIC BOARD
19D901690G4
ISSUE 2

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	19A702061P77	Ceramic: 470 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
C713 thru C717	19A702052P5	Ceramic: 1000 pF + or -10%, 50 VDCW.
C719 and C720	19A702061P77	Ceramic: 470 pF + or - 5%, 50 VDCW, temp coef 0 + or - 30 PPM.
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.
		- - - - - - - - - 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.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B800608P156	Rivet Tube.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES