# *THE PROM SETTER*

# *MANUAL*



SZERLIP ENTERPRISES
1414 West 259th Street
Harbor City, California 90710

# PARTS LIST

| | | | |
|---|---|---|---|
| ___ | 5 | 14 Pin IC | SOCKET |
| ___ | 14 | 16 Pin IC | SOCKET |
| ___ | 1 | 24 Pin Test | SOCKET |
| ___ | 1 | 50 Pin Socket | CONNECTOR |
| ___ | 3 | 25 Pin Socket | CONNECTOR |
| ___ | 1 | 25 Pin Plug | CONNECTOR |
| ___ | 1 | Back Shell | CONNECTOR |
| ___ | 1 | Removal and Insertion * | TOOL |
| ___ | 1 | HEAT SINK | |
| ___ | 52 | Transistor Pads | |
| ___ | 9 | 6-32x3/8 | SCREWS |
| ___ | 6 | 6-32x½ | SCREWS |
| ___ | 6 | 6 Lock Washers | |
| ___ | 15 | 6 Flat Washers | |
| ___ | 15 | 6-32 | NUT |
| ___ | 4 | Rubber Feet | |
| ___ | | 1/16 Dia. Heat Shrink ** | TUBING |
| ___ | | 3/32 Dia. Heat Shrink ** | TUBING |
| ___ | 10 in. | 22 guage TFE | TUBING |
| ___ | 10 in. | 22 Guage solid | WIRE |
| ___ | 12 Ft. | 15 Conductor Ribbon | WIRE |
| ___ | 1 | MANUAL | |

* Tool is included when removal pin connector is supplied

** Amount of Heat Shrink Tubing varies with the type of connectors supplied

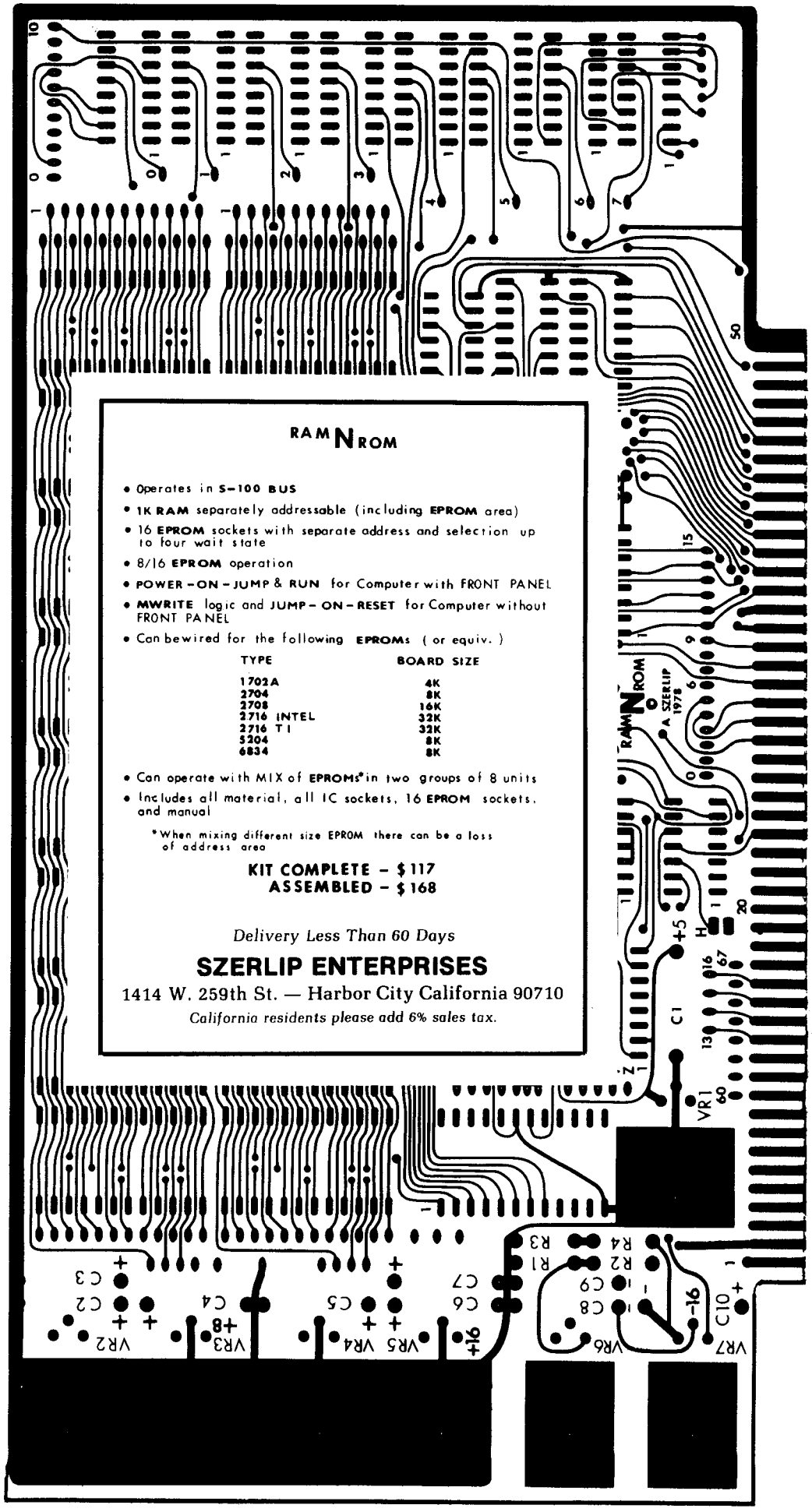
# PARTS LIST

| | | | | |
|---|---|---|---|---|
| ___ | 2 | 4009 | | IC |
| ___ | 1 | 7400 | | IC |
| ___ | 1 | 74L00 | | IC |
| ___ | 2 | 7404 | | IC |
| ___ | 1 | 7410 | | IC |
| ___ | 6 | 74L75 | | IC |
| ___ | 1 | 74155 | | IC |
| ___ | 4 | 74367/8097/8T97 | | IC |
| ___ | 1 | 8131 | | IC |
| ___ | 1 | 340T-12/7812 | | IC |
| ___ | 1 | 340T-5/7805 | | IC |
| ___ | 1 | 320T-12/7912 | | IC |
| ___ | 29 | 2N2222A | | TRANSISTOR |
| ___ | 23 | 2N2907A | | TRANSISTOR |
| ___ | 1 | D41D1 | | TRANSISTOR |
| ___ | 30 | 1N4001 | | DIODE |
| ___ | 1 | 1N5223 | 2.7 Volt | ZENOR |
| ___ | 1 | 1N5240 | 10 Volt | ZENOR |
| ___ | 19 | 1N5254 | 27 Volt | ZENOR |
| ___ | 1 | 1N5261 | 47 Volt | ZENOR |
| ___ | 1 | 1N5342 | 6.8 Volt | ZENOR |
| ___ | 6 | 2.7 Ohm | ¼ W | RESISTOR |
| ___ | 1 | 47 Ohm | ¼ W | RESISTOR |
| ___ | 1 | 68 Ohm | ¼ W | RESISTOR |
| ___ | 1 | 120 Ohm | ¼ W | RESISTOR |
| ___ | 1 | 330 Ohm | ¼ W | RESISTOR |
| ___ | 22 | 680 Ohm | ¼ W | RESISTOR |
| ___ | 3 | 1 K Ohm | ¼ W | RESISTOR |
| ___ | 38 | 2.2 K Ohm | ¼ W | RESISTOR |
| ___ | 19 | 10 K Ohm | | RESISTOR |
| ___ | 6 | 0.1 UF | 50 Volt | CAPACITOR |
| ___ | 3 | 4.7 UF | 25 Volt | CAPACITOR |
| ___ | 3 | 22 UF | 25 Volt | CAPACITOR |
| ___ | 1 | 47 UF | 25 Volt | CAPACITOR |
| ___ | 1 | 100 UF | 35 Volt | CAPACITOR |
| ___ | 1 | SPDT | | SWITCH |
| ___ | 1 | TPS 100 | Main Module | BOARD |
| ___ | 1 | TPS 200 | Socket | BOARD |

# PARTS LIST

| | | | |
|---|---|---|---|
| ___ | 8 | 21L02 450nsec | IC |
| ___ | 2 | 74L00/74LS00 | IC |
| ___ | 1 | 74L02/74LS02 | IC |
| ___ | 1 | 74L04/74LS04/74L14/74LS14 | IC |
| ___ | 1 | 74L154/74LS154 | IC |
| ___ | 1 | 74L175/74LS175 | IC |
| ___ | 2 | 74367/8097/8T97 | IC |
| ___ | 2 | 8131 | IC |
| ___ | 2 | 340T-12/7812 | IC |
| ___ | 2 | 340T-5/7805 | IC |
| ___ | 2 | 320T-5/7905 | IC |
| ___ | 2 | 1N5228B 3.9 volt | ZENER |
| ___ | 2 | 1N5235B 6.8 volt | ZENER |
| ___ | 2 | 680 Ohm 1/4W | RESISTOR |
| ___ | 2 | 1K Ohm 1/4W | RESISTOR |
| ___ | 16 | 2.2K Ohm 1/4W | RESISTOR |
| ___ | 4 | 0.1 µf 16 Volt | CAPACITOR |
| ___ | 3 | 4.7 µf 25 Volt | CAPACITOR |
| ___ | 7 | 22 µf 25 Volt | CAPACITOR |
| ___ | 1 | RNR 100 | BOARD |
| ___ | 4 | 14 Pin IC | SOCKET |
| ___ | 13 | 16 Pin IC | SOCKET |
| ___ | 17 | 24 Pin | SOCKET |
| ___ | 1 | 6 Position | SWITCH |
| ___ | 1 | 9 Position | SWITCH |
| ___ | 9 | 12 Pin Wire Wrap | STRIP |
| ___ | 7 | | HEAT SINK |
| ___ | 7 | 6-32 x 3/8 | SCREWS |
| ___ | 7 | 6-32 | NUT |
| ___ | 7 | 6 Lock | WASHERS |
| ___ | 7 | 6 Flat | WASHERS |
| ___ | 10 in. | 22 Gauge Solid | WIRE |
| ___ | 6 in. | 15 Conductor Ribbon | WIRE |
| ___ | 60 | 4 in. Wrap | WIRE |
| ___ | 1 | RAM-N-ROM | MANUAL |

**Power Requirements (supplied from Computer Bus):**
**Logic and RAM +8 volts 0.38 amps**
**ROM +16, +8, -8 volts depends on EPROMs**




SZERLIP ENTERPRISES
RAM N ROM
RNR 100

TABLE OF CONTENTS

# SECTION I

# INTRODUCTION AND GENERAL INFORMATION

## THE PROM SETTER MODULE

## AND

## EPROM SOCKET UNIT

## 1.1 INTRODUCTION

This manual contains the information required to assemble, test and operate The Prom Setter. It is suggested that you first scan the entire manual before starting assembly or using The Prom Setter.

Secondly, for kit purchases, check the parts list against the supplied material. Inform us immediately if you discover any discrepancy.

It is best that you follow the assembly procedure as outlined in Section II. Use the best type of tools to insure professional results.

If you experience difficulty or problems during assembly, feel free to contact us. We will do our best to assist you. If the completed unit does not function properly, recheck your assembly, check for backward or wrongly placed components. See Section 1.3.3 for details of factory servicing.

## 1.2 THE PROM SETTER GENERAL DESCRIPTION

The Prom Setter is designed to be compatible with the S-100 bus, such as is used in the Altair/IMSAI computer, and utilizes the existing power supply of the computer to perform its tasks. (No external power supplies are required.)

The Prom Setter consists of a main module board, TPS 100, and an external EPROM socket board, TPS 200, with interconnecting cables.

The Prom Setter will write and read a number of Programmable Read Only Memory (PROM). The TPS-100A with socket set TPS-200A is used for writing and reading the 1702A, the 2704 and 2708 Erasable Programmable Read Only Memory (EPROM). When not used as a Prom Setter, the main module board can be used as an eight-bit parallel I/O port (see Section 4.2.4).

The Prom Setter address is selectable to any of 63 address segments (FF is used by the computer) of the 256 I/O addresses available with the microprocessor. It uses four (4) consecutive addresses. The first two bits of the address ($A_0$ and $A_1$) are used to select which registers of The Prom Setter are to be activated. The rest of the address, $A_2$ through $A_7$, is selectable by you. (See Section 2.2.1, Step 11.)

The Prom Setter main module (TPS-100) contains all the electronics required to read and write a PROM, such as the 1702A. This module plugs directly into the S-100 bus of the computer. On the top of this module

is a 50-pin edge connector, which is used to interconnect this unit to The Prom Setter socket (TPS-200).

An interconnecting cable is used to bring the output of the main module to the rear of your computer. This cable has 50-pin connector which mates to the main module on one end and several DB25 pin connectors on the other end. The DB25 connectors are attached to the rear of your computer.

These 25-pin connectors at the rear of your computer are used to interconnect the external Prom Setter socket unit to the main module. The connectors arrange the appropriate socket connections for the given PROM type that is to be read or set.

A Write-Disable switch is provided on The Prom Setter Socket unit. This switch, when in the "Write Disable" position, insures that no possibility of write conditions can exist. It is advised that this switch be in the "Write Disable" position when inserting and removing the PROM and also during the read operation.

All control and operation of The Prom Setter is accomplished by the computer itself. The computer sets a series of latches which define the address and data lines. A latch is also used to control the programming signals.

Tristate units are used to buffer the PROM read data to the S-100 data bus lines. Low power input units are used for all input lines.

## 1.3 GENERAL INFORMATION

### 1.3.1 Receiving Inspection

Carefully inspect all materials shipped for signs of damage. Also check the packing list to insure that all materials were received.

If any discrepancies are found or damage noted, please write us at once, describing the condition, so that we can take appropriate action. Save the shipping material until your inspection proves that the material received is satisfactory.

### 1.3.2 Replacement Parts

Replacement parts will be supplied upon request (see Section 1.3.4). When requesting replacement parts, be sure to properly describe the components requested.

### 1.3.3 Factory Service

Factory service is offered for in-warranty and out-of-warranty units. Before returning The Prom Setter for service, it is required that you obtain authorization to do so. Upon receiving authorization for factory service, package the unit to prevent damage and return postpaid to:

SZERLIP ENTERPRISES
1414 West 259th Street
Harbor City, California 90710

Under separate correspondence, send information of the shipment, giving carrier and waybill number. To protect yourself, it is suggested that you insure the package.

### 1.3.4 Warranty

The parts supplied in The Prom Setter are warranted against defects in materials and workmanship for a period of ninety (90) days after the date of shipment or purchase, whichever is the later date.

A complete "Statement of Warranty" is given in Appendix I.

### 1.3.5 Tools

Before undertaking kit assembly, you should have professional tools. A quality soldering iron will insure a professional product. Soldering guns should not be used. For additional information on this subject, see Appendix II.

As a minimum, a voltmeter will be required and, preferably, an oscilloscope should be available to check out The Prom Setter.

An S-100 extender board would prove helpful during the checkout of the unit.

### 1.3.6 Hazard

Care must be taken when handling the main module board due to the sharp prongs of the IC sockets which can cause skin cuts to the hand.

# SECTION II

# ASSEMBLY

## 2.1 GENERAL

Before starting to assemble The Prom Setter, it is necessary to insure that the ±16 volt lines have sufficient voltage to allow acceptable operation of the unit. Some early computers had very small power transformers which results in low supply voltages.

Using an extender board, insert the TPS-100 board (without any components) into the extender board, and the extender board into the S-100 bus. Turn on the computer and, with a dc voltmeter, measure the +16 and then the -16 volt lines. These are located at the upper left-hand side of the board. Record the results for future reference.

| | Parasitic Eng. | | 2nd gen. Mits P.S. |
|---|---|---|---|
| +16 volts | +16.9 | +14 volts minimum | +15.8 |
| -16 volts | -16.9 | -14 volts minimum | -13.8 |

4-20-79 TT

If the voltage is lower than the minimum given at the right side of the boxes (i.e., ±14 volts), you should consider rebuilding the power supply. In some computers, series of diodes were used in the ±16 volt supply to reduce the supply voltage when the loads are light. In these cases, low supply voltage can be increased by removing some of the extra series diodes. Under no circumstance do you ever remove all the diodes. At least one set of diodes is required for proper supply operation.

CAUTION

(A) Some of the devices used are MOS integrated circuits which can be DAMAGED by static electricity discharge. Avoid unnecessary handling of the MOS IC's. Synthetic clothing tends to generate static electricity. Cotton clothing is preferable.

The above applies to the EPROM's.

(B) Damage may occur if accidental shorting of adjacent components leads takes place. If it becomes necessary to make electrical measurements of components on the board, use extreme care.

(C) Make sure that the proper transistor is inserted in its appropriate position and that the leads are not crossed. Use the plastic pads supplied under each of the TO-18 transistor types. The transistor should be pushed down on these pads and then align the transistors so that they do not touch the unit next to them. (Note that the collectors are electrically connected to the metal TO-18 can.)

## MAIN MODULE

| Circuit Symbol | Component |
|---|---|
| U1 | 7404 |
| U2 | 74155 |
| U3 | 4009 |
| U4 | 8131 |
| U5 | 4009 |
| U6 | 74L00 |
| U7 | 74367/8097/8T97 |
| U8 | 74367/8097/8T97 |
| U9 | 74L75 |
| U10 | 7400 |
| U11 | 7404 |
| U12 | 7410 |
| U13 | 74L75 |
| U14 | 74L75 |
| U15 | 74L75 |
| U16 | 74L75 |
| U17 | 74L75 |
| U18 | 74367/8097/8T97 |
| U19 | 74367/8097/8T97 |
| R1A through R1H | 680 ohm 1/4w |
| R2A through R2H | 2.2k ohm 1/4w |
| R3A through R3H | 10k ohm 1/4w |
| R4A through R4H | 680 ohm 1/4w |
| R5A through R5H | 2.2k ohm 1/4w |
| R6A through R6H | 10k ohm 1/4w |
| R8A through R8F | 2.2k ohm 1/4w |
| R9 | 120 ohm 1/4w |
| R10 | 2.2k ohm 1/4w |
| R11 | 2.2k ohm 1/4w |
| R12 | 680 ohm 1/4w |
| R13 | 2.2k ohm 1/4w |
| R14 | 680 ohm 1/4w |
| R15 | 2.2k ohm 1/4w |
| R16 | 68 ohm 1/4w |

| Circuit Symbol | Component |
|---|---|
| R17 | 680 ohm 1/4w |
| R18 | 10k ohm 1/4w |
| R19, R20, R25 | 2.2k ohm 1/4w |
| R26 | 680 ohm 1/4w |
| R27 | 2.2k ohm 1/4w |
| R28 | 2.2k ohm 1/4w |
| R29 | 2.2k ohm 1/4w |
| R30 | 680 ohm 1/4w |
| R31 | 2.2k ohm 1/4w |
| R32 | 1k ohm 1/4w |
| R33A/B | 2.7 ohm 1/4w |
| R34A/B | 2.7 ohm 1/4w |
| R35A/B | 2.7 ohm 1/4w |
| R36 | 10k ohm 1/4w |
| R37 | 2.2k ohm 1/4w |
| R38 | 2.2k ohm 1/4w |
| R39 | 330 ohm 1/4w |
| R40 | 47 ohm 1/4w |
| R41 | 2.2k ohm 1/4w |
| R42 | 1k ohm 1/4w |
| R43 | 2.2k ohm 1/4w |
| R44 | 680 ohm 1/4w |
| R45 | 2.2k ohm 1/4w |
| R46 | 10k ohm 1/4w |
| R47 | 1k ohm 1/4w |
| C1 | 4.7 µf 25v |
| C2 | 22 µf 25v |
| C3 | 4.7 µf 25v |
| C4 | 22 µf 25v |
| C5 | 4.7 µf 25v |
| C6 | 22 µf 25v |
| C7 | 47 µf 25v |
| C9 | 100 µf 35v |
| C8,C10 through C-14 | 0.1 µf 50v |

| Circuit Symbol | Component | | |
|---|---|---|---|
| CR1A through CR1H | 1N5254 | 27v | Zener |
| CR2A through CR2H | 1N4001 | | Diode |
| CR3 | 1N5342 | 6.8v | Zener |
| CR4A through CR4H | 1N5254 | 27v | Zener |
| CR5A through CR5H | 1N4001 | | Diode |
| CR7 | 1N4001 | | Diode |
| CR9 | 1N5254 | 27v | Zener |
| CR10 | 1N5254 | 27v | Zener |
| CR11 | 1N5240 | 10v | Zener |
| CR12, CR13, CR14 | 1N4001 | | Diode |
| CR15 | 1N5223/1N746A | 2.7v | Zener |
| CR18 through CR24 | 1N4001 | | Diode |
| CR25 | 1N5261 | 47v | Zener |
| CR26 | 1N5254 | 27v | Zener |
| CR27 | 1N4001 | | Diode |
| Q1A through Q1H | 2N2907A | PNP | Transistor |
| Q2A through Q2H | 2N2222A | NPN | Transistor |
| Q3A through Q3H | 2N2907A | PNP | Transistor |
| Q4A through Q4H | 2N2222A | NPN | Transistor |
| Q5 | 2N2222A | NPN | Transistor |
| Q6 | 2N2907A | PNP | Transistor |
| Q7 | 2N2222A | NPN | Transistor |
| Q8 | 2N2907A | PNP | Transistor |
| Q9 | 2N2222A | NPN | Transistor |
| Q10 | 2N2907A | PNP | Transistor |
| Q11 | 2N2222A | NPN | Transistor |
| Q16 | 2N2222A | NPN | Transistor |
| Q17 | 2N2907A | PNP | Transistor |
| Q18 | 2N2222A | NPN | Transistor |
| Q19 | 2N2907A | PNP | Transistor |
| Q20, Q21, Q22, Q23 | 2N2222A | NPN | Transistor |
| Q24 | D41D1 | PNP | Transistor |
| Q25 | 2N2222A | NPN | Transistor |
| Q26 | 2N2907A | PNP | Transistor |
| Q27 | 2N2222A | NPN | Transistor |
| Q28 | 2N2907A | PNP | Transistor |
| Q29 | 2N2222A | NPN | Transistor |
| VR1 | 340T-5 | +5 volts | Regulator |
| VR2 | 340T-12 | +12 volts | Regulator |
| VR3 | 320T-12 | -12 volts | Regulator |

SOCKET BOARD

| | | |
|---|---|---|
| CR28, CR29 | 1N4001 | Diode |
| SW1 | SPDT | Switch |

COMPONENT CIRCUIT SYMBOL

NOT USED:

R7, R21, R22, R23, R24
CR6, CR8, CR16, CR17
Q12, Q13, Q14, Q15

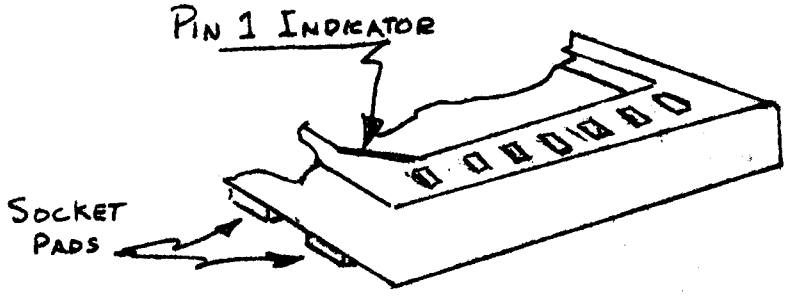
LAST NUMBER USED: U19 R47 C14 CR27 Q29 VR3

(D) When inserting electrolytic capacitors, be careful to align the polarities correctly. Incorrect direction will damage components.

(E) Diodes and zener diodes must be properly inserted to prevent damage to components.

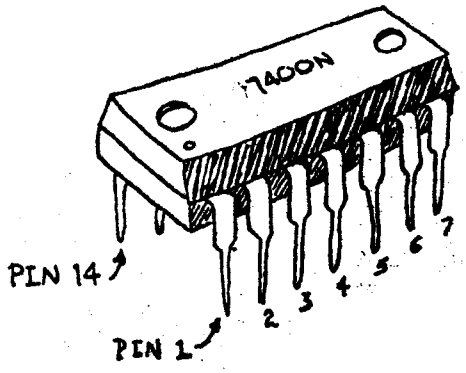
2.1.1 Dual In-Line Sockets

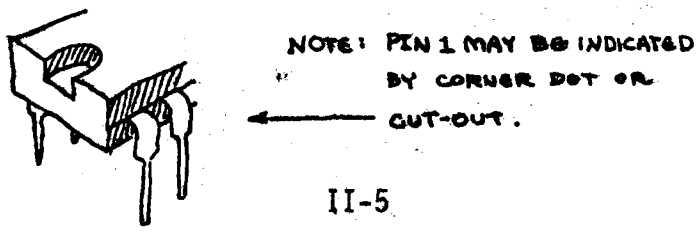
The IC sockets are designed with a small corner section that can be used to indicate the position of pin 1.




Place the socket so that Pin 1 Indicator aligns to the pin 1 of the PC board. Insert the socket from the front side onto the board and, while holding it flush on the board, solder (from the rear of the board) only the two opposite end pins. Then check that the socket pads are flush to the board. If a large gap exists under the socket pads, reheat the pins and, at the same time, push down on the socket to obtain a flush condition. Once the socket is flush, solder the rest of the pins. Always inspect your soldering joints to be sure that the solder is smooth with no eruption outgassing holes and that there is not an excessive amount of solder. Check that no short was made to adjacent circuit printed wiring lines.

The plastic Dual In-Line Package (DIP) integrated circuits indicate pin 1 of the package by a dot or cutout as shown below.



DO NOT insert the DIP IC's until the +5 volt regulator has been installed and tested. When inserting the IC, make sure no pin is accidentally bent under the package instead of going into the socket.

A DIP IC insertion tool would prove helpful for inserting and removing the IC from the sockets.

Printed Circuit (PC) Dual In-Line Layout IC U1 through U12, U18 and U19 all have their pin 1 located at the bottom. IC U13 through U17 have their pin 1 located to the left. These positions are in relation to the view when looking at the front of the board with the 100-pin edge connector at the bottom.

## 2.2 ASSEMBLY - MAIN MODULE BOARD

The following assembly procedures are written in logical steps. Variation of these steps is permitted, although consideration should be given to any impact that a change in the sequence may have.

The Address and Data circuits A through H (center top of the board) components are called out as R1A, R1B, etc.

ALL COMPONENTS ARE INSERTED FROM
THE FRONT OF THE BOARD.

### 2.2.1 Assembly Procedure

STEP 1. DIP Sockets Installation

There are five (5) 14-pin DIP sockets and fourteen (14) 16-pin DIP sockets. Install these sockets using the procedure outlined in the General section, 2.1.1.

STEP 2. Jumper Installation

There are five (5) Jumpers located at the upper-half center of the PC board. These jumpers are labeled A, B, C, D, and E, as seen from the rear of the board.

Working from the rear of the board, insert a piece of solid 22- or 24-gauge wire into one of the jumper points and solder. Slip a piece of sleeving over the wire and insert the open end into the other jumper point having the same letter. Push the wire flat and solder from the front of the board. Then trim the wire as close as possible to the board. This is necessary so that the components above the jumper pads can be placed close to the surface of the PC board to make a professional-looking product.

Repeat this procedure until all five jumpers are in position.

STEP 3A. TO-18 Transistor Installation - General Information

There are two types of TO-18 transistors used. These are:

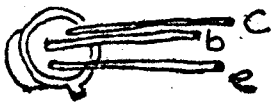
2222=P
2907=N

| | | |
|---|---|---|
| 2N2222A | NPN | Positive (P) type |
| 2N2907A | PNP | Negative (N) type |

To assist in proper transition location, a letter "P" is placed near the 2N2222A transistor and a letter "N" is located near the 2N2907A.

Take enough time during this procedure to insure you have selected the appropriate transistors before soldering. This would save you a lot of frustration and is well worth the extra time that you will invest.

The transistor pin connections, looking from the bottom (see picture below), reading clockwise and starting from the tab, are emitter (e), base (b), and the collector (c).




The transistor must NOT be placed directly flush on the board; otherwise, shorts of printed wiring may occur. Also, this will make it difficult to remove a transistor if it becomes necessary. Plastic pads are supplied for each TO-18 transistor. These pads are placed under the transistor before insertion. These pads must be used or an equivalent clearance must be given under the transistor; otherwise, the warranty may be invalidated.

STEP 3B. TO-18 Transistor Installation

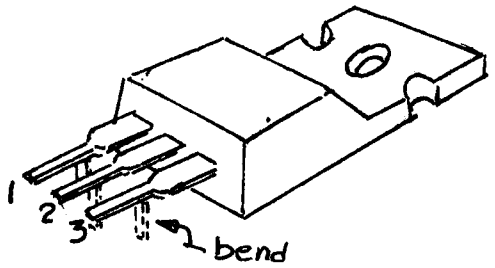
Install the transistors from the front of the board in their proper locations. Before installation, place the plastic pad supplied under the transistor. Push the transistor down so that it is in contact with the pad and so that the pad is in contact with the board, then solder one lead, from the rear of the board. Check the positioning of the transistor and that its alignment is such that it would not touch any transistors in its vicinity. If necessary, reheat the lead and readjust the transistor. When satisfied, solder the other two leads, then trim the leads from the rear side close to the board.

STEP 4A. IC Regulator - General Information

There are three IC voltage regulators in the TO-220 case. These are (other equivalent part numbers may be substituted):

| | | |
|---|---|---|
| VR1 | 340T-5/7805 | +5 volts |
| VR2 | 340T-12/7812 | +12 volts |
| VR3 | 320T-12/7912 | -12 volts |

The positive regulator (340T) pins are from left to right (see drawing below): INPUT (Pin 1), GROUND (Pin 2), OUTPUT (Pin 3). Note that the metal tab is at the same potential as Pin 2. The negative regulator (320T) pins are GROUND (Pin 1), INPUT (Pin 2), OUTPUT (Pin 3). The negative regulator tab will have a negative potential, and care should be taken not to short this part of the regulator case.




As a note, do not confuse the PNP D41D1 transistor with the voltage regulator (see Step 7A for information about this transistor).

STEP 4B. IC Regulator - Installation

The three regulators are located on the left side of the board. Select the appropriate regulator and bend the leads as shown above to fit the pad layout on the PC board. Repeat this procedure for all three regulators.

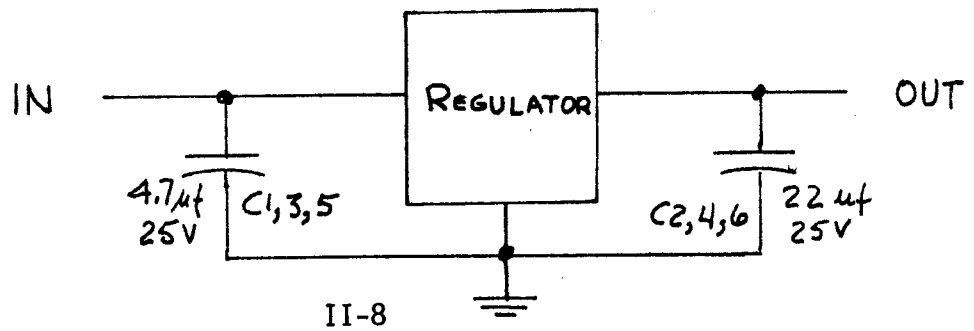
Insert the IC and put a 6-32 3/8 screw from the rear of the PC board. Adjust the leads, if necessary. Install an internal tooth lockwasher before putting the nut on.

The positive +5V (VR1) regulator uses a heat sink. Once the +5V regulator has been inserted and adjusted, remove the screw and slide the heat sink between the PC board and the regulator. Then insert the screw again as given above. Place another screw, also from the rear, in the second hole of the heat sink and add the washer and nut. Torque all the nuts down.

Once the IC regulators are installed, then solder the leads. If necessary, trim the leads from the rear side close to the board.

STEP 5A. Filter Capacitor - General Information

There are two filter capacitors for each voltage regulator. The typical circuit is shown below.



The polarity of these filter capacitors must be observed. The capacitors are marked indicating the polarities. Depending on the manufacturer of the capacitor, either the positive or negative leads are indicated. Sometimes, the polarity of the capacitor can be determined by inspection. In general, the negative end of the capacitor is the metal part of the capacitor can.

STEP 5B. Filter Capacitor - Installation

Take three (3) 4.7 µf and three (3) 22 µf capacitors and bend their leads to a 3/4-inch separation. Insert the capacitors from the front of the board in their proper location and proper polarities. Hold the capacitor onto the board and, from the rear of the board, solder the leads. Trim the leads from the rear side close to the board.

STEP 6. Test Voltage

A) Insert the main module into the S-100 bus. Using a dc voltmeter, connect across capacitor C2. Turn on the computer and measure the voltage. Record the results below.

Parasitic Eng. P.S.

4-20-7912 +5 volts [ +4.9 ] +4.8 to +5.3 volts

If the voltage is more or less than the limits indicated, turn the power off and go to Troubleshooting, Section 4.1.

B) Repeat the above for the +12 volts, using capacitor C4.

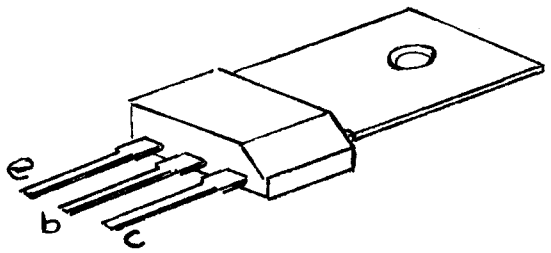
+12 volts [ +11.7 ] +11.5 to +12.7 volts

C) Repeat the above for the -12 volts, using capacitor C6.

-12 volts [ -12.0 ] -11.5 to -12.7 volts

STEP 7A. D41D1 Transistor - General Information

The PNP transistor (D41D1) pins are, from left to right (see drawing below): emitter, base, collector.



Note that the collector is indicated by the chamfer of the plastic case and the metal tab is internally connected to the collector. Care should be taken not to short this metal tab.

STEP 7B. D41D1 Transistor - Installation

Bend the leads as shown in the drawing above to fit the pad layout on the PC board. Hold the plastic case against the PC board and bend the metal tab so that it lies flat against the PC board. Insert a 6-32 x 3/8 screw from the rear of the PC board. Adjust the leads, if necessary. Install a flat washer and an internal tooth lock washer before putting on the nut. Torque the nut down and solder the three leads. If necessary, trim the leads from the rear side close to the board.

STEP 8A. Resistor - General Information

All resistors used are 1/4 watt size. The leads are bent close to the body, which should give a distance of 0.35 inches. This is the PC board spacing.

The following resistors are omitted in this step. They are inserted after further testing in later steps (see Step 14).

R9
R16
R40

STEP 8B. Resistor - Installation

Refer to the component layout shown in Figure 30 and the schematic shown in Figure 31.

Select the appropriate resistor for the position and insert the resistor from the front side of the board. Solder the leads and trim from the rear side of the board.

Start with the Address and Data circuits. Begin with Address circuit A, component R3A, top line; insert and solder the 10k resistor. Continue with the next resistor, R3B, two pads to the right, repeating the soldering process. This will continue until R3H has been inserted. Now jump over to the Data circuit H, component R6H, top line, second pad over. This is the pad going to top connector pin 11. Repeat the process above. Continue through R6A, and then to the programmer circuit R46.

Repeat all the above for R2A, 2.2k, located at the center row. Continue through R2H, then to R5H through R5A and R45.

Repeat all the above for R1A, 680Ω, located at the bottom row. Note that the pad arrangement is different, having only the single circuit element in this row. Continue for R1H and then R4H through R4A and R44.

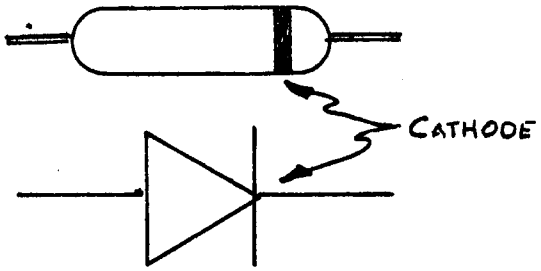
Next, do the six Address Select resistors, R8A through R8F, to the left of IC U5.

All of the rest of the resistors are located on the right-hand side of the board. Repeat the installation as described above.

STEP 9A. Diode - General Information

All the diodes are 1N4001 (alternate series of equivalent diodes may be substituted). The diode leads are bent to the same spacing as the resistors, which is 0.35 inches. Be careful <u>not</u> to mix these diodes with the zener diodes.

Care must be taken to insure that the diodes are installed in the proper direction. Follow the schematic for polarity indication. The band on the diode indicates the cathode end, as shown below.




To assist in installation, a bar was placed on the PC board, next to the connection which takes the cathode. (Only one indication is given in the Address and Data section. All the Address and Data diodes are placed in the same direction.)

STEP 9B. Diode - Installation

Start with the Address and Data circuits. Install from the front of the board with the diode cathode facing up. Beginning with Address circuit A, component CR2A, insert the diode, pushing down on the PC board. Solder the leads and trim from the rear of the board. Continue with the next diode, CR2B, two pads to the right, repeating the soldering process. This will continue until CR2H has been inserted. Now, jump over to the Data circuit H, component CR5H, top line, first pad. This is the pad to the left of the resistor which went to the top connector pin 11. Repeat the process through CR5A and CR27.

All the rest of the diodes are located on the right-hand side of the board. Repeat the installation as described above.

STEP 10. Bypass Capacitor - Installation

There are six (6) bypass capacitors. All the bypass capacitors are 0.1 mf. Insert these capacitors into circuit elements C8, C10, C11, C12, C13 and C14.

The capacitor leads will have to be formed properly so that no short circuits may occur. This is especially true for C9, C13, and C14. Additional care must be taken with bypass capacitor C14. The capacitor should be centered over the feedthrough pad. Note that this capacitor is connected between the right side of the Address Select resistor pads and the right side of the Address Select jumper pads.

STEP 11A. Address Select - General Information

Place jumpers across selected address for A2 through A7. (NOTE: At least one jumper must be used; otherwise, it would have the address FF, which is used within the computer.)

A six-pole DIP switch can be used, if you wish.

Information about the selection process is covered in Section 4.2.2.

STEP 11B. Address Select

From the front of the board, solder a piece of 22- or 24-gauge wire at the selected address pads for A2 through A7.

STEP 12. Insert DIP IC's

Insert DIP IC U1 through U19. Reread Section 2.1 for pin location and caution when inserting the IC's.

STEP 13. Test IC Operation

Place the module board on a card extender, which is inserted into the S-100 bus. Use an IC test probe to read signals existing at the IC pins. During these tests, a "1" would be a voltage over 3.0 volts (in Step 13D and 13E, a "1" is over 2.5 volts). A "Ø" would be a voltage of 0 to about +0.5 volts.

If improper operation occurs, refer to the Troubleshooting Section, IV.

A) Test Voltage

Repeat Step 6 above.

B) Test Address Enable

Place the IC test probe on U4 (8131) and connect a voltmeter between Ground and Pin 9. Turn on the computer.

The voltmeter should read a "1". Set the program for output port address selected as follows:

D 3
X X
Ø Ø

where XX is the selected address. Single step the program to open the output port. At this point, the voltage should go to a "0". Advance the program one step and the enable line (Pin 9) should go back to a "1".

C) Test Address Select

Place the IC test probe on U2 (74155). Measure the voltage on Pins 4, 5, 6, 7, 9 and 10. All of these voltages should be a "1". Now move the IC test probe to U1 (74Ø4). Measure the voltage on Pins 2, 4, 6, 8, and 1Ø. All of these voltages should be a "0".

Replace the IC test probe to U2. Set address select $A_1$ and $A_0$ to "0" and step the program for opening the output port. Pin 4 should go to "0". Continue as shown in the following table.

| | | U2 | | | | | | U1 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $A_1$ $A_0$ Pin | 4 | 5 | 6 | 7 | 9 | 10 | 2 | 4 | 6 | 8 |
| D3 | Ø | Ø | 1 | 1 | 1 | 1 | 1 | 1 | Ø | Ø | Ø |
| | 1 | 1 | 1 | Ø | 1 | 1 | 1 | Ø | Ø | 1 | Ø |
| | 2 | 1 | Ø | 1 | 1 | 1 | 1 | Ø | 1 | Ø | Ø |
| | 3 | 1 | 1 | 1 | Ø | 1 | 1 | Ø | Ø | Ø | Ø |
| DB | 1 | 1 | 1 | 1 | 1 | 1 | Ø | Ø | Ø | Ø | Ø |
| | 3 | 1 | 1 | 1 | 1 | Ø | 1 | Ø | Ø | Ø | 1 |

In tests D) through G), refer to the following table.

| | Pin Connector | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3E | 1 | 8 | 11 | 14 | 9 | 10 | 15 | 16 |
| Data (D) U16,U17 | ØØ | Ø | Ø | Ø | Ø | 1 | 1 | 1 | 1 |
| | FF | 1 | 1 | 1 | 1 | Ø | Ø | Ø | Ø |
| Address (E) U14,U15 | ØØ | Ø | Ø | Ø | Ø | 1 | 1 | 1 | 1 |
| | FF | 1 | 1 | 1 | 1 | Ø | Ø | Ø | Ø |
| Address (F) U13 | ØØ | Ø | Ø | Ø | Ø | 1 | 1 | 1 | 1 |
| | FF | 1 | 1 | 1 | 1 | Ø | Ø | Ø | Ø |
| Control (G) U9 | ØØ | Ø | Ø | Ø | Ø | 1 | 1 | 1 | 1 |
| | FF | 1 | 1 | 1 | 1 | Ø | Ø | Ø | Ø |

LATCH TABLE

D) Test Data Latch (74L75)

The data latch is set when $A_1$ and $A_0$ are set to "3". Expand the program to set "A" first to ØØ and then to FF.

3E
ØØ
D3
XX
ØØ

Single step through the program.

Place the IC test probe on U16 and U17. Test pins 1, 14, 11, and 8. With "A" set to ØØ, the output should be "0" on all pins. Change the program "A" to FF. Single step through the program. Remeasure pins 1, 14, 11, and 8. The output should be "1" on all pins.

E) Test Address Latch (Lower)

The lower address latch is set when $A_1$ and $A_0$ are set to "1". Repeat the above procedure (D) except using U14 and U15, pins 16, 15, 10, and 9; set "A" to FF first.

F) Test Address Latch (Upper)

The upper address latch is set when $A_1$ and $A_0$ are set to "2". Repeat procedure D) for pins 11 and 8 only, except using U13; set "A" to ØØ first.

G) Set Control Latch

The control latch is set when $A_1$ and $A_0$ are set to "Ø". Repeat the above, except using U9, pins 1, 14, 11, and 8; set "A" to ØØ first.

H) Test Control Logic

Place the IC test probe on U12. Pins 4 and 11 are at VCC (+5 volts) and pin 10 should be at "1".

In the following, $A_1$ and $A_0$ are set to "Ø". Set "A" to Ø8 (by putting Ø8 in Step 2 and step through the program given in procedure D). Pin 3 of U12 should be "Ø". Pins 6 and 12 should be "1" and pin 8 should be "0".

Set "A" to ØØ and step through the program. Pin 6 should still be "1", but pin 12 should now be "0".

Momentarily short pin 10 to Ground (be careful that it is pin 10). Pin 6 should now go to "0" and pin 12 should go back to "1". You now have tested the over current latch logic.

Repeat the program first with "A" set to Ø8 and then to ØØ. Now move the test probe to U10. Pins 6, 8 and 11 should be "1". Move the test probe to U11. Pins 6, 8 and 10 should all be "0" and pin 12 should be "1".

Set A to Ø7. With the test probe on U11, pins 6, 8, 10 and 12 should all be "1".

STEP 14A. Resistors R9, R16, R40 - General Information

These three resistors are all in the high voltage generator circuits. If an abnormal operation occurs, due to failure of some circuit component, then excessive wattages could be produced in these resistors, resulting in the generation of heat and the destruction of the resistors.

To make replacement of these resistors easy and to prevent discoloring of the printed circuit board, it is suggests that these resistors be placed OFF the board by a little more than one-half of the body diameter (about 1/16 inch).

STEP 14B. Resistors R9, R16, R40 - Installation

Select the appropriate resistor for the position and insert the resistor from the front side of the board. Solder the leads and trim

from the rear side of the board. Make sure the resistor is not down in contact with the board.

Repeat the above procedure until all three resistors are in place.

STEP 15A. Capacitors C7 and C9 - General Information

These two capacitors are the pulse capacitors used in the high voltage generation circuits.

STEP 15B. Capacitors C7 and C9 - Installation

Select the appropriate capacitor for the position and insert the capacitor from the front side of the board, making sure that the polarity is correct. Repeat the above for the second capacitor.

Looking at the front of the board with the 100-pin connector at the bottom, the C7 negative side is on the right side and the C9 negative side is on the left side.

STEP 16A. Zener Diode - General Information

There are five different types of zener diodes used. These are:

Low Power

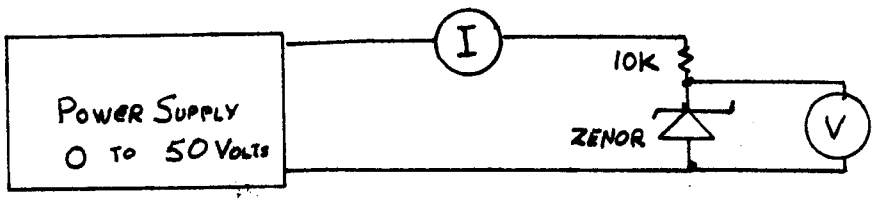
| | |
|---|---|
| 1N5223 | 2.7 volts |
| 1N5240 | 10 volts |
| 1N5254 | 27 volts |
| 1N5261 | 47 volts |

High Power

| | |
|---|---|
| 1N5342 | 6.8 volts |

(Alternate series of equivalent diodes may be substituted.)

If, for some reason, the identification of the diode is obscured, the actual value can be measured utilizing the circuit given below.



Starting from 0, increase the power supply voltage until a further increase in supply voltage causes only a very small change in the voltmeter placed across the zener. If a current meter is available and placed in the main supply lead, then zener action can be noted when there is a sharp increase of the supply current as the voltage is increased. The voltmeter reading is then the zener voltage. Note that this voltage may be a few volts lower than the stated zener voltage. This is due to the fact that the current drawn by this circuit can be lower than the rated test value.

STEP 16B. Zener Diode - Installation

Start with the Address and Data circuits. Install from the front of the board with the cathode facing down. Beginning with Address circuit A, component CR1A, inser the diode, pushing down on the PC board. Solder the lead and trim from the rear of the board. Continue with the next diode, CR1B, two pads to the right, repeating the soldering process. This will continue until CR2H has been inserted. Now jump over to the Data circuit H, component CR4H, center line, second pad. This pad is to the right of R5. Repeat this process through CR4A and CR26.

Next install zener diode 1N5342 into location CR3. The component location is located to the left of the top row of the Address group. This device can be distinguished from the other zener diodes by its larger body diameter.

All the rest of the zener diodes are located on the right-hand side of the board. Repeat the installation as described above.

STEP 16C. Test CR3 Voltage

Place the main module board on a card extender which is inserted into the S-100 bus and turn the computer ON. Using a dc voltmeter, measure the voltage output from the diode (pin CC of top connector) to Ground. The voltmeter should read about -5.2 volts with a 10K ohm load.

STEP 17. Test Pulse Voltage Generator

Place the main module board on a card extender which is inserted into the S-100 bus. Place the 50-pin edge connector on the top board connector.

At this point, an oscilloscope would prove helpful. A dc voltmeter (10,000 ohms per volt or better) is necessary to properly test the board operation. In the following, the voltmeter has one lead attached to the board Ground. If an oscilloscope is used, it is also grounded to to the board Ground.

Care must be taken not to accidentally short circuit the voltage being measured.

Turn the computer ON and follow the steps given below.

Set the following program. This program turns OFF both Address and Data busses for this portion of the test.

```
0000    3E      ┐
0001    00      │
0002    D3      │  Turn OFF DATA
0003    F3      ┘

0004    3E      ┐
0005    FF      │
0006    D3      │  Turn OFF ADDRESS
0007    F1      ┘

0008    3E      ┐
0009    08      │
000A    D3      │  Reset Latch
000B    F0      ┘

000C    3E      ┐◄──────────────────┐
000D    00      │                   │
000E    D3      │  Set Charge       │
000F    F0      ┘                   │
                                    │
0010    05 ◄─┐  ┐                   │
0011    C2   │  │  Delay            │
0012    10   │  │                   │
0013    00 ──┘  ┘                   │
                                    │
0014    3E      ┐                   │
0015    07      │                   │
0016    D3      │  Set Pulse        │
0017    F0      ┘                   │
                                    │
0018    05 ◄─┐  ┐                   │
0019    C2   │  │  Delay            │
001A    18   │  │                   │
001B    00 ──┘  ┘                   │
                                    │
001C    C3                          │
                                    │
001D    0C      ┐                   │
001E    00 ─────┘───────────────────┘
```

Run this program and make the following measurements:

A) 2708 Positive Pulse

Now attach a voltmeter to capacitor C7 positive lead. You can use pin 1 of the top connector. Meter should read about +12.5 volts. Move the lead to the negative lead of C7. The meter should read about -1.2 volts. Waveform C7 positive lead is about Ground to +27 volts peak.

B) Negative Pulse

Attach the voltmeter to capacitor C9 negative lead. Meter should read about -30 volts. Move the lead to the positive lead of C9.

The meter should read about -1.2 volts. Waveform C9 negative lead is about -16 volts to -47 volts peak.

C) 1702A Program Pulse

Attach the voltmeter to program pulse output, pin E, of the top connector. The meter should read about -22 volts. Waveform should read about Ground to -47 volts peak.

D) 1702A $V_{DD}$ Pulse

Attach the voltmeter to $V_{DD}$ pulse output, pin 2 of the top connector. The meter should read about -28 volts. Waveform should read about -9 volts to -47 volts peak.

E) 1702A $V_{GG}$ Pulse

Attach the voltmeter to $V_{GG}$ pulse ouptut, pin 3 of the top connector. The meter should read about -23.5 volts. Waveform should read about -9 volts to -37 volts peak.

F) 1702A Address Pulse

Attach the voltmeter to each of the Address pulse outputs, one at a time: pins S,T, U, V, W, X, Y, and Z. The meter should read about zero.

Set program step 0005 to ØØ and run the program from the start.

Repeat the above. The meter should read about -19 volts. Waveform should read about Ground to -47 volts peak. Reset step 0005 to FF.

G) 1702A Data Pulse

Attach the voltmeter to each of the Data pulse outputs, one at a time: pins 4, 5, 6, 7, 8, 9, 10, and 11. The meter should read about zero.

Set program step 0001 to FF and run the program from the start.

Repeat the above. The meter should read about -19 volts. Waveform should read about ground to -47 volts peak.

This completes the circuit testing procedure. Upon successful results, your Prom Setter will operate properly.

## 2.3 ASSEMBLY INTERCONNECTING CABLE

The Interconnecting Cable connects the main module board of The Prom Setter to the back of your computer. It uses the same ribbon cable as is used with the socket board.

There are three DB25S (female) connectors used to arrange the Prom socket pin connectors and signals for operating the 1702A and 2708.

The other end of the cable is attached to a 50-pin connector (50-50EE-30), J2. This connector is a dual 25-pin type and is labeled 1 through 25 and then A through Z and AA, BB, CC with the following letters not used: G, I, O, Q.

Pin connections of J2 are given in Figure 1. The three rear connectors (DB25S type) J3, J4, and J5 pin connections to J2 are given in Figure 2.

Assembly is accomplished by first attaching the ribbon cable to connectors J3, J4, and J5, then making the cable run to connector J2. Enough cable should be used to allow your Prom Setter module to operate when placed on an extender board.

There are two types of DB25 connectors that may be supplied with each kit. These connectors are either one in which the pins are molded into the connector body or one where the pins are removable from the body of the connector. Both types will perform identically, although they require different assembly procedures.

### 2.3.1 Removable Pin Connector

The pins of this type of connector are inserted and removed using a special tool that is supplied with the kit. Only light force is required when using this tool. The tool is made of plastic and excessive force may destroy the thin end. A slit along the length of the tool will allow the wire to enter into the center of the tool.

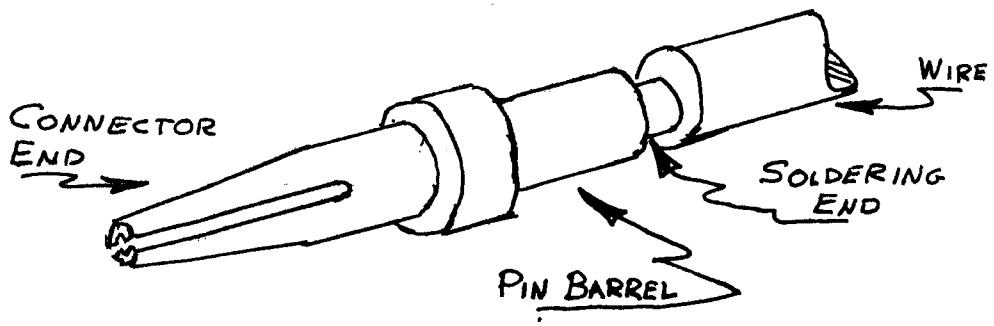
To remove an inserted pin, push the tool's thin end into the connector body from the wire side. Then from the other side, push the pin out. For the female pin, a small paper clip will prove useful as a pushing tool.

To insert a pin, place the thin edge of the plastic tool against the ridge of the connector pin from the wire side. Then push the pin into the connector body. This should require only a light force. Once the pin is properly inserted, the plastic tool is slid back along the wire and then removed by allowing the wire to pass through the slit along its length.

CAUTION

Before soldering a wire to the connector, make sure you are operating from the proper end. The connector side has two slits. The wire

soldering end has the shorter barrel as shown below.




Care should be taken to prevent excessive solder forming around the pin barrel. UNDER NO CIRCUMSTANCES should solder be allowed to flow onto the connector side of the pin; otherwise, the connector pin may be destroyed.

NO SLEEVING is used when assembling this type of connector.

2.3.2 Fixed Pin Connector

The pins of this type of connector are molded into the connector body and are not removable.

Before soldering the wire to the connector, a short piece of shrink tubing (about 3/8 inches) is placed over the wire. Once all the wires are soldered into place on the connector, the tubing is pushed down all the way so that it covers the rear pin. Be careful not to have excessive solder on the outer surface of the connector pin. The tubing supplied is heat-shrink type and requires heat of over 250°F to cause the tubing to shrink. A heat gun is normally used to shrink the tubing. You can try a 1000-watt hairdryer. An alternate method is to place the connector assembly into a preheated 250°F oven for about two (2) minutes. Repeat this process if necessary.

DO NOT OVERDO the oven heating; otherwise, components may be damaged. Use the largest size tubing for pins which hold two wires.

STEP 18A. Interconnecting Cable Assembly - General Information

The ribbon cable supplied has 15 wires. The cable is color coded, starting with brown, going through white, and then continuing with black through green. Assign the color code number as brown = 1, red = 2, etc. Write the color code number on the figures as connections are made to the DB25 connectors.

Assembly of the wire to the connector is accomplished by first trimming the wire insulation back for about 3/8 inch. Then twist the wire smooth and tin the end. Then cut the wire back (about 1/8 inch) to fit flush into the connector pin. When two wires are used in a single connector

pin, follow the above procedure except twist both wires together before tinning the end. Do not use more than two wires per pin.

A small vise may prove helpful when soldering the connector pins.

Solder the DB25S sockets first, then make the run to the main module board connector J2.

Suggested arrangement of the three DB25 connectors is to put the 1702A Write (J3) on the bottom with the 1702A Read (J4) on top. The 2708 Read/Write (J5) can then be placed above or to one side of the other connectors.

Note the front side of the main module J2 has numeric pins and the rear connector pins are letters.

STEP 18B. 1702A Write Connector J3

Take the ribbon cable and strip all wires from the wire next to it for about 1-1/2 inch. Continue to strip back the two end wires colored green and yellow for about two feet. This will leave thirteen (13) wires on the ribbon cable. Use the removed two wires for interconnect jumper on the connector.

Starting with the first wire (brown), twist together with a jumper wire about 4 inches long and solder to connector pin 1. Take the second wire (red) and solder this single wire to pin 2 of the connector. Continue this procedure for the rest of the pins except for pin 7 (Write Disable control) which has a jumper wire as was accomplished for pin 1.

Now take the other end of the ribbon cable, repeating the above stripping, except this time continue to strip back the first three wires for about two feet. These are brown, red and orange wires.

Starting with the first wire (yellow), solder this single wire to pin 14 of the connector. Continue making pins 15 and 17 having jumper wires. Attach the rest of the wires till pin 23 is reached.

Take the jumper wire attached to pin 1, leaving a service loop, make a second jumper wire and solder to pin 23 and then to the second jumper and soldered it to pin 24.

Take the next wire of the ribbon cable and solder it to pin 25 of the connector. In this process, the wire color code will represent the pin connection (except for the last connection made) and assist in connection to J2.

Remove the outside two wires not used in the above procedure.

Now temporarily attach the connector to the back of the computer and make the two pieces of ribbon wire run as neat as possible and as it will be used in the computer. Remember to leave enough service loop to permit the main module board to be operational when placed on an extender board.

Let the wire cable extend about two inches beyond the connector J2 and cut the cable. NOTE: The direction of the cable is determined by your computer and where the DB25 connector is placed.

STEP 18C. 2708 Read/Write Connector J5

With this connector, almost all the pins have two wires attached to them. The only single wires are

19, 20, 21, 22, 23, 24 .

Repeat the process as outlined in Step 18B. Starting with the first wire (brown), twist together with a jumper wire and solder to connector pin 1. All jumpers are used to connect to J4 and should be about 4 inches long. Repeat this process until connector pin 13 is reached. Then continue with a second ribbon cable as was given in Step 18B. Starting with the first wire (yellow), continue the operation until pin 25 of the connector is soldered.

As in Step 18B, temporarily attach the connector to the back of the computer and run the two ribbon cables to connector J2 of the main module. Cut the cable as before.

STEP 18D. 1702A Read Connector J4

This connector uses the jumpers from both J3 and J5. At this point, there should be four (4) jumpers from J3 as follows:

| Pin J3 | | Pin J4 |
|---|---|---|
| 7 | Disable | 7 |
| 15 | Ground | 15 |
| 17 | $V_{GG}$ | 17 |
| 25 | $V_{DD}$ | 25 |

and from J5 there are 19 jumpers. These are all pins <u>except</u> 19, 20, 21, 22, 23, and 24.

Most of the jumpers are single wires soldered to connector J4. The following pin connections of J4 are wire pairs:

7, 14, 15, 16, 23, 24

Starting with the jumpers from J5, connect all the single jumpers. A wire connection table for J4 from J3 and J5 is given in Figure 2.

STEP 18E. 50-Pin Main Module Connector J2

Temporarily attach the three connectors J3, J4 and J5 to the back of the computer. You now have four ribbon cables coming from the connectors, going to J2. Make the ribbon wire run as before.

Take the ribbon cable and strip all wires from the wire next to it the full length of connector J2 and about one inch further. Mark the main cable (from J3 and J4) and lace the cables together, about one inch beyond where the wires were separated from each other. Then remove the cable and J2 from the computer. This will make it easier to work and will insure that no damage will occur to your computer due to solder droppings.

All pins take a single wire except pins 13 and A. These two pins have wires coming from J3 and J5.

A small vise may prove helpful when soldering the connector pins. Place connector J2 into the vise with the wire soldering connections facing up and the top of the body about at the top jaws of the vise. Do not put too much pressure; otherwise, the connector may be broken.

Bend the pins 90 degrees, starting about 1/32 of an inch above the connector body.

Cut 1/2-inch lengths of heat shrink tubing. Starting with the shortest cable length (either J2, pin 1/A, or J2, 25/CC, depending on the direction the cable is coming from)

Hold the cable in place and cut the shortest connecting wires, leaving about 1 inch extra length. Then trim the wire insulation back for at least 1/2 inch. When two wires go to the same pin, they can be either put on one at a time or both twisted together. Twist smooth and tin the wire end and cut back to about 1/4 inch. Slide a piece of heat-shrink tubing over the wire. When two wires are used, both wires should be put into one piece of tubing. Mechanically attach the wire to the connector lug. Solder the wire to the lug, making sure that the heat shrink tubing will slide down over the lug all the way.

Repeat the above procedure until all connections are made. Figure 1 gives the wire interconnections to J2.

After completion of all soldering, using an ohmmeter or other continuity measuring device, carefully check all connections to make sure proper connection was made and no shorts exist.

Slide all the heat shrink tubing down onto the connector lugs and shrink the tubing (see paragraph 2.3.2 for methods of shrinking the tubing).

STEP 18F. Install Connecting Cable

Permanently install the three DB25 connectors. Use lacing string to form the ribbon cable run as required to make a professional run. The connectors are held in place with 6-32 x 1/2-inch screws. Use an internal tooth lock washer and then the nut. Torque the nut down. Clean up the 50-pin connector J2 with lacing string.

## 2.4 PROM SOCKET BOARD ASSEMBLY

You have now completed the assembly of the main module. The next series of steps is to assemble the socket board.

Looking at the back side of the PROM socket board TPS-200, you will note a tape placed on the board. DO NOT REMOVE THIS TAPE. The tape is a special high temperature insulating tape to assist the assembly processes.

### STEP 19A. Interconnecting Cable - General Information

The ribbon cable has 15 wires. The first cable uses 13 leads and the second cable uses 12 leads. The cable is color-coded starting with brown going through white and then continuing with black through green. Assign the color code numbers such as brown = 1, red = 2, etc. Note the pads have no through-holes.

### STEP 19B. Interconnecting Cable - Installation 1

Cut a length of 15-wire ribbon cable about 26 inches long. Strip off the end green and yellow wires. [The cable will now start with a brown wire (1) and end with an orange wire (3)].

Strip all wires back by about 1-1/2 inches. Be careful not to expose the wire from the insulation. Now take the wires starting from each end and trim as an inverted V, "Λ", to fit the layout on the pads on the upper back of the socket board TPS-200.

Trim the insulation back for about 3/16 inch on each wire, being careful not to cut the wires. Twist smooth and, with solder, tin the ends, then cut to about 1/8 inch long. Starting from the left with the first wire (brown), solder the 13 leads to the upper pads.

### STEP 19C. Interconnecting Cable - Installation 2

Cut another length of ribbon cable the same length as used in Step 19B. This time, strip off the first three wires—brown, red and orange. [The cable now starts with yellow (4) and ends with green (5)].

Strip, trim, and solder the wires as was accomplished in Step 19B. Starting from the left with the first wire [yellow (4)], solder the 12 leads to the center pads.

### STEP 19D. Interconnecting Cable - Installation 3

Put a couple of tie wraps through the two back holes on the socket board and around the two ribbon cables.

Hold the cables flat and trim the two ribbons to the same length. Now, strip all wires from the wire next to it for about 1-3/4 inch. Trim the wire insulation back for about 3/8 inch. Then twist the wire smooth

and tin the end. Cut the wire back (to about 1/8 inch) to fit flush into the connector pin.

For Fixed-Pin Connector type, follow the use of heat shrink tubing as given in section 2.3.2. Using an ohmmeter or other continuity measuring device, carefully check all connections to make sure proper connection was made and no shorts exist.

The connector pin interconnections are given in Figure 5.

Once the connector is assembled, fit the plastic cover to the connector.

STEP 19E. Socket Board Rubber Feet

There are four rubber feet supplied with the kit. Push a flat washer down into the center of the rubber foot. This takes a small amount of force and it helps if the flat washer is inserted at an angle. Follow this with a 6-32 nut.

Place an internal lock washer over a 6-32 x 3/8 screw and insert the screw from the top of the socket board into one of the four holes at the corners. Holding the screw in position, place the rubber foot from the back side, small hole, over the screw, then turn the screw until taut.

STEP 19F. Diode Installation General Information

The two diodes on the socket board allow the Write Disable Switch to connect the write disable line to ground. These diodes were necessary since the ground connection changes when operating with the 1702A or 2708.

STEP 19G. Diode Installation

Insert the two diodes as shown by the symbol into the board and solder from the back side.

STEP 19H. 24-Pin Socket

Insert the 24-pin socket from the front of the socket board. While holding the socket in contact with the board, solder pins on opposite corners, and check that the socket is in contact with the PC board. Solder the remaining pins.

It would be helpful if you have a 24-pin IC that you can place into the socket when soldering the pins. This will help align the socket contacts.

STEP 19I. Switch Installation

Push the switch into the socket board from the front side with the switch activator arm facing the word "ON". Solder from the back the two metal frame parts and the three switch connections.

This is the last step in the assembly procedure.

| Pin J2 (Front) | | Pin J2 (Rear) | | |
|---|---|---|---|---|
| 1 | +Pulse | A | Write Disable | |
| 2 | $V_{DD}$ | B | $V_{CC}$ | 1702A |
| 3 | $V_{GG}$ | C | $\overline{CS}$/WE | 2708 |
| 4 | D0 1702 (A) | D | $V_{BB}$ | 1702A |
| 5 | D1 1702 (B) | E | Prog. Pulse | 1702A |
| 6 | D2 1702 (C) | F | D0 | 2708 (A) |
| 7 | D3 1702 (D) | H | D1 | 2708 (B) |
| 8 | D4 1702 (E) | J | D2 | 2708 (C) |
| 9 | D5 1702 (F) | K | D4 | 2708 (E) |
| 10 | D6 1702 (G) | L | D5 | 2708 (F) |
| 11 | D7 1702 (H) | M | D6 | 2708 (H) |
| 12 | D3 2708 (D) | N | -12 | |
| 13 | Ground | P | +12 | |
| 14 | +5V | R | +16 | |
| 15 | D7 2708 | S | A7 | 1702A (H) |
| 16 | A7 2708 | T | A6 | 1702A (G) |
| 17 | A6 2708 | U | A5 | 1702A (F) |
| 18 | A5 2708 | V | A4 | 1702A (E) |
| 19 | A4 2708 | W | A3 | 1702A (D) |
| 20 | A3 2708 | X | A2 | 1702A (C) |
| 21 | A2 2708 | Y | A1 | 1702A (B) |
| 22 | A1 2708 | Z | A0 | 1702A (A) |
| 23 | AØ 2708 | AA | -5 $V_{BB}$ | |
| 24 | A8 2708 | BB | A10 | |
| 25 | A9 2708 | CC | A11 | |

Figure 1. Connector J2 Pin Connection

| Pin | J3 1702A Write | | | J4 1702A Read | | J5 2708 Read/Write | |
|---|---|---|---|---|---|---|---|
| 1 | J2- B | +5/$\phi$ | | J2-14 | +5 | J2-13 | Grd |
| 2 | 11 | D7 | 1702 | 15 | D7 | J | D2 |
| 3 | 10 | D6 | 1702 | M | D6 | H | D1 |
| 4 | 9 | D5 | 1702 | L | D5 | F | D0 |
| 5 | 8 | D4 | 1702 | K | D4 | 23 | A0 |
| 6 | 7 | D3 | 1702 | 12 | D3 | 22 | A1 |
| 7 | A | Disable | | A | Disable | A | Disable |
| 8 | 6 | D2 | 1702 | J | D2 | 21 | A2 |
| 9 | 5 | D1 | 1702 | H | D1 | 20 | A3 |
| 10 | 4 | D0 | 1702 | F | D0 | 19 | A4 |
| 11 | Z | A0 | 1702 | 23 | A0 | 18 | A5 |
| 12 | Y | A1 | 1702 | 22 | A1 | 17 | A6 |
| 13 | X | A2 | 1702 | 21 | A2 | 16 | A7 |
| 14 | E | Prog | 1702 | 14 | +5 | 12 | D3 |
| 15 | 13 | Grd | | 13 | Grd | K | D4 |
| 16 | D | $V_{BB}$ | 1702 | 14 | +5 | L | D5 |
| 17 | 3 | $V_{GG}$ | 1702 | 3 | $V_{GG}$ | M | D6 |
| 18 | S | A7 | 1702 | 16 | A7 | 15 | D7 |
| 19 | T | A6 | 1702 | 17 | A6 | 1 | Prog |
| 20 | U | A5 | 1702 | 18 | A5 | P | $V_{DD}$ (+12) |
| 21 | V | A4 | 1702 | 19 | A4 | C | $\overline{CS}$/WE |
| 22 | W | A3 | 1702 | 20 | A3 | AA | $V_{BB}$ (-5) |
| 23 | B | +5/$\phi$ | | 14 | +5 | 25 | A9 |
| 24 | B | +5/$\phi$ | | 14 | +5 | 24 | A8 |
| 25 | 2 | $V_{DD}$ | 1702 | 2 | $V_{DD}$ | 14 | $V_{CC}$ (+5) |

Figure 2. Connectors J3, J4, and J5

| Pin | J4 Connector | J3 Jumper Pin | J5 Jumper Pin |
|---|---|---|---|
| 1 | from 14J4 | --- | --- |
| 2 | | --- | 18 |
| 3 | | --- | 17 |
| 4 | | --- | 16 |
| 5 | | --- | 15 |
| 6 | | --- | 14 |
| 7 | (double wire) | 7 | 7 |
| 8 | | --- | 2 |
| 9 | | --- | 3 |
| 10 | | --- | 4 |
| 11 | | --- | 5 |
| 12 | | --- | 6 |
| 13 | | --- | 8 |
| 14 | to 1 from 16J4 | --- | --- |
| 15 | (double wire) | 15 | 1 |
| 16 | to 14 from 23J4 | --- | --- |
| 17 | | 17 | --- |
| 18 | | --- | 13 |
| 19 | | --- | 12 |
| 20 | | --- | 11 |
| 21 | | --- | 10 |
| 22 | | --- | 9 |
| 23 | to 14 from 24J4 | --- | --- |
| 24 | to 23J4 from 25J5 | --- | 25 |
| 25 | | 25 | --- |

Figure 3. J4 Pin Connections

J2 to J3 and J5 Pin Connection

| Pin J2 (Front) | | Color Code | Pin J2 (Rear) | | Color Code |
|---|---|---|---|---|---|
| 1 | 19J5 | | A | 7J3 and 7J5 | |
| 2 | 25J3 | | B | 1J3 | |
| 3 | 17J3 | | C | 21J5 | |
| 4 | 10J3 | | D | 16J3 | |
| 5 | 9J3 | | E | 14J3 | |
| 6 | 8J3 | | F | 4J5 | |
| 7 | 6J3 | | H | 3J5 | |
| 8 | 5J3 | | J | 2J5 | |
| 9 | 4J3 | | K | 15J5 | |
| 10 | 3J3 | | L | 16J5 | |
| 11 | 2J3 | | M | 17J5 | |
| 12 | 14J5 | | N | NC | |
| 13 | 15J3 and 1J5 | | P | 20J5 | |
| 14 | 25J5 | | R | NC | |
| 15 | 18J5 | | S | 18J3 | |
| 16 | 13J5 | | T | 19J3 | |
| 17 | 12J5 | | U | 20J3 | |
| 18 | 11J5 | | V | 21J3 | |
| 19 | 10J5 | | W | 22J3 | |
| 20 | 9J5 | | X | 13J3 | |
| 21 | 8J5 | | Y | 12J3 | |
| 22 | 6J5 | | Z | 11J3 | |
| 23 | 5J5 | | AA | 22J5 | |
| 24 | 24J5 | | BB | NC | |
| 25 | 23J5 | | CC | NC | |

Figure 4. Ribbon Wire Interconnector Pin Configuration

| Plug Connection | | TPS-200 Socket Board | |
|---|---|---|---|
| Pin | Color Code | EPROM Socket Pin | Color Code |
| 1 | | 12 | |
| 2 | | 11 | |
| 3 | | 10 | |
| 4 | | 9 | |
| 5 | | 8 | |
| 6 | | 7 | |
| 7 | | (Write Disable) | |
| 8 | | 6 | |
| 9 | | 5 | |
| 10 | | 4 | |
| 11 | | 3 | |
| 12 | | 2 | |
| 13 | | 1 | |
| 14 | | 13 | |
| 15 | | 14 | |
| 16 | | 15 | |
| 17 | | 16 | |
| 18 | | 17 | |
| 19 | | 18 | |
| 20 | | 19 | |
| 21 | | 20 | |
| 22 | | 21 | |
| 23 | | 22 | |
| 24 | | 23 | |
| 25 | | 24 | |

Figure 5. Socket Board Interconnection Wiring to Connector

# SECTION III

# READ AND WRITE OTHER EPROMS

## 3.1 GENERAL

This section contains information on putting your PROM SETTER to work reading and writing the 2716 of TI and INTEL, along with 5204 of NATIONAL, S5204 AMI, and the 6834, besides the 1702A and the 2704/2708.

You will have to decide which combination of EPROMs are to be added to the PROM SETTER capabilities. As more EPROM types are added to the list, the more complicated is the make-up of the interconnecting cable that comes from the top of the PROM SETTER main module to the 25-pin connector that attaches to the rear of the computer.

The PROM SETTER kit is initially set to read and write 1702A and 2704/2708 EPROMs. The following gives all the information that will allow the READING and WRITING of other EPROMs.

With the materials supplied, the PROM SETTER can be arranged to read and write any one of the following combinations of EPROMs:

1702A and 2704/2708
1702A and 2716 TI
2704/2708 and 2716 TI
S5204 and 2704/2708
S5204 and 2716 TI
6834 and 2704/2708
6834 and 2716 TI

Adding a double-pole, double-throw switch will allow the present three output connector unit to read and write any one of these combinations of EPROMs.

1702A, 2704/2708, and 2716 TI
S5204, 2704/2708, and 2716 TI
6834, 2704/2708, and 2716 TI

Adding a five-pole triple-throw (nonshorting) switch with a diode, a zenor (24 volt 1N5252), two 1/4w resistors, and a transistor circuit will permit the addition of the INTEL 2716 to the above EPROMs. Adding eight zenor diodes and a single-pole, double-throw switch will allow the reading and writing of the 5204 National EPROM in place of the 1702A or S5204 or 6834 in the above listings. Including two additional 25-pin connectors to the above material will allow reading and writing of all the listed EPROMs.

## 3.2 EPROM PIN DESIGNATION

A list of pin designations on EPROMs 1702A, 2704/2708, 2716 TI, 2716 INTEL, 5204 NATIONAL, S5204 AMI, and 6834 are given in Table 3.1.

When dual voltages are used to do a READ/WRITE function, they are indicated as the Read voltage followed by a "/" and then the Write voltage is given. The pulsed voltages required during EPROM WRITE for Prog, $V_{GG}$, $V_{DD}$ are given in Table 3.2.

## 3.3 INTERCONNECTING CABLE CONNECTIONS

The following tables, 3.3 through 3.9, give the wiring for each EPROM. These are the connections from the main module top connector J2 to one (or two) of the 25-pin (DB25) connectors. The 25-pin connectors are normally brought to the rear of your computer.

Tables 3.3 and 3.4 are the same wiring as given previously in Section II of this manual. Note that the 1702A (Table 3.3) will require two 25-pin connectors (one for Read and one for Write), due to the fact that 17 connections are changes for a Read to Write operation. This requirements for two 25-pin connectors also applies to the 5204 NATIONAL (Table 3.7).

All the EPROMs, except the 2716 INTEL (Table 3.6), can be wired and used to Read and Write the EPROMs. The 2716 INTEL can be added, providing the reduced positive pulse limiting circuit consisting of the diode and zenor IN5252 are disconnected whenever programming or reading the 2704/2708 and 2716 TI. The S5204 and 6834 would require a switch to go from the Read to the Write operation or two 25-pin connectors can be used. Improper operation would result in a Read operation with the connection made for Write, or vice versa.

Some of the modifications require circuits to permit Read and Write operations. These are shown in Figures 3.3.1 through 3.3.6. Information on adapting the PROM SETTER for these additional EPROMS are given in Section 3.4. Below is the circuit for adapting the 2708, 2716 INTEL and 2716 TI.

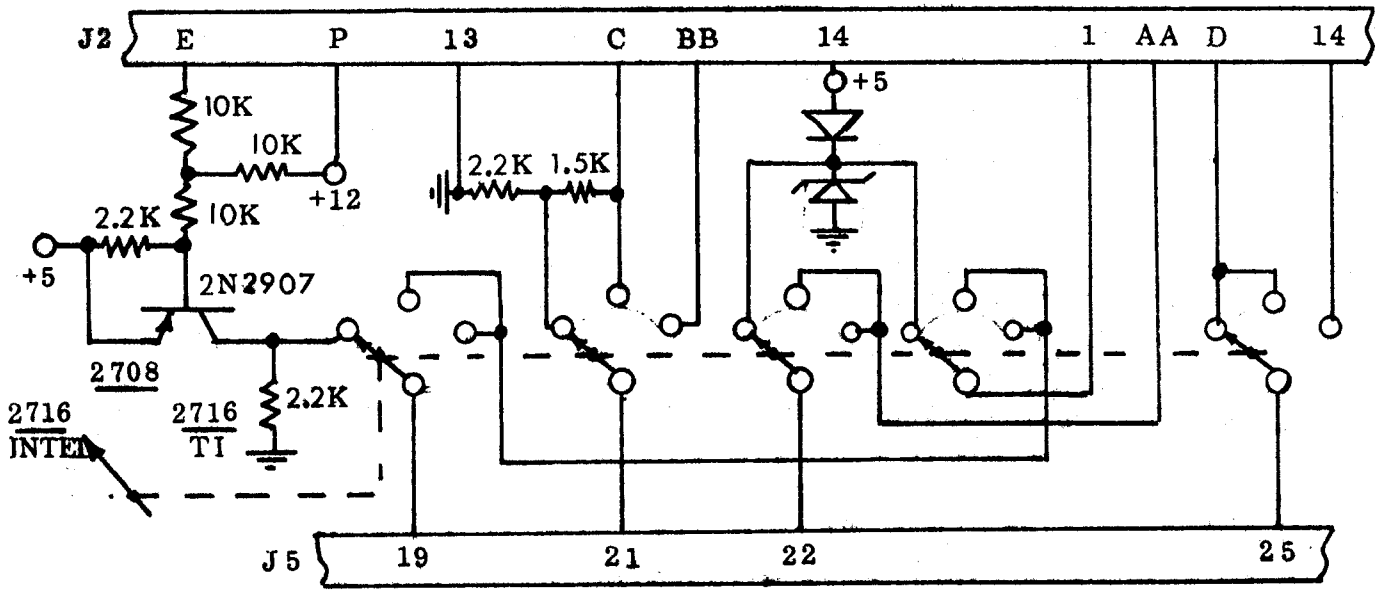



Figure 3.3.0

## 3.4 MODIFICATION INFORMATION

The following discussion contains information for modifying the PROM SETTER to permit operation with other EPROMs as listed below.

| Paragraph | EPROM | Table |
|---|---|---|
| 3.4.1 | 2716 TI | 3.5 |
| 3.4.2 | 2716 INTEL | 3.6 |
| 3.4.3 | 5204 NATIONAL | 3.7 |
| 3.4.4 | S5204 AMI | 3.8 |
| 3.4.5 | 6834 | 3.9 |

The wiring for each of these EPROMs is given in Tables 3.5 through 3.9. Each of the following sections gives several methods that can be applied for operating with the above EPROMs.

### 3.4.1 MODIFICATION FOR TEXAS INSTRUMENTS 2716 (2716 TI)

The 2716 TI can be adapted to the PROM SETTER using three methods:

1. Adding a double-pole, double-throw (nonshorting) switch.
2. Adding an additional 25-pin connector.
3. Replacing the 2704/2708 with the 2716 TI.

With the addition of a switch, the 2704/2708 connector J5 can be made to also Read and Write the 2716 TI. The 2716 Intel does NOT program the same as the TI and the Intel unit should not be used with this modification.

The 2716 TI is similar to the 2708 except for two pins, 2Ø and 24. This corresponds to the wires attached to the 25-pin connector (J5) pins 21 and 25, respectively.

There are no changes in the existing program except for the Clear Test 2708. To perform a clear test of the 2716 requires program step ØØAF changed

| FROM | TO |
|---|---|
| Ø3 | Ø7 |

METHOD 1

A double-pole, double-throw (nonshorting) switch is used to adapt this 25-pin connector for either the 2704/2708 or the 2716 TI. For the 2708, pin 21 of J5 goes to the $\overline{CS}$/WE voltage of Ø/12 which comes from pin C of J2. For the 2716 TI, pin 21 of J5 goes to address AlØ which comes from pin BB of J2.

For the 2708, pin 25 of J5 goes to +5 volts which comes from pin 14 of J2. For the 2716 TI, pin 25 of J5 requires +5 volts during Read and +12 volts during Write. This is obtained from pin D of J2.

Procedure

Remove the two wires going to the 2708 connector (J5), pins 21 and 25. Attach the wires disconnected from J5 to one set of each section of the double-pole switch. From each arm of this switch, return two wires back to pins 21 and 25 of J5, so that when the switch is in the 2708 position, the connections are the same as they were originally.

The other set of contacts are used for the 2716 TI. Wire the switch section contact that connects to pin 21 of J5 to pin BB of J2. The other switch section contact is wired to pin D of J2. This circuit arrangement is shown in Figure 3.3.1 (located with Table 3.5).

METHOD 2

In this method, an additional 25-pin connector is added. It does not require any switch.

Procedure

Wire the 25-pin connector for the 2716 TI (see Table 3.5). No other circuit changes are required.

METHOD 3

This method is exactly the same procedure as given in Method 2, except that the 2708 connector J5 is used for the 2716 TI.

Procedure

Wire the 25-pin connector J5 for the 2716 TI. No other circuit changes are required.

3.4.2 MODIFICATION FOR 2716 INTEL

The 2716 INTEL can be adapted to the PROM SETTER using two methods:

1. Replacing the 2704/2708 25-pin connector (J5) with the 2716 INTEL.
2. Adding an additional 25-pin connector and a single-pole, single-throw, nonshorting switch.

The 2716 INTEL is generally similar to the 2708. That is, the Address and Data lines are the same as the 2708, except for the extra Address line (A1Ø) in the 2716. The chip enable uses +5 volts in the 2716 instead of the +12 volts used for the 2708. The program voltage for the 2716 INTEL is a pulsed +5 volts, where the 2708 uses +27 pulsed volts. Finally, pin 21 of the 2716 INTEL uses +5 volts during Read

and +25 volts during Programming. (In the 2708, pin 21 has -5 volts applied during both Read and Write operation.)

The 2716 INTEL does NOT program the same as the 2716 TI (do not use this modification on a 2716 TI unit). A change is required in the Write program for the 2716 INTEL. This modified Write program uses the same area as was assigned to the 1702A Write program (see Section 3.5 for program).

There is also a change required in the 2708 Clear program for testing the full 2716. Only one word has to be changed in this Test Clear program for the 2716. The change for 2716 requires that program step ØØAF change

| FROM | TO |
|---|---|
| Ø3 | Ø7 |

METHOD 1

In this method, three circuits are required. The circuit arrangement is shown in Figures 3.3.2, 3.3.3, and 3.3.4 (located with Table 3.6). The Write program is given in Section 3.5.

Procedure

Wire the 25-pin connector (J5) for the 2716 INTEL except for pins 19, 20, 21 and 22 of J5. Make a small circuit board to hold the components of the three circuits shown in Figures 3.3.2, 3.3.3, and 3.3.4 (all resistors 1/4W). See Table 3.6 for interconnections for the 2716 INTEL.

METHOD 2

In this method, an additional 25-pin connector is added. A single-throw, single-pole switch is required. In this method, the PROM SETTER will be set up to do the 1702A, 2704/2708, and 2716 INTEL.

Procedure

Wire the 25-pin connector for the 2716 INTEL as given in Table 3.6, except add the single-pole switch between pin 1 of J2 and the diode/zenor diode of Figure 3.3.2. This switch allows the positive pulse to have the proper levels for the 2708 and then for the 2716 INTEL.

Note SW1 is in the open position when writing the 2704/2708. The switch is closed when writing the 2716 INTEL.

### 3.4.3 MODIFICATION FOR 5204 NATIONAL

The 5204 NATIONAL can be adapted to the PROM SETTER using two methods:

1. Replacing the two 1702A connectors for Reading and Writing the 5204 NATIONAL.
2. Using two additional 25-pin connectors.

A change in the 1702A Write program is advisable, although the 1702A program as is can Write the 5204. There is a change required in the 1702A Clear program for testing the full 5204. Only one word has to be changed in this Test Clear program for the 5204. The change for 5204 requires program step ØØ89 to be changed

| FROM | TO |
|---|---|
| ØØ | Ø1 |

The 5204 Write program uses the same program area as assigned for the 1702A. A listing of the 5204 program is given in Table 3.7.

METHOD 1

This method takes both the 1702A connectors and wires them for the 5204 NATIONAL. The 5204 requires one 25-pin connector for Read and another 25-pin connector for the Write operation. This modification requires one single-pole, double-throw (nonshorting) switch and eight zenor diodes.

The zenor diodes (1N5256) correct the voltages of the PROM SETTER supplied for the Data Write to those required for the 5204 NATIONAL. The switch is used during the Write procedure to set address A8 in the 1/O state. A transistor circuit can be used in place of the switch. These circuits are shown in Figure 3.3.5 (with Table 3.7).

Procedure

Wire the two 25-pin connectors J3 and J4 for the 5204 NATIONAL (see Table 3.7). The following are special instructions for the Write connector assembly.

Write Connector

Pin 15 of J3 (Write connector) is wired to the arm of a single-pole (nonshorting), double-throw switch. One of the switch contacts is wired to pin N of J2 (-12 volts). This is a ZERO state for Address A8. The other switch contact is wired to pin 13 of J2 (Ground) which represents a ONE state for A8. (A ZERO is produced by applying -12 volts to this address line. A ONE is produced whe this address line is grounded.) The transistor circuit uses the eighth address to perform the operation of addressing the 5204. This circuit replaces the use of the switch given above.

Eight 30-volt zenor diodes (1N5256) are placed in series with the eight data lines (DØ through D7) which come from the main module board J2, pins 4 through 11. The cathodes of these zenor diodes are terminated in pins 16 through 23 of the 5204 Write connector (J3). Connect these diodes at the Write connector, leaving about 1/4 to 1/2 inch lead (for strain relief). Make a butt joint of the other zenor lead and the wire that goes to connector J2. Slide a piece of heat shrink tubing over the connections to prevent shorting of these signals.

METHOD 2

This is the same as Method 1, except that two additional 25-pin connectors are added for the Read and Write of the 5204 NATIONAL. In this method, the 1702A capabilities of the PROM SETTER are maintained.

Procedure

Wire the additional two connectors as outlined in Method 1.

### 3.4.4 MODIFICATION FOR S5204 AMI

The S5204 AMI can be adapted to the PROM SETTER using four methods:

1. Replacing the 2704/2708 with the S5204 and a double-pole, double-throw (nonshorting) switch.
2. Adding an additional 25-pin connector and a double-pole, double-throw (nonshorting) switch.
3. Adding two 25-pin connectors (one for Read and one for Write).
4. Replacing the two 1702A connectors with the S5204.

A change in the 1702A Write program is advisable, although the 1702A program as is can Write the S5204. There is a change required in the 1702A Clear program for testing the full S5204. Only one word has to be changed in this Test Clear program for the S5204. The change for S5204 requires program step ØØ89 be changed

| FROM | TO |
|---|---|
| ØØ | Ø1 |

The S5204 Write program uses the same program area as assigned for the 1702A. A listing of the S5204 program is given in Section 3.5.

METHOD 1

This method takes the 2704/2708 connector (J5) and wires it for the S5204 AMI. This modification requires one double-pole, double-throw (nonshorting) switch. The switch is used to switch operation from Read to Write. For Read operation, pin 10 of J5 is wired for +5 volts and pin 12 of J5 is wired to ground. For Write operation, pin 10 of J5 is wired to the negative program pulse which is obtained from pin E of J2 and pin 12 of J5 is wired for +5 volts.

Procedure

Wire the 25-pin connector J5 for the S5240 AMI (see Table 3.8) except for pins 10 and 12 of J5. Wire the arms of the double-throw switch, one to pin 10 and the other to pin 12 of J5. In the Read position, wire the switch section going to pin 10 of J5 to pin 14 of J2. Wire the switch section going to pin 12 of J5 to pin 13 of J2. Wire the other contact of the switch section whose arm is attached to pin 10 of J5 to pin E of J2. Wire the other switch section (connecting to pin 12 of J5) to pin 14 of J2

METHOD 2

In this method, an additional 25-pin connector is added. The double-pole, double-throw (nonshorting) switch is required. In this method, the PROM SETTER will be set up to do the 1702A, 2704/2708, and S5204.

Procedure

Wire the 25-pin connector for the S5204 as given in Method 1.

METHOD 3

This method uses two 25-pin connectors and does NOT require any switch. One connector is used for the Read operation and the other is used for the Write operation.

Procedure

Wire the two 25-pin connectors for the S5204 except for pins 10 and 12. The Read 25-pin connector pins 10 and 12 are wired with pin 10 of this connector going to pin 14 of J2 and pin 12 is wired to pin 13 of J2. The Write 25-pin connector pins 10 and 12 are wired with pin 10 of this connector going to pin E of J2 and pin 12 is wired to pin 14 of J2.

METHOD 4

This method is exactly the same as Method 3 except that the two 1702A Read/Write connectors are used for the S5204 Read/Write operation.

Procedure

Wire connector J3 and J4 as outlined in Method 3 with the Read connector being J3 and the Write connector being J4.

### 3.4.5 MODIFICATION FOR 6834

The 6834 can be adapted to the PROM SETTER using four methods:

1. Replacing the 2704/2708 with the 6834 and a single-pole, double-throw (nonshorting) switch.
2. Adding an additional 25-pin connector and a single-pole, double-throw (nonshorting) switch.
3. Adding two 25-pin connectors (one for Read and one for Write).
4. Replacing the two 1702A connectors with the 6834.

A change in the 1702A Write program is advisable, although the 1702A program as is can Write the 6834. There is a change required in the 1702A Clear program for testing the full S5204. Only one word has to be changed in this Test Clear program for the 6834. The change for 6834 requires program step ØØ89 be changed

| FROM | TO |
|---|---|
| ØØ | Ø1 |

The 6834 Write program uses the same program area as assigned for the 1702A. A listing of the 6834 program is given in Section 3.5.

METHOD 1

This method takes the 2704/2708 connector (J5) and wires it for the 6834 (see Table 3.9). This modification requires one single-pole, double-throw (nonshorting) switch. The switch is used to switch operation from Read to Write. For Read operation, pin 2 of J5 is wired for +5 volts. For Write operation, pin 2 of J5 is wired to Pin E of J2.

Procedure

Wire the 25-pin connector J5 for the 6834 (see Table 3.9) except for pin 2 of J5. Wire the arm of this switch to pin 2 of J5. In the Read position, wire the switch contact to pin 14 of J2. Wire the other contact (Write position) to pin E of J2 as shown

METHOD 2

In this method, an additional 25-pin connector is added, wired as given in Table 3.9. The single-pole, double-throw (nonshorting) switch is required. In this method, the PROM SETTER will still be set up to do the 1702A, as well as the 6834.

Procedure

Wire the 25-pin connector for the 6834, as given in Method 1.

METHOD 3

This method uses two 25-pin connectors and does NOT require any switch. One connector is used for READ operation and the other is used for Write operation.

Procedure

Wire the two 25-pin connectors for the 6834 except for pin 2. The Read 25-pin connector pin 2 is wired to pin 14 of J2. The Write 25-pin connector pin 2 is wired to pin E of J2.

METHOD 4

This method is exactly the same as Method 3, except that the two 1702A Read and Write connectors are used for the 6834 Read/Write operation.

Procedure

Wire connectors J3 and J4 as outlined in Method 3, with the Read connector being J3 and the Write connector being J4.

## 3.5 PROGRAMMING THE ADDITIONAL EPROMS

There are no changes in the major portion of the present PROM SETTER program. The main change for the additional EPROMs is to the Write portion of the program and a single word change to the Test Clear program. The following are the Write programming changes required for these additional EPROMs. (Note the 2716 TI does not require any change in the present program. The 2716 TI uses the 2708 Write program which starts at ØØ46.)

The 5204, S5204, and 6834 can be written using the existing 1702A Write program. A Write program for the above EPROMs is included. This program replaces the 1702A program.

The 2716 INTEL requires a special program for writing this EPROM. This program also replaces the 1702A program.

| | EPROM SOCKET PIN | | | | | | |
|---|---|---|---|---|---|---|---|
| FUNCTION | 1702A | 2704*/2708 | 2716 TI | 2716 INTEL | 5204 NATIONAL | S5204 AMI | 6834 |
| Address | | | | | | | |
| AØ | 3 | 8 | 8 | 8 | 5 | 5 | 24 |
| 1 | 2 | 7 | 7 | 7 | 6 | 6 | 23 |
| 2 | 1 | 6 | 6 | 6 | 7 | 7 | 22 |
| 3 | 21 | 5 | 5 | 5 | 8 | 8 | 21 |
| 4 | 2Ø | 4 | 4 | 4 | 9 | 9 | 2Ø |
| 5 | 19 | 3 | 3 | 3 | 1Ø | 1Ø | 19 |
| 6 | 18 | 2 | 2 | 2 | 11 | 11 | 18 |
| 7 | 17 | 1 | 1 | 1 | 13 | 13 | 17 |
| 8 | -- | 23 | 23 | 23 | 14 | 14 | 16 |
| 9 | -- | 22 | 22 | 22 | -- | -- | -- |
| 1Ø | -- | -- | 2Ø | 19 | -- | -- | -- |
| Data | | | | | | | |
| DØ | 4 | 9 | 9 | 9 | 15 | 15 | 2 |
| 1 | 5 | 1Ø | 1Ø | 1Ø | 16 | 16 | 3 |
| 2 | 6 | 11 | 11 | 11 | 17 | 17 | 4 |
| 3 | 7 | 13 | 13 | 13 | 18 | 18 | 5 |
| 4 | 8 | 14 | 14 | 14 | 19 | 19 | 6 |
| 5 | 9 | 15 | 15 | 15 | 2Ø | 2Ø | 7 |
| 6 | 1Ø | 16 | 16 | 16 | 21 | 21 | 8 |
| 7 | 11 | 17 | 17 | 17 | 22 | 22 | 9 |
| Voltage | | | | | | | |
| Ø | 14 | 12 | 12 | 12 | 2,3,24 | 3,24 | 15 |
| -5 | -- | 21 | 21 | -- | -- | -- | -- |
| -12 | -- | -- | -- | -- | -- | 23 | 1Ø |
| +5 | -- | 24 | 24 | 24 | -- | 1,12 | 13 |
| +12 | -- | 19 | 19 | -- | -- | -- | -- |
| Ø/5 | -- | -- | -- | 2Ø | -- | 2 | -- |
| Ø/12 | -- | 2Ø | -- | -- | -- | -- | -- |
| 5/Ø | 12,22,23 | -- | -- | -- | 12 | -- | 14 |
| 5/12 | 15 | -- | -- | -- | 1 | -- | -- |
| 5/25 | -- | -- | -- | 21 | -- | -- | -- |
| 0/Prog | -- | 18 | 18 | 18 | -- | -- | -- |
| 5/Prog | 13 | -- | -- | -- | 4 | 4 | 11 |
| $-9/V_{GG}$ | 16 | -- | -- | -- | -- | -- | -- |
| $-9/V_{DD}$ | 24 | -- | -- | -- | -- | -- | -- |
| $-12/V_{DD}$ | -- | -- | -- | -- | 23 | -- | -- |

*For 2704 address, A9 is made a one ("1"). This is accomplished by setting the EPROM starting address as Ø2ØØ Hex.

TABLE 3.1

| | WAVEFORMS | | | SOFTWARE |
|---|---|---|---|---|
| | PROG | $V_{GG}$ | $V_{DD}$ | Write Program |
| 1702A | 0 / -47 | -9 / -37 | -9 / -47 | 1702A |
| 2708 | +27 / 0 | | | 2708 |
| 2716 TI | +27 / 0 | | | 2708 |
| 2716 INTEL | +5 / 0 | | | 2716 INTEL |
| 5204* NATIONAL | 0 / -50 | | -9 / -50 | 5204/6834 |
| 5204 AMI | 0 / -50 | | | 5204/6834 |
| 6834 | 0 / -50 | | | 5204/6834 |

*Write for 5204 NATIONAL Data and Address are:

| | |
|---|---|
| Data | Ø = Ø to -11 volts<br>1 = -12 to -18 volts |
| Address | 1 = Ø to -11 volts<br>Ø = -12 to -50 volts |

TABLE 3.2 Programming Information

| Socket EPROM | Description | Connector DB 25 | J2 100B |
|---|---|---|---|
| 1 | A2 | 13 | 21/X |
| 2 | A1 | 12 | 22/Y |
| 3 | AØ | 11 | 23/Z |
| 4 | DØ | 1Ø | F/4 |
| 5 | D1 | 9 | H/5 |
| 6 | D2 | 8 | J/6 |
| 7 | D3 | 6 | 12/7 |
| 8 | D4 | 5 | K/8 |
| 9 | D5 | 4 | L/9 |
| 1Ø | D6 | 3 | M/10 |
| 11 | D7 | 2 | 15/11 |
| 12 | +5/Ø | 1 | B |
| 13 | +5/Prog | 14 | 14/E |
| 14 | Ø | 15 | 13 |
| 15 | 5/12 | 16 | D |
| 16 | $-9/V_{GG}$ | 17 | |
| 17 | A7 | 18 | 16/S |
| 18 | A6 | 19 | 17/T |
| 19 | A5 | 20 | 18/U |
| 2Ø | A4 | 21 | 19/V |
| 21 | A3 | 22 | 2Ø/W |
| 22 | 5/Ø | 23 | B |
| 23 | 5/Ø | 24 | B |
| 24 | $-9/V_{DD}$ | 25 | 2 |
| | Write Disable | 7 | A |

Read/Write Notation

TABLE 3.3 1702A

| Socket EPROM | Description | Connector DB 25 | J2 100B |
|---|---|---|---|
| 1 | A7 | 13 | 16 |
| 2 | A6 | 12 | 17 |
| 3 | A5 | 11 | 18 |
| 4 | A4 | 1Ø | 19 |
| 5 | A3 | 9 | 2Ø |
| 6 | A2 | 8 | 21 |
| 7 | A1 | 6 | 22 |
| 8 | AØ | 5 | 23 |
| 9 | DØ | 4 | F |
| 1Ø | D1 | 3 | H |
| 11 | D2 | 2 | J |
| 12 | Ø | 1 | 13 |
| 13 | D3 | 14 | 12 |
| 14 | D4 | 15 | K |
| 15 | D5 | 16 | L |
| 16 | D6 | 17 | M |
| 17 | D7 | 18 | 15 |
| 18 | Ø/Prog | 19 | 1 |
| 19 | +12 | 2Ø | P |
| 2Ø | Ø/12 | 21 | C |
| 21 | -5 | 22 | AA |
| 22 | A9* | 23 | 25 |
| 23 | A8 | 24 | 24 |
| 24 | +5 | 25 | 14 |
| | Write Disable | 7 | A |

Read/Write Notation

*For 27Ø4 address, A9 is made a one ("1"). This is accomplished by setting the EPROM starting address as ØØ2Ø Hex and the length, for a full read or write, as Ø1FF Hex.

TABLE 3.4 2704/2708

| Socket EPROM | Description | Connector DB 25 | J2 100B |
|---|---|---|---|
| 1 | A7 | 13 | 16 |
| 2 | A6 | 12 | 17 |
| 3 | A5 | 11 | 18 |
| 4 | A4 | 1Ø | 19 |
| 5 | A3 | 9 | 2Ø |
| 6 | A2 | 8 | 21 |
| 7 | A1 | 6 | 22 |
| 8 | AØ | 5 | 23 |
| 9 | DØ | 4 | F |
| 1Ø | D1 | 3 | H |
| 11 | D2 | 2 | J |
| 12 | Ø | 1 | 13 |
| 13 | D3 | 14 | 12 |
| 14 | D4 | 15 | K |
| 15 | D5 | 16 | L |
| 16 | D6 | 17 | M |
| 17 | D7 | 18 | 15 |
| 18 | Ø/Prog | 19 | 1 |
| 19 | +12 | 2Ø | P |
| 2Ø | A1Ø | 21 | BB |
| 21 | -5 | 22 | AA |
| 22 | A9 | 23 | 25 |
| 23 | A8 | 24 | 24 |
| 24 | 5/12 | 25 | D |
| | Write/Disable | 7 | A |
| | Read/Write Notation | | |

Can use 2708 connector with a DPDT switch to operate 2716 TI

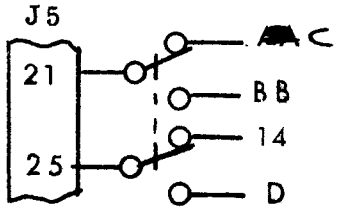
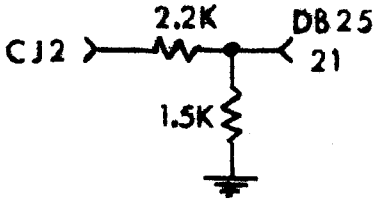
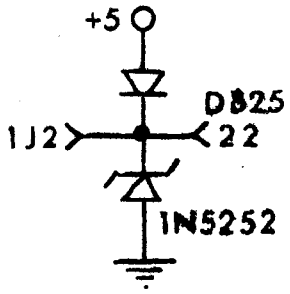



TABLE 3.5 2716 TI

| Socket EPROM | Description | Connector DB 25 | J2 100B |
|---|---|---|---|
| 1 | A7 | 13 | 16 |
| 2 | A6 | 12 | 17 |
| 3 | A5 | 11 | 18 |
| 4 | A4 | 10 | 19 |
| 5 | A3 | 9 | 20 |
| 6 | A2 | 8 | 21 |
| 7 | A1 | 6 | 22 |
| 8 | A0 | 5 | 23 |
| 9 | D0 | 4 | F |
| 10 | D1 | 3 | H |
| 11 | D2 | 2 | J |
| 12 | 0 | 1 | 13 |
| 13 | D3 | 14 | 12 |
| 14 | D4 | 15 | K |
| 15 | D5 | 16 | L |
| 16 | D6 | 17 | M |
| 17 | D7 | 18 | 15 |
| 18 | 0/Prog (+5V) | 19 Circuit | E |
| 19 | A10 | 20 | BB |
| 20 | 0/5 | 21 Circuit | C |
| 21 | 5/25 | 22 Circuit | 1 |
| 22 | A9 | 23 | 25 |
| 23 | A8 | 24 | 24 |
| 24 | +5 | 25 | 14 |
| | Write/Disable | 7 | A |

Read/Write Notation



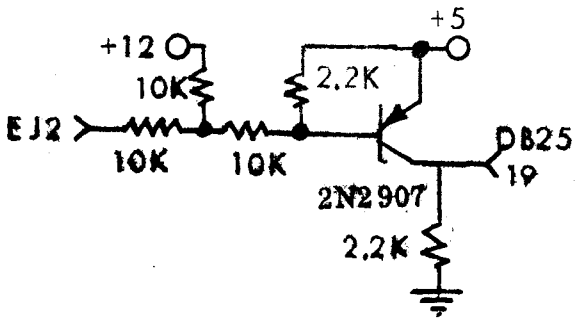




TABLE 3.6 2716 INTEL

| Socket EPROM | Description | Connector DB 25 | J2 100B |
|---|---|---|---|
| 1 | 5/12 | 13 | D |
| 2 | Ø | 12 | 13 |
| 3 | Ø | 11 | 13 |
| 4 | 5/Prog | 10 | 14/E |
| 5 | AØ | 9 | 23/Z |
| 6 | A1 | 8 | 22/Y |
| 7 | A2 | 6 | 21/X |
| 8 | A3 | 5 | 20/W |
| 9 | A4 | 4 | 19/V |
| 1Ø | A5 | 3 | 18/U |
| 11 | A6 | 2 | 17/T |
| 12 | 5/Ø | 1 | B |
| 13 | A7 | 14 | 16/S |
| 14 | A8 | 15 | 24/*Circuit |
| 15 | DØ | 16 | F/4 |
| 16 | D1 | 17 | H/5 |
| 17 | D2 | 18 | J/6 |
| 18 | D3 | 19 | 12/7 |
| 19 | D4 | 2Ø | K/8 |
| 2Ø | D5 | 21 | L/9 |
| 21 | D6 | 22 | M/1Ø |
| 22 | D7 | 23 | 15/11 |
| 23 | $-12/V_{DD}$ | 24 | N/2 |
| 24 | Ø | 25 | 13 |
| 25 | Write Disable | 7 | A |

Read/Write Notation

Diode 1N5256 use with write connector

*Use switch -12V Lower address A8 or circuit:
ØV Upper address A8

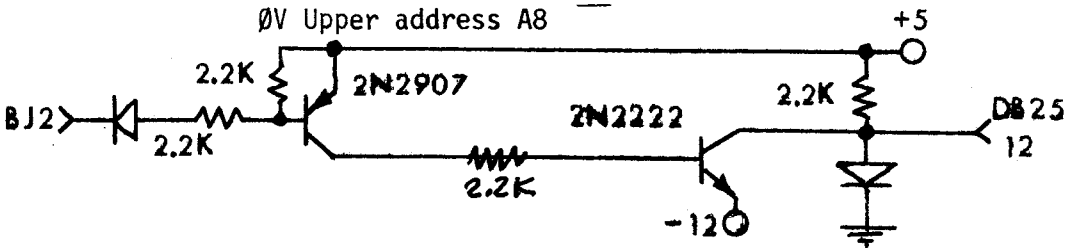



TABLE 3.7 5204 NATIONAL

| Socket EPROM | Description | Connector DB 25 | | J2 100B |
|---|---|---|---|---|
| 1 | +5 | 13 | | 14 |
| 2 | Ø/5 | 12 | Circuit | B |
| 3 | Ø | 11 | | 13 |
| 4 | +5/Prog | 1Ø | Switch | 14/E |
| 5 | AØ | 9 | | 23 |
| 6 | A1 | 8 | | 22 |
| 7 | A2 | 6 | | 21 |
| 8 | A3 | 5 | | 2Ø |
| 9 | A4 | 4 | | 19 |
| 1Ø | A5 | 3 | | 18 |
| 11 | A6 | 2 | | 17 |
| 12 | +5 | 1 | | 14 |
| 13 | A7 | 14 | | 16 |
| 14 | A8 | 15 | | 24 |
| 15 | DØ | 16 | | F |
| 16 | D1 | 17 | | H |
| 17 | D2 | 18 | | J |
| 18 | D3 | 19 | | 12 |
| 19 | D4 | 2Ø | | K |
| 2Ø | D5 | 21 | | L |
| 21 | D6 | 22 | | M |
| 22 | D7 | 23 | | 15 |
| 23 | -5 | 24 | | N |
| 24 | Ø | 25 | | 13 |
| | Write Disable | 7 | | A |

Read/Write Notation

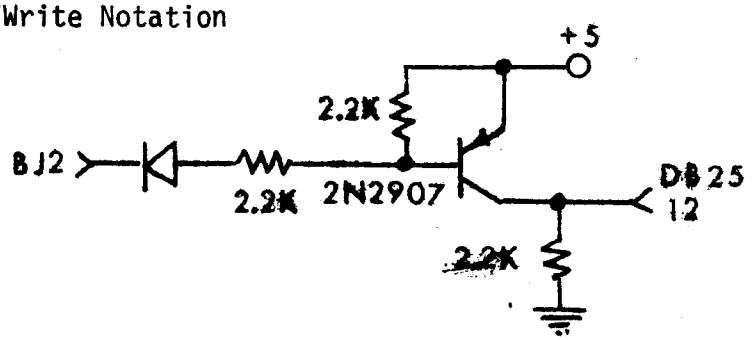
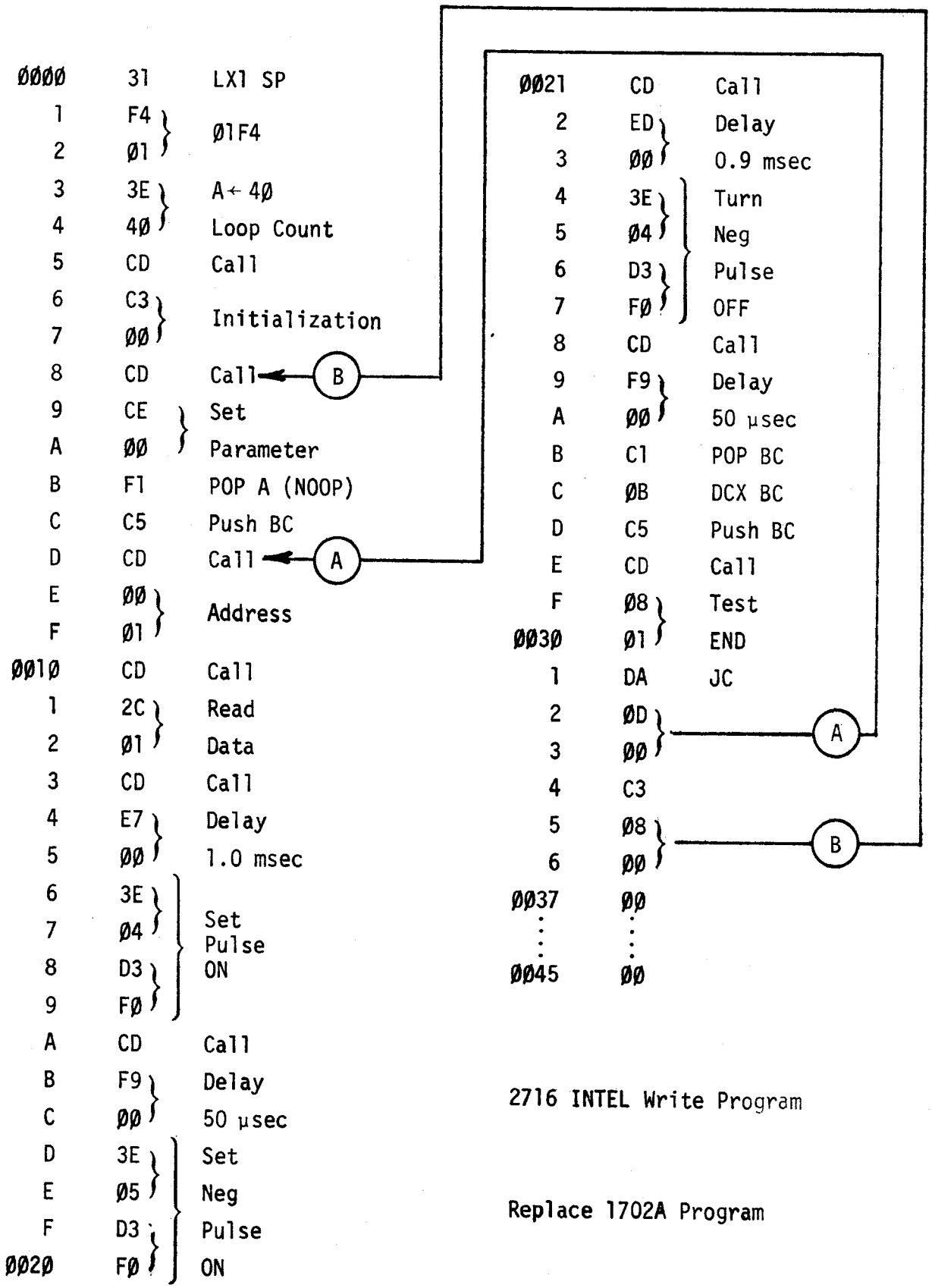
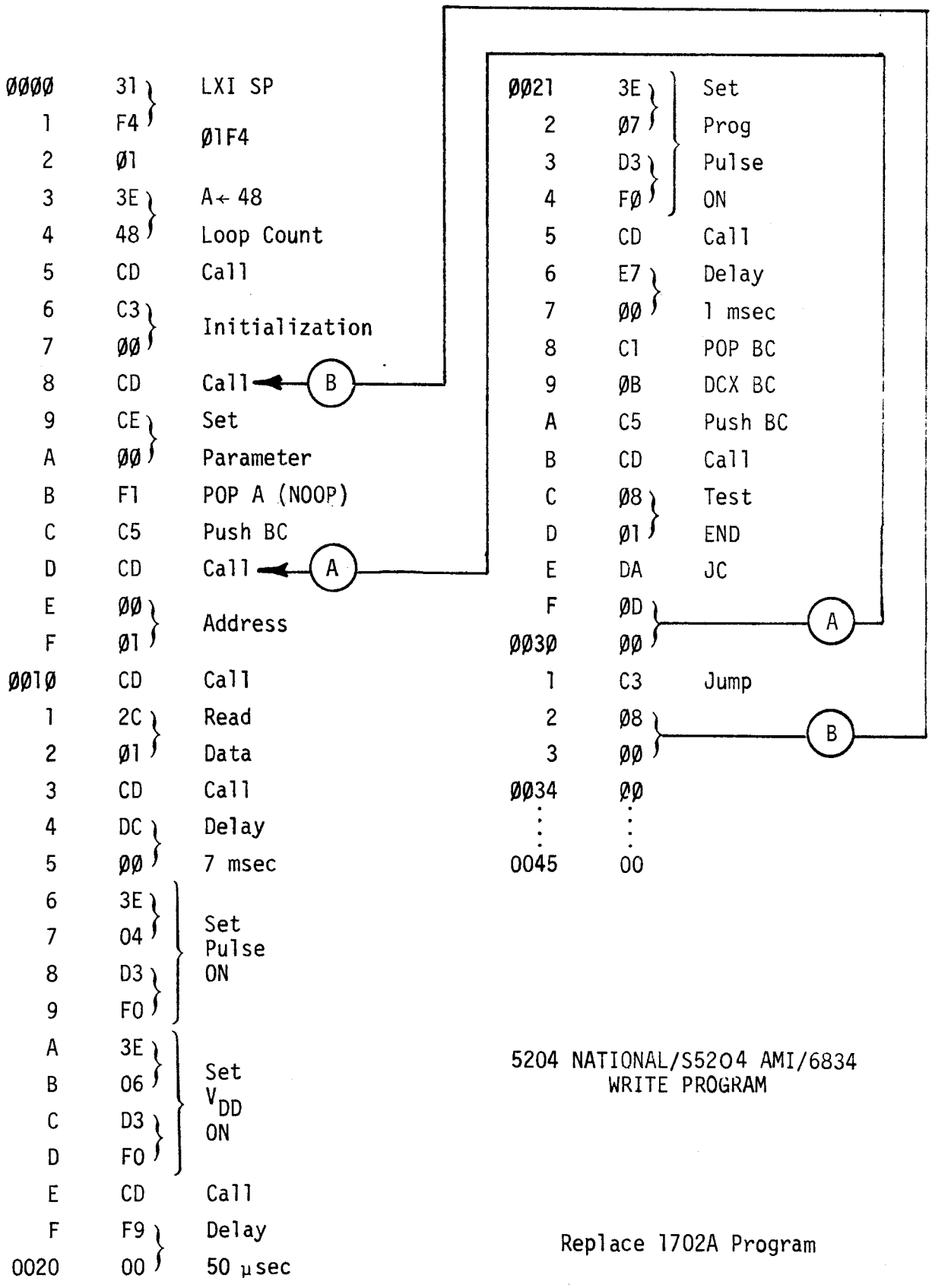



TABLE 3.8 S5204 AMI

| Socket EPROM | Description | Connection DB 25 | | J2 100B |
|---|---|---|---|---|
| 1 | Ø | 13 | | 13 |
| 2 | DØ | 12 | | F |
| 3 | D1 | 11 | | H |
| 4 | D2 | 1Ø | | J |
| 5 | D3 | 9 | | 12 |
| 6 | D4 | 8 | | K |
| 7 | D5 | 6 | | L |
| 8 | D6 | 5 | | M |
| 9 | D7 | 4 | | 15 |
| 1Ø | -12 | 3 | | N |
| 11 | +5/Prog | 2 | Switch | 14/E |
| 12 | +5 | 1 | | 14 |
| 13 | +5 | 14 | | 14 |
| 14 | +5/Ø | 15 | | B |
| 15 | Ø | 16 | | 13 |
| 16 | A8 | 17 | | 24 |
| 17 | A7 | 18 | | 16 |
| 18 | A6 | 19 | | 17 |
| 19 | A5 | 2Ø | | 18 |
| 2Ø | A4 | 21 | | 19 |
| 21 | A3 | 22 | | 2Ø |
| 22 | A2 | 23 | | 21 |
| 23 | A1 | 24 | | 22 |
| 24 | AØ | 25 | | 23 |
| | Write/Disable | 7 | | A |
| | Read/Write Notation | | | |

TABLE 3.9 6834


0000 31 LXI SP
1 F4
2 01
01F4
3 3E
4 40
A ← 40
Loop Count
5 CD Call
6 C3
7 00
Initialization
8 CD Call
B
9 CE
A 00
Set Parameter
B F1 POP A (NOOP)
C C5 Push BC
D CD Call
A
E 00
F 01
Address
0010 CD Call
1 2C
2 01
Read Data
3 CD Call
4 E7
5 00
Delay 1.0 msec
6 3E
7 04
8 D3
9 F0
Set Pulse ON
A CD Call
B F9
C 00
Delay 50 µsec
D 3E
E 05
F D3
0020 F0
Set Neg Pulse ON
0021 CD Call
2 ED
3 00
Delay 0.9 msec
4 3E
5 04
6 D3
7 F0
Turn Neg Pulse OFF
8 CD Call
9 F9
A 00
Delay 50 µsec
B C1 POP BC
C 0B DCX BC
D C5 Push BC
E CD Call
F 08
0030 01
Test END
1 DA JC
2 0D
3 00
A
4 C3
5 08
6 00
B
0037 00
0045 00
2716 INTEL Write Program
Replace 1702A Program




5204 NATIONAL/S5204 AMI/6834
WRITE PROGRAM

Replace 1702A Program

# SECTION IV

# THEORY OF OPERATION

## 4.1 EPROM INFORMATION

The Prom Setter is used to read and write both the 1702A and 2704/2708 EPROMs.

The 1702A EPROM requires a more complex voltage programming to write this device.

Both 1702A and 2704/2708 EPROMs are cleared using ultraviolet light. Ultraviolet intensity in the 2537Å region of greater than 6 wsec/cm$^2$ should normally clear the EPROMs in about 20 minutes.

When cleared, the 1702A will have "0" in all data positions, while the 2704/2708 will have "1" in all data positions.

Both EPROMs are written using a program pulse.

One pass through all addresses (page length) to be programmed is defined as a program loop. The number of loops (N) required is a function of the applied program pulse width ($t_{PW}$) and the amplitude of the program pulse voltage. Typical value for programming the EPROM at the specified normal operating voltages for each address is

$$N \cdot t_{PW} \geq 100 \text{ ms}.$$

This time may extend tenfold when low programming voltage is applied to the EPROM.

Due to the high power applied to the 1702A during programming, it is advisable to have a pulse duty rate less than 20%, that is, to program the pulse on for two time periods out of a ten time period cycle.

Both the 1702A and 2704/2708 have their Address and Data bus presented in parallel before the program pulse is applied. With the 1702A, the Address is first set in complementary then converted to the true address before the program pulse is applied.

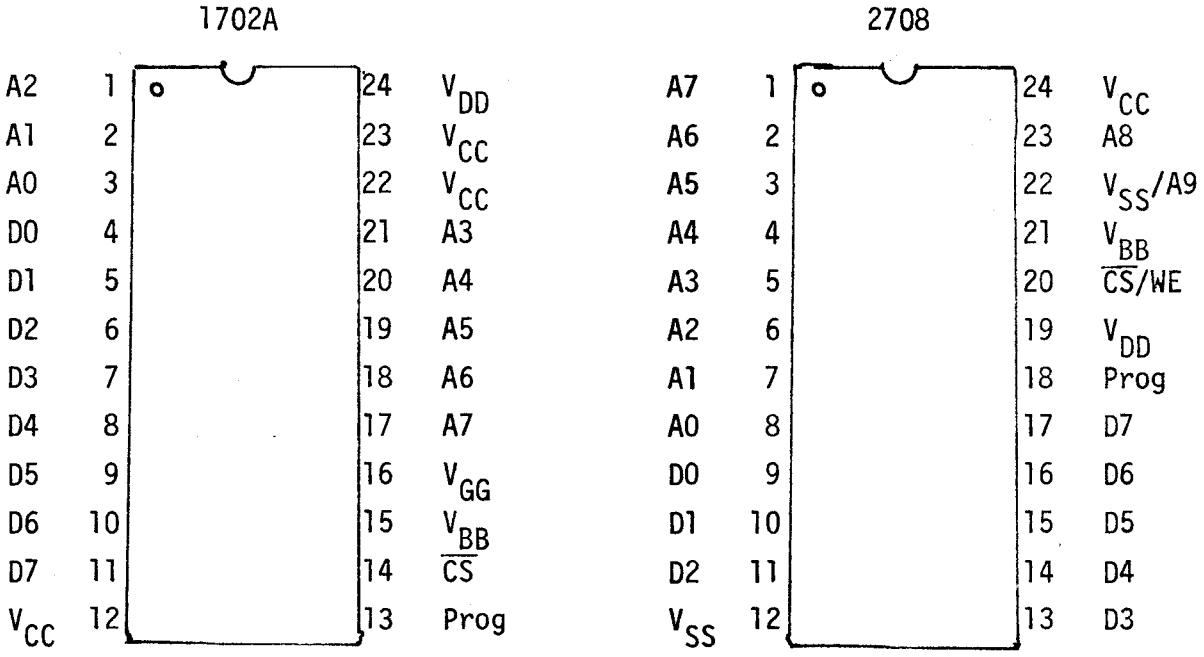
Pin configurations for the 1702A and 2708 are given on the next page.

IMPORTANT

We have noted varied operations from EPROMs. Some of the typical effects associated with the EPROM are:

1. Light sensitivity
2. Inability to erase some bits
3. Inability to write some bits
4. Phantom bits
5. Inability to write given decoder lines.

Also, the EPROM can be destroyed by static electricity.




## 4.2 MAIN MODULE BOARD

A simplified block diagram of The Prom Setter is shown in Figure 6.

The Data bus is supplied in parallel to the Address, Data, and control latches. The Address latch sets 10 lines, of which 8 lines can be pulsed for operating with the 1702A EPROM. The Data latch sets 8 lines which can also be pulsed for 1702A operation. The control latch produces 7 control lines, of which 4 lines are pulsed.

The full schematic for the main module board is shown in Figure 31. A detailed explanation of the circuit operations is given below.

The main module board sets the data, address, and control voltages.

The computer communicates with the main module board, which operates as a four (4) consecutive address Input/Output device. This consecutive address is selected with the first two bits AØ and A1 of the I/O address set by the computer. A listing of the action in the main module controlled by I/O address bits AØ and A1 is given in Table 1.

The rest of the addresses, A2 through A7, are selected by the user. This selection is made by connecting to ground the appropriate pull-up resistors R8A through R8F.

There must be at least one position grounded in the address select. Otherwise, a conflict will occur between The Prom Setter and the machine at address "FF".

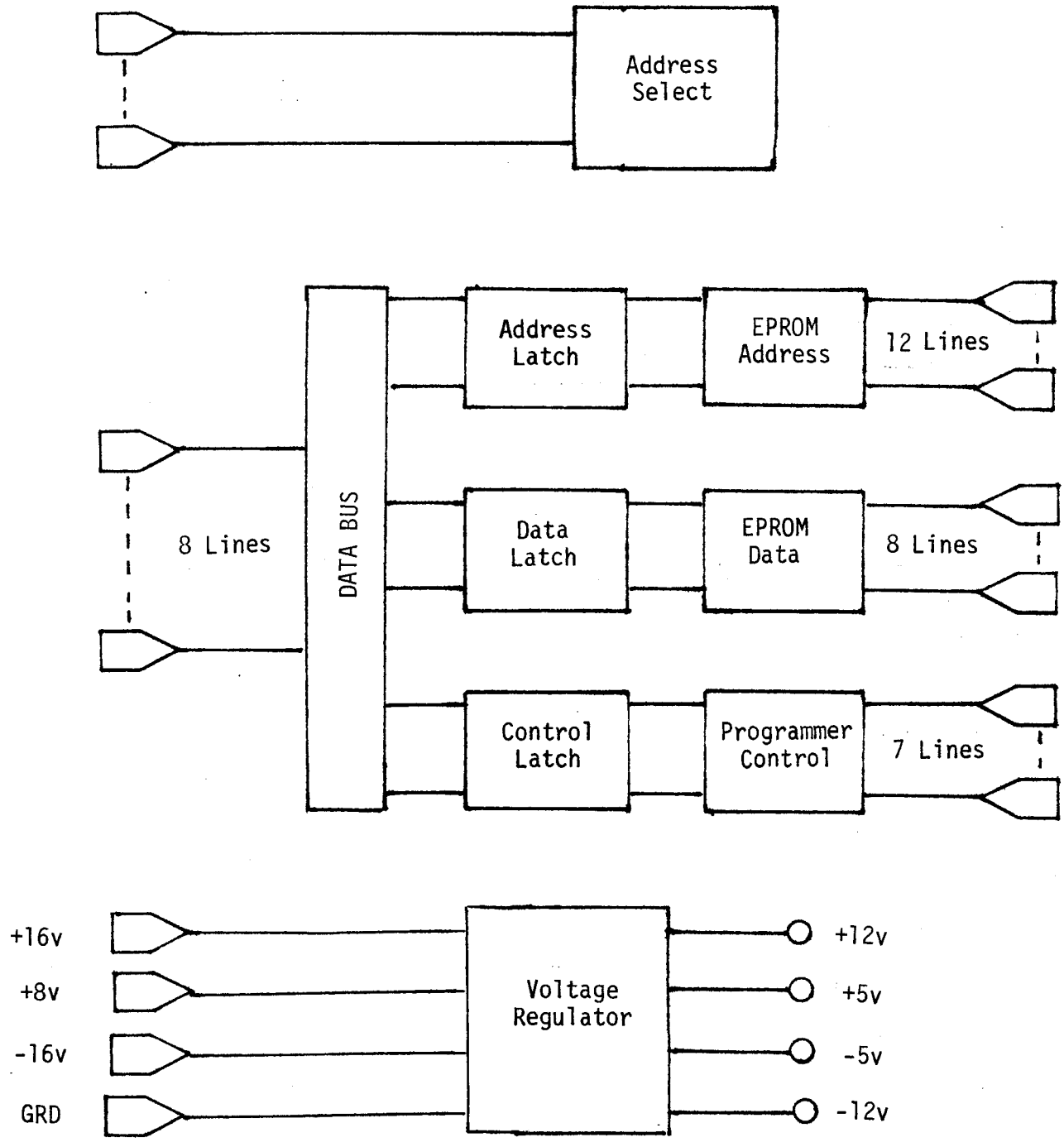



Figure 6. The Prom Setter Simplified Block Diagram

Table 1. I/O Address Bits AØ and A1, Main Module Operation

| Address Select | A1 | AØ | Data* Control | Operation |
|---|---|---|---|---|
| Ø | Ø | Ø | 1 | Set Control |
| 1 | Ø | 1 | | Set lower Address |
| 2 | 1 | Ø | | Set upper Address |
| 3 | 1 | 1 | | Set Data |
| 1 | Ø | 1 | 2 | Read Status Test |
| 3 | 1 | 1 | | Read Data |

*See Appendix III, 74155 Decoder.

The programming controls are used to set the circuit conditioning voltage for the EPROM.

The conditioning circuit can be disabled by two conditions. These are operation of

1. The Write Disable switch
2. Excessive circuit current.

The Write Disable switch is located on the PROM socket board and is used to prevent accidental operation of the pulse generation circuits used to write the PROMs. When writing the PROMs, this switch must be in the OFF position.

The excessive circuit current control is used to protect The Prom Setter components. There are three excessive current sensing circuits. These are Q20, Q21, and Q22, with resistors R33A/B, R34A/B, and R35A/B. When excessive current exists, then the voltage drop across the base to emitter resistors will increase until the transistor collector will start drawing current through (latch U12 resistor) R43. When the voltage at pin 10 of U12 becomes "0", the latch will switch, turning off the pulse generator voltages.

The excessive current may be a result of a bad EPROM that has an internal short or accidental shorting of the pins of the EPROM socket.

The status of the Write Disable switch and excessive current latch U12 can be read by setting Input Address A0 and A1 to "1", as given in Table 1 above.

The programming controls are set by the output port's first four bits—DØ, D1, D2, D3—when Address AØ and A1 are "0". A listing of the control word operation is given in Table 2.

Table 2. Control Word Operation

| Output Port Word | | | | Operation |
|---|---|---|---|---|
| D3 | D2 | D1 | DØ | |
| 1 | X | X | X | Reset Latch |
| 1 | Ø | Ø | Ø | Read |
| Ø | Ø | Ø | Ø | Set Pulse Generator Charge |
| Ø | 1 | Ø | Ø | Pulse Generator ON/2708 Program ON |
| Ø | 1 | 1 | Ø | Pulse $V_{DD}/V_{GG}$ ON |
| Ø | 1 | 1 | 1 | Pulse 1702A Program ON |

There are two pulse generators used to produce the programming voltages of +26 volts for the 2704/2708 and a -47 volts used to program the 1702A's.

These pulse generator operations are similar, although they produce pulse voltages of opposite polarity. The pulse capacitors are charged when pin 11 of U11 is a "1" and pulsed when pin 10 of U11 is made a "1".

The positive pulse capacitor C7 is charged from ground through the forward diode conductance of CR9 to -16 volts through R16 and transistor Q9. This places -16 volts across the capacitor referenced from ground. Output voltage is produced by turning off the charge circuit and turning on the pulse transistor Q6, which brings the bottom of the capacitor to +16 volts. This would raise the top end of C7 to about 32 volts, except for the zener operation of CR9 which holds this voltage to +27 volts. Resistor R9 limits the current and protects the zener diode from excessive currents.

The negative pulse capacitor C9 is charged from -16 volts through the forward diode conductance of CR24 to +16 volts through R40 and transistor Q24. This places a total of about 32 volts across the capacitor. Output voltage is produced by turning off the charge circuit and turning on the pulse transistor Q27 which brings the top of the capacitor to a -16 volts. This would raise the bottom end of C9 to about -48 volts.

Feedback zener diode CR25 limits the output to -47 volts.

The 1702A Address, Data and programming circuits are similar. The following description applies to all of these circuits.

When the negative pulse is present and the input 680-ohm resistor sees a "1", then the input PNP transistor is made to conduct, causing its collector to pull current through the output NPN transistor base. This turns the output transistor ON and its collector is pulled down to its emitter. Under normal conditions, the voltage of collector to emitter on the output transistors is only a fraction of 1 volt.

When the negative pulse is not present, the output transistor emitter is at about -16 volts. Now turning on the input PNP transistor will result in almost no current flowing in its collector since the zener, a 27-volt device, placed between this point and the output transistor base cannot conduct enough current to turn the output transistor ON.

The 1702A $V_{DD}$ and $V_{GG}$ pulse circuit operation is similar to the above description except for the diode and zener arrangement which holds these outputs to about -9 volts when not being pulsed and produces a 10-volt lower pulse for $V_{GG}$ when pulsed.

Read/Write voltages for both the 1702A and 2704/2708 are produced with transistors Q16, Q17, Q18, and Q19. These circuits are switched when going from or to Read/Write.

In Write, Q17 is ON and Q19 is OFF. In Read, the reverse happens, where Q17 is OFF and Q19 is set ON.

4.2.1 Latch Operation

There are six 4-bit latches used on the main module. These are U9, U13, U14, U15, U16, and U17.

Latch U9 is used to hold the output control word.

Latch U13 holds the upper address word, while U14 and U15 hold the lower address word.

Latches U16 and U17 hold the 8-bit data programming word.

The data word from the S-100 bus passes through isolation IC's U5 and U6 and is paralleled to all of the latches. When an appropriate output address is selected, an enable pulse from multiplex U2 enables the particular latch to reflect in input data bus signals. This enable pulse width is controlled by the S-100 bus signal $\overline{PWR}$ and must be turned OFF before the data bus signals are changed. Otherwise, the latch would reflect the changed data word and not the desired word.

If the input Data word has been loaded by other computer cards, there may be incorrect operation of the latch.

### 4.2.2 Address Select for I/O Operation

The Address Select U4 is a six exclusive OR circuit, which produces a "0" at pin 9 when the input address of bits A2 through A7 is the same as the selected address wiring.

This output (pin 9) will enable demultiplex U2 when it goes to "0". Demultiplex U2 is controlled by the lower two address bits AØ and A1, and by the input or output S-100 bus signals DB SNIP, DBN, and SOUT D3, along with $\overline{PWR}$.

### 4.2.3 Tri-State Logic

There are four tri-state IC's. These are U7, U8, U18 and U19.

Tri-state U7 and U8 are used for output signals to the S-100 bus.

The tri-state IC's output is in a high impedance state when the control line is a "1" and goes to a lower impedance state when the control line is a "0".

Tri-state U18 and U19 are used to drive the 2704/2708 Write operation. When U7 and U8 are in the low impedance state, U18 and U19 are in the high impedance state. This switches the Data latch output OFF when reading the EPROM input Data.

### 4.2.4 I/O Operation

The main module board can be used as an eight (8) bit parallel I/O port. The Address section is used as the output, while the Data section is used as the input. Operation is the same as when operating The Prom Setter.

The Data input signals are sent to connector J2 pins F, H, J, 12, K, L, M, and 11 for DØ, 1, 2, 3, 4, 5, 6, and 7. Connection can be made to the DB25S, J5 pins 4, 3, 2, 14, 15, 16, 17, and 18.

Output signals are obtained from J2 pins 23, 22, 21, 20, 19, 18, 17, and 16 for DO-Ø, 1, 2, 3, 4, 5, 6, and 7. Connection can be made to the DB25S, J5 pins 5, 6, 8, 9, 10, 11, 12, and 13.

Signals giving status of this input/output can be obtained by the upper address obtained from J2 pins 24 and 25, which can be found at DB25S, J5 pins 24 and 23.

### 4.2.5 Programming Timing

The programming timing for 1702A is shown in Figure 7. The Address and Data outputs are pulsed when the control pulse is produced.

To program a "1", the Data line must be pulsed (-48 volts) and a "0" produced by not producing any pulse and leaving the line near Ground.

The Address line is set to a "1" by not producing any pulse and set to a "0" by applying a pulse (-48 volts).

The programming timing for 2704/2708 is shown in Figure 8. The Address and Data outputs are NOT pulsed. The Address and Data lines are TTL programmed.

Different computers have different timing. The supplied program is set for a computer whose clock speed is about 500 nanoseconds. If the effective clock speed (actual computer clock speed or memory board wait cycle which reduces the speed) is either slower or faster, then the delay subroutine loop counts must be changed to achieve the waveforms as shown in Figures 7 and 8.

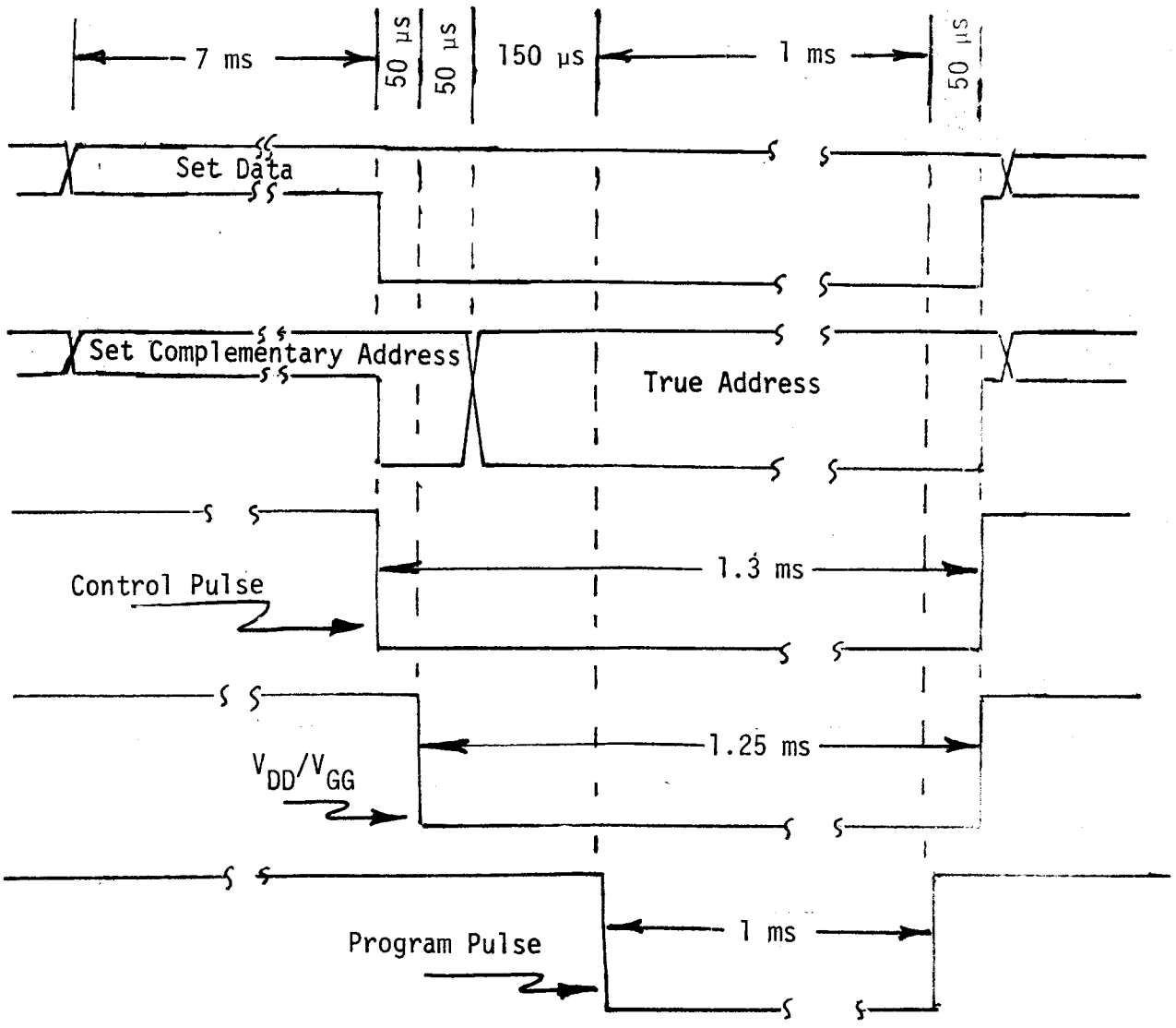



Figure 7. 1702A Timing Diagram

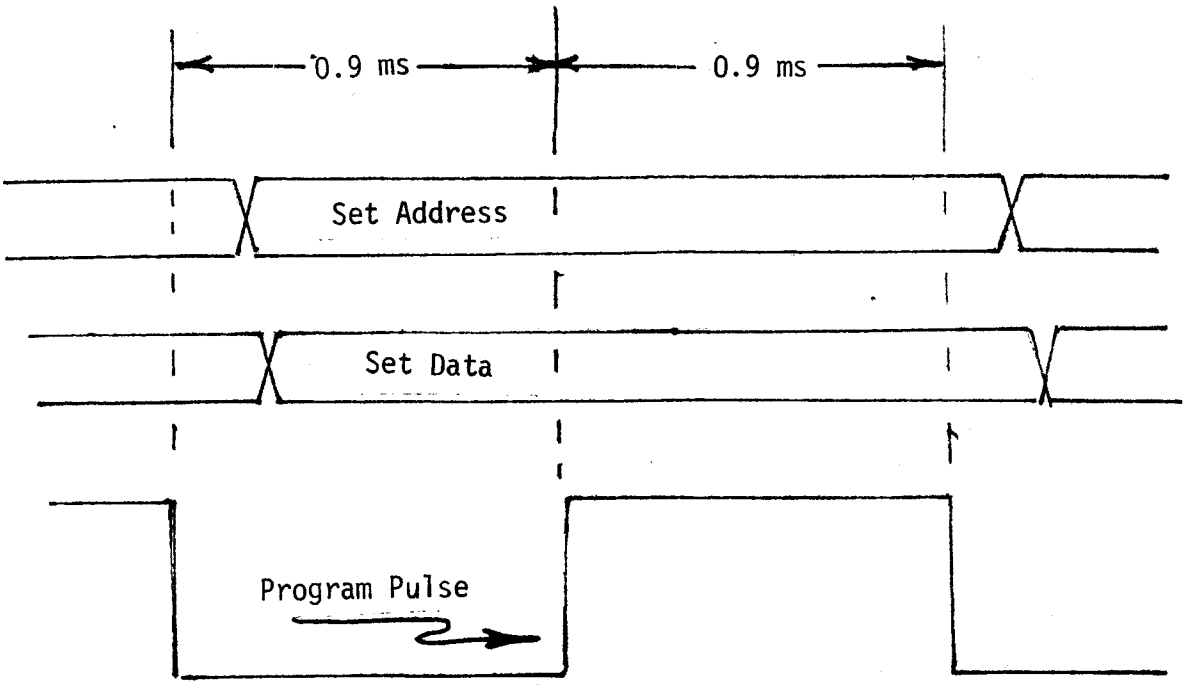



Figure 8. 2704/2708 Timing Diagram

## 4.3 PROM SETTER OPERATION

Selection of the EPROM type to be programmed for either Read or Write is accomplished by connecting the Prom socket board cable into the appropriate DB25 socket.

It is suggested that you always place the WRITE DISABLE switch ON when inserting or removing the EPROM.

We have found that the EPROM can be placed into or removed from the EPROM socket while the cable is connected to the computer. Also, good operation was obtained when leaving the EPROM in the socket and connecting or disconnecting the socket board cable from the computer.

CAUTION

Inserting the EPROM incorrectly into the wrong pins of the socket board could cause failure of the EPROM. Typical errors are placing the EPROM one pin in either direction out of alignment or completely turning the device around so that pin 13 is placed into pin 1 of the socket.

The following is the procedure for programming of EPROMs. It is assumed The Prom Setter is operating properly and that the program exists in the computer.

### 4.3.1 Reading an EPROM

STEP 1. Connect the socket board cable to the appropriate DB25 socket.

STEP 2. Toggle the Address length, the EPROM start Address, and the memory start Address into the computer. Then set the computer to the address for the Read program.

STEP 3. With the WRITE DISABLE switch ON, place the EPROM to be read into the socket on the socket board, and run the computer.

### 4.3.2 Writing an EPROM

The information to be written on the EPROM should reside in the computer before starting the next series of steps. See paragraph 6.2.3 for error indication during programming.

STEP 1. Connect the socket board cable to the appropriate DB25 socket.

STEP 2. Toggle the Address length, the EPROM start Address, and the memory start Address into the computer. Then set the computer to the address for the Write program for the type of EPROM being written.

STEP 3. With the WRITE DISABLE switch ON, place the EPROM to be written into the socket on the socket board. Then turn the WRITE DISABLE switch OFF and run the computer.

4.3.3 Testing Written EPROM

If this test takes place directly after writing of EPROMs, then the existing toggled information is already in the computer and it is not necessary to repeat Step 2. The information to be tested should reside in the computer. See paragraph 6.2.3 for error indication during programming.

STEP 1. Connect the socket board cable to the appropriate DB25 socket.

STEP 2. Toggle the Address length, the EPROM start Address, and the memory start Address into the computer. Then set the computer to the test program.

STEP 3. With the WRITE DISABLE switch ON, place the EPROM to be tested into the socket on the socket board and run the computer.

4.3.4 Test Cleared EPROM

See paragraph 6.2.3 for error indication during programming.

STEP 1. Connect the socket board cable to the appropriate DB25 socket.

STEP 2. Set the computer to the address for Test Program for the type of EPROM being tested and run the computer.

4.3.5 Error Indications

4.3.5.1 During the Write program (6.2.1), there are tests to establish improper operation. If there is improper operation, a printout is generated.

If the WRITE DISABLE switch is left in the ON position, a printout of the number "3" will result. It is necessary to turn this switch OFF and reset the start of the Write program.

If overcurrent exists, then a printout of the number "0" is produced. Try to rerun the program. If the condition still exists for the particular EPROM, then this device requires more current than The Prom Setter can supply.

4.3.5.2 During the testing of the EPROM (6.2.3), errors of incorrect EPROM words will produce a printout of the particular word address. The program will then continue finding all other errors. If errors are indicated, note what word should be at the error address, then read the EPROM (using 4.3.1 above) and check the word at the address.

If the error results during a Clear check, showing that the EPROM was not completely cleared, then try additional UV exposure. The UV exposure time must be longer than is necessary to just clear the device. Too short a UV exposure will result in phantom bits appearing in a word.

If the error results during a Written check, showing that not all the EPROM word bits were written, then try to rewrite the device. If the bit still is not written, where most of the other words are correct, it can be assumed that the particular EPROM is defective.

# SECTION V

# TROUBLESHOOTING

5.0 Before troubleshooting, check the main module board for wrong or incorrectly positioned components. Look for excessive heat from a component. Doublecheck the soldering on the board.

You should have had experience in troubleshooting previously. If not, try to get a friend who has had this type of experience.

Remove and replace any defective components and return them for replacement under the Warranty provisions.

If solutions are not found for the problems, then follow the procedure listed in Section 1.3.3 for factory service.

## 5.1 GENERAL INFORMATION

A series of tests for The Prom Setter were outlined in Section II. There are four test steps which would insure proper operation of The Prom Setter. These are:

| | |
|---|---|
| Power supply voltages | Step 6 |
| IC operation | Step 13 |
| Zener CR3 | Step 16 |
| Pulse generation | Step 17 |

Improper operation during any of the above steps must be corrected before proper operation of The Prom Setter is obtained.

## 5.2 POWER SUPPLY VOLTAGE

Lack of voltage or low voltage can be caused due to a bad IC regulator, a short, or improper supply voltage to the main module.

First test the supply voltage from the computer main bus. This can be accomplished directly on the board at capacitors C1, C3 and C5. If low voltages are noted, move the voltmeter to the computer supply. If there is higher voltage at the supply, then there is a problem in your computer bus.

If the voltage at the supply and the module are about the same, then remove The Prom Setter module board and note if the computer supply voltage increases. If there is no change in the supply voltage, the problem is in the computer. Now, if the computer supply voltage increases to normal, then The Prom Setter board is drawing too much current for the computer supply.

If this indication of low voltage occurred after components were placed on the board, other than the IC sockets, go to the second paragraph below. If it was measured before putting the active components on the board, continue with the next paragraph.

It is necessary to establish if there is a short on The Prom Setter board. This can be accomplished by lifting the output lead of the voltage regulator from the board and connecting a current meter between the lead and the main circuit. Start at the highest current range and work your way to lower ranges, but not below the 1-amp range. If the current is 1 amp or higher, then there is a short on the board. Carefully inspect the board for any solder splashes and excessive solder around connections. Correct any abnormal conditions.

The following paragraphs deal with shorts existing only after the active components are placed on the board. It is assumed that all components are in their correct position and are properly oriented as to pin connection. Under these conditions, it has to be assumed that one of the transistors or IC's is internally shorted.

If the short is on the 5-volt line, then the problem is most likely due to a short internal to one of the IC's. Remove the IC's one at a time while observing the current meter until the excessive current is reduced to a normal level. The normal current with all IC's on the board for the 5-volt lines is less than 0.7 amps.

Upon removing all IC's, if there are still excessive currents, look for shorts due to solder splashes or excessive solder.

If the short is on the plus or minus 12 volt lines, the problem is most likely associated with solder shorting one of these lines to ground. Double check the soldering in this area.

If the short is on the plus or minus 16 volt lines, the problem is most likely associated with the pulse generation circuit. Check R9, R16, and R40 for overheating. If these show no problem, then check all of the 2N2222A on the address, data and program circuits for overheating.

If all of the above resistors show signs of being overheated, then remove IC U11. If the voltage returns to normal level, check IC U11 for improper operation.

If R16 or R40, but not both, shows signs of overheating, look for shorts on the board. If none are found, then remove the resistor in question and test the circuit for a transistor that has an internal short.

## 5.3 IC OPERATION

Lack of proper signals from an IC can be caused by a bad device. If the problem exists on an IC that is used in other places on the board, then exchange the two IC's and see if the problem stays or moves with the exchanged device.

If the problem stayed, even though the IC's were changed, then inspect the board for poor solder joints or excessive soldering which has shorted the pin to adjacent pins or printed circuit lines.

Test signal lines for shorts by removing the IC's associated with the circuit and connecting a voltmeter to the particular signal pin. Except for the address select, there are no pull-up resistors. The pin should read "no voltage". If a voltage is read, then check for shorted lines. If no voltage is read, then using a resistor of about 1k ohms connect one end to the +5 volt line and the other end of the resistor to the pin being checked. The voltage should go to +5 volts. With the resistor still connected to the pin, check pins on either side (other than those that are wired together) for voltage. Remove the resistor and, if the voltage on adjacent pins is also removed, then there is most likely a short between the pins. If an unwanted short is shown to exist, then remove the excessive solder and retest.

Another problem can result from the IC pins being bent under the case. It is difficult to see a bent pin while the IC is in the socket. Remove the IC and look for bent pins.

If problems of latch operations are noted, check the signal $\overline{PWP}$ from pin 77 on the S-100 bus. This is a narrow pulse which comes on when the data is stable and must go OFF before the Data bus is changed.

Excessive loading of the Data bus lines due to other devices plugged into the S-100 bus could cause improper operation. Remove these devices and test for latch operation. If proper operation is obtained, then some modification to the S-100 drive for the Data bus lines or reduction of the device which loaded these lines should be considered.

## 5.4 ZENER CR3

If a negative 12 volts is measured, then either the zener is in backwards or the zener is shorted. Replace or place the zener in the proper direction.

## 5.5 PULSE GENERATOR OPERATION

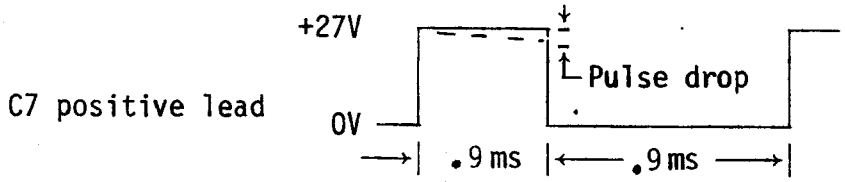
There are two pulse generators used in The Prom Setter, one for generation of a +27 volt pulse and the other to generate a -47 volt pulse. It is advisable to use an oscilloscope during troubleshooting of these circuits.

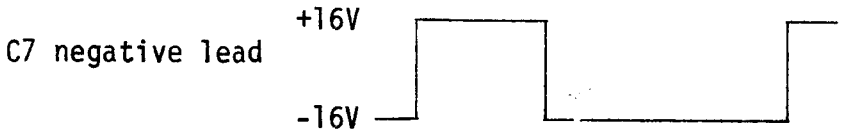
At no time should R9, R16 or R40 become excessively warm. If that condition does exist, it indicates that both the charge and the pulse transistors are conducting at the same time. The circuit is arranged such that these two transistors cannot be on (except during switching transients) at the same time.

If R16 or R40 shows signs of excessive heating, then a problem exists in the pulse and charge circuits.

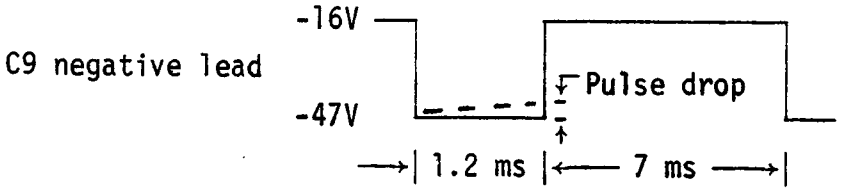
Normal waveforms for the pulse generators are given below, when in the 1702A Write program. With low ±16 volt lines, the pulse peak voltage will reduce. When these lines are a low ±14 volts, then programming of 1702A will require about 10 minutes.

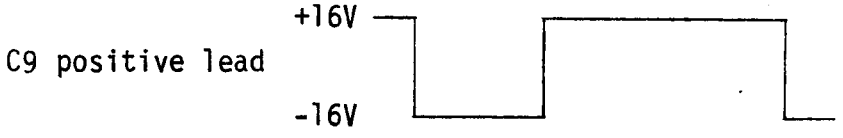
Positive Pulse Generator Waveform




Negative Pulse Generator Waveform




## 5.6 PROBLEM WITH WRITING EPROM

There are a number of problems that may cause improper writing of the EPROM. Some improper operations of EPROM are listed in Section 4.1.

If partial writing of an EPROM takes place, where some cleared bits have not been written, then try rerunning the program.

To troubleshoot, place an oscilloscope on the output from the pulse generator (the positive lead of C7 for the positive pulse, the negative lead of C9 for the negative pulse). Run the Write program without an EPROM in the socket board. Note the waveform at the pulse ON

time. (See the waveforms above.) Now place the EPROM in the socket board and repeat the Write program. Note the voltage of the pulse at the end of its ON time. The pulse drop in about 1 ms without the EPROM should be less than 2 volts, and should be less than 7 volts with the EPROM in the socket.

If greater pulse displacement takes place with the EPROM in the socket, there will be problems in writing. Typically, earlier 1702's tested exhibited higher currents and programming was not possible.

# SECTION VI

# SOFTWARE

## 6.1 GENERAL INFORMATION

The software supplied will perform all the functions to Write or Read EPROMs. The main programs are given below. These are:

| | | |
|---|---|---|
| 1. | Write 1702A (ØØØØ) | Figure 7.1 |
| 2. | Write 2704/2708 (ØØ46) | Figure 7.2 |
| 3. | Read 1702A and 2704/2708 (Ø1AØ) | Figure 7.3 |
| 4. | Test Clear 1702A (ØØ84) | Figure 7.4 |
| 5. | Test Clear 2704/2708 (ØØAA) | Figure 7.5 |
| 6. | Test Written EPROM 1702A and 2704/2708 (ØØ7Ø) | Figure 7.7 |

A series of subroutines are required to perform with the main programs. These are:

WRITE

| | | |
|---|---|---|
| 1. | Initialization (ØØC3) | Figure 7.8 |
| 2. | Parameter Set (ØØCE) | Figure 7.9 |
| 3. | Set Data Set and Test Conditions (Ø12C) | Figure 7.12 |
| 4. | Delay (ØØDC) | Figure 7.10 |
| 5. | Test END (Ø1Ø8) | Figure 7.11 |
| 6. | Address (Ø1ØØ) | Figure 7.6 |

READ

| | | |
|---|---|---|
| 1. | Read 1 (Ø142) | Figure 7.13 |
| 2. | Read 2 (Ø14F) | Figure 7.13 |

Further Subroutines

| | | |
|---|---|---|
| 1. | Hex Print (Ø161) | Figure 7.14 |
| 2. | Hex 1 Print (Ø175) | Figure 7.15 |
| 3. | Hex 2 Print (Ø186) | Figure 7.16 |
| 4. | Print Word (Ø1BØ) | Figure 7.17 |
| 5. | Print (Ø195) | Figure 7.18 |

The printout words are located at Ø1CØ.

It is necessary to toggle into the computer information about locations and lengths for the EPROM and Memory before the program can be run. This data is read by the Parameter Set subroutine during operation of the program. The following is the address where this information is toggled in. To operate, set the computer to the RAM address given and toggle in the information.

| Computer Address (Hex) | Description (to be Toggled IN) | |
|---|---|---|
| 01F8 | Lower Length | } Size of program to |
| 01F9 | Upper Length | } be read or written |
| 01FA | Lower Address | } EPROM start address |
| 01FB | Upper Address | } |
| 01FC | Lower Address | } Memory start address |
| 01FD | Upper Address | } |

The Delay statements written in the program are for a 500 nsec clock period computer. The Delay subroutine is located at address ØØDC. When slower or faster clock rates are used, then it is necessary to change the loop counts which set the given delays.

The Delays are established by the words at the following locations:

| Delay | | Address |
|---|---|---|
| 50 | µs | ØØFA |
| 150 | µs | ØØF4 |
| 0.9 | ms | ØØEE |
| 1 | ms | ØØE8 |
| 8 | ms | ØØDD and ØØDE |

The full program uses 512 words. An allocation on top of this is required for toggled-in information and the Stack pointer operation.

## 6.2 FLOW DIAGRAMS

The following are the flow diagrams for the supplied programs.

### 6.2.1 Write 1702A

The 1702A Write flow diagram is shown in Figure 7.1

The Stack pointer is set to a location selected by you. It is usually set near the top of the memory. During operation, program information is stored in descending address from the address of the Stack pointer.

The loop count sets the number of times one full EPROM address set has beem completely programmed. The loop count was set to a value that would properly write the EPROM. With the given loop count, full programming of the 256 words takes 2-1/2 minutes.

The Initialization subroutine stores the loop count above the Stack pointer. It then resets the control latch and then sets the pulse generator to the Charge mode.

The next subroutine, Parameter Set, goes to a memory location where the EPROM address length, EPROM Start address, and memory Start address was toggled in before starting the run of the program. The location of these three double words are selectable to any part of the memory. We suggest that these words be placed above the Stack pointer and loop count address.

The Set Data and Test condition will set the Data latch of The Prom Setter and then test the condition of the control logic to see if the Write Disable switch was ON or if an overcurrent condition existed. If abnormal conditions exist, the computer will print out a number showing the condition as shown below:

| | | |
|---|---|---|
| Write Disable ON | = | 3 |
| Overcurrent | = | 2 |
| Both of the above | = | 2 |

The next group of steps is the algorithm used to program the EPROM, which sets the pulses ON and OFF with proper delays to program one address of this EPROM.

One full EPROM address is called a page. The next step of the program is to reduce the page count by one and then to test if the page has been completed. If the page is not complete, the program continues to the next higher address for both the memory and EPROM. If the page is complete, the loop count is reduced by one and tested to see if the loop count has been reduced to zero. If the loop count is not zero, then the program goes back to the preset parameters for length of the page and Start address, and repeats the above. Upon completing the loop count, the computer will print Completion of Write.

### 6.2.2 Write 2704/2708

The 2704/2708 Write flow diagram is shown in Figure 10.

The 2704/2708 program is similar to that for the 1702A, except that it uses a different algorithm for programming this EPROM.

### 6.2.3 Read Programs

The Read and Read Test are similar programs as can be seen by their flow diagrams. The center of the program changes to put the data read into memory, or to compare the data read to that held in the memory, or to compare the data read to zeroes or ones.

The program sets the Stack Pointer, then goes to Read 1. The program continues to store or test the data read. The program now goes to Read 2 and then loops until the words have been read.

During the test programs, any errors that are detected have their address locations printed out.

In the cases of Test Read, if an error is detected, the address is printed out in Hex form. The program then returns to test other locations until page end is reached.

6.2.3.1 Read 1702A and 2704/2708 flow diagram given in Figure 11. The word Read from the EPROM is placed into memory.

6.2.3.2 Test Written EPROM 1702A and 2704/2708 flow diagram is given in Figure 12. The word Read from the EPROM is compared with the word in memory.

6.2.3.3 Test Clear 1702A flow diagram is given in Figure 14. Each word of the EPROM is tested for all bits to be zero.

6.2.3.4 Test Clear 2704/2708 flow diagram is given in Figure 15. Each word of the EPROM is tested for all bits to be "1".

6.2.4 Program Timing with Wait States

The 1702A requires over 1 microsecond reading time. A PROM board would require a wait state of two cycles, giving 1.5 µs.

If the PROM SETTER program is stored on the 1702A, then a change in the Delay subroutine is required, as shown below (see pageVII-11statement starting at ØØDC).

| | Clock Rate | | |
|---|---|---|---|
| Statement | 500 ns | 1.0 µs | 1.5 µs |
| ØØDD | Ø3 | Ø3 | Ø2 |
| ØØDE | FØ | FØ | FØ |
| ØØE8 | 1Ø | 1Ø | ØA |
| ØØEE | 61 | 5Ø | 4Ø |
| ØØF4 | ØE | Ø9 | Ø9 |
| ØØFA | Ø3 | Ø2 | Ø2 |

6.2.5 Relocation of The Prom Setter Programs

To assist in relocation of the programs, an additional program is included. This program will allow the relocation address to be established by you. The revised program is located at Hex address Ø4ØØ to Ø6ØØ.

You set the Relocation address and the Stack Pointer address as given below. (Note that the Stack Pointer address must reside in RAM memory and requires six (6) words of RAM space above and below the given address.)

| | |
|---|---|
| Relocation | Ø3FA<br>Ø3FB |
| Stack Pointer | Ø3FC<br>Ø3FD |
| I/O Address | Ø3FE |

This program is located at Address Hex 0200. To run the program, set the Relocation and Stack Pointer address as given above. Then run the program.

The Prom Setter program located in the bottom address (i.e., from ØØØØ) is now shifted up to address starting at Ø4ØØ and all the statements have been corrected to reflect the selected relocation and stack pointer.

Note that the program now located at Ø4ØØ cannot be used at that address (unless that is where you wanted to relocate this program) since the jump statements have the address of the relocation which are outside of the present program location. You are now ready to copy this on an EPROM for use at the relocated address.

To write the EPROM, set the toggle information at 01F8 to 01FD, as shown at the top of page V-3.

| | 1702A | | 2704/2708 |
|---|---|---|---|
| Address | 1st | 2nd | |
| 01F8 | FF | FF | FF |
| 01F9 | ØØ | ØØ | Ø1 |
| 01FA | ØØ | ØØ | ØØ |
| 01FB | ØØ | ØØ | ØØ |
| 01FC | ØØ | ØØ | ØØ |
| 01FD | Ø4 | Ø5 | Ø4 |

It takes two 1702A to hold the full program. Only one-half of the 2708 EPROM storage is required for this program.

Once the toggle addresses are set, then go to the Write program for the given EPROM:

| | |
|---|---|
| 1702A Write | ØØØØ |
| 2708 Write | ØØ46 |

and run the program. At completion, test the writing by going to the Test program located at ØØ7Ø.

# VII
# PROGRAMS

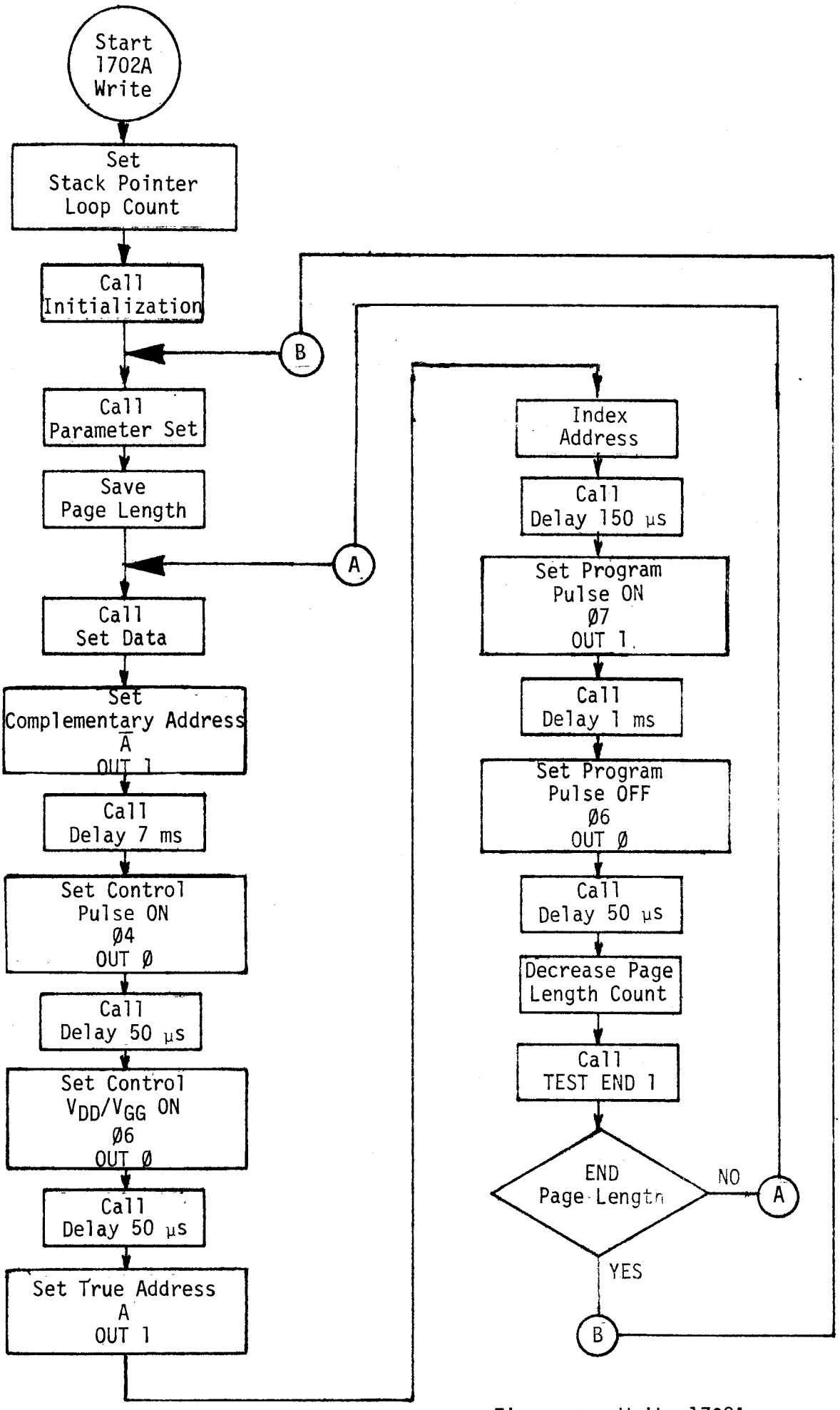



Figure 7.1 Write 1702A

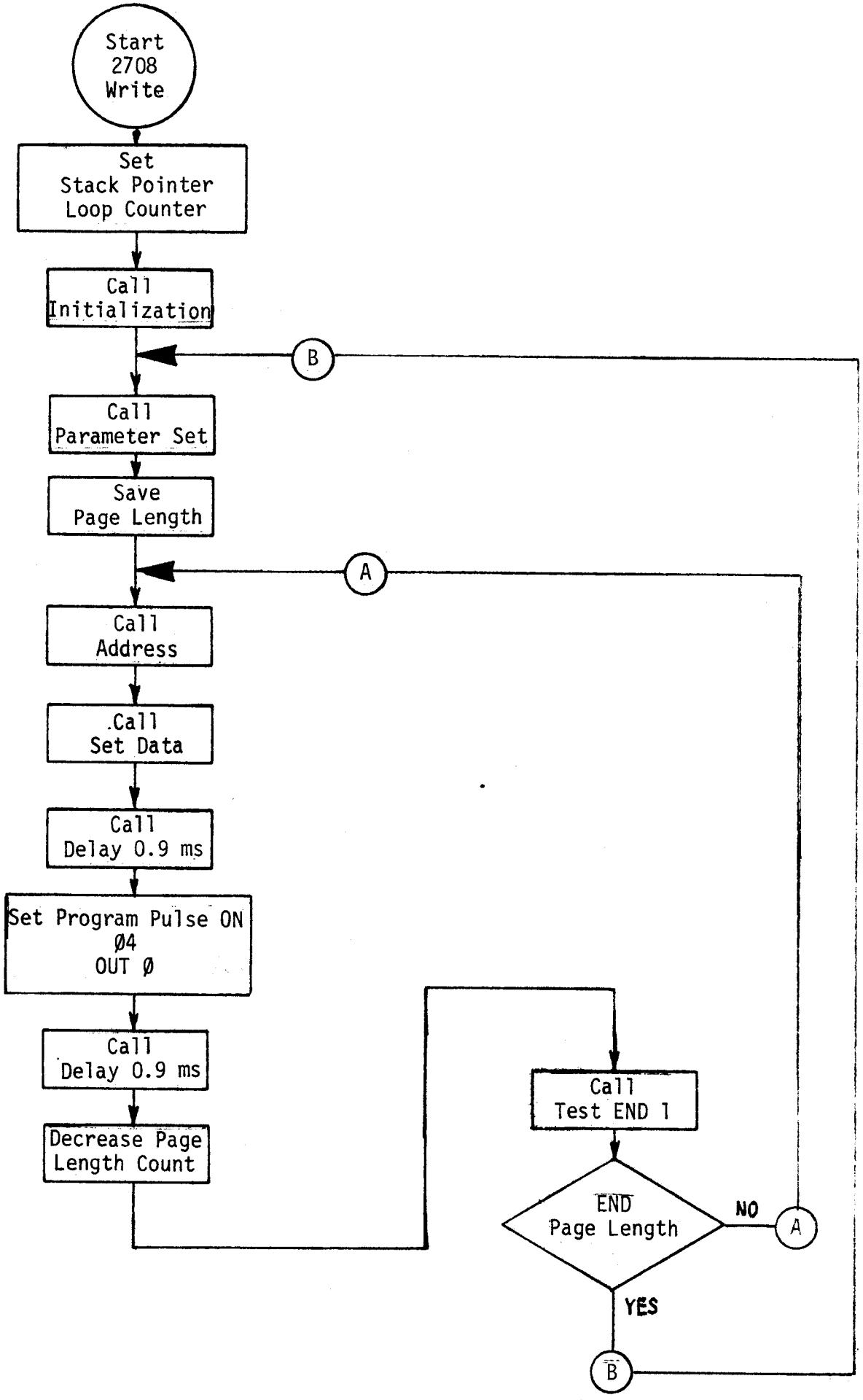



Figure 7.2 Write 2704/2708

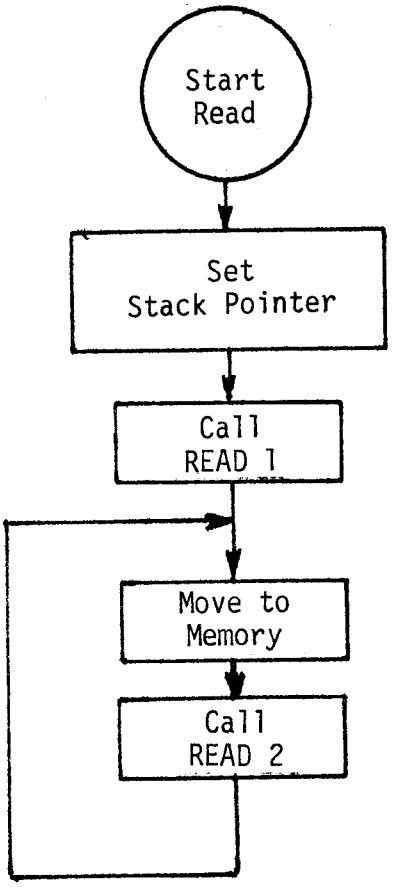



Figure 7.3 Read 1702A and 2704/2708

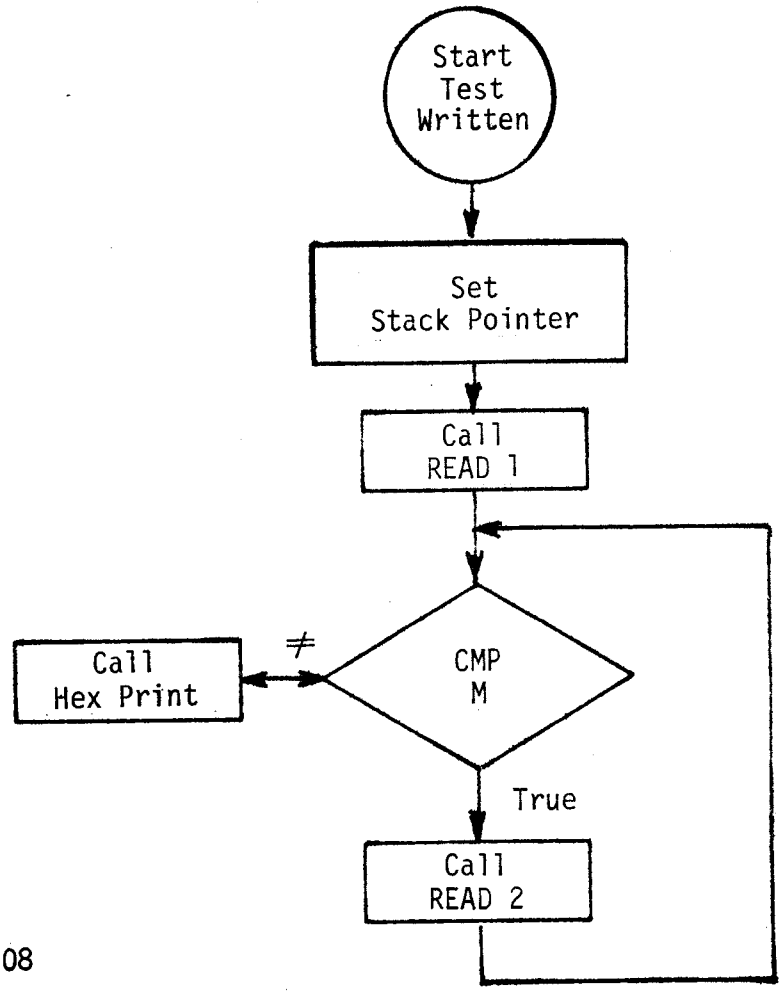
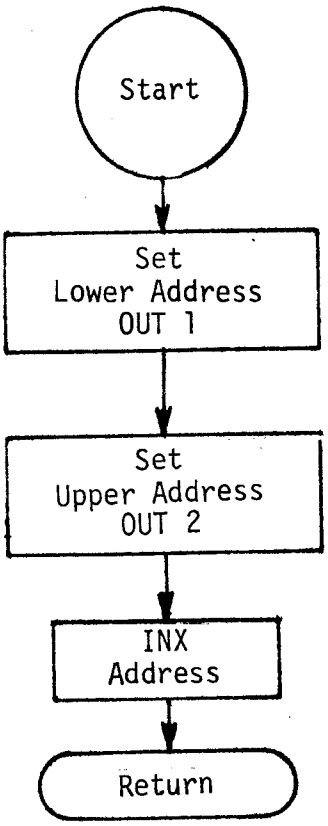



Figure 7.4 Test Written EPROM 1702A and 2704/2708

Figure 7.5 Test Clear 1702A

Figure 7.6 Subroutine Address Set



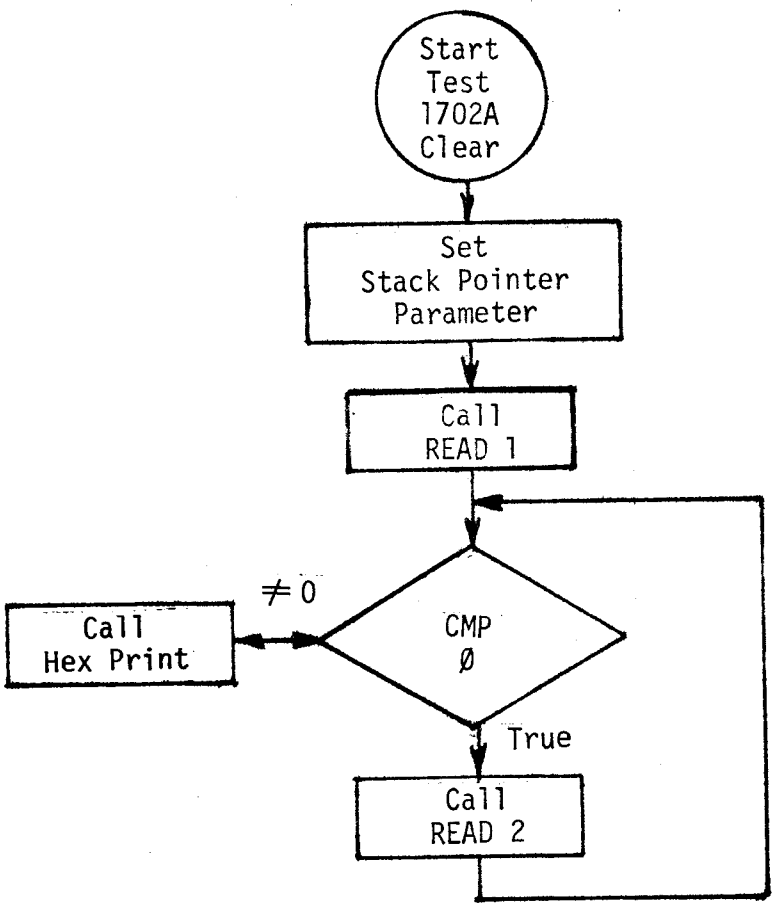



Figure 7.7 Test Clear 2704/2708

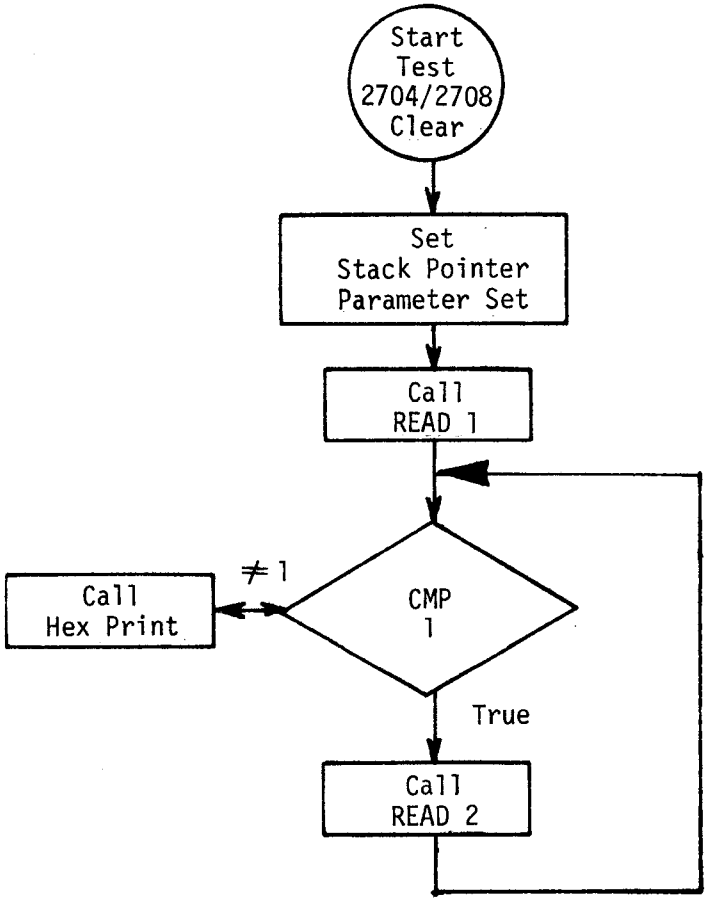
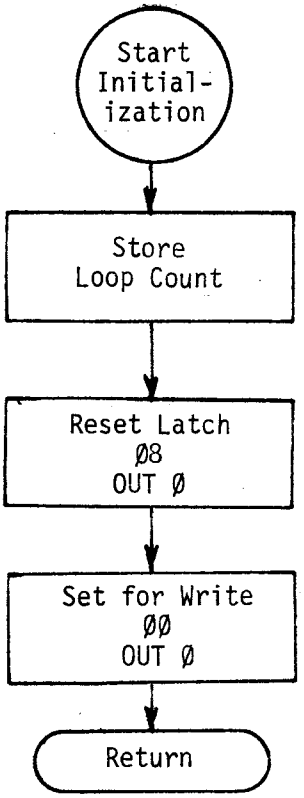



Figure 7.8 Initialization



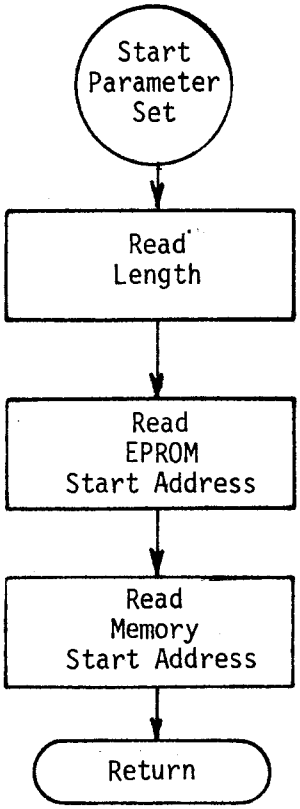




Figure 7.9 Parameter Set

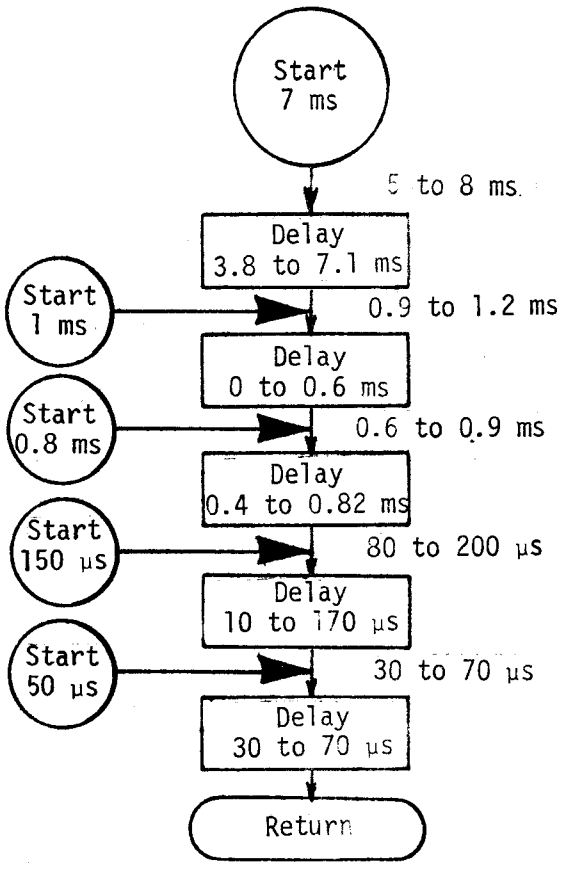



Figure 7.10 Subroutine Delay

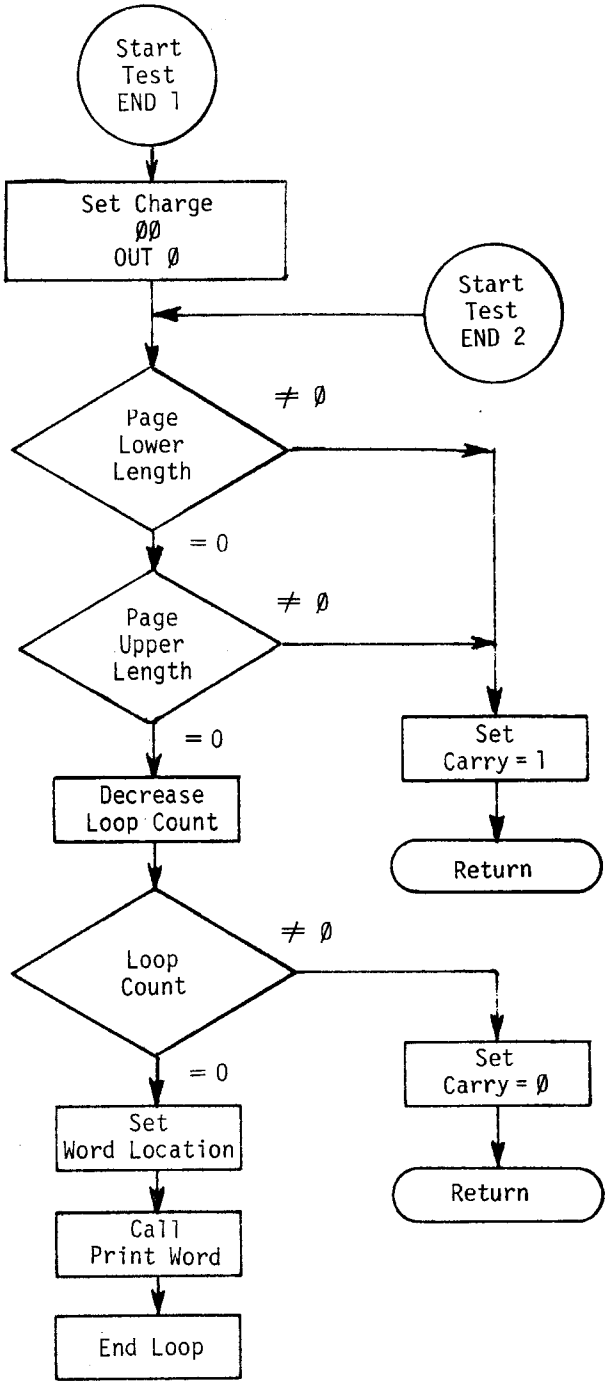



Figure 7.11 Subroutine Test End

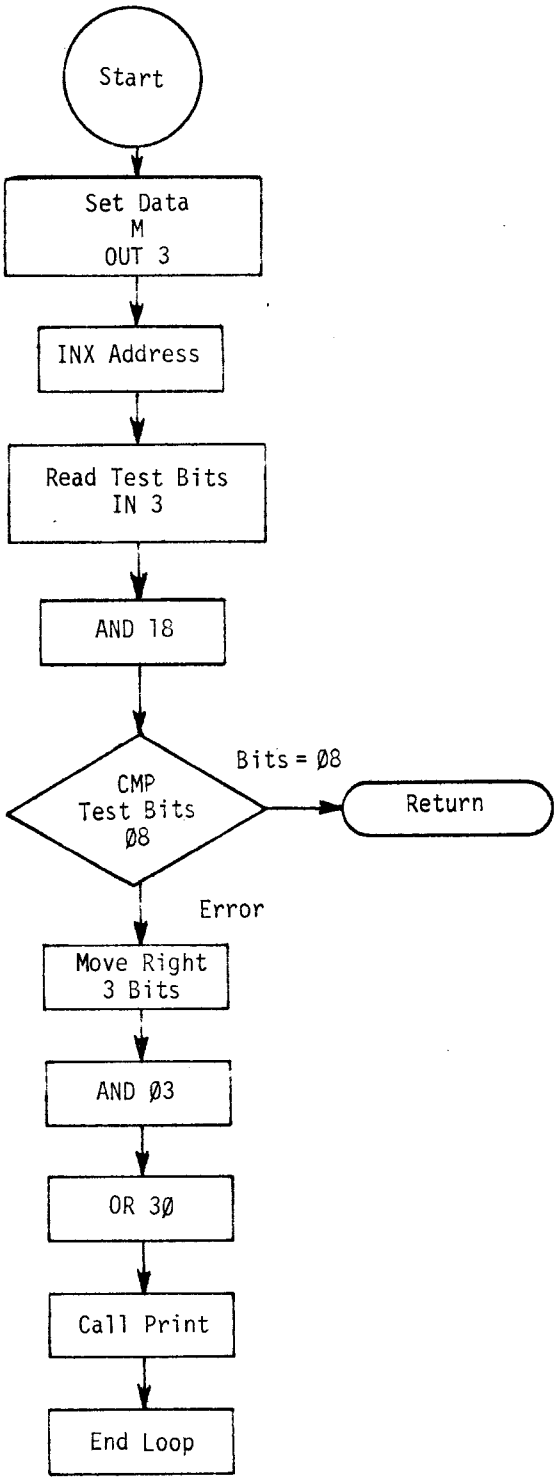



Figure 7.12 Subroutine Set Data and Test Condition

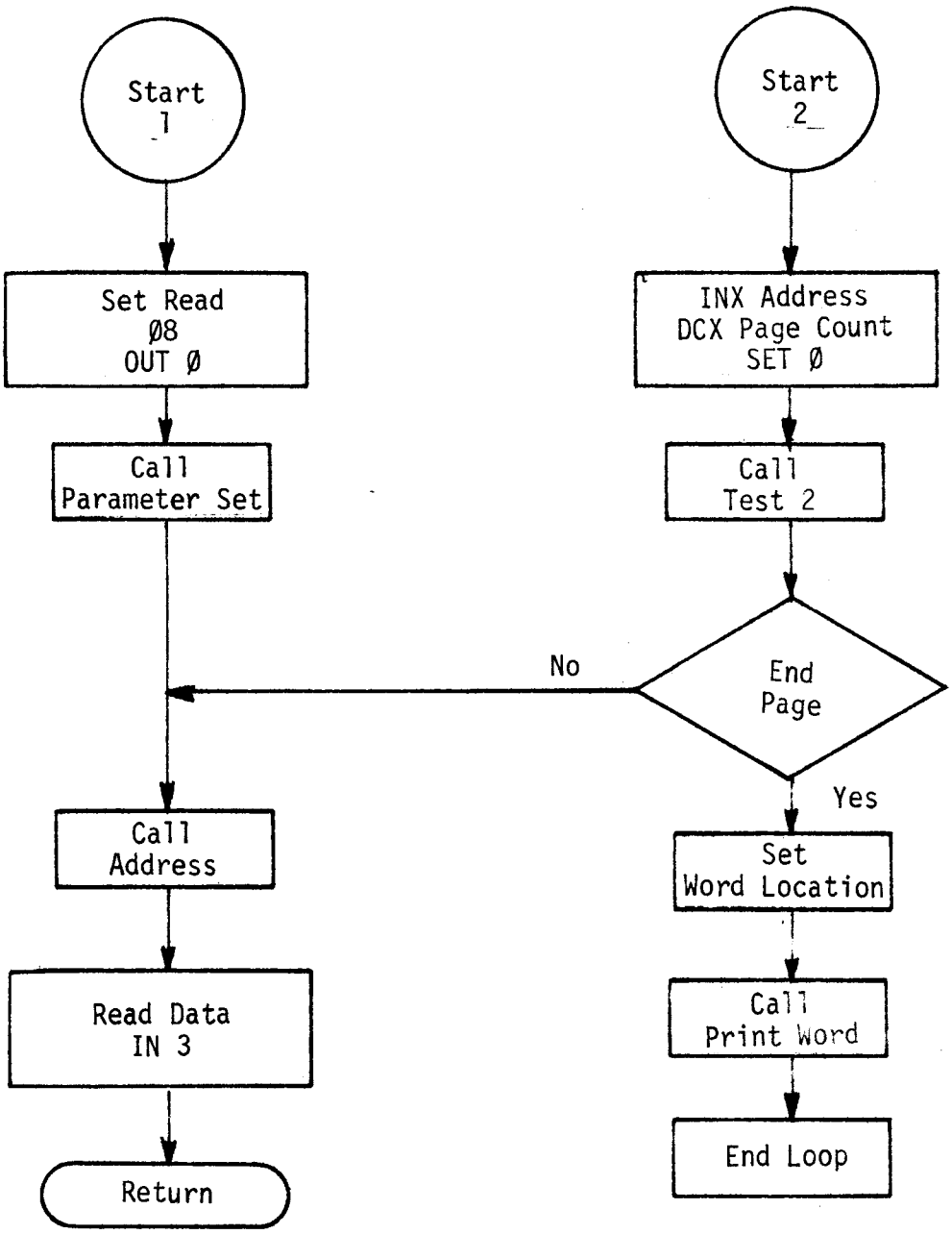



Figure 7.13 Subroutine Read 1 and 2

Figure 7.14 Subroutine HEX PRINT

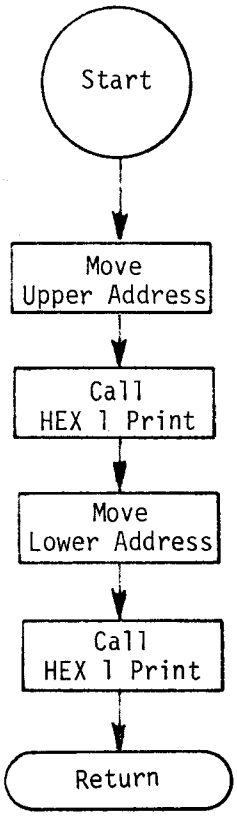



Figure 7.15 HEX 1 Print

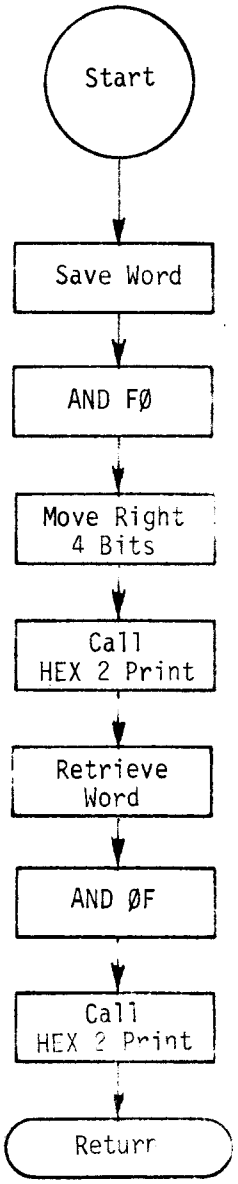
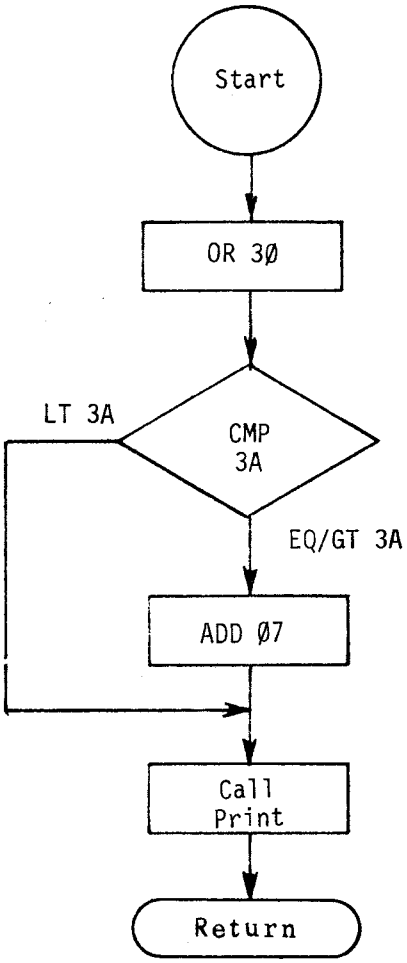



Figure 7.16 HEX 2 Print



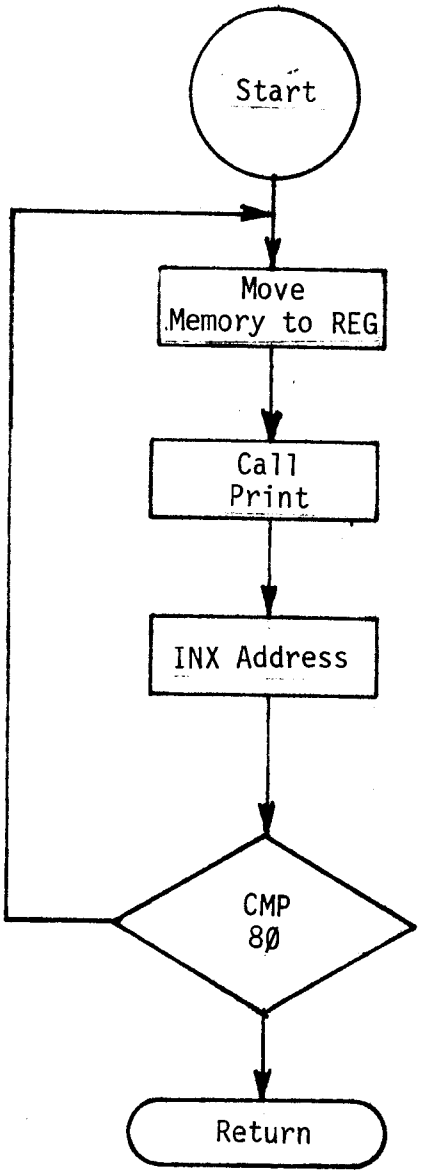



Figure 7.17 Subroutine PRINT Word

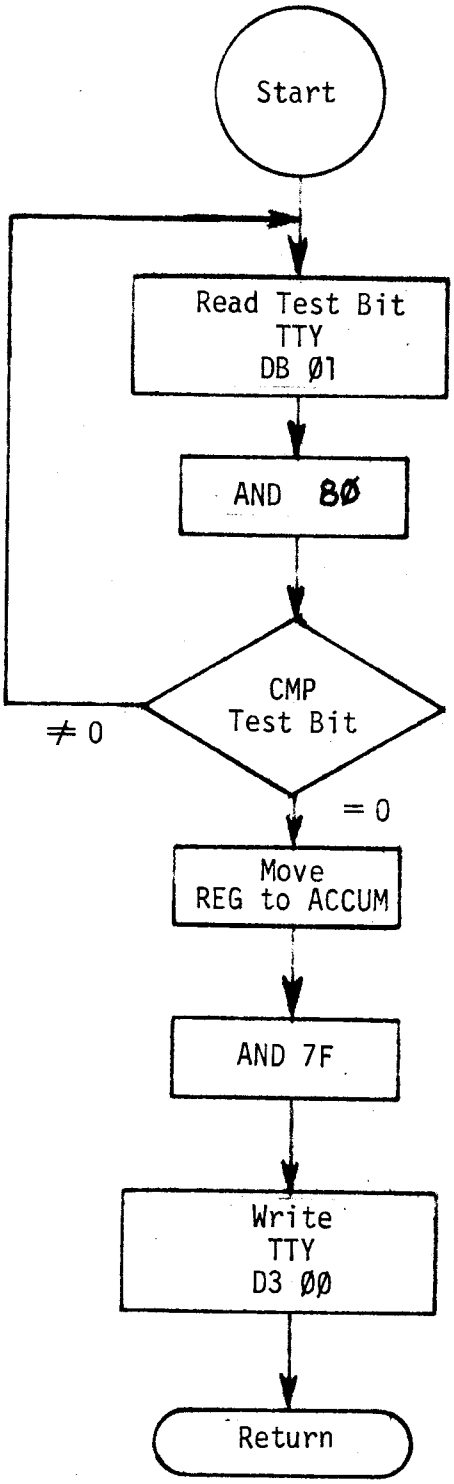



Figure 7.18 Subroutine PRINT

# WRITE

## 1702A

```
0000:  31  LXI   SP,01F4
0003:  3E  MVI   A,48
0005:  CD  CALL  00C3
0008:  CD  CALL  00CE
000B:  F1  POP   PSW
000C:  C5  PUSH  B
000D:  CD  CALL  012C
0010:  7B  MOV   A,E
0011:  2F  CMA
0012:  D3  OUT   F1
0014:  CD  CALL  00DC
0017:  3E  MVI   A,04
0019:  D3  OUT   F0
001B:  CD  CALL  00F9
001E:  3E  MVI   A,06
0020:  D3  OUT   F0
0022:  CD  CALL  00F9
0025:  7B  MOV   A,E
0026:  D3  OUT   F1
0028:  1C  INR   E
0029:  CD  CALL  00F3
002C:  3E  MVI   A,07
002E:  D3  OUT   F0
0030:  CD  CALL  00E7
0033:  3E  MVI   A,06
0035:  D3  OUT   F0
0037:  CD  CALL  00F9
003A:  C1  POP   B
003B:  0B  DCX   B
003C:  C5  PUSH  B
003D:  CD  CALL  0108
0040:  DA  JC    000D
0043:  C3  JMP   0008
```

## 2704/2708

```
0046:  31  LXI   SP,01F4
0049:  3E  MVI   A,60
004B:  CD  CALL  00C3
004E:  CD  CALL  00CE
0051:  F1  POP   PSW
0052:  C5  PUSH  B
0053:  CD  CALL  0100
0056:  CD  CALL  012C
0059:  CD  CALL  00ED
005C:  3E  MVI   A,04
005E:  D3  OUT   F0
0060:  CD  CALL  00ED
0063:  C1  POP   B
0064:  0B  DCX   B
0065:  C5  PUSH  B
0066:  CD  CALL  0108
0069:  DA  JC    0053
006C:  C3  JMP   004E
006F:  00  NOP
```

# TEST WRITE

```
0070:  31  LXI   SP,01F5
0073:  CD  CALL  0142
0076:  C5  PUSH  B
0077:  1B  DCX   D
0078:  BE  CMP   M
0079:  C4  CNZ   0161
007C:  13  INX   D
007D:  C1  POP   B
007E:  CD  CALL  014F
0081:  C3  JMP   0076
```

# TEST CLEAR

## 1702A

```
0084:  31  LXI   SP,01F5
0087:  21  LXI   H,00FF
008A:  CD  CALL  009D
008D:  C5  PUSH  B
008E:  1B  DCX   D
008F:  FE  CPI   00
0091:  C4  CNZ   0161
0094:  13  INX   D
0095:  C1  POP   B
0096:  CD  CALL  014F
0099:  C3  JMP   008D
```

## SUB CLEAR 1

```
009C:  00  NOP
009D:  22  SHLD  01F8
00A0:  21  LXI   H,0000
00A3:  22  SHLD  01FA
00A6:  CD  CALL  0142
00A9:  C9  RET
```

## 2704/2708

```
00AA:  31  LXI   SP,01F5
00AD:  21  LXI   H,03FF
00B0:  CD  CALL  009D
00B3:  C5  PUSH  B
00B4:  1B  DCX   D
00B5:  FE  CPI   FF
00B7:  C4  CNZ   0161
00BA:  13  INX   D
00BB:  C1  POP   B
00BC:  CD  CALL  014F
00BF:  C3  JMP   00B3
```

## INITIALIZATION

```
00C2:  00    NOP
00C3:  32    STA    01F7
00C6:  3E    MVI    A,08
00C8:  D3    OUT    F0
00CA:  AF    XRA    A
00CB:  D3    OUT    F0
00CD:  C9    RET
```

## SET PARAMETER

```
00CE:  2A    LHLD   01F8
00D1:  23    INX    H
00D2:  E5    PUSH   H
00D3:  C1    POP    B
00D4:  2A    LHLD   01FA
00D7:  EB    XCHG
00D8:  2A    LHLD   01FC
00DB:  C9    RET
```

## DELAY

```
00DC:  01    LXI    B,E003
00DF:  05    DCR    B
00E0:  C2    JNZ    00DF
00E3:  0D    DCR    C
00E4:  C2    JNZ    00DF
00E7:  06    MVI    B,10
00E9:  05    DCR    B
00EA:  C2    JNZ    00E9
00ED:  06    MVI    B,68
00EF:  05    DCR    B
00F0:  C2    JNZ    00EF
00F3:  06    MVI    B,0E
00F5:  05    DCR    B
00F6:  C2    JNZ    00F5
00F9:  06    MVI    B,03
00FB:  05    DCR    B
00FC:  C2    JNZ    00FB
00FF:  C9    RET
```

## SET ADDRESS

```
0100:  7B    MOV    A,E
0101:  D3    OUT    F1
0103:  7A    MOV    A,D
0104:  D3    OUT    F2
0106:  13    INX    D
0107:  C9    RET
```

## TEST END

```
0108:  AF    XRA    A
0109:  D3    OUT    F0
010B:  B9    CMP    C
010C:  C2    JNZ    0128
010F:  B8    CMP    B
0110:  C2    JNZ    0128
0113:  3A    LDA    01F7
0116:  3D    DCR    A
0117:  32    STA    01F7
011A:  FE    CPI    00
011C:  C2    JNZ    012A
011F:  21    LXI    H,01C0
0122:  CD    CALL   01B0
0125:  C3    JMP    0125
0128:  37    STC
0129:  C9    RET
012A:  B7    ORA    A
012B:  C9    RET
```

## SET DATA and TEST

```
012C:  7E    MOV    A,M
012D:  D3    OUT    F3
012F:  23    INX    H
0130:  DB    IN     F1
0132:  E6    ANI    18
0134:  FE    CPI    08
0136:  C8    RZ
0137:  0F    RRC
0138:  0F    RRC
0139:  0F    RRC
013A:  F6    ORI    30
013C:  CD    CALL   018F
013F:  C3    JMP    013F
```

## READ

```
0142:  3E    MVI    A,08
0144:  D3    OUT    F0
0146:  CD    CALL   00CE
0149:  CD    CALL   0100
014C:  DB    IN     F3
014E:  C9    RET
014F:  23    INX    H
0150:  0B    DCX    B
0151:  AF    XRA    A
0152:  CD    CALL   010B
0155:  DA    JC     0149
0158:  21    LXI    H,01D0
015B:  CD    CALL   01B0
015E:  C3    JMP    015E
```

## HEX PRINT

```
0161:  7A    MOV   A,D
0162:  CD    CALL  0175
0165:  7B    MOV   A,E
0166:  CD    CALL  0175
0169:  06    MVI   B,0D
016B:  CD    CALL  0195
016E:  06    MVI   B,0A
0170:  CD    CALL  0195
0173:  C9    RET
0174:  00    NOP
```

HEX 1

```
0175:  F5    PUSH  PSW
0176:  E6    ANI   F0
0178:  0F    RRC
0179:  0F    RRC
017A:  0F    RRC
017B:  0F    RRC
017C:  CD    CALL  0186
017F:  F1    POP   PSW
0180:  E6    ANI   0F
0182:  CD    CALL  0186
0185:  C9    RET
```

HEX 2

```
0186:  C6    ADI   30
0188:  FE    CPI   3A
018A:  DA    JC    018F
018D:  C6    ADI   07
018F:  47    MOV   B,A
0190:  CD    CALL  0195
0193:  C9    RET
0194:  00    NOP
```

## TTY WRITE

```
0195:  DB    IN    00
0197:  E6    ANI   80
0199:  C2    JNZ   0195
019C:  78    MOV   A,B
019D:  D3    OUT   01
019F:  C9    RET
```

## READ

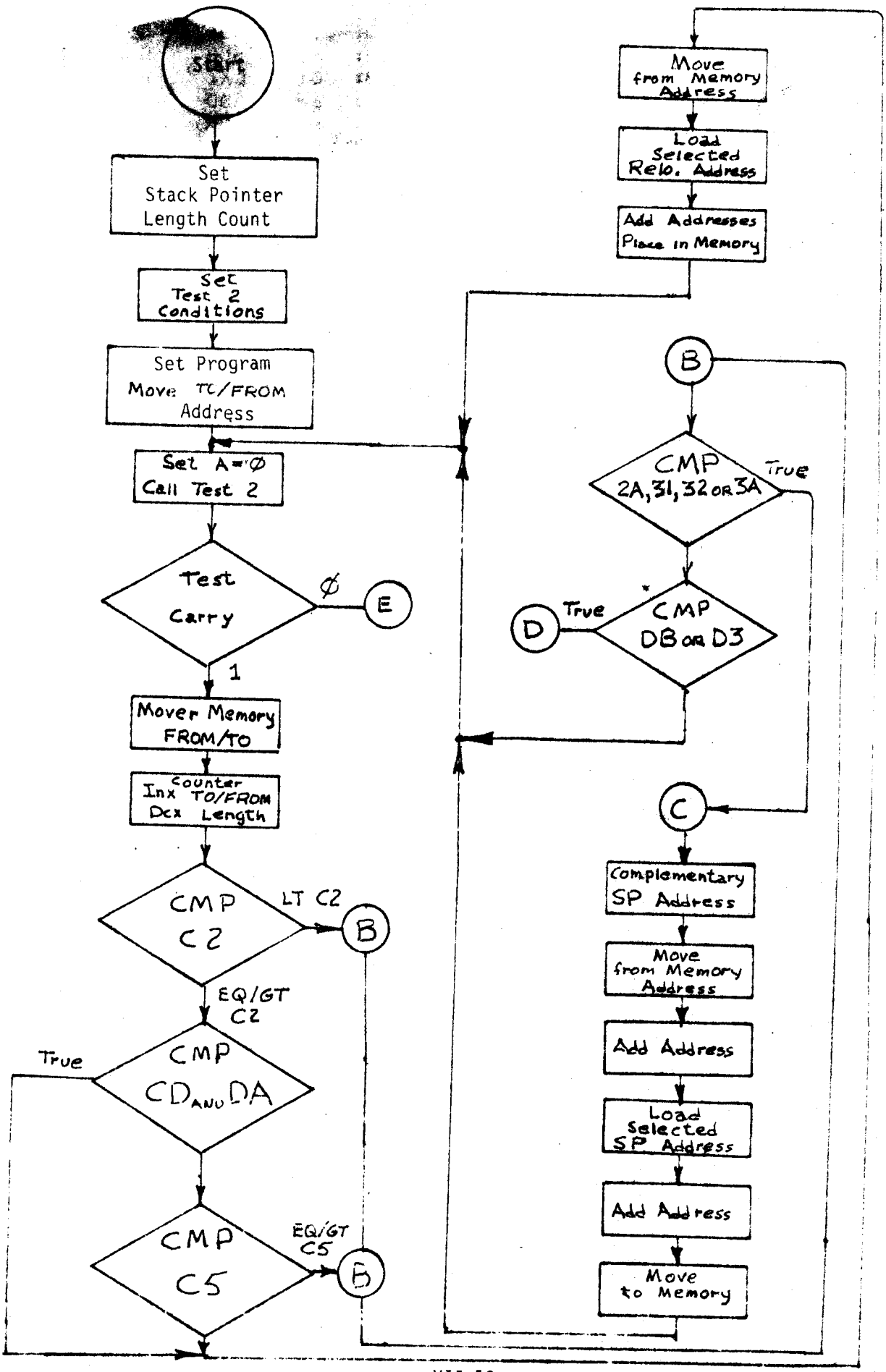
```
01A0:  31    LXI   SP,01F5
01A3:  CD    CALL  0142
01A6:  77    MOV   M,A
01A7:  CD    CALL  014F
01AA:  C3    JMP   01A6
01AD:  00    NOP
01AE:  00    NOP
01AF:  00    NOP
```

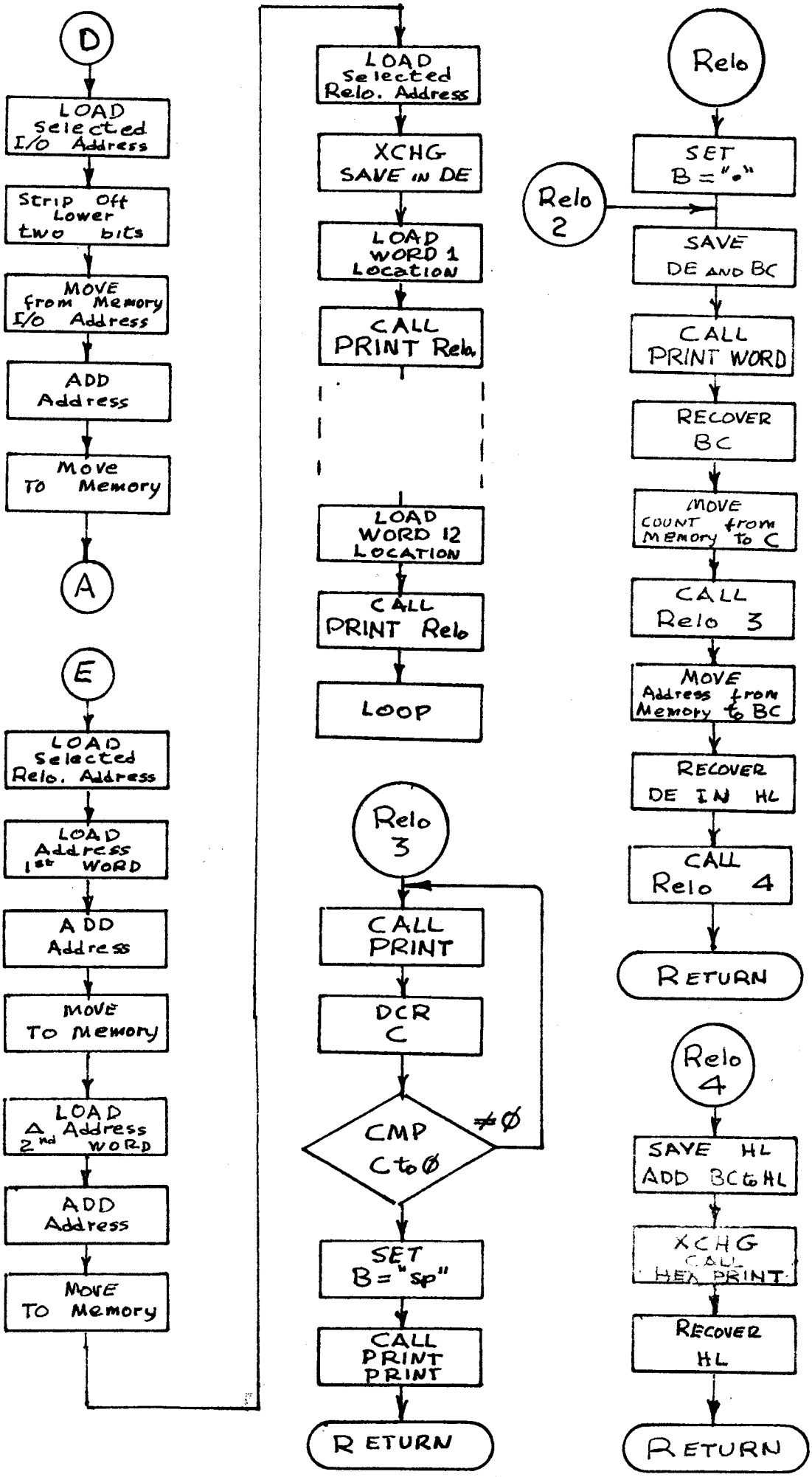
## PRINT WORD


## WORDS

```
01C0:  0D  CR
01C1:  0A  LF
01C2:  00
01C3:  00
01C4:  57  W
01C5:  52  R
01C6:  49  I
01C7:  54  T
01C8:  45  E
01C9:  20
01CA:  45  E
01CB:  4E  N
01CC:  44  D
01CD:  0D
01CE:  8A
01CF:  00
01D0:  0D  CR
01D1:  0A  LF
01D2:  00
01D3:  00
01D4:  52  R
01D5:  45  E
01D6:  41  A
01D7:  44  D
01D8:  20
01D9:  4F  O
01DA:  4B  K
01DB:  0D  CR
01DC:  8A  LF
```

# RELOCATION


Start
Set Stack Pointer Length Count
Set Test 2 Conditions
Set Program Move TO/FROM Address
Set A=Ø Call Test 2
Test Carry
Ø
E
1
Mover Memory FROM/TO
Counter Inx TO/FROM Dcx Length
CMP C2
LT C2
B
EQ/GT C2
CMP CD AND DA
True
CMP C5
EQ/GT C5
B
Move from Memory Address
Load Selected Relo. Address
Add Addresses Place in Memory
B
CMP 2A, 31, 32 OR 3A
True
D
True
CMP DB or D3
C
Complementary SP Address
Move from Memory Address
Add Address
Load Selected SP Address
Add Address
Move to Memory


D
LOAD Selected I/O Address
Strip Off Lower two bits
MOVE from Memory I/O Address
ADD Address
Move TO Memory
A
E
LOAD Selected Relo. Address
LOAD Address 1st WORD
ADD Address
MOVE To Memory
LOAD Address 2nd WORD
ADD Address
MOVE TO Memory
LOAD Selected Relo. Address
XCHG SAVE IN DE
LOAD WORD 1 Location
CALL PRINT Relo
LOAD WORD 12 LOCATION
CALL PRINT Relo
LOOP
Relo 3
CALL PRINT
DCR C
CMP C to Ø
≠Ø
SET B="sp"
CALL PRINT PRINT
RETURN
Relo
SET B="."
Relo 2
SAVE DE AND BC
CALL PRINT WORD
RECOVER BC
MOVE COUNT from Memory to C
CALL Relo 3
MOVE Address from Memory to BC
RECOVER DE IN HL
CALL Relo 4
RETURN
Relo 4
SAVE HL ADD BC to HL
XCHG CALL HEX PRINT
RECOVER HL
RETURN

# RELOCATION PROGRAM

```
0200 31   Set Stack
0201 F8 } Pointer
0202 03 } Ø3F8
0203 01   LXI BC
0204 E0 } LENGTH
0205 01 } ØIEØ
0206 3E } Set
0207 08 } A←Ø8      } SET FOR TEST2
0208 32   STA
0209 F7 }
020A 01 }
020B 11   LXI DE
020C 00 } MOVE TO (START) ADDRESS
020D 04 }
020E 21   LXI HL
020F 00 } MOVE FROM (START) ADDRESS
0210 00 }
0211 00   NOP
0212 AF   Set A←Ø  ← (A)
0213 CD   CALL
0214 0B } TEST 2
0215 01 }
0216 D2   JUMP
0217 9C } CARRY = Ø → (E)
0218 02 }
0219 7E   A←M
021A 12   MDE←A
021B 13   INX DE
021C 23   INX HL
021D 0B   DCX BC
021E FE } CMP
021F C2 } C2
0220 DA   JUMP
0221 49 } CARRY = 1 → (B)
0222 02 }
0223 FE } CMP
0224 CD } CD
0225 CA   JUMP ZERO
0226 32 }
0227 02 }
0228 FE } CMP
0229 DA } DA
022A CA   JUMP ZERO
022B 32 }
022C 02 }
022D FE } CMP
022E C5 } C5
022F D2   JUMP
0230 49 } CARRY = Ø → (B)
0231 02 }
0232 C5   PUSH BC
0233 4E   C←M
0234 23   INX HL
0235 46   B←M
0236 23   INX HL
0237 E5   PUSH HL
0238 2A   LOAD HL
0239 FA } RELOCATION
023A 03 } START ADDRESS
```

```
023B 09   DAD BC  ADD BC to HL
023C 7D   A←L
023D 12   MDE←A
023E 13   INX DE
023F 7C   A←H
0240 12   MDE←A
0241 13   INX DE
0242 E1   POP HL
0243 C1   POP BC
0244 0B   DCX BC
0245 0B   DCX BC
0246 C3   JUMP
0247 12 } → (A)
0248 02 }
0249 FE } CMP ← (B)
024A 2A } 2A
024B CA   JUMP ZERO
024C 6A } →
024D 02 }
024E FE } CMP
024F 31 } 31
0250 CA   JUMP ZERO
0251 6A } →
0252 02 }
0253 FE } CMP
0254 32 } 32
0255 CA   JUMP ZERO
0256 6A } →
0257 02 }
0258 FE } CMP
0259 3A } 3A
025A CA   JUMP ZERO
025B 6A } →
025C 02 }
025D FE } CMP ← (C)
025E DB } DB
025F CA   JUMP ZERO
0260 89 } →
0261 02 }
0262 FE } CMP
0263 D3 } D3
0264 CA   JUMP ZERO
0265 89 } →
0266 02 }
0267 C3   JUMP ← (D)
0268 12 } → (A)
0269 02 }
026A C5   PUSH BC ← (C)
026B 01   LXI BC
026C 0C } COMPLEMENTARY
026D FE } STACK POINTER
026E D5   PUSH DE
026F 5E   E←M
0270 23   INX HL
0271 56   D←M
0272 23   INX HL
0273 EB   XCHG
0274 09   DAD BC
0275 4D   C←L
0276 44   B←H
```

```
0277 2A  LOAD HL
0278 FC  RAM
0279 03  STACK POINTER ADDRESS
027A 09  DAD BC
027B 4D  C ← L
027C 44  B ← H
027D E1  POP HL
027E 71  M ← C
027F 23  INX HL
0280 70  M ← B
0281 23  INX HL
0282 C1  POP BC
0283 0B  DCX BC
0284 0B  DCX BC
0285 EB  XCHG
0286 C3  JUMP
0287 12  → A
0288 02
0289 3A  LDA ← D
028A FE  NEW
028B 03  I/O ADDRESS
028C E6  AND
028D FC  FC
028E C5  PUSH BC
028F 47  B ← A
0290 7E  A ← M
0291 23  INX HL
0292 E6  AND
0293 03  Ø3
0294 80  ADD B to A
0295 C1  POP BC
0296 12  M DE ← A
0297 13  INX DE
0298 0B  DCX BC
0299 C3  JUMP
029A 12  → A
029B 02
029C 2A  LOAD HL ← E
029D FA  RELOCATION
029E 03  START ADDRESS
029F 01  LXI BC
02A0 C0  1ST WORD
02A1 01  ADDRESS
02A2 09  DAD BC
02A3 22  STORE HL
02A4 20  Ø52Ø
02A5 05
02A6 01  LXI BC
02A7 10  2ND WORD
02A8 00  (ADD TO 1ST)
02A9 09  DAD BC
02AA 22  STORE HL
02AB 59  Ø559
02AC 05
02AD 2A  LOAD HL
02AE FA  RELOCATION
02AF 03  START ADDRESS
02B0 01
02B1 8F
02B2 01
02B3 09  DAD BC
02B4 22  STORE HL
02B5 8B  Ø58B
02B6 05
02B7 3E  set
02B8 DA  A = DA
02B9 32  STA
02BA 8A  Ø58A
02BB 05
02BC AF  set A = Ø
02BD 32  STA
02BE 96  Ø596
02BF 05
02C0 3C  INR A
02C1 32  STA
02C2 9E  Ø59E
02C3 05
02C4 2A  LOAD HL
02C5 FA  RELOCATION START ADDRESS
02C6 03
02C7 EB  STORE IN DE
02C8 21  LOAD HL
02C9 20  WORD
02CA 03  LOCATION
02CB 06  LOOP COUNT
02CC 06  SET B = Ø6
02CD C5  PUSH BC ←
02CE CD  CALL
02CF F0  PRINT
02D0 02  Relo
02D1 C1  POP BC
02D2 05  DCR BC
02D3 C2  JNZ
02D4 CD  →
02D5 02
02D6 2A  LOAD HL
02D7 FC  STACK POINTER
02D8 03  ADDRESS
02D9 EB  STORE IN DE
02DA 21  LOAD HL
02DB 9A  WORD
02DC 03  LOCATION
02DD 06  LOOP COUNT
02DE 03  set B = Ø3
02DF C5  PUSH BC ←
02E0 CD  CALL
02E1 F0  PRINT
02E2 02  Relo
02E3 06  set
02E4 20  B = "SP"
02E5 CD  CALL
02E6 F2  Relo 2
02E7 02
02E8 C1  POP BC
02E9 05  DCR BC
02EA C2  JNZ
02EB DF  →
02EC 02
02ED C3  LOOP ←
02EE ED  →
02EF 02
```

SUBRUTINE Relo

```
02F0 06  SET B = "."
02F1 2E
02F2 C5  PUSH BC ← START 2
02F3 CD  CALL
02F4 B0  PRINT
02F5 01  WORD
02F6 C1  POP BC
02F7 4E  C ← M
02F8 23  INX HL
02F9 CD  CALL
02FA 04  Relo 3
02FB 03
02FC 4E  C ← M
02FD 23  INX HL
02FE 46  B ← M
02FF 23  INX HL
0300 CD  CALL
0301 14  Relo 4
0302 03
0303 C9  RETURN
```

Relo 3

```
0304 CD  CALL ←
0305 95  PRINT
0306 01
0307 0D  DCR C
0308 C2  JNZ
0309 04  →
030A 03
030B 06  Set
030C 20  B = "SP"
030D CD  CALL
030E 95  PRINT
030F 01
0310 CD  CALL
0311 95  PRINT
0312 01
0313 C9  RETURN
```

Relo 4

```
0314 D5  PUSH DE
0315 EB  XCHG DE ⇄ HL
0316 09  DAD BC
0317 EB  XCHG DE ⇄ HL
0318 CD  CALL
0319 61  HEX PRINT
031A 01
031B D1  POP DE
031C C9  RETURN
031D 00  NOP
031E 00  NOP
031F 00  NOP
```

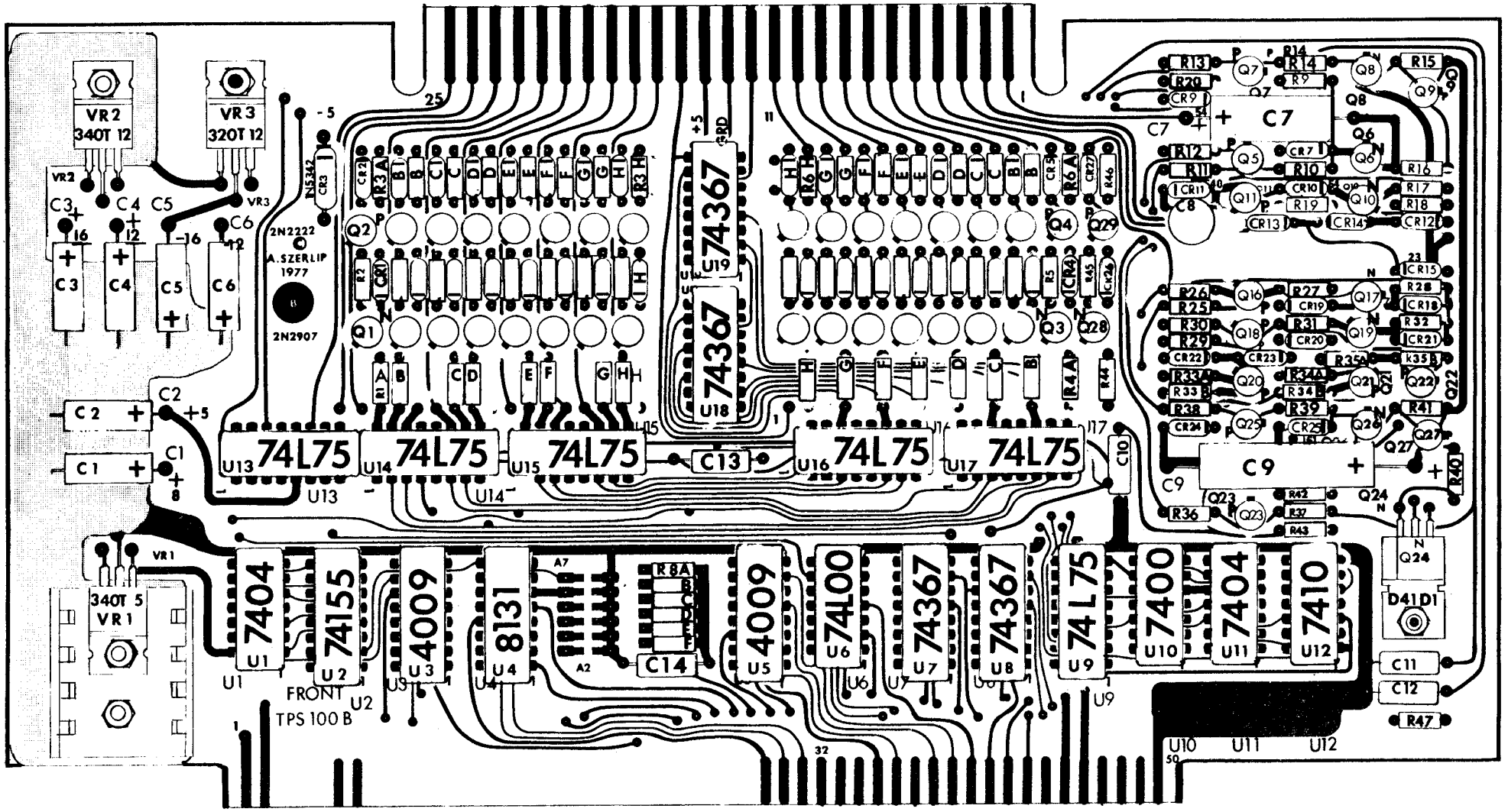
```
0320 0D    CR
0321 0A    LF
0322 00    NOP
0323 00    NOP
0324 52    R
0325 4C    L
0326 2E    .
0327 20    SP
0328 41    A
0329 44    D
032A 44    D
032B 52    R
032C 45    E
032D 53    S
032E 53    S
032F 45    E
0330 53    S
0331 0D    CR
0332 0A    LF
0333 0A    LF
0334 00    SP
0335 57    W
0336 52    R
0337 49    I
0338 54    T
0339 45    E
033A 0D    CR
033B 0A    LF
033C 00    NOP
033D 00    NOP
033E 20    SP
033F 20    SP
0340 31    1
0341 37    7
0342 30    0
0343 32    2
0344 C1    A
0345 0C    COUNT
0346 00    1702A
0347 00    ADDRESS
0348 20    SP
0349 20    SP
034A 32    2
034B 37    7
034C 30    0
034D B8    8
034E 0D    COUNT
034F 46    2708
0350 00    ADDRESS
0351 52    R
0352 45    E
0353 41    A
0354 44    D
0355 0D    CR
0356 0A    LF
0357 00    NOP
0358 00    NOP
0359 20    SP
035A 20    SP
035B 41    A
035C 4C    L
035D CC    L
035E 0E    COUNT
035F A0    READ
0360 01    ADDRESS
```

```
0361 54    T
0362 45    E
0363 53    S
0364 54    T
0365 20    SP
0366 57    W
0367 52    R
0368 49    I
0369 54    T
036A 54    T
036B 45    E
036C 4E    N
036D 0D    CR
036E 0A    LF
036F 00    NOP
0370 00    NOP
0371 20    SP
0372 20    SP
0373 41    A
0374 4C    L
0375 CC    L
0376 0E    COUNT
0377 70    TEST
0378 00    ADDRESS
0379 54    T
037A 45    E
037B 53    S
037C 54    T
037D 20    SP
037E 43    C
037F 4C    L
0380 45    E
0381 41    A
0382 52    R
0383 0D    CR
0384 0A    LF
0385 00    NOP
0386 00    NOP
0387 20    SP
0388 20    SP
0389 31    1
038A 37    7
038B 30    0
038C 32    2
038D C1    A
038E 0C    COUNT
038F 84    1702A
0390 00    TEST ADDRESS
0391 20    SP
0392 20    SP
0393 32    2
0394 37    7
0395 30    0
0396 B8    8
0397 0D    COUNT
0398 AA    2708
0399 00    TEST ADDRESS
```

```
039A 53    S
039B 45    E
039C 54    T
039D 0D    CR
039E 0A    LF
039F 00    NOP
03A0 00    NOP
03A1 20    SP
03A2 20    SP
03A3 4C    L
03A4 45    E
03A5 4E    N
03A6 47    G
03A7 54    T
03A8 C8    H
03A9 0B    COUNT
03AA 04    SET LOWER LENGTH ADDRESS
03AB 00
03AC A0    SP
03AD 12    COUNT
03AE 05    SET UPPER LENGTH ADDRESS
03AF 00
03B0 20    SP
03B1 20    SP
03B2 50    P
03B3 52    R
03B4 4F    O
03B5 4D    M
03B6 20    SP
03B7 53    S
03B8 54    T
03B9 41    A
03BA 52    R
03BB D4    T
03BC 07    COUNT
03BD 06    SET LOWER PROM START ADDRESS
03BE 00
03BF A0    SP
03C0 12    COUNT
03C1 07    SET UPPER PROM START ADDRESS
03C2 00
03C3 20    SP
03C4 20    SP
03C5 4D    M
03C6 45    E
03C7 4D    M
03C8 4F    O
03C9 52    R
03CA 59    Y
03CB 20    SP
03CC 53    S
03CD 54    T
03CE 41    A
03CF 52    R
03D0 D4    T
03D1 05    COUNT
03D2 08    SET LOWER MEMORY START ADDRESS
03D3 00
03D4 A0    SP
03D5 12    COUNT
03D6 09    SET UPPER MEMORY START ADDRESS
03D7 00
```

# VIII

# COMPONENT LAYOUT AND SCHEMATIC




**COMPONENT LAYOUT**

Figure 30.

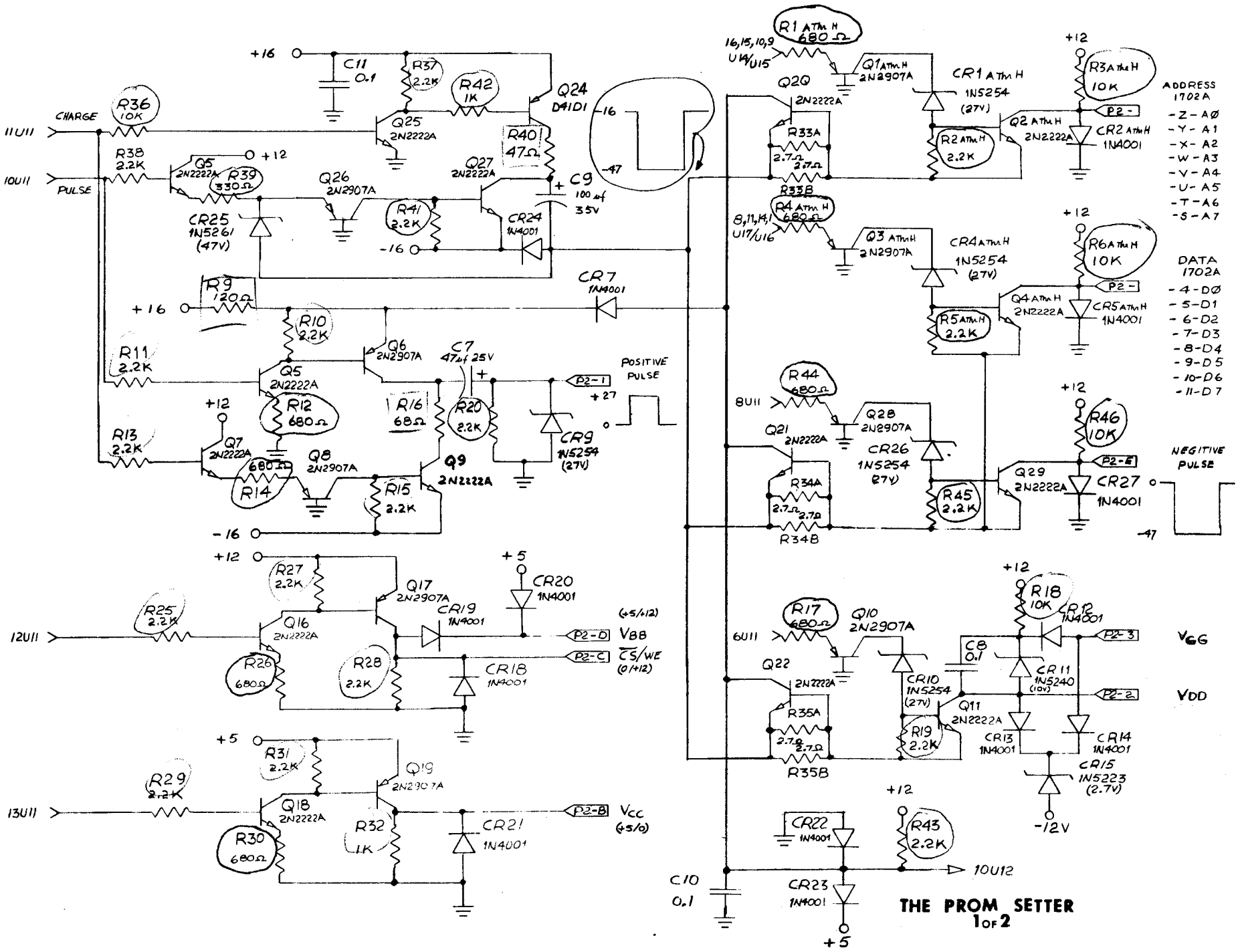



Figure 31. Schematic Diagram

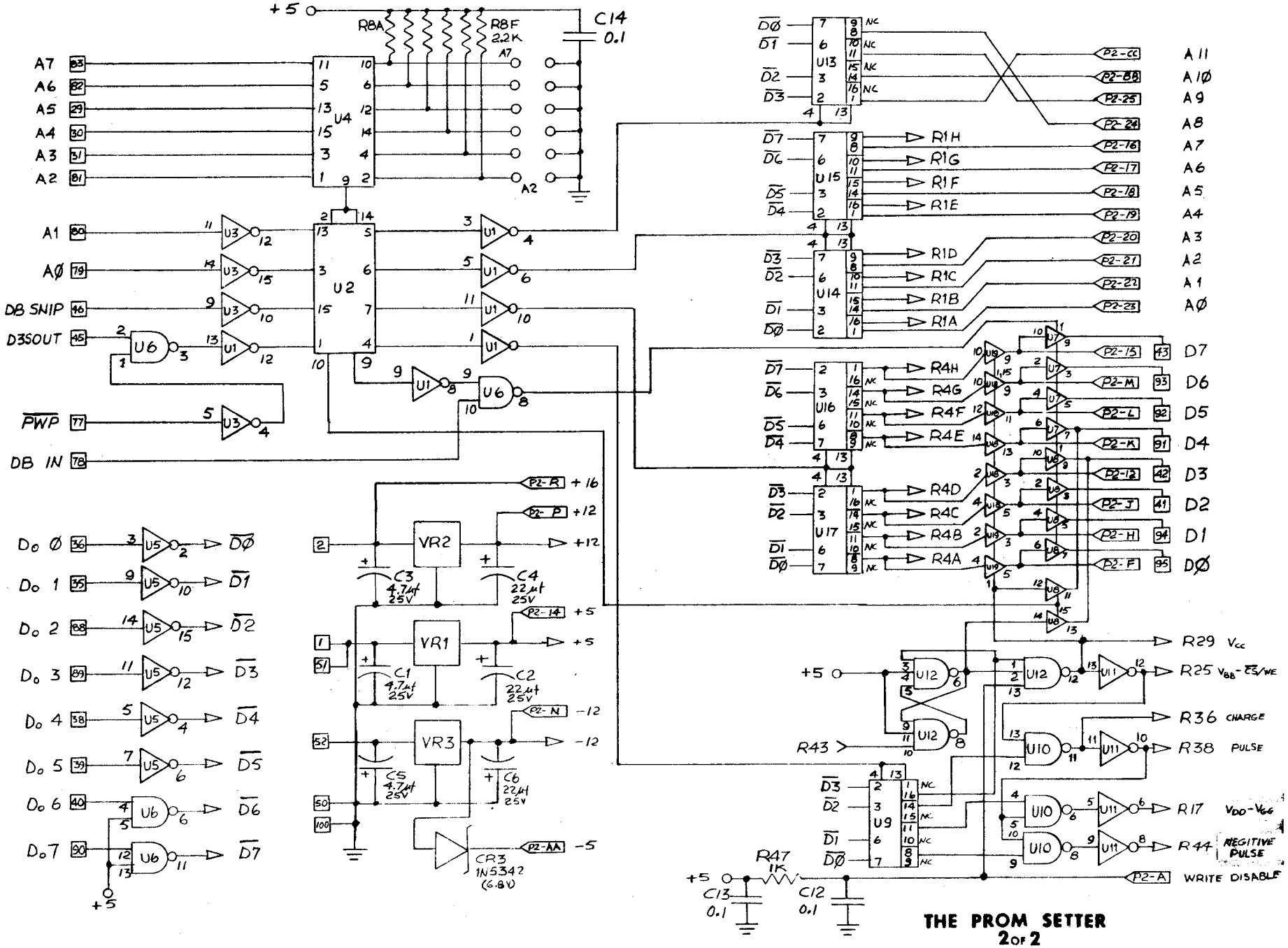



Figure 31. Schematic Diagram

# APPENDIX

# APPENDIX I
## WARRANTY

The parts supplied in the PROM SETTER are warranteed against defects in material and workmanship for a period of 90 days after the date of shipment or purchase, whichever is the later date.

Any malfunctioning module, purchased as a kit within the above warranty period, which in our judgment has been assembled with normal care, and not subject to mechanical or electrical abuse, will be restored to proper operating condition for shipping and handling charge of $2.50.

Any malfuncting module, purchased as a kit not covered by the above conditions will be repaired and returned at a cost commensurate with the work required. In NO CASE will the charge exceed $22.50 without prior notification and approval of the owner.

Any module purchased assembled is guaranteed to meet specifications as in effect at the time of manufacture for the full warranty period. If malfunctioning occurs to these modules within the warranty period they will be repaired without charge providing that no attempt was made to modify the unit.

This warranty is made in lieu of all other warranties expressed or implied, and is limited in any case to the repair or replacement of the module involved.

# APPENDIX II

Assembly, Soldering and Cleaning Notes

General: Assembly of printed circuit boards can range from very "shoddy" to "beautiful" in the workmanship category. My experience over the years has indicated to me that a printed circuit board "works about like it looks." I find that if great care is used in assembly and soldering, one experiences a certain pride in workmanship and a board usually functions that way in an almost "human" manner, i.e., with pride.

A few do's and don't's may help your workmanship.

DO's

1) Familiarize yourself with the general operations to be performed.

2) Make sure all necessary tools, materials, parts, etc. are available.

3) Make sure tools, fixtures, etc., are clean and in good working order.

4) Arrange tools in order of usage and frequency.

5) Orient tools for easy grasp.

6) Select proper soldering iron, tip, wattage, etc., required for the job.

7) Be sure chair is proper height and comfortable for your work station.

8) Keep work area clean and uncluttered.

9) Obey all safety precautions and exercise good judgment at all times.

10) Strive for neatness and uniformity.

11) Keep food and drink away from work area.

12) Remove bits and pieces of scrap wire, solder pieces, as you progress so they do not become buried in your work.

DON'T'S

1) Don't have unnecessary items at your work station.

2) Don't have worn or damaged tools at your work area.

3) Don't solder on equipment that is plugged in.

4) Don't use unknown cleaning solutions.

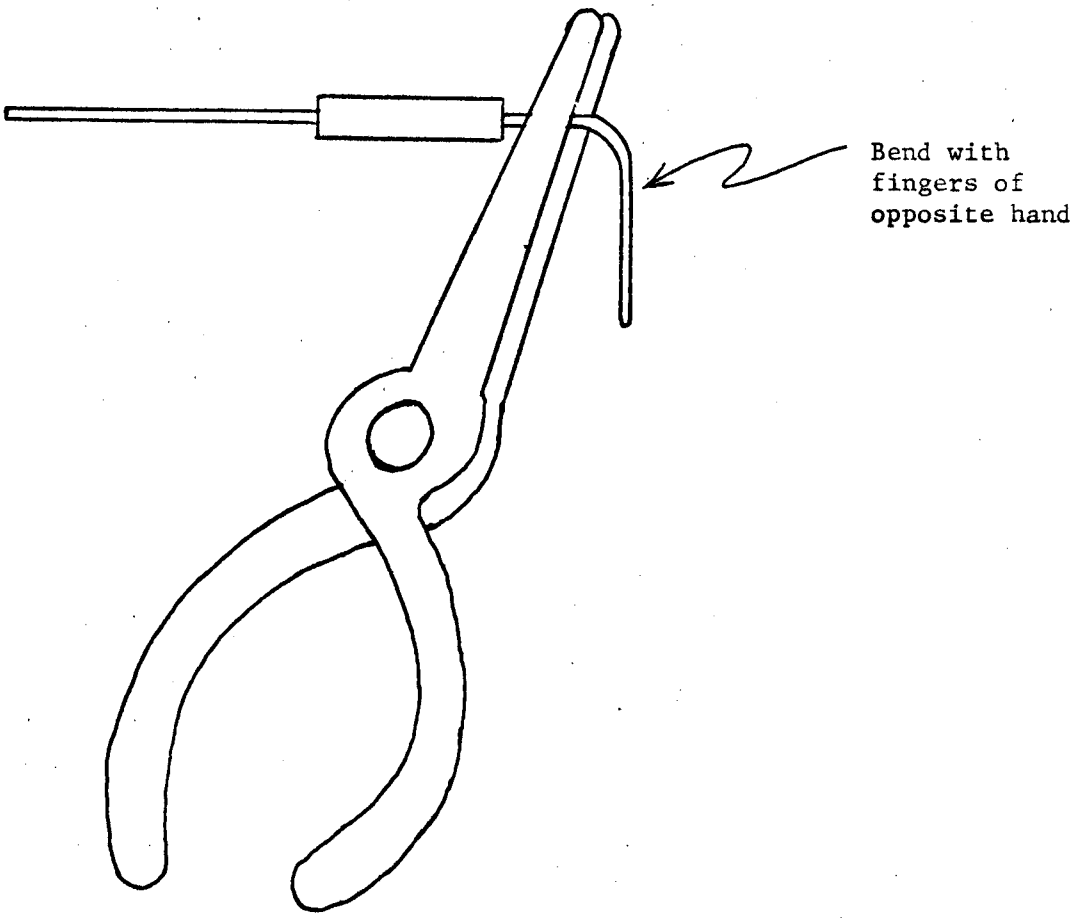
5) Never pull on a solder joint to see if it is good.

6) Never flip excess solder off of your soldering iron.

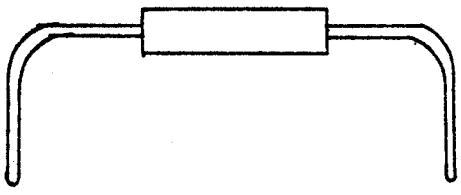
7) Never add solder to your iron then transfer it to a cold joint.

**Assembly**

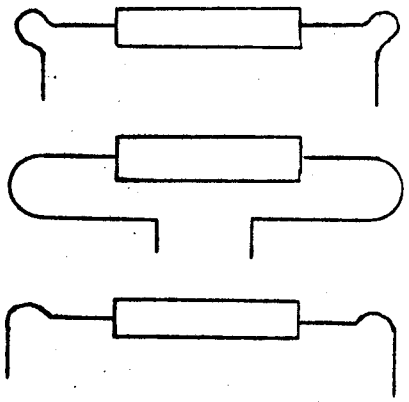
**Lead forming - Lead forming is performed by grasping the body of the part with the fingers of one hand. With the other hand holding long-nose pliers, grasp the lead near the body with the taper of the pliers defining the length of lead from body of the part to the lead. Bend the lead with the opposite hand to form the bend as in the following figure.**




**Hand Forming Operation**



**Preferred Bend Configuration**

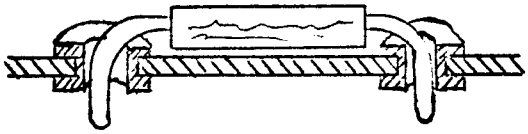


**Alternate Bend Configurations**

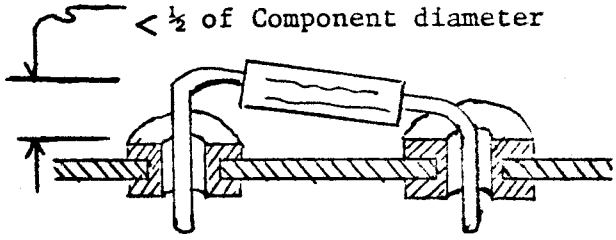
The lead should have a discernible length extending straight from the body of the component before beginning the bend. The component body shall not be damaged nor the body-to-lead seal damaged by the forming operation. The component should be centered between the bends, although this is not a requirement. Where feasible, all forming should be done so that the part number is visible when installed in the circuit board.

Component Installation

Install all components in their proper location, and if polarity is important, observe the proper markings. The component should be installed flush with the circuit board, unless a clearance is specifically called out. This clearance is suually required for hot components that might burn or discolor the printed circuit board.



GOOD (Before Soldering




ACCEPTABLE

Soldering

Soldering techniques probably are the hardest to master of any electronic assembly technique. If you have never soldered at all, it is probably best that you practice on some old scrap printed circuit board available at most electronic part stores and surplus shops.

For electronic assembly, always use <u>resin</u> core solder, not <u>acid</u> core solder. Acid core solder will corrode, and it's impossible to stop the corrosion. It will eventually ruin the printed circuit board.

A soldering iron of small wattage, preferably 27 watts to 40 watts maximum, should be used. Always keep the tip clean and free from dross (oxidized solder) by wiping on a moistened sponge or folded-up Kleenex (moistened). Use small solder with a 60 - 40 ratio which means 60% tin and 40% lead.

When ready to solder a joint, apply heat to the joint first, then apply the solder to the opposite side of the joint from the iron (see Figure 1). Then remove the solder and finally the soldering iron. A good solder joint has an even flow of solder over the entire joint. A good joint will have a bright glistening look. A bad solder joint, commonly called a cold solder joint, will have a dull appearance. Also, do not move the part or lead while the solder is cooling or a cold or fractured solder joint will result (see Figure 2).

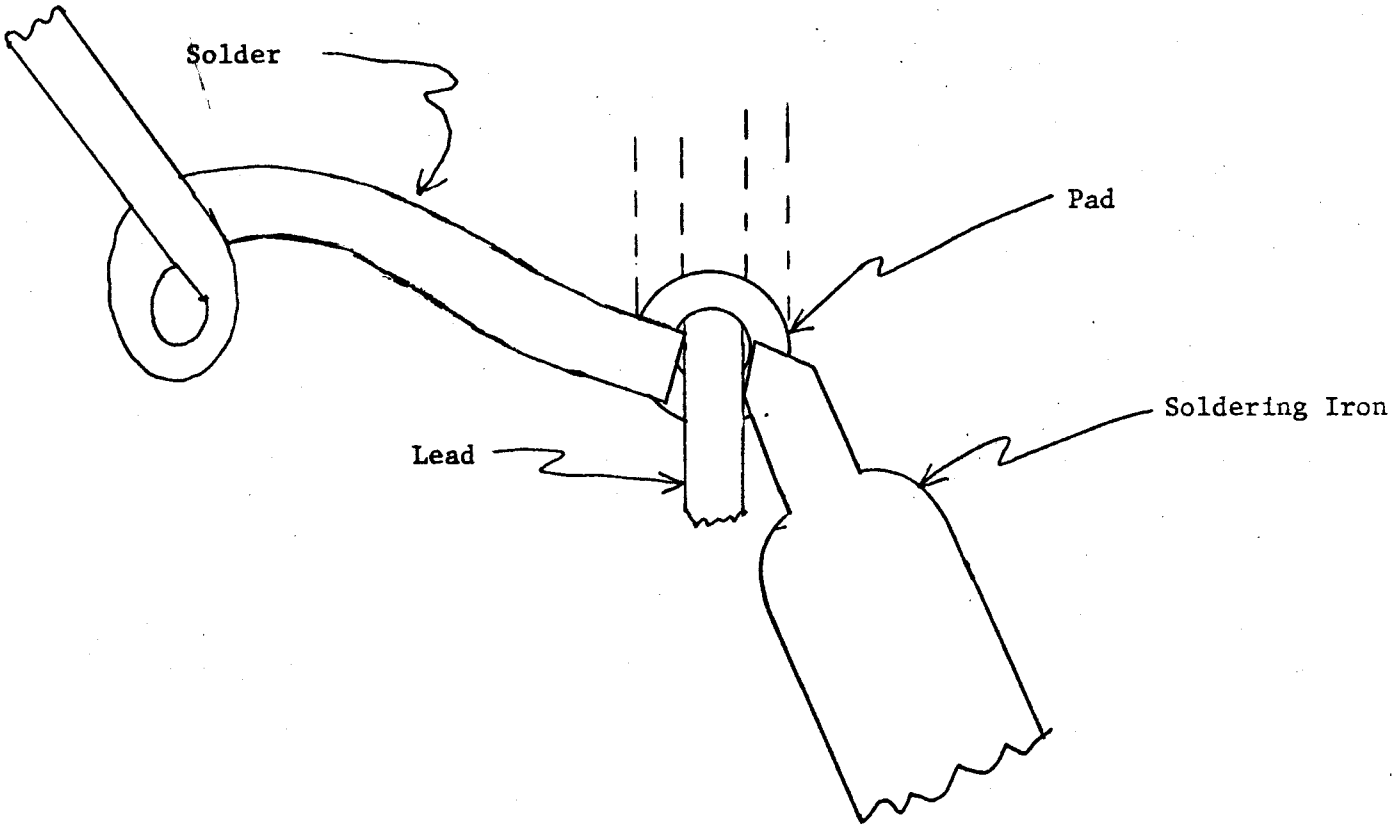
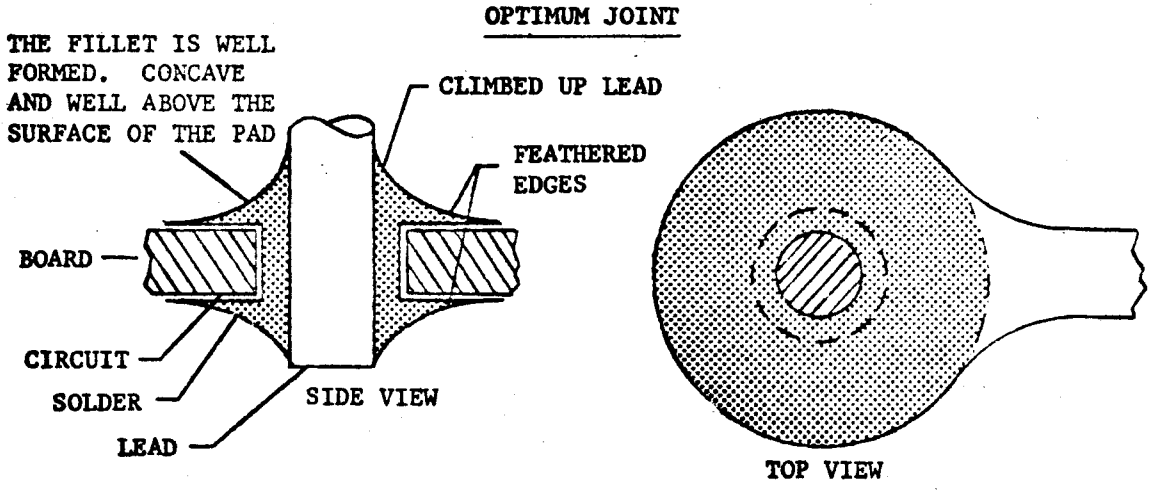


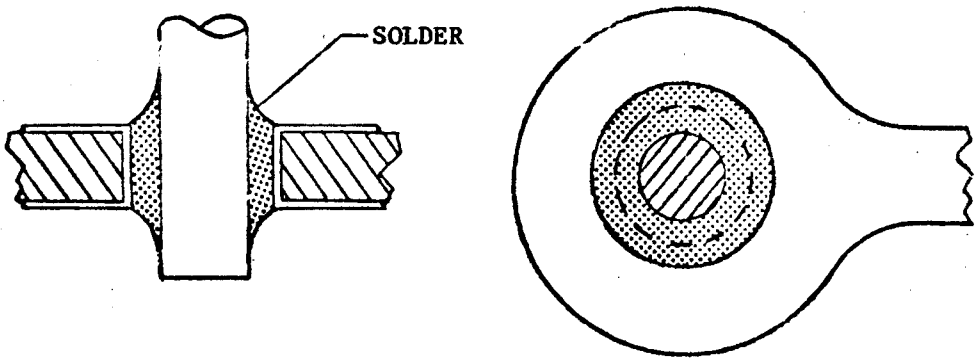

Figure 1 -Solding Technique-apply solder to opposite side of lead from the soldering iron




THE SOLDER SHALL BE CLEAN, SMOOTH AND BRIGHT

Figure 2a

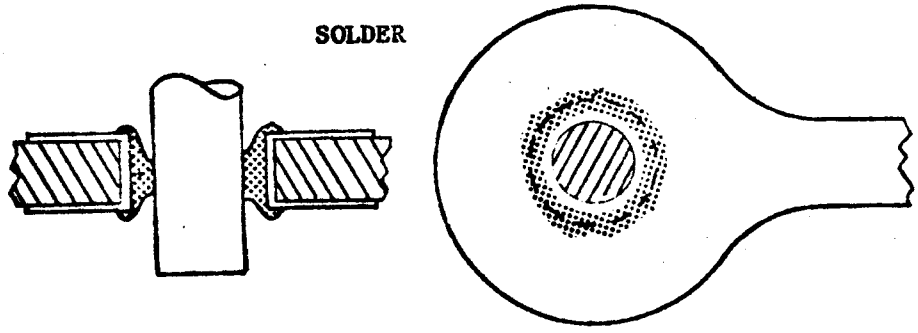
MINIMUM SOLDER ACCEPTABLE




SOLDER FLOW RESULTING IN A MINUTE FILLET RADIUS ON EITHER OR BOTH SIDES OF THE BOARD IS ACCEPTABLE.

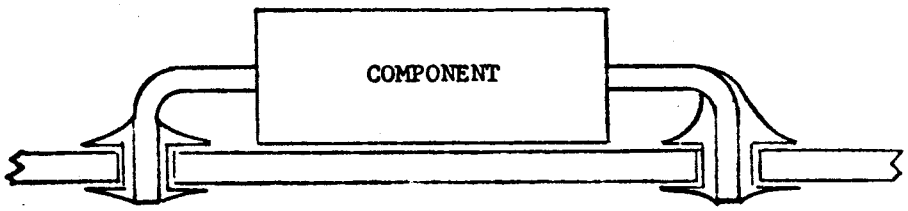
Figure 2b

INSUFFICIENT SOLDER




INSUFFICIENT SOLDER. INDICATED BY LACK OF FILLET ON ONE OR BOTH SIDES OF BOARD.

Figure 2c



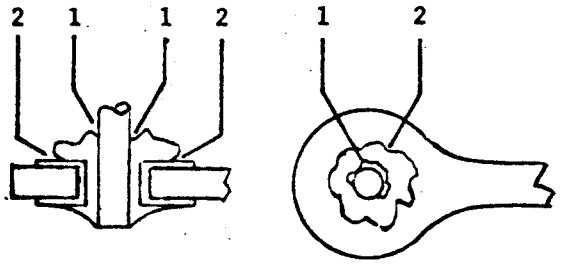

ACCEPTABLE

STRESS RELIEF AND SOLDER BUILD-UP ON AXIAL LEAD COMPONENTS

AT LEAST ONE END OF AXIAL LEAD COMPONENTS SHALL HAVE ADEQUATE STRESS RELIEF AND ABSENCE OF SOLDER BUILD UP.

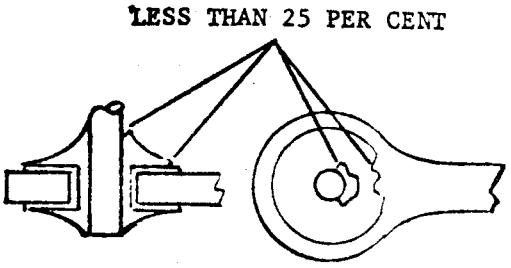
Figure 2d

LACK OF ADHESION




NOT ACCEPTABLE

LACK OF ADHESION INDICATED BY EVIDENCE 1 THE LEAD IS NOT WET ON COMPONENT SIDE, OR 2 THE PAD IS NOT WET AT THE SOLDER PAD INTERFACE.




ACCEPTABLE

LACK OF ADHESION CONFINED TO LESS THAN 25% OF THE LEAD PERIMETER SHALL BE ACCEPTABLE PROVIDED THE LACK DOES NOT EXTEND BENEATH BOARD SURFACE. IF DEFECT EXTENDS BELOW, THE LIMIT IS 10% OF LEAD PERIMETER.

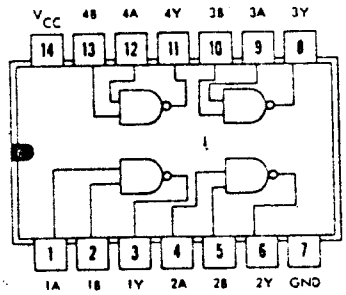
Figure 2e

# APPENDIX II

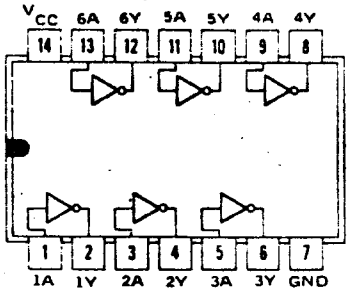
## Cleaning

After you have finished soldering, a flux residue will be left on the board. This is the resin that is in the solder core. With a pan of alcohol and a small brush, i.e., paint brush, old toothbrush, wash both sides of the board with the alcohol and scrub with the brush. An indistrial solution called "Alpha" may also be used. After you have washed the resin off, examine the board on both sides for any residue of etch or "solder bridges," splashes, etc. Do this under a strong light or preferably a X10 microscope. With a fine pointed instrument, such as a jewelers screwdriver or small pointed metal pick, scrape between printed wiring etches which are close together. This may take some time, but it is well worth it, since solder shorts on printed circuit boards may take several hours to find and identify.

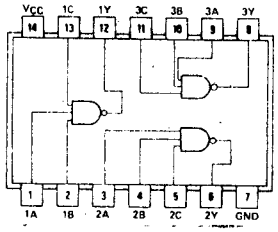
# 7400



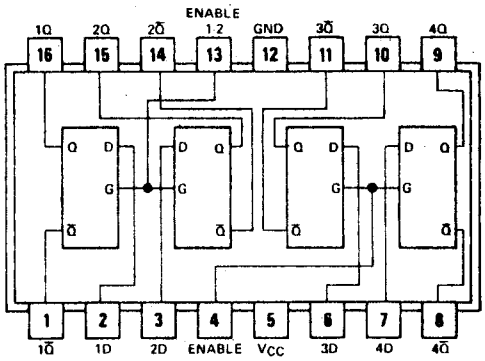

# 7404




# 7410




# 74L75

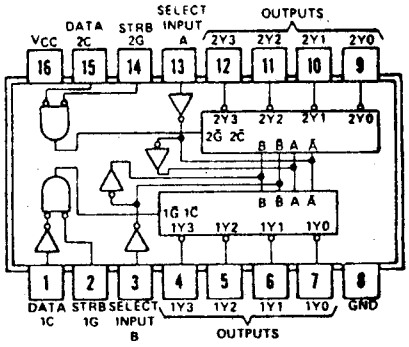



**FUNCTION TABLE**
(Each Latch)

| INPUTS | | OUTPUTS | |
|---|---|---|---|
| D | G | Q | $\bar{Q}$ |
| L | H | L | H |
| H | H | H | L |
| X | L | $Q_0$ | $\bar{Q}_0$ |

H = high level, L = low level, X = irrelevant
$Q_0$ = the level of Q before the high-to-low transition of G

# 74155

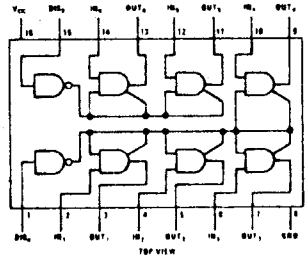



2-LINE-TO-4-LINE DECODER
OR 1-LINE-TO-4-LINE DEMULTIPLEXER

| INPUTS | | | | OUTPUTS | | | |
|---|---|---|---|---|---|---|---|
| SELECT | | STROBE | DATA | | | | |
| B | A | 1G | 1C | 1Y0 | 1Y1 | 1Y2 | 1Y3 |
| X | X | H | X | H | H | H | H |
| L | L | L | H | L | H | H | H |
| L | H | L | H | H | L | H | H |
| H | L | L | H | H | H | L | H |
| H | H | L | H | H | H | H | L |
| X | X | X | L | H | H | H | H |

| INPUTS | | | | OUTPUTS | | | |
|---|---|---|---|---|---|---|---|
| SELECT | | STROBE | DATA | | | | |
| B | A | 2G | 2C | 2Y0 | 2Y1 | 2Y2 | 2Y3 |
| X | X | H | X | H | H | H | H |
| L | L | L | L | L | H | H | H |
| L | H | L | L | H | L | H | H |
| H | L | L | L | H | H | L | H |
| H | H | L | L | H | H | H | L |
| X | X | X | H | H | H | H | H |

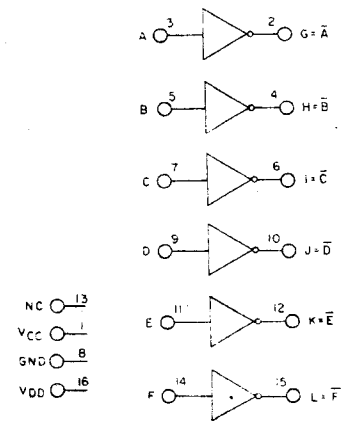
# 74367



| DISABLE $DIS_4$ | INPUT $DIS_2$ | INPUT | OUTPUT |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| X | 1 | X | Hi-z* |
| 1 | X | X | Hi-z** |

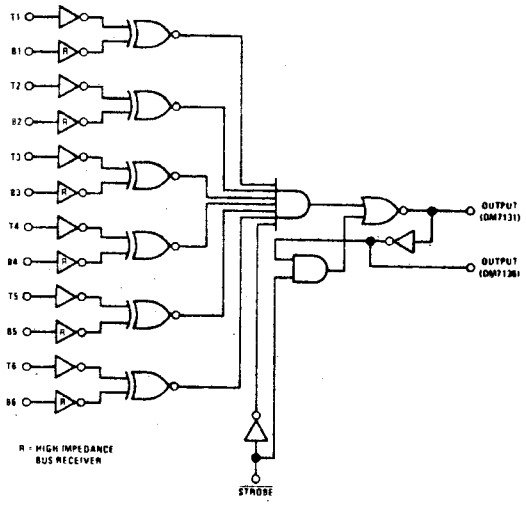
*Output 5-6 only
**Output 1-4 only
X = Irrelevant

# 4009

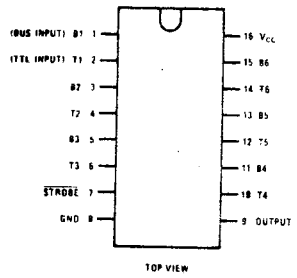


logic and connection diagrams

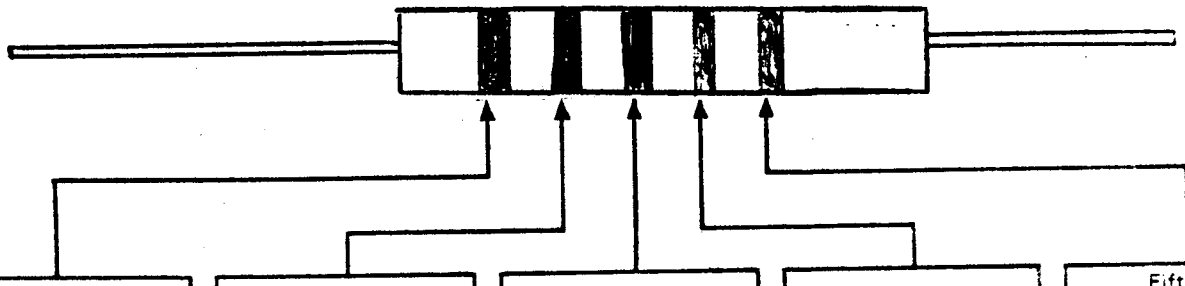
# 8131




Dual-In-Line and Flat Package




## STANDARD COLOR CODE



| First Band 1st Digit | |
|---|---|
| Color | Digit |
| Black | 0 |
| Brown | 1 |
| Red | 2 |
| Orange | 3 |
| Yellow | 4 |
| Green | 5 |
| Blue | 6 |
| Violet | 7 |
| Gray | 8 |
| White | 9 |

| Second Band 2nd Digit | |
|---|---|
| Color | Digit |
| Black | 0 |
| Brown | 1 |
| Red | 2 |
| Orange | 3 |
| Yellow | 4 |
| Green | 5 |
| Blue | 6 |
| Violet | 7 |
| Gray | 8 |
| White | 9 |

| Third Band Multiplier | |
|---|---|
| Color | Multiplier |
| Black | 1 |
| Brown | 10 |
| Red | 100 |
| Orange | 1,000 |
| Yellow | 10,000 |
| Green | 100,000 |
| Blue | 1,000,000 |
| Silver | 0.01 |
| Gold | 0.1 |

| Fourth Band* Resistance Tolerance | |
|---|---|
| Color | Tolerance |
| Silver | ±10% |
| Gold | ± 5% |
| *No Band | ±20% |

| Fifth Band* Reliability Level (Percent Per 1,000 Hours) | |
|---|---|
| Color | Level |
| Brown | M = 1.0% |
| Red | P = 0.1% |
| Orange | R = 0.01% |
| Yellow | S = 0.001% |

*MIL-R-39008 Resistors Only

## RESISTOR BAND COLOR CODE

FEEDBACK AND GRIPES

We at Szerlip Enterprises are interested in you, our customer, providing us feedback as to your usage of our product, so that we may better serve you in the future. We appreciate your response and hope you will take a moment to fill out the questionnaire and return it to the address below:

Szerlip Enterprises
1414 West 259th Street
Harbor City, CA 90710

Comment

1) Was your memory board received in a reasonable length of time? YES NO

2) Was anything damaged in shipment? YES NO

3) Were any parts missing? YES NO

If yes, what? _____

4) Was the quality of the material and workmanship reasonable? YES NO

5) Did you have any trouble understanding the manual? YES NO

If yes, what area? _____

6) Have you encountered any problems with the memory board? YES NO

If yes, what? _____

_____

_____

7) Did you solve the problem? YES NO

If yes, how? _____

_____

_____

8) Are you dissatisfied with the memory board? YES NO

If yes, in what way? _____

_____

_____

9) Do you have any suggestions for design improvements? YES NO

If yes, what? _____

_____

_____

10) What is the major disadvantage of this memory board?

_____

_____

_____

11) What is your name, address and phone number?

NAME _____

ADDRESS _____

_____

PHONE # (  ) _____

12) Other comments?

_____

_____

_____

_____

13) Other criticism?

Write here ⟶ ☐