SD SALES COMPANY

P.O. BOX 28810 • DALLAS, TEXAS 75228

USERS MANUAL FOR

S.D. SALES EXPANDOPROM BOARD   TM

"Innovations in Digital Applications"

INTRODUCTION

The SD SALES EXPANDOPROM[TM] board provides a low cost means for expanding the Programmable Read Only Memory capability for computers utilizing the S-100 bus structure. The SD SALES EXPANDOPROM [TM] will interface directly to the following computers: IMSAI, ALTAIR A, ALTAIR B, SOL-20, CROMEMCO, and the SD SALES Z-80 CPU card.

GENERAL DESCRIPTION

The SD SALES EXPANDOPROM[TM] board is a high performance PROM board using the industry standard 2708 1Kx8 EPROM and the 2716 2Kx8 EPROM by INTEL CORPORATION. The SD SALES EXPANDOPROM[TM] may be configured to have a memory capacity of 1K to 16K bytes of PROM using the 2708 EPROM, or 2K to 32K bytes of PROM using the INTEL 2716 EPROM. Other notable features of the SD SALES EXPANDOPROM[TM] board include:

(1) DIP switch addressing on 16K/32K boundaries.
(2) Each EPROM is DIP switch selectable.
(3) DIP switch selectable wait states.

PHYSICAL

The SD SALES EXPANDOPROM[TM] board is implemented on a single 5.25" x 10.0" x 0.65" printed circuit board. The board requires three DC voltages at levels of +8V to +10V, +16V to 18V, and -16V to -18VDC. The SD SALES EXPANDOPROM[TM] board is interfaced to the system by connector J-1.

SPECIFICATIONS

Table 1-1 lists the overall specifications for the SD SALES EXPANDOPROM[TM] board. Table 1-2 lists the pin usages of connector J-1 for the EXPANDOPROM.[TM]

TABLE 1-1

Memory Capacity	Up to 16,384 bytes (2708)
	Up to 32,768 bytes (2716 INTEL)
Memory Access	Depends on Device selected by user
Interface levels	TTL Compatible
Operating Temperature	0^0C to 50^0C (ambient)

TABLE 1-2

CONNECTOR J-1 USAGE FOR EXPANDOPROM

PIN #	SIGNAL NAME	DIRECTION	DESCRIPTION
1,51	+8V to +10V		Power
2	+16V to +20V		Power
24	$\phi2$	Input	Phase 2 Clock
79,80,81,31,30,29,82,83	Aϕ - A7	Input	Address Bus
84,34,37,87,33,85,86,32	A8-A15	Input	Address Bus
95,94,41,42,91,92,93,43	DIϕ - D17	Output	Data Bus Out
47	SMEMR	Input	Memory read
72	PRDY	Output	Ready
76	PSYNC	Input	Sync
78	PDBIN	Input	Data bus in
100,50	GROUND		

SECTION II

FUNCTIONAL DESCRIPTION

The major functions of the SD SALES EXPANDOPROM^{TM} board are shown in figure 2-1. The following functions make up the memory interface memory array, memory decode and control, and data buffers.

Memory Array: The memory array consists of up to 16 2708 or 2716 INTEL EPROMS. Each 2708 has a 1, 024 x 8 bit capacity while the INTEL 2716 has a 2,048 x 8 bit capacity. The total storage capacity of the SD SALES EXPANDOPROM^{TM} board is 16, 384, x 8 bits using the 2708 EPROM or 32,768 x 8 bits using the INTEL 2716 EPROM.

Memory Decode and Control: The memory decode and control section is responsible for decoding the selected address boundary, selecting or deselecting the output buffer, and generating "wait states" if selected.

Address and Data Buffers: The address and data buffers isolates the memory array from the system bus.

TABLE 3-1,3-2

SECTION III

CONSTRUCTION

The SD SALES EXPANDOPROM^{TM} board kit is intended for those persons who have had some prior experience with kit building and digital electronics. If you do not fall into this category, it is highly recommended that you either: (1) find an experienced person to help you assemble and check out the board or (2) return the board to SD SALES and have the board assembled and tested for a nominal fee.

Table 3-1 shows the parts list for the SD SALES EXPANDOPROM^{TM} board while Table 3-2 shows the parts list broken down into shipping packets. Double check all parts against the parts list. If any shortages are noted, please call SD SALES at 1-800-527-3460. General construction information, assembly diagram and schematic diagram can be found in SECTION V.

ASSEMBLY PROCEDURE

NOTE: ALL SOCKETS AND COMPONENTS ARE MOUNTED ON THE SILK SCREENED SIDE OF THE PRINTED CIRCUIT BOARD.

(1) Install the I.C. sockets in their proper locations. NOTE: No sockets are provided for DIP switches U17,U21 and U23.

(2) Install the resistors as follows:

( ) R1 .5 ohm 1W Power Resistor
( ) R2 1.8 ohm 2W Power Resistor
( ) R3 1.5 ohm 5W Power Resistor
( ) R4,R5,R6,R7,R8 1K ohm ¼W Brown, Black, Red
( ) Resistor packs: RP1, RP2, RP3, 3K ohm 10 Pin SIPS

NOTE: Pin 1 of the SIP's is designated by a dot or a notch on one end of the package.

(3) Install the capacitors as follows:

( ) C1-C8, C13-C20, C23-C28 .15 uf ceramic
( ) C9,C10,C11,C12,C21,C22 10uf tantalum @ 25V

NOTE PROPER POLARITY

(4) Install the three voltage regulators with heat sinks, using the hardware supplied. NOTE: There are three types of voltage regulators supplied. (Refer to assembly drawing)

       ( ) VR1 LM340-5/7805 Mounted together on large heat sink.

       ( ) VR2 LM340-12/7812 Mounted together on large heat sink.

       ( ) VR3 LM320-5 Mounted on smaller heat sink.

(5) Install DIP switches so that the numbers on the switch are toward the top of the board.

TOP OF BOARD
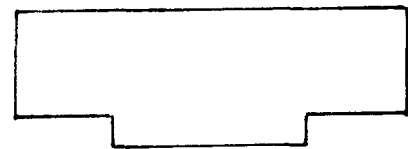
       ( ) U17, U21, U23 8 Position DIP switch

CHECK OUT PROCEDURE

(1) Refer to utilization section for proper configuration of jumper options. E1-E6. and U27.

(2) Install the board in the computer and measure the output of voltage regulator VR1,VR2, and VR3.

       ( ) VR1 = +5 Volts
       ( ) VR2 = +12 Volts
       ( ) VR3 = -5 Volts

(3) Measure the power supply voltages in the memory array. (Any of the memory array IC sockets can be used. U1-U16)

    NOTE: Different power supply voltages will be present in the memory array depending on the type of EPROM that the board has been set up for. Refer to utilization section for jumper options.

JUMPERED FOR 2708	JUMPERED FOR 2716
( ) Pin 19 U1=+12VDC	( ) Pin 19 U1 = Address A10
( ) Pin 21 U1 = -5 VDC	( ) Pin 21 U1 = +5 VDC
( ) Pin 24 U1 = +5 VDC	( ) Pin 24 U1 = +5 VDC
( ) Pin 18 U1 = GND	( ) Pin 18 U1 = GND
( ) Pin 12 U1 = GND	( ) Pin 12 U1 = GND

    NOTE: DO NOT PROCEED WITH CHECK OUT UNTIL ALL POWER SUPPLY VOLTAGES ARE CORRECT! TTL Logic and MOS memories can be permanately damaged if improper voltages are applied.

(4) Install the IC's in their sockets observing the Pin 1 designation on each socket on the PC board.

        ( ) U18 74LS14
        ( ) U19 74LS20
        ( ) U20 74LS367
        ( ) U22 74S133
        ( ) U24 74LS74
        ( ) U25 7412
        ( ) U26 74LS367
        ( ) U28 74LS138
        ( ) U29 74LS244
        ( ) U30 74LS138

(5) Double check all IC's for proper orientation and location.

(6) Refer to UTILIZATION section for proper configuration of jumpers E1-E6, U27 and DIP switch settings for addressing, device selection, and wait states.

(7) Install a programed 2708 or 2716 EPROM in U1 and perform the following:

    (1) Set address switch U17 for board address 0-3FFF H.

    (2) Set wait state according to speed of prom.

    (3) Insert the board and power up the computer, and by using a monitor program or front panel, examine the contents of the PROM.

    (4) If the output of the EXPANDOPROM^{TM} is incorrect, then power down the board and recheck the board for cold solder joints, solder shorts, bent IC pins or improper DIP switch settings.

    (5) Retry step number (3) if the board does not function properly, then call SD SALES for further assistance in trouble shooting the board. 1-800-527-3460 (Toll free)

    (6) If the EPROM in socket U1 can be read then proceed to check each socket by moving the prom to U2 through U16 and repeating step 3. Refer to UTILIZATION section for the address of each socket. Each PROM socket will increment the address by 1K for the 2708 and 2K for the 2716.

    (7) Power down the computer and reinstall test prom in socket U1. Check to see that the PROM can be read in the other address blocks. Refer to UTILIZATION section switch setting of U17.

UTILIZATION

This section will explain the various jumper options for the EXPANDOPROM^{TM} memory board.

2708 (1Kx8) or 2716 (2Kx8) DEVICE SELECTION JUMPERS

The SD SALES EXPANDOPROM^{TM} board will accept two types of EPROM's. They are the 2708 (1Kx8) and the INTEL 2716 (2Kx8). NOTE: The SD SALES EXPANDOPROM^{TM} will only work with the INTEL 2716.

Table 4-1 gives the jumper connections that must be made for configuring the SD SALES EXPANDOPROM^{TM} board for use with the 2708 (1Kx8) EPROM.

JUMPERS FOR THE 2708

JUMPERS

| E1 to E2 | Connected |
| E4 to E5 | Connected |

U27

| Using the DIP header supplied wire U27 as shown at left. |
| Install the header in U27. |

TABLE 4-1

Table 4-2 shows the jumpers for using the INTEL 2716 (2Kx8) EPROM.

JUMPERS

| E2 to E3 | Connected |
| E5 to E6 | Connected |

U27

Using the DIP header supplies wire U27 as shown at left

Install the header in U27.

TABLE 4-2

ADDRESSING

The SD SALES EXPANDOPROM^{TM} board can be addressed on 16K boundaries for
the 2708 configuration (16Kx8) and addressed on 32K boundaries for
the 2716 configuration (32Kx8)

Table 4-3 shows the switch settings of U17 for addressing the
board in the 2708 configuration. Table 4-4 shows the switch
settings of U17 for addressing the board in the 2716 configuration.
See Tables 4-6, and 4-7 for the individual addresses of each PROM.

		U17 SWITCH POSITION			
	ADDRESS	1	2	3	4
2708	0-3FFF H	ON	ON	OFF	OFF
Configuration	4000-7FFF H	OFF	ON	ON	OFF
(16Kx8)	8000-3FFF H	ON	OFF	OFF	ON
	C000-FFFF	OFF	OFF	ON	ON

Table 4-3

		U17 SWITCH POSITION			
2716	ADDRESS	1	2	3	4
Configuration	0-7FFF H	ON	ON	OFF	OFF
(32Kx8)	8000-FFFF H	OFF	ON	ON	OFF

Table 4-4

DEVICE SELECTION

DIP switches U21 and U23 are used to select or deselect EPROM's
U1 thru U16. These DIP switches are useful for deselecting unused
sockets so that the memory space will not be wasted.

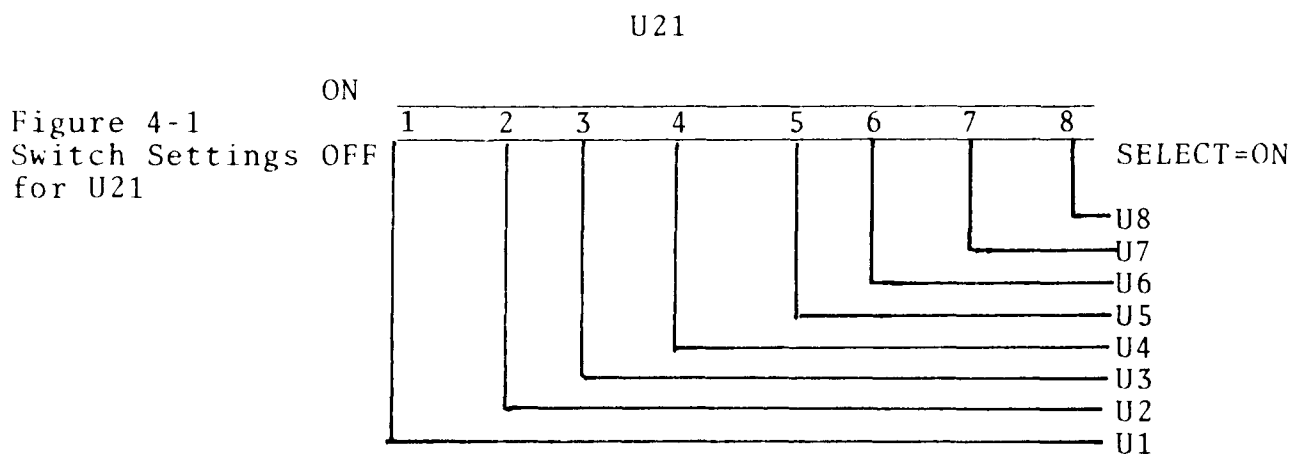Figures 4-1 and 4-2 show the switch settings of U21 and U23 res-
pectively.

U21

Figure 4-1
Switch Settings
for U21

ON
OFF   1 2 3 4 5 6 7 8   SELECT=ON
U8
U7
U6
U5
U4
U3
U2
U1

U23

ON

OFF

```
      1     2     3     4     5     6     7     8   SELECT-ON
                                                    ──U16
                                                    ──U15
                                                    ──U14
                                                    ──U13
                                                    ──U12
                                                    ──U11
                                                    ──U10
                                                    ──U9
```
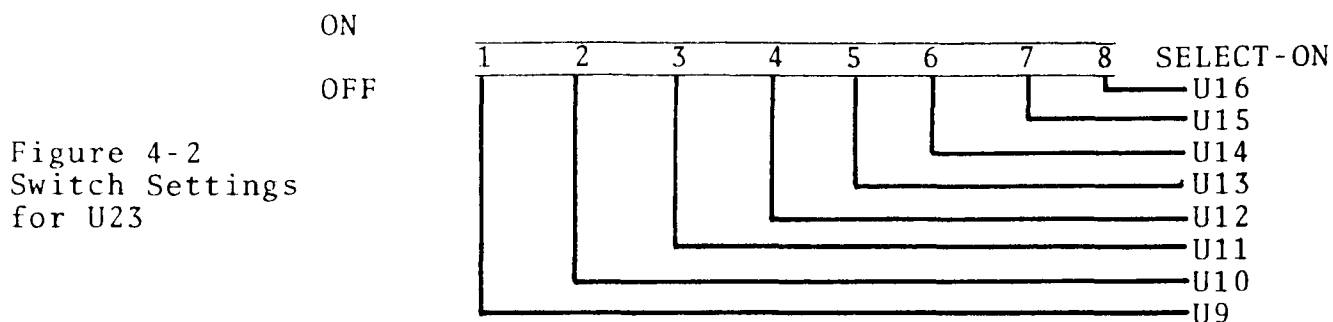
Figure 4-2
Switch Settings
for U23

WAIT STATE SELECTION

A section of DIP switch U17 is used to select the number of wait states for the SD SALES EXPANDOPROM^{TM} board.

Table 4-5 shows the switch setting for U17 for selecting.

U17 Switch Setting
for Selecting Wait
States

	0,1,or 2 WAIT STATES				
	U17 SWITCH POSITION				
NUMBER OF WAIT STATES	5	6	7	8	Table 4-5
0	ON	ON	OFF	OFF	
1	OFF	ON	ON	OFF	
2	OFF	OFF	ON	ON	

INDIVIDUAL PROM ADDRESSES FOR
EACH 16K BOUNDARY (2708 CONFIGURATION)

PROM SOCKET	PROM ADDRESS WITH U17 SET FOR 0000H BOUNDARY	PROM ADDRESS WITH U17 SET FOR 4000H BOUNDARY	PROM ADDRESS WITH U17 SET FOR 8000H BOUNDARY	PROM ADDRESS FOR U17 SET FOR C000 BOUNDARY
U1	0000-03FF	4000-43FF	8000-83FF	C000-C3FF
U2	0400-07FF	4400-47FF	8400-87FF	C400-C7FF
U3	0800-0BFF	4800-4BFF	8800-8FBB	C800-CBFF
U4	0C00-0FFF	4C00-4FFF	8C00-8FFF	CC00-CFFF
U5	1000-13FF	5000-53FF	9000-93FF	D000-D3FF
U6	1400-17FF	5400-57FF	9400-97FF	D400-D7FF
U7	1800-1BFF	5800-5BFF	9800-9BFF	D800-DBFF
U8	1C00-1FFF	5C00-5FFF	9C00-9FFF	DC00-DFFF
U9	2000-23FF	6000-63FF	A000-A3FF	E080-E3FF
U10	2400-27FF	6400-67FF	A400-A7FF	E400-E7FF
U11	2800-2BFF	6800-6BFF	A800-ABFF	E800-EBFF
U12	2C00-2FFF	6C00-6FFF	AC00-AFFF	EC00-EFFF
U13	3000-33FF	7000-73FF	B000-B3FF	F000-F3FF
U14	3400-37FF	7400-77FF	B400-B7FF	F400-F7FF
U15	3800-3BFF	7800-7BFF	B800-BBFF	F800-FBFF
U16	3C00-3FFF	7C00-7FFF	BC00-BFFF	FC00-FFFF

* ALL ADDRESSES IN HEXIDECIMAL

TABLE 4-6

INDIVIDUAL PROM ADDRESSES FOR
EACH 32K BOUNDARY (2716 CONFIGURATION)

PROM SOCKET	PROM ADDRESS WITH U17 SET FOR 0000 BOUNDARY	PROM ADDRESS WITH U17 SET FOR 8000 BOUNDARY
U1	0000-07FF	8000-87FF
U2	0800-0FFF	8800-8FFF
U3	1000-17FF	9000-97FF
U4	1800-1FFF	9800-9FFF
U5	2000-27FF	A000-A7FF
U6	2800-2FFF	A800-AFFF
U7	3000-37FF	B000-B7FF
U8	3800-3FFF	B800-BFFF
U9	4000-47FF	C000-C7FF
U10	4800-4FFF	C800-CFFF
U11	5000-57FF	D000-D7FF
U12	5800-5FFF	D800-DFFF
U13	6000-67FF	E000-E7FF
U14	6800-6FFF	E800-EFFF
U15	7000-77FF	F000-F7FF
U16	7800-7FFF	F800-FFFF

* ALL ADDRESSES IN HEXIDECIMAL

TABLE 4-7
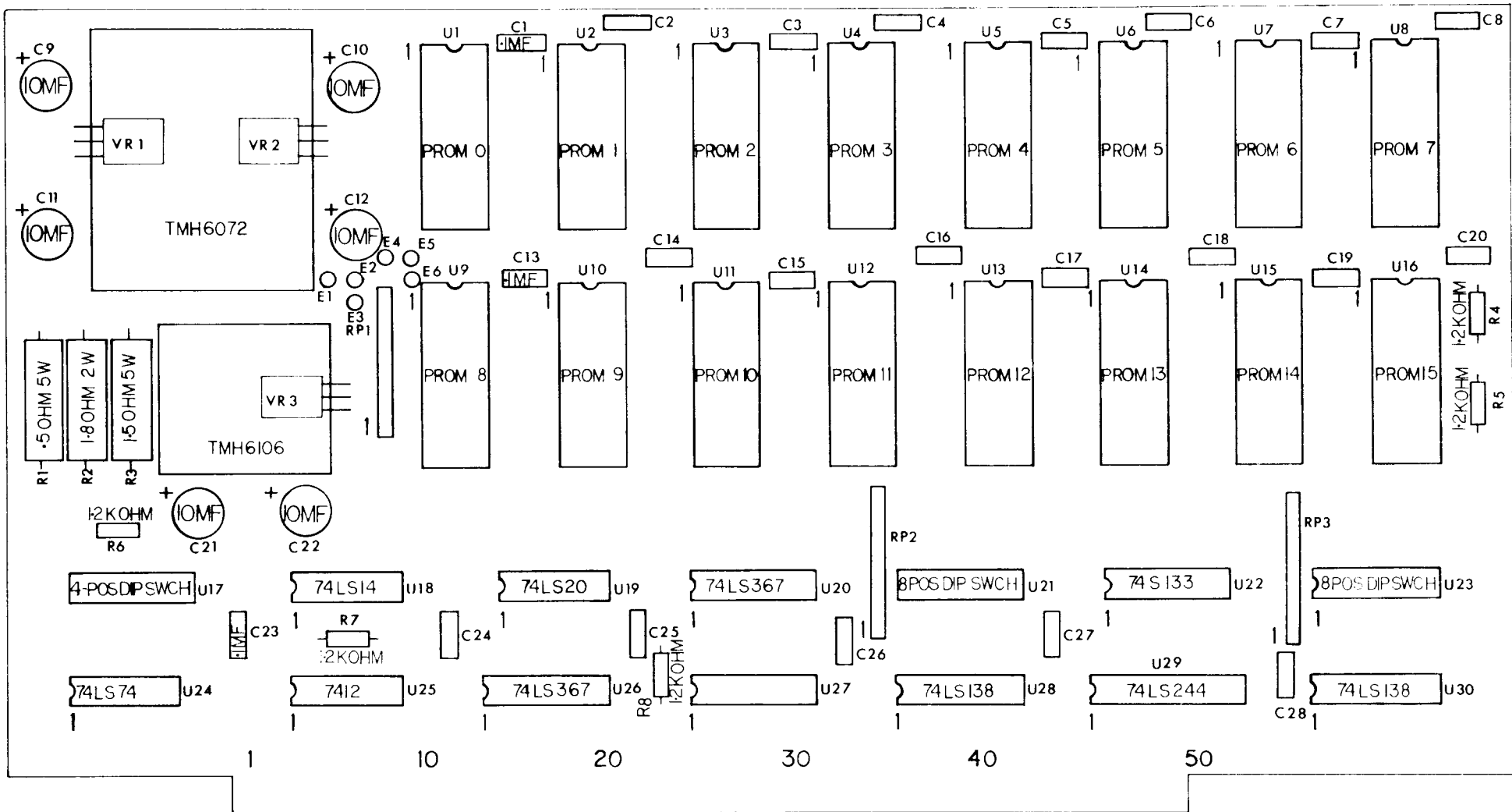
SOLDERING INSTRUCTIONS

For construction of this kit we recommend use of a 25 of 30 watt soldering iron with a pencil tip and .031 diameter rosin core solder. Acid core solder, soldering guns, and large soldering irons should NEVER be used for electronic component installation. Please use extreme care during construction to avoid solder bridges between the etched circuits. The majority of complaints we receive concerning our kits are the results of bridges. Should these occur during construction, they are easily removed using commercially available solder wick or desoldering tools. Components are mounted on the side of the P.C. Board which has no circuit track.

(16) 2708 OR 2716 EPROMS