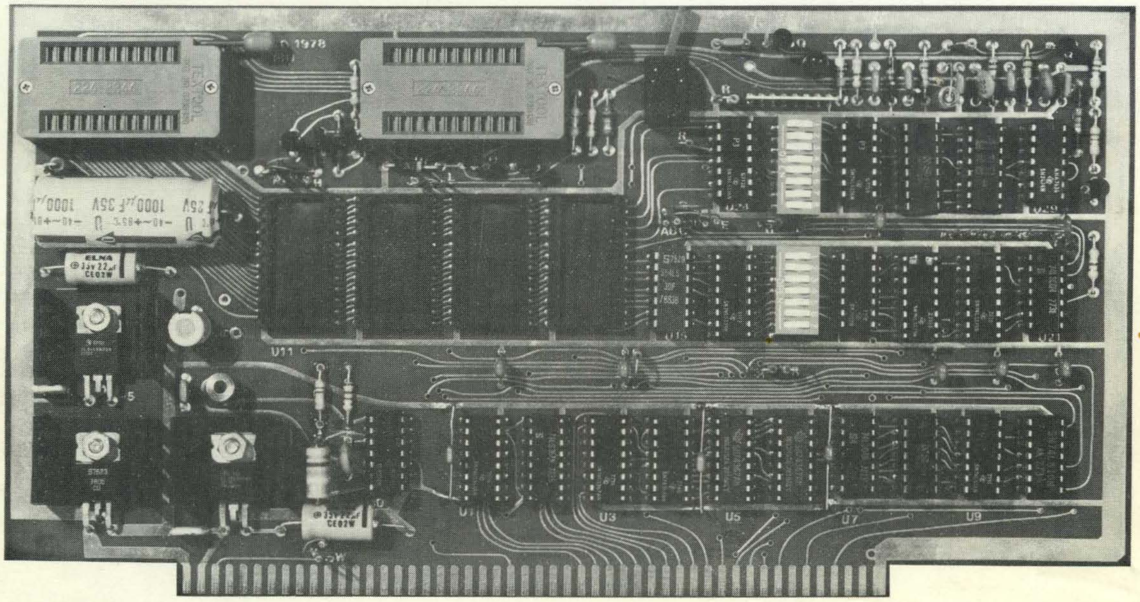
Microcomputer Products, 2116 Walsh Avenue, Santa Clara, CA 95050, (408) 246-2707

PB1 2708/2716 PROGRAMMER & 4K/8K EPROM BOARD



FEATURES:

SYSTEM COMPATIBILITY
- S-100 bus computer systems.

EPROM PROGRAMMER
- 2 separate programming sockets for 2708 or 2716 (5V) EPROMs.
- Meets all manufacturers data sheet requirements for programming.
- Programming voltage generated on board--no need for an external power supply.
- Programming sockets are DIP switch addressable to any 4K boundary.
- Software control of 2708/2716 programming selection--no hardware reconfiguration required.
- Provisions for 2 optional ZIP sockets from Textool for easier insertion and removal of EPROMs being programmed.
- Special safety features to prevent accidental programming include LED indicator for programming mode and an on-off switch for programming voltage.

ON-BOARD EPROMS
- 4 separate sockets for 4K of 2708 or 8K of 2716 EPROMs.
- Addressable by DIP switch to any 4K or 8K boundary above 8000 Hex.
- Unused EPROM sockets do not enable data bus drive so the board is never committed to the full 4K or 8K of memory.
- Jumper selectable wait states (0 to 4) for fast or slow EPROMs.

SOFTWARE
- Complete subroutines for checking EPROM erasure, programming and verification.

OTHER FEATURES
- Address and data lines fully buffered.
- Solder masked PC board with gold plated edge connector contacts.
- Low profile sockets provided for all ICs.
- Power requirements: +8V @ 500ma, +16V @ 25ma (less EPROM), -16V @ 5ma (less EPROM).

We used to be Solid State Music. We still make the blue boards.

PB1
2708/2716 Programmer & 4K/8K EPROM Board

Instruction Manual

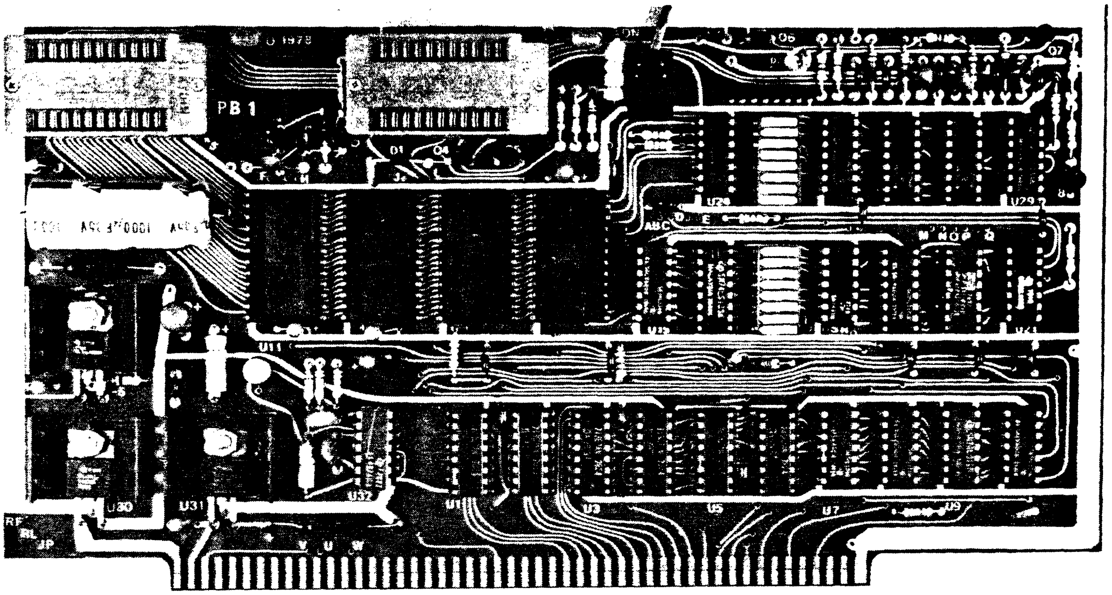
SSM MICROCOMPUTER PRODUCTS, INC.
A Division of Transend Corporation
2190 Paragon Drive
San Jose, California 95131

(408) 946-7400 • SourceMail ST1422

ELECTRONIC BULLETIN BOARD: (408) 946-3616

SSM Microcomputer Products
2190 Paragon Drive
San Jose, CA 95131
(408) 946-7400

PB1 2708/2716 PROGRAMMER & 4K/8K EPROM BOARD



FEATURES:

SYSTEM COMPATIBILITY
. S-100 bus computer systems.

EPROM PROGRAMMER
. 2 separate programming sockets for 2708 or 2716 (5V) EPROMs.
. Meets all manufacturers data sheet requirements for programming.
. Programming voltage generated on board--no need for an external power supply.
. Programming sockets are DIP switch addressable to any 4K boundary.
. Software control of 2708/2716 programming selection--no hardware reconfiguration required.
. Provisions for 2 optional ZIP sockets from Textool for easier insertion and removal of EPROMs being programmed.
. Special safety features to prevent accidental programming include LED indicator for programming mode and an on-off switch for programming voltage.

ON-BOARD EPROMS
. 4 separate sockets for 4K of 2708 or 8K of 2716 EPROMs.
. Addressable by DIP switch to any 4K or 8K boundary above 8000 Hex.
. Unused EPROM sockets do not enable data bus drive so the board is never committed to the full 4K or 8K of memory.
. Jumper selectable wait states (0 to 4) for fast or slow EPROMs.

SOFTWARE
. Complete subroutines for checking EPROM erasure, programming and verification.

OTHER FEATURES
. Address and data lines fully buffered.
. Solder masked PC board with gold plated edge connector contacts.
. Low profile sockets provided for all ICs.
. Power requirements: +8V @ 500ma, +16V @ 25ma (less EPROM), -16V @ 5ma (less EPROM).

We used to be Solid State Music. We still make the blue boards.

TABLE OF CONTENTS:

March, 1983

PB1 EPROM PROGRAMMER BOARD

1.0 ASSEMBLY INSTRUCTIONS (refer to figure 1)

☐ Check kit contents against parts list.

☐ Check PC board for possible warpage and straighten if required. To straighten the board, bend with the hands (not a vise) against the warp. Sight down the edge of the board after bending to check if the warp was removed, if not then try bending again.

☐ Insert 11-16 pin sockets (U1-6,16,19,20,27,28) and 11-14 Pin sockets (U7-10,15,18,21,24,29,32) into the component side of the board with the pin 1" index toward the top of the board. (The component side is the side on which "PB1" is printed.) DO NOT insert 2-24 pin sockets into the two horizontal 24 pin patterns at the upper left-hand corner of the board. Insert 4-24 pin sockets into the middle of the board with "pin 1" toward the top of the board.

☐ Place a flat piece of stiff cardboard of appropriate size on top of the board to hold them in place.

☐ Holding the cardboard in place against the sockets, turn the board over and lay it on a flat surface. (Be sure that all of the socket pins are through the holes.)

☐ On each socket, solder two of the corner pins, choosing two that are diagonally opposite of each other.

☐ Once the sockets are secured, lift the board and check to see if they are flat against the board. If not, seat the sockets by pressing on the top while reheating each soldered pin.

☐ Complete soldering the remaining pins of each socket. Keep the iron tip against the pin and pad just long enough to produce a filet between pin and pad.

☐ Insert and solder 2-2.2 ohm resistors (R37A & R37B).

☐ Insert and solder:

2-	470 ohm (R16 & R20)
1-	1.2K ohm (R38)
4-	3.3K ohm(R3,R5,R17,R34)
2-	4.7K ohm (R7,R25)
1-	6.8K ohm (R24)
3-	10K ohm (R2,R6,R35)
1-	20K ohm (R18)
3-	51K ohm (R19,R21,R22)

☐ Insert:

2-	2.7K ohm (R41 & R42) (near SW3)
1-	47K ohm (R1) (near U22)

These parts must be mounted vertically on the board with the top lead bent back down along the part. Solder.

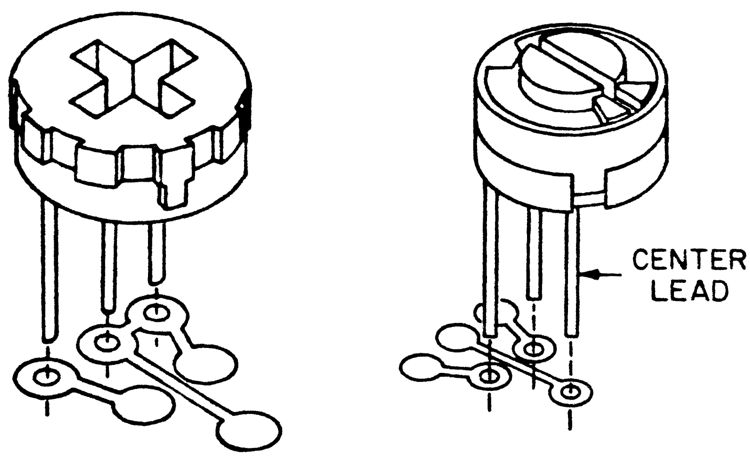
☐ Insert and solder:

6-	2.7K ohm (R8,R23,R33,R39,R40,R43)
1-	47K ohm (R4)

☐ Insert and solder 2-2.7K ohm SIPs (R9-15,R26-32).

☐ Insert and solder 1-50K trim-potentiometer (R36).

Set knob to mid scale or full clockwise rotation. You can save a step if you make the resistance setting of (R36). As stated in the second sentence of 2.4 at this time.



☐ Insert and solder:

1-	15pf(C2)
2-	220pf (C7,C37)
1-	330pf (C26)
1-	0.001uf (C8)
18-	0.1uf (C4,C5,C9-C15,C19) (C21-C25,C33,C35,C36)
1-	150pf (C27)

☐ Observing polarity, insert and solder 3.3uf timing capacitor (C6).

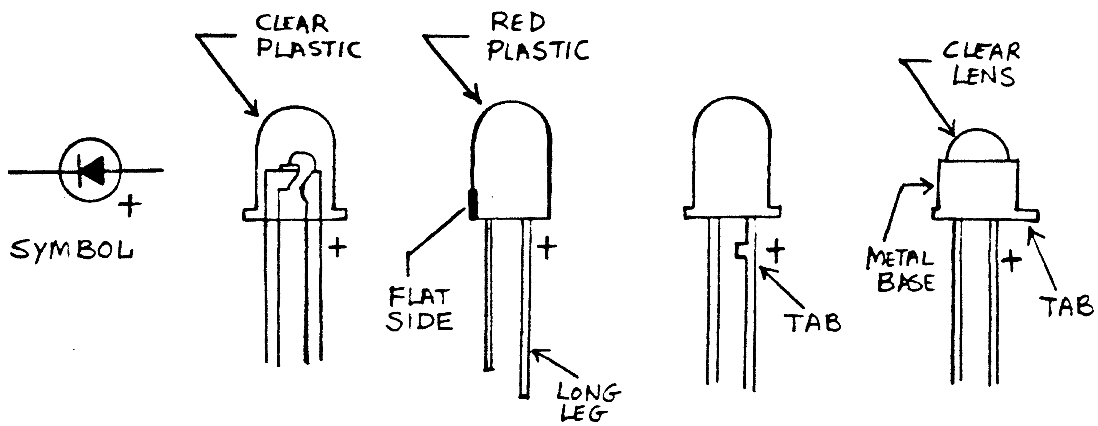
☐ Insert:

2-	0.27/0.74uf (C18,C28)
2-	1uf (C3,C20)
4-	4.7uf (C30,C31,C32,C34)
2-	22uf (C16,C29)
1-	47uf Dip (C17)
1-	1000uf (C1)

Observing polarity, (marked with plus sign) and solder.

1.0 ASSEMBLY INSTRUCTIONS (continued)

☐ Insert and solder 1 diode and 1 LED (light-emitting diode). The Diode (D1) should have its banded end to the right. The LED (D2) should be mounted with the positive lead to the right.



☐ Insert and solder 1-220uH coil (L1).

☐ Insert and solder 8 transistors (Q1 thru Q8) (observe emitter orientation).

☐ Insert and solder 2-8 position dip switches (SW2 & SW3) and 1 SPST PC board switch (SW1).

☐ If you are using Textool sockets for programming, insert and solder 2-24 pin sockets with the levers pointing toward the right side of the PC board. If you are not going to use Textool sockets, then insert and solder two standard 24 pin sockets into the upper left-hand side of the board.

☐ Carefully bend the leads of the 3 voltage regulators to the proper PC board mounting configuration. (U30, U31 U33)

☐ Mount each regulator along with a heatsink to the PC board using a 6-32 X 3/8" screw, #6 lock-washer and nut. Note that the nut is on the component side of the board.

☐ Solder all leads of the 3 voltage regulators.

NOTE: U30, U31 & U33 are different voltage ratings, don't mix-up these regulators when installing.

☐ Do not install any IC's at this time.

2.0 FUNCTIONAL CHECK

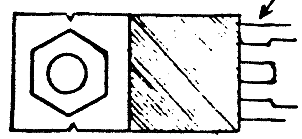
WARNING! DO NOT INSTALL OR REMOVE BOARD WITH POWER ON. DAMAGE TO THIS AND OTHER BOARDS COULD OCCUR.

2.1 If an ohmmeter is available, measure the resistance between the following pins:

Negative Probe		Positive Probe	Resistance
Bus pin 50	to	Bus pin 1	greater than 20
Bus pin 50	to	Bus pin 2	greater than 20
Bus pin 52	to	Bus pin 50	greater than 30

If your reading is below these values, check for electrical shorts on your card.

2.2 Apply power (+8v to +10v) to board by plugging into the computer or by connection to a suitable power supply. Measure the output of the +5v regulator (U30).



The voltage should be between +4.8v and +5.2v. If the regulator doesn't meet this test, then check the board for shorts or errors.

CAUTION: WHILE IT HAS NEVER HAPPENED TO US, SHORTED REGULATORS HAVE BEEN KNOWN TO EXPLODE WITH POSSIBLE INJURY TO EYES OR HANDS. BETTER SAFE THAN SORRY --- KEEP FACE AND HANDS CLEAR OF THE REGULATOR SIDE OF THE BOARD DURING THIS TEST.

2.3 Apply power +14v to +19v to Bus pin 2 and -14v to -19v to Bus pin 52 with Bus pin 50 ground. Verify that the outputs U31 and U33 are about +12 volts and -5 volts respectively.

2.4 Remove power from the board. Set trimpot R36 to less than 5K ohm, when measured with an ohmmeter between U32, pin 1 & U32, pin 6. Insert U32. Apply power and adjust R36 until the output of the DC-DC converter reads +26.5v (C1, plus lead end with respect to ground).

2.5 Remove power and insert the remaining IC's (except EPROMs). Apply power and again measure the outputs of +5v, +12v and -5v regulators.

2.6 Set DIP switch SW2 to decode an unused 4K block of memory and an unused I/O port for the programming sockets. Temporarily jumper the board for one wait state. Refer to section 3 for jumper and switch settings.

2.7 Examine any memory location in the selected 4K block and verify that the LED is off.

2.8 Output 01 to the selected I/O port and verify that the LED is on. Repeat step 7 to verify the LED goes out.

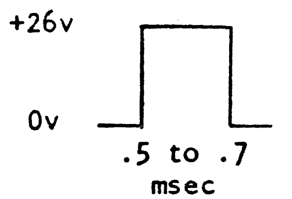
2.0 FUNCTIONAL CHECK (continued)

2.9 Output 02 to the selected I/O port and verify that the LED is on. Repeat step 7 to verify the LED goes out.

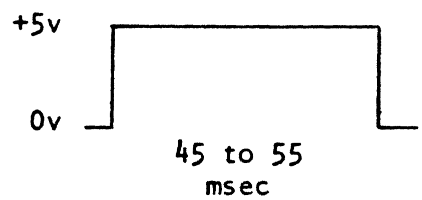
2.10 Verify that SW1 is in the off position. Place a 2708 with known data into the socket for U22 and examine the selected 4K memory block. The data should repeat four times in the 4K boundary.

2.11 If available place a 2716 with known data into the socket for U23 and examine the selected 4K block. The data should repeat twice.

2.12 Remove any EPROMs from the sockets for U22 and U23. With the sockets empty, follow the procedures in section 4 for programming a 2708 and then a 2716. Check the programming time for each EPROM type. If an oscilloscope is available check for the following program pulse waveforms.



2708 (pin 18)



2716 (pin 18)

2.13 If you have been able to verify the above steps, then you are ready to program EPROMs.

2.14 If you have decided to use the on-board 2708 or 2716 EPROM area, set DIP switch SW3 to decode an unused 4K (2708) or 8K (2716) memory block. Jumper the board for the type of EPROM selected. Refer to section 3 for jumper and switch settings.

2.15 Place an appropriate EPROM (2708 or 2716) with known data successively into the sockets U11 through U14 and examine the respective 1K or 2K memory block. Select one or more wait states if required.

2.16 Finally, to test the on-board EPROM memory disable circuit, set DIP switch SW3 to decode a currently used memory area (RAM or ROM) in your system. Remove all EPROMs to simplify this test. Exercise this memory area and verify that no conflicts arise.

3.0 SET-UP

3.1 Address Selection of Programming Sockets

The PB-1 card reserves a 4K block of memory for the programming sockets. This block can be set to any 4K boundary using DIP switch SW2 positions 1 through 4.

OFF = SWITCH OPEN   ON = SWITCH CLOSED

Starting Address		A15	A14	A13	A12
Hex	Decimal	SW2 - 1	SW2 - 2	SW2 - 3	SW2 - 4
0000	0	OFF	OFF	OFF	OFF
1000	4096	OFF	OFF	OFF	ON
2000	8192	OFF	OFF	ON	OFF
3000	12288	OFF	OFF	ON	ON
4000	16384	OFF	ON	OFF	OFF
5000	20480	OFF	ON	OFF	ON
6000	24576	OFF	ON	ON	OFF
7000	28672	OFF	ON	ON	ON
8000	32768	ON	OFF	OFF	OFF
9000	36864	ON	OFF	OFF	ON
A000	40960	ON	OFF	ON	OFF
B000	45056	ON	OFF	ON	ON
C000	49152	ON	ON	OFF	OFF
D000	53248	ON	ON	OFF	ON
E000	57344	ON	ON	ON	OFF
F000	61440	ON	ON	ON	ON

3.2 Selection of Memory Block Containing Data to be Programmed

The PB-1 card can receive a program or data from any section of memory into EPROM except for the 4K block addressing the programming sockets. Any part of the block of on-board read only EPROMs can also be used, allowing for very convenient copying of EPROMs. The high order byte of the starting address of the data is contained at location 10D of the program (see software in section 4.0), while the low order byte is at location 10C.

3.3 Origin of System Monitor

The programs in section 4 end with a jump to the system monitor at location F021 (entry address of SSM 8080 monitor). To adapt this to the origin of your system monitor enter the low byte of this origin at program location 11F and the high byte at location 120. If the user does not want this feature replace the last instruction with a halt.

Loc	Code	Mnemonic
011E	76	HLT

3.4 Output Port Address Selection

To enable programming, data must be written to an output on the PB-1 card. This port can be set to any one of 16 addresses using DIP switch SW2 positions 5 through 8.

Port Address

Hex	Decimal	A7 SW2 - 5	A6 SW2 - 6	A5 SW2 - 7	A4 SW2 - 8
00	0	OFF	OFF	OFF	OFF
10	16	OFF	OFF	OFF	ON
20	32	OFF	OFF	ON	OFF
30	48	OFF	OFF	ON	ON
40	64	OFF	ON	OFF	OFF
50	80	OFF	ON	OFF	ON
60	96	OFF	ON	ON	OFF
70	112	OFF	ON	ON	ON
80	128	ON	OFF	OFF	OFF
90	144	ON	OFF	OFF	ON
A0	160	ON	OFF	ON	OFF
B0	176	ON	OFF	ON	ON
C0	192	ON	ON	OFF	OFF
D0	208	ON	ON	OFF	ON
E0	224	ON	ON	ON	OFF
F0	240	ON	ON	ON	ON

NOTE: The port address must differ from the high order byte of the address of the programming sockets.

3.5 Selection of EPROM Type

Four sockets for on-board read only memory are provided. These sockets are jumper selectable for 2708 or 2716 (5 volt) operation. To select this area install the following jumpers:

2708	2716
A-E (A10)	B-E (A11)
B-D (A11)	C-D (A12)
F-H (-5v)	F-G (+5v)
J-K (+12v)	J-L (A10)

3.6 Address Selection of EPROM Area For 2708's

The PROM area is addressable to any 4K (2708) boundary above 8000 (HEX) using DIP switch SW3. (Be sure jumpers installed per 3.5).

OFF = SWITCH OPEN   ON = SWITCH CLOSED

Set SW3-1 to "OFF".

	SW3- Position					
ADDRESS	2	3	4	5	6	7
8000	OFF	ON	ON	OFF	OFF	OFF
A000	OFF	ON	OFF	ON	OFF	OFF
C000	OFF	ON	OFF	OFF	ON	OFF
E000	OFF	ON	OFF	OFF	OFF	ON

3.6 Address selection of EPROM Area for 2708's (continued)

Address	2	3	4	5	6	7 (continued)
9000	ON	OFF	ON	OFF	OFF	OFF
B000	ON	OFF	OFF	ON	OFF	OFF
D000	ON	OFF	OFF	OFF	ON	OFF
F000	ON	OFF	OFF	OFF	OFF	ON

3.7 Address Selection of EPROM Area for 2716's

The PROM area is addressable to any 8K (2716) boundary above 8000 (Hex) using DIP switch SW3. (Be sure jumpers installed per 3.5).

OFF = SWITCH OPEN   ON = SWITCH CLOSED

Set SW3-1 to "on"

	SW3- Position					
Address	2	3	4	5	6	7
8000	OFF	OFF	ON	OFF	OFF	OFF
A000	OFF	OFF	OFF	ON	OFF	OFF
C000	OFF	OFF	OFF	OFF	ON	OFF
E000	OFF	OFF	OFF	OFF	OFF	ON

3.8 EPROM Socket Disable

The PB-1 board is equipped with automatic disable circuitry for unused PROM sockets. The user can have only 1 or 2K of active PROM area by inserting just one or two 2708's, the unused sockets will automatically disable the card from the data bus. This means you can have a RAM area at an address within the range of the PB-1 block if there is no PROM in the socket at that address.

If you do not need the on-board 4K/8K EPROM area, but just the two programming sockets, then switch SW3 - 4, 5, 6, & 7 to OFF (open) to disable all four sockets.

3.9 Wait State Selection

The PB-1 can be set for zero to four wait states. These refer to read operations only on either the programming sockets or the read only area. To select wait states connect the following jumpers:

Wait States	0	1	2	3	4
jumpers	R-S	S-T,Q-P	S-T,Q-0	S-T,Q-n	S-T,Q-M

3.10 Ready Line Selection

The PB-1 requires the use of the READY signal to the CPU for programming and wait states (if used). To add flexibility, the user can select S-100 bus pin 3 or 72:

	PRDY (bus pin 3)	XRDY (bus pin 72)
jumper	U-V	U-W

3.11 NORTH STAR Z80 CPU USER

Be sure the CPU board is set-up for wait-states per page 21 of the North Star Manual. Set-up J2 option by installing jumper 1W. If the CPU isn't set-up for wait-states,Then the programming time will be a couple of seconds which will not program an EPROM.

4.0 PROGRAMMING

4.1 Step by Step Procedure

4.1.1 Make sure the programming sockets are empty, SW1 is off (switch lever to the right side), and the LED is off. If the LED is on, perform a read command with your monitor for a location in the programming socket address block.

4.1.2 Make sure the data you wish to program is in memory.

4.1.3 Insert the EPROM in the appropriate socket - U22 for 2708, U23 for 2716. Verify it is erased. (Section 4.4)

4.1.4 Enter the program of Section 4.2 or 4.3 at location 1ØØH. Modify the starting address of the memory to be copied to match where your data is located (Section 3.2).

4.1.5 Turn SW1 to the ON position.

4.1.6 You are now ready to program the EPROM. Execute the routine at location 1ØØ.

4.1.7 During programming the LED should be lit. Programming time for the 2708 should be about 160 seconds, for the 2716, 100 seconds. After programming is complete the LED will turn off and control will be returned to your monitor.

4.1.8 Turn off SW1.

4.1.9 Verify the data was programmed correctly by comparing data in memory to data in EPROM. (Section 4.5)

4.2 2708 Programming Software

```
                ;A SIMPLE ROUTINE FOR PROGRAMMING 2708'S.
                ;COPYRIGHT BY SOLID STATE MUSIC,1978

                ;REGISTER USAGE:
                ;REG.A....PASS DATA FROM MEMORY TO THE PROGRAMMER
                ;REG.B....REPEATED PROGRAMMING CYCLES
                ;REG.C....SIZE.  SIZE=256(REG.C +1)
                ;REG.DE...PROM CARD ADDRESS
                ;REG.HL...DATA ADDRESS TO BE COPIED

0100            LOC     EQU     100H
D000            PROM    EQU     0D000H  ;PROGRAMMING SOCKET
4000            RAM     EQU     4000H   ;DATA TO BE COPIED
0010            CPORT   EQU     10H     ;CONTROL PORT FOR PB1
F021            MONIT   EQU     0F021H  ;EXIT ADDR. SET BY USER.

0100                    ORG     LOC
                ;START OF PROGRAM.
                ;       INITIALIZE BOARD.
0100 3E01       PROG0:  MVI     A,01    ;01=2708 ROM
0102 D310               OUT     CPORT   ;PRESET BOARD
                ;SET UP PARAMETERS.
                ;       NUMBER OF PROGRAMMING CYCLES
0104 06FF               MVI     B,0FFH  ;256 CYCLES FOR 2708

                ;       NUMBERS OF BYTES =256(C+1)
0106 0E03               MVI     C,03    ;03=2708

                ;       SET UP ADDRESSES FOR TRANSFER
0108 1100D0     PROG1:  LXI     D,PROM
010B 210040             LXI     H,RAM
                ;PROGRAM THE EPROM.
010E 7E         PROG2:  MOV     A,M
010F 12                 STAX    D
0110 13                 INX     D
0111 23                 INX     H
0112 7A                 MOV     A,D
0113 A1                 ANA     C
0114 B3                 ORA     E
0115 C20E01             JNZ     PROG2
0118 05                 DCR     B
0119 C20801             JNZ     PROG1
011C 1B                 DCX     D
011D 1A                 LDAX    D       ;RESET PB1
011E C321F0             JMP     MONIT   ;BACK TO MONITOR

0000                    END
```

```
                ;A SIMPLE ROUTINE FOR PROGRAMMING 2716'S.
                ;COPYRIGHT BY SOLID STATE MUSIC,1978

                ;REGISTER USAGE:
                ;REG.A....PASS DATA FROM MEMORY TO THE PROGRAMMER
                ;REG.B....REPEATED PROGRAMMING CYCLES
                ;REG.C....SIZE.  SIZE=256(REG.C +1)
                ;REG.DE...PROM CARD ADDRESS
                ;REG.HL...DATA ADDRESS TO BE COPIED

0100            LOC     EQU     100H
D000            PROM    EQU     0D000H  ;PROGRAMMING SOCKET
4000            RAM     EQU     4000H   ;DATA TO BE COPIED
0010            CPORT   EQU     10H     ;CONTROL PORT FOR PB1
F021            MONIT   EQU     0F021H  ;EXIT ADDR. SET BY USER.

0100                    ORG     LOC
                ;START OF PROGRAM.
                ;       INITIALIZE BOARD.
0100 3E02       PROG0:  MVI     A,02    ;02=2716 ROM
0102 D310               OUT     CPORT   ;PRESET BOARD
                ;SET UP PARAMETERS.
                ;       NUMBER OF PROGRAMMING CYCLES
0104 0601               MVI     B,01    ;1 CYCLE FOR 2716

                ;       NUMBERS OF BYTES =256(C+1)
0106 0E07               MVI     C,07    ;07=2716

                ;       SET UP ADDRESSES FOR TRANSFER
0108 1100D0     PROG1:  LXI     D,PROM
010B 210040             LXI     H,RAM
                ;PROGRAM THE EPROM.
010E 7E         PROG2:  MOV     A,M
010F 12                 STAX    D
0110 13                 INX     D
0111 23                 INX     H
0112 7A                 MOV     A,D
0113 A1                 ANA     C
0114 B3                 ORA     E
0115 C20E01             JNZ     PROG2
0118 05                 DCR     B
0119 C20801             JNZ     PROG1
011C 1B                 DCX     D
011D 1A                 LDAX    D       ;RESET PB1
011E C321F0             JMP     MONIT   ;BACK TO MONITOR

0000                    END
```

4.4 2708/2716 Erase Verification Software

```
                    ;A SIMPLE ROUTINE FOR CHECKING IF THE EPROM
                    ;IS ERASED. PRINTS P=PASS,F=FAIL.
                    ;COPYRIGHT BY SOLID STATE MUSIC,1978

                    ;REGISTERS USED:
                    ;REG.A....TEST AND PASS A CHARACTER
                    ;REG.B....NOT USED
                    ;REG.C....SIZE.
                    ;REG.DE...PROM CARD ADDRESS
                    ;REG.HL...NOT USED

0140                LOC       EQU       140H
D000                PROM      EQU       0D000H  ;PROGRAMMING SOCKET
F021                MONIT     EQU       0F021H  ;EXIT TO USER
F009                CO        EQU       0F009H  ;CONSOLE OUT ROUTINE

0140                          ORG       LOC
                    ;CHECKING EPROM START.
                    ;
0140 0E03           ERASE:    MVI       C,03    ;03=2708, 07=2716
0142 1100D0                   LXI       D,PROM  ;EPROM ADDRESS

0145 1A             ER1:      LDAX      D       ;READ EPROM
0146 13                       INX       D
0147 FEFF                     CPI       0FFH    ;TEST FOR ERASE
0149 3E46                     MVI       A,'F'   ;FAIL CHARACTER
014B C25601                   JNZ       ERROR
014E 7A                       MOV       A,D
014F A1                       ANA       C
0150 B3                       ORA       E       ;DONE YET?
0151 C24501                   JNZ       ER1
0154 3E50                     MVI       A,'P'   ;PASS CHARACTER
0156 4F             ERROR:    MOV       C,A
                    ;
                    ;OUTPUT ROUTINE CALLS USER MONITOR ENTRY
                    ;POINT FOR CONSOLE OUTPUT. DATA IS IN REG.-C.
                    ;BE SURE TO CHANGE THIS TO MEET YOUR NEEDS.
0157 CD09F0                   CALL      CO
015A C321F0                   JMP       MONIT

0000                          END
```

4.5 2708/2716 Copy Verification Software

```
                    ;A SIMPLE ROUTINE FOR VERIFYING THE ORIGINAL
                    ;SOURCE DATA IN MEMORY AGAINST THE EPROM COPY.
                    ;PRINTS P=PASS, F=FAIL.
                    ;COPYRIGHT BY SOLID STATE MUSIC,1978

                    ;REGISTER USAGE:
                    ;REG.A....TEST AND PASS CHARACTERS
                    ;REG.B....ORIGINAL DATA
                    ;REG,C....SIZE. SIZE=256(REG.C +1)
                    ;REG.DE...PROM CARD ADDRESS
                    ;REG.HL...ADDRESS OF ORIGINAL

0180                LOC     EQU     180H
D000                PROM    EQU     0D000H  ;PROGRAMMING SOCKET
4000                RAM     EQU     4000H   ;ORIGINAL DATA ADDR.
F021                MONIT   EQU     0F021H  ;EXIT TO USER
F009                CO      EQU     0F009H  ;CONSOLE OUTPUT

0180                        ORG     LOC
                    ;START OF VERIFY
0180 0E03           VERF:   MVI     C,03    ;03=2708, 07=2716

0182 1100D0                 LXI     D,PROM  ;SOCKET ADDR. OF COPY
0185 210040                 LXI     H,RAM   ;POINT TO RAM MASTER
0188 46             VERF1:  MOV     B,M     ;GET ORIGINAL DATA
0189 1A                     LDAX    D       ;GET ROM COPY
018A 13                     INX     D
018B 23                     INX     H
018C B8                     CMP     B       ;ARE THEY ALIKE?
018D 3E46                   MVI     A,'F'
018F C29A01                 JNZ     ERROR
0192 7A                     MOV     A,D
0193 A1                     ANA     C
0194 B3                     ORA     E
0195 C28801                 JNZ     VERF1   ;GO BACK FOR NEXT BYTE
0198 3E50                   MVI     A,'P'
                    ;OUTPUT ERROR CHARACTER.
019A 4F             ERROR:  MOV     C,A
019B CD09F0                 CALL    CO      ;OUTPUT IT.
019E C321F0                 JMP     MONIT

0000                        END
```

5.0 TROUBLE SHOOTING HINTS

5.1 Check for proper setting of the DIP switches and jumper arrangements

5.2 Verify that all IC's are in the correct sockets.

5.3 Visually inspect all IC's to be sure that pins are in the sockets and not bent under the IC.

5.4 Verify that the output voltage of each regulator is correct. (See section 2.0)

5.5 Inspect back side of the board for solder bridges. Run a small sharp knife blade between traces that appear suspicious.

5.6 If you have an addressing problem:
- a. Check the address line buffers U1, U2 & U3 for shorts, or opens to the sockets or a defective IC.
- b. Check the address decoders U16, U18, U24 & U26 for shorts, or opens to the sockets or a defective IC.
- c. Check general logic U6,U10 or U21 for shorts, or opens to the sockets or a defective IC.

5.7 If incorrect data is transferred on a read (or write):
- a. Check the data buffers U4, U5 & U6 for shorts, or opens to the socket or a defective IC.
- b. Check general logic U7, U8 & U9 for shorts, or opens to the socket or a defective IC.

5.8 If you can read a PROM in the programming socket, but can not program it:
- a. Check the DC-to-DC converter (U32) for the correct voltage (+26.5 volt) on C1 the + end. Check if the voltage drops out of regulation when you are programming a PROM, and if so, inspect the circuitry around U32 for shorts or opens.
- b. Check pin 18 of U22 & U23 for the correct pulse widths during programming (refer to 2.12 for pulse widths).

5.9 If the PB1 puts the computer into a infinite wait-state:
- a. PSYNC signal on the bus is very noisy, and presets U29 for additional wait-states. This condition can be corrected in some mainframes by adding a 1000pf filter capacitor between U29, pin 10 and U29, pin 7 on the back of the board.
- b. U28, pin 12 is not changing states. Check U27 & U28 monostables for correct operation.

6.0 THEORY OF OPERATION

6.1 Usage

1) U1-U3 (Hex Tri-state buffers 74LS367) are used to buffer the address lines onto the card and RDY onto the bus.

2) U4-U6 (Hex Tri-state buffers 74LS367) are used to buffer the data bus and various other signals (address decode, SWO status).

3) U7 (Hex inverter 74LS04) is used to buffer various signals on the card and drive the LED.

4) U8 (triple 3 input NAND 74LS10) is used to enable or reset the programming flip flop and to generate the data output enable for memory read.

5) U9 (triple 3 input AND 74LS11) is used to enable the data set-up one shot, enable the wait state circuit U20, and buffer SMEMR onto the board.

6) U10 (triple 3 input NAND 74LS10) is used to form part of the programming flip flop, generate CS to the programming sockets and to enable the PROM block decoder, U16.

7) U11-U14 are the sockets for 4K of 2708 or 8K of 2716 read-only-memory.

8) U15 (8 Input NAND 74LS30) is a detector for FF (Hex) bytes.

9) U16 (Dual 1 of 4 decoder 74LS139) decodes the address of the U11-U14 PROM block.

10) U17 (DIP switch) selects the address for the PROM block.

11) U18 (Quad 2 input NOR open collector 7433) decodes the 4 LSB of the output port address and enables the RDY buffer.

12) U19 (Quad latch 74LS175) latches data bits Ø and 1 to select 2708 or 2716 programming circuitry.

13) U20 (4-bit registor 74LS173) generates read cycle wait-states for the PROMs.

14) U21 (Quad 2 input NAND 74LS00) forms part of the programming flip flop, buffers Ø2 and gates wait-state signals to the buffer (U3).

15) U22 <u>2708</u> programming socket.

16) U23 <u>2716</u> programming socket.

17) U24 (Quad 2 input exclusive-or, 74LS136) is used to decode an out port to enable the programming circuitry.

18) U25 is an addressing DIP switch. The upper four switch positions address the programming sockets. The lower four positions address the programming flip flop.

19) U26 (Quad 2 input exclusive-or, 74LS136) is used to decode a 4K block for the programming sockets.

20) U27, U28 (Dual one shot, 74LS123) control set-up, hold and programming pulse times for 2708, 2716.

21) U29 (Dual flip flop 74LS74) controls wait-state circuitry for read and programming cycles.

22) U30 +5 volt regulator.

23) U31 +12 volt regulator.

24) U32 (DC to DC converter TL497) generates +26.5V programming voltage.

25) U33 -5 volt regulator.

6.2 Operation

Addressing
The PB1 has three address circuits:

a) Addressing for the programming sockets (U22 & U23).
b) Addressing for on-board PROM (U11 thru U14).
c) One I/O port for PROM select (2708 vs. 2716).

U26 is used to decode a 4K boundary of memory for the two programming sockets. The output of U26 is buffered by U6, pin 14, and is sent U1Ø, pin 4 to control the chip select of U22 & U23 and also can reset the programming flip-flop by enabling U8, pin 3 for a SMEMR cycle.

U16 generates four chip select signals for PROMs U11 thru U14 by setting the jumpers A thru E and the DIP switch SW3 (U17). Address line A15 must be a one to U1Ø, pin 1Ø to enable U16, so the valid PROM addresses are any 4K or 8K boundary from 8ØØØ Hex to FØØØ Hex.

U24 decodes the programming flip-flop's I/O address. U18 pins 2, 3, 11 & 12 must be zero to enable the output of U24. U18 detects if AØ thru A3 is zero and then U24 decodes the upper four address lines, A4 thru A7. The programming flip-flop can therefore be addressed to any Hex port where the lower digit is zero (like port ØØ, 1Ø, 2Ø, 3Ø, etc.).

Programming
Programming is controlled by a flip-flop made up of U1Ø, pin 12 and U21, pin 8. Power-on-clear (Bus pin 99) will reset the programming flip-flop to a non-programming mode, and also a memory read cycle to the programming sockets.

When U8, pin 11 receives a logic one (valid I/O address), U8, pin 1Ø gets a write pulse and U8, pin 9 detects the status for an output instruction, then the programming flip-flop is set. The LED (D2) turns on to indicate the flip-flop is set.

U8, pin 8 which sets the programming flip-flop also clocks a couple of D-flip flops (U19) to save data bits DØ & D1 which will be used later to control a monostable U27.

U19 controls the clear lines of U27 (Dual monostable). If U19 receives a Ø1 Hex code, then U27, pin 13 is held reset and U27, pin 5 is allowed to give 0.6 ms pulses to program a 2708 EPROM. If U19 receives a Ø2 Hex code, then U27, pin 5 is held reset and U27, pin 13 is allowed to give 50 ms pulses to program a 2716 EPROM. Therefore outputting a binary code to the programming flip-flop port also sets which PROM will be programmed.

If the programming flip-flop is set, a write instruction ($\overline{\text{SWO}}$) to the programming socket address area will produce a logic one on U9, pin 6 which triggers U28, pin 2 starting the set-up time. The end of the set-up pulse from U28 triggers U27, pin 5 or U27, pin 13 depending on which is not cleared. U27, pin 13 generates the programming pulse for the 2716 on U23, pin 18. U27, pin 5 generates the programming pulse for the 2708 and is level shifted by Q1, Q2 & Q3 to produce a high voltage programming pulse on U22, pin 18. The trailing edge of either programming pulse triggers U28, pin 12 to generate a negative pulse to release the processor to proceed to the next data byte, therefore controlling the data hold time.

6.2 Operation (continued)

Wait Circuitry

The wait-state cycles for reading any of the on-board PROM is controlled by U20 which is connected up to act like a four bit shift register. PSYNC resets this shift register, then Ø2 is used as a clock to shift a one through the register. The number of wait-state cycles is selected by a jumper to one of the shift register's stages. The two D-flip flops (U29) are preset by PSYNC to a logic 1. U29, pin 9 controls programming wait cycles and U29, pin 5 controls the memory read wait cycles. U29's outputs are combined by U21 to make a wait-request signal which can be enabled or disabled by U18, pin 1Ø.

In the programming mode, U2Ø is inhibited and the wait-state period ends at the completion of the data hold time which is signified by the rising edge of a logic signal on U29, pin 11. In the memory read mode, U2Ø is enabled and the wait cycles are shifted out until a rising logic state is sent to U29, pin 3. (Jumper T to S must be connected for read wait-states.)

Programming Voltage

The programming voltage is generated by a switching power supply designed around U32. The current is stored in C1 (1000mfd) and the capacitor is charged to+26.5Vfor programming. The switch SW1 is used to pass on the programming voltage to the PROMs to allow for manual defeat to prevent accidental programming. The programming voltage drives a pulse shaping circuit (Q1, Q2 & Q3) (for 2708's) and an enable circuit (Q4 & Q5) (for 2716's) for the high voltage to U22 & U23. During the programming mode, Q6, Q7 & Q8 control the CS pin of U22, which is at +12V during programming, +5V when not selected and +ØV when selected for reading.

7.0 Warranty

SSM warrants its products to be free from defects in materials and/or workmanship for a period of ninety (90) days for kits and bare boards, and one (1) year for factory assembled boards. In the event of malfunction or other indication of failure attributable directly to faulty workmanship and/or material, then, upon return of the product (postage paid) to SSM at 2190 Paragon Drive, San Jose, CA 95131, "Attention: Warranty Claims Department", SSM will, at its option, repair or replace the defective part or parts to restore said product to proper operating condition. All such repairs and/or replacements shall be rendered by SSM without charge for parts or labor when the product is returned within the specified period of the date of purchase. This warranty applies only to the original purchaser.

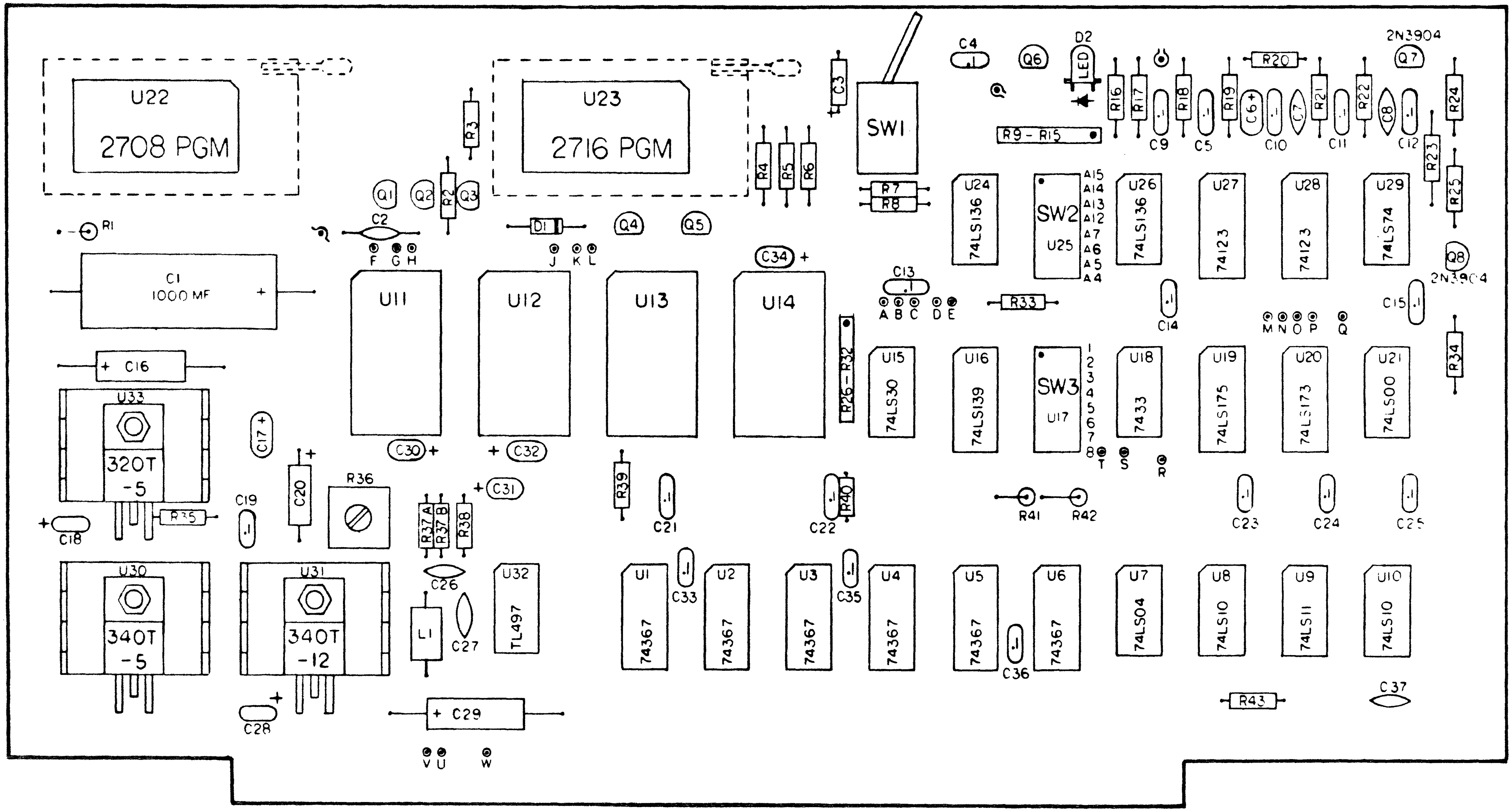
This warranty will not cover the failure of SSM products which at the discretion of SSM shall have resulted from accident, abuse, negligence, alteration, or misapplication of the product. While every effort has been made to provide clear and accurate technical information on the application of SSM products, SSM assumes no liability in any events which may arise from the use of said technical information.

This warranty is in lieu of all other warranties, expressed or implied, including warranties of mercantability and fitness for use. In no event will SSM be liable for incidental and consequential damages arising from or in any way connected with the use of its products. Some states do not allow the exclusion or limitation of incidental or consequential damage, so the above limitation or exclusion may not apply to you.

IMPORTANT: Proof of purchase necessary for products returned for repair under warranty. Before returning any product, please call our Customer Service Department for a return authorization number.

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	PRODUCTION RELEASE	5-18-81	M.T.Wright



TOLERANCES UNLESS OTHERWISE SPECIFIED		SSM MICROCOMPUTER PRODUCTS, INC.		
FRACTIONS ± DEC ± ANGLES ±		PB1 ASSEMBLY DWG		
APPROVALS	DATE			
DRAWN MTW	2-7-79			
CHECKED MTW	3-20-79	SCALE 2/1	SIZE C	DRAWING NO 1020-004
		DO NOT SCALE DRAWING		SHEET 1 OF 1

PB1 PARTS LIST

CHIP PACK

1 - U21	74LS00
1 - U7	74LS04
2 - U8,U10	74LS10
1 - U9	74LS11
1 - U15	74LS30
1 - U18	74LS33
1 - U29	74LS74
2 - U27,U28	74123
2 - U24,U26	74LS136
1 - U16	74LS139
1 - U20	74LS173
1 - U19	74LS175
6 - U1-U6	74LS367
1 - U32	TL497;DC-DC CONVERTER

SOCKET PACK

1 - SW1	SPST PCB SWITCH
2 - SW2 (U25),SW3 (U17)	8 POSITION DIP SWITCH
11 - U7-10,15,18,21,24,26, 29,32	14 PIN SOCKETS
11 - U1-6,16,19,20,27,28	16 PIN SOCKETS
4 - U11-14	24 PIN SOCKETS
2 - U22,U23	24 PIN TEXTOOL SOCKETS

SEMICONDUCTOR PACK

1 - D1	1N4001/1N4002/1N4003 DIODE
1 - D2	LED
8 - Q1-8	2N3904 TRANSISTOR

HARDWARE PACK

1 - U30	340T-5/7805 REGULATOR I.C.
1 - U31	340T-12/7812 REGULATOR I.C.
1 - U33	320T-5/7905 REGULATOR I.C.
3	SETS #6 HARDWARE
3	TO-220 HEAT SINKS

CAPACITOR PACK

1 - C2	15pF CERAMIC (RADIAL)/20pF CERAMIC (RADIAL)
2 - C7,C37	220pF CERAMIC (RADIAL)
1 - C26	330pF CERAMIC (RADIAL)
1 - C8	0.001uF CERAMIC (RADIAL)
18 - C4,5,9-15,19,21-25,33, 35,36	0.1uF DIP TANT (RADIAL)
1 - C27	150pF MONOLITHIC (RADIAL)
2 - C18,28	0.47uF DIP TANT (RADIAL)
2 - C3,20	1.0uF 35V (AXIAL)
1 - C6	3.3uF 5V DIP TANT (RADIAL)
4 - C30-32,34	4.7uF 25V DIP TANT (RADIAL)

CAPACITOR PACK

2 - C16,29	10uF 25V ELECTROLYTIC (AXIAL)
1 - C17	47uF 10V DIP TANT (RADIAL)
1 - C1	1000uF 35V (AXIAL)
1 - L1	220uH COIL (AXIAL)

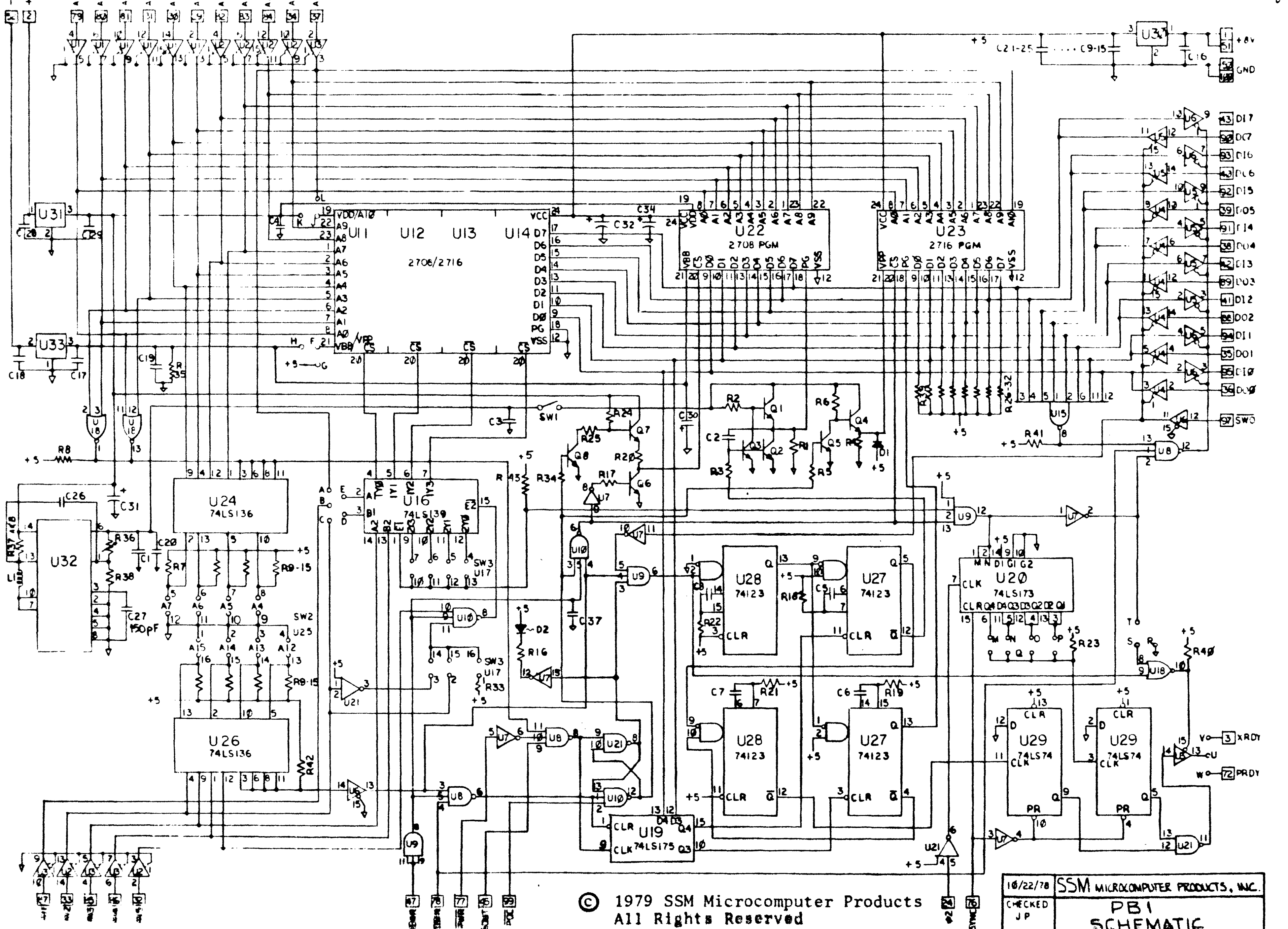
RESISTOR PACK

2 - R37A,R37B	2.2oHm 1/4W (RED,RED,GOLD)
2 - R16,R20	470oHm 1/4W (YELLOW,VIOLET,BROWN)
1 - R38	1.2K 1/4W (BROWN,RED,RED)
8 - R8,23,33,39-43	2.7K 1/4W (RED,VIOLET,RED)
4 - R3,5,17,34	3.3K 1/4W (ORANGE,ORANGE,RED)
2 - R7,R25	4.7K 1/4W (YELLOW,VIOLET,RED)
1 - R24	6.8K 1/4W (BLUE,GRAY,RED)
3 - R2,6,35	10K 1/4W (BROWN,BLACK,ORANGE)
1 - R18	20K 1/4W (RED,BLACK,ORANGE)
2 - R1,R4	47K 1/4W (YELLOW,VIOLET,ORANGE)
3 - R19,21,22	51K 1/4W (GREEN,BROWN,ORANGE)
2 - R9-15,26-32	2.7K X 7 SIP RESISTORS
1 - R36	50K POTENTIOMETER

MISCELLANEOUS

1	PB1 PC BOARD
1	PB1 INSTRUCTION MANUAL
1	WARRANTY CARD

				REVISIONS		
B	INCORP ECN 112	8-1-81	M.T. Wright			
C	INCORP ECN 151	11-4-82	M.T. Wright	LTR	DESCRIPTION	DATE	APPROVED
				A	PRODUCTION RELEASED	5-18-81	M.T. Wright



10/22/78	SSM MICROCOMPUTER PRODUCTS, INC.
CHECKED JP	PB1 SCHEMATIC
SHEET 1 OF 1	1020-002

SSM MICROCOMPUTER PRODUCTS, INC.
2190 Paragon Drive
San Jose, California 95131

(408) 946-7400 • Telex: 171171
TWX: 910-338-2077