68A2 PROM MONITOR

The 68A2 PROM Monitor is identical to the older 68A PROM Monitor except that it resides at FF00 up instead of FE00 up.

Please change all references to addresses in the range of FEXX to FFXX.

OSI 68A 8K PROM MONITOR

The OSI 68A 8K is a 256 word program supplied in a 1702A PROM. It provides all necessary "front panel" and bootstrap loader functions on an OSI system minimally containing a 6800 based 400 CPU board with serial interface and an ASCII terminal. 68A 8K is optimized for use with 8K of RAM memory, but can be used with 1K, 4K, or more than 8K with some caution. 68A 8K also supports a PIA based high speed paper tape interface located on the PA side of a PIA at F7XX.

The monitor has four commands:

(L) Load memory from keyboard or paper tape. The first four characters are the starting address and are given in hexadecimal. Each pair of succeeding hexadecimal characters is loaded into successive memory locations. The monitor ignores all non hexadecimal characters except (R).

(P) Print or punch memory in hexadecimal starting with the location specified by the four hexadecimal numbers entered by keyboard. 8 bytes are listed per line and the monitor injects spaces, carriage returns, line feed, and nulls.

(R) Return to Command Mode from either (L) or (P).

(G) Go to the user program starting at the location specified by two locations on page 1F.

Operation:

The L Command

The user can enter programs via the keyboard or teletype based paper tape reader with the L command. To manually load memory, simply type an "L", the starting address, and enter data.

For example, load location 0146 with 4E 6F 01.

Type:

L 0146 4E 6F 01 R

The "R" is used to return to the command mode. The load command will directly accept paper tapes generated by the P command. Simply type an "L", place the tape in the reader, and turn the unit on.

The P Command

The Punch/Print command allows the user to examine memory and punch tapes of programs. The user simply types a "P", then a four digit starting address. Then, the monitor will start listing memory in rows of 8 bytes. Typing any key on the keyboard will terminate this operation at the end of the existing line.

The L and P commands provide a convenient mass storage and retrieval method for teletype systems. They can also be utilized for mass storage with any other mass storage device which can be connected in the serial interface loop with the terminal such as the National Multiplex CC-7A digital cassette or the SWTP AC-30 audio cassette unit.

OSI
11679 HAYDEN STREET
HIRAM, OHIO 44234

The G Command

68A, like 68V and Motorola MIK Bug, has a register stack starting at 1F29 as is given below.

1F29 - Condition Codes
1F2A - B Accumulator
1F2B - A Accumulator
1F2C - Index Register High
1F2D - Index Register Low
1F2E - Program Counter High
1F2F - Program Counter Low
1F30 - Stack Pointer High
1F31 - Stack Pointer Low

The contents of these locations are installed in the corresponding processor registers when the GO command is executed. When the processor encounters a software interrupt (3F, the processor registers are placed in these locations and the monitor is re-entered. 3F is a "breakpoint" command which allows the user to examine all processor conditions at any point of a program.

To execute a program, the user must load the starting location of the program into 1F2E (High) and 1F2F (Low). It may also be necessary to set other registers at this time, particularly the stackpointer. On 6800 systems, the stackpointer may be anywhere in memory so that if it is arbitrarily set, it may destroy important code. OSI recommends setting the stack to 1F80 for small programs. For example, execute a program at 0200 which does not initialize itself.

Type:

L1F2E 0200 1F 80 R G

Vectors:

Reset - FEA8
Software Interrupt - FEA8
IRQ - 1FD0
NMI - 1FE0
INCH - FE00
OUTCH - FE88

68A8K resets the 400 board's optional PIA on reset so PIA intialization is not necessary in operating system software.

Memory Usage:

68A 8K resides at FEXX and FFXX. A second PROM containing the restart vectors can be installed at FFXX by address modifications covered in the 400 manual. 68A 8K uses 1F29 through 1F3C for its GO stack and temporary storage. 68A can be used on 1K OSI 400 systems which are not address decoded. Thus, the GO stack will appear at 1F2X as well as 032X, 072X, 0B2X, 0F2X, etc. 68A can be used on 4K OSI 400 systems if the system has all of its memory on a 420 board and A_{12} on that 420 board is left open so that the stack will appear at 0F2X and 1F2X. OSI supplied 6800 programs larger than 8K allocate room for 68A 8K so no conflicts exist on large memory systems.

68A 8K has provisions for high speed paper tape and other input. The key to this is an input routine flag at 1FDF. If this location is zero, normal input operations occur. If it is not zero, the input routine jumps to 1FB0. An alternative input routine from a high speed paper tape reader or 430 board based magnetic tape interface can be placed at this location so that the input data is placed in Accumulator A and then a jump to FE09 is performed.

The monitor resets a PIA at F7XX. The following routine is for a paper tape reader located on the PA0 side of this PIA such that the presence of a hole is a logical high. The low order seven bits are connected to PA0 through PA6. The sprocket hole sensor is connected to PA7. If the paper tape reader runs faster than the terminal, display echo must be suppressed by use of the alternate code at 1F BA.

PAPER TAPE INPUT ROUTINE

```
1FB0        B6      LDAA PIA
1FB1        F7
1FB2        00
1FB3        2B      BMI
1FB4        FB
1FB5        B6      LDAA PIA
1FB6        F7
1FB7        00
1FB8        2A      BPL
1FB9        FB
1FBA        7E  }
1FBB        FE  }     If echo is not desired, jump back to the monitor
1FBC        09  }           using the following:
                            1FBA      84    AND A
                            1FBB      7F
                            1FBC      39    RETURN
```

PROGRAM TO SET PAPER TAPE MODE!

```
1FC0        7C      INC 1FDF
1FC1        1F
1FC2        DF
1FC3        7E      JMP TO PROGRAM AT XX YY
1FC4        XX
1FC5        YY
```

The following is a listing of 68A 8K via its own print command. The end of this manual is an article reprint from the August 1976 OSI Systems Journal. It contains very important information and sources of software compatible with OSI 6800 computers.

```
P FF00
7E FE D3 47 24 FA B6 FC
01 84 7F 81 7F 27 F1 7E
FE 88 8D EC 81 52 27 13
81 30 2B F6 81 39 2F 0A
81 41 2B EE 81 46 2E EA
80 07 39 7E FE A8 8D 07
8D 13 A7 00 08 20 F9 8D
0C B7 1F 34 8D 07 B7 1F
35 FE 1F 34 39 8D CB 48
48 48 48 16 8D C4 84 0F
1B 39 00 00 8D E1 86 0D
8D 2E 86 0A 8D 2A 8D 17
8D 15 8D 13 8D 11 8D 0F
8D 0D 8D 0B 8D 09 B6 FC
00 47 24 E2 7E FE B2 8D
26 39 44 44 44 44 84 0F
88 30 81 39 23 02 88 07
37 F6 FC 00 57 57 24 F9
B7 FC 01 33 39 A6 00 8D
E1 A6 00 8D E1 08 39 8D
F4 86 20 20 E3 00 00 00
86 03 B7 FC 00 86 81 B7
FC 00 8E 1F 28 86 0D 8D
CF 86 0A 8D CB BD FE 00
16 8D DE C1 4C 26 03 7E
FE 2E C1 50 27 86 C1 47
26 E0 38 B6 1F DF 27 03
7E 1F B0 B6 FC 00 47 24
FA 7E FE 06 00 00 00 7F
1F DF C6 00 F7 F7 01 F7
F7 00 C6 04 F7 F7 01 7E
FE A8 FE A8 1F E0 FE E7
```

MIK Bug compatible paper tapes are in a special block oriented check-sum format. Each block is usually 16 bytes long. The block also contains a starting identifier (S1), a block length indicator, and a check sum. Each block is separated by a carriage return, line feed, and some nulls. The tape is terminated by a (S9). Thus, the format allows for alphabetic labeling of tapes before the first (S1) error checking via checksums and an indication of where one is in the load or dump process via absolute addresses.

The OSI MIK Bug compatible loader is part of the listing here from 1D00 to 1D62. The loader must be at these locations in conjunction with a 68A 8K mod or similar monitor. To use the loader, load 1F2E, 2F (program counter in 68A 8K) with 1D00 and 1F30, 31 with 1F80 (stack) then return and type a"G". Load a MIK Bug format tape into the reader and turn it on. If a check sum error occurs, the terminal will stop echoing the tape and will type a "?". If this occurs, stop the reader immediately and back up at least one complete data block which is dinstinguishable by a group of nulls between blocks and restart the program as above. Since each block of data has its own address, the tape will automatically load at the right place. The end of the listing is the OSI MIK Bug compatible tape puncher. This is located starting at 1D70 to 1DE3. The user must load the starting address of the dump into 1E02 and 1E03 and the last address of the dump into 1E04 and 1E05 (8K system). The program is started by loading 1F2E and 1F2F with 1D70 and 1F30 and 1F31 with 1F80 (or other stack pointer), returning to the monitor, turning the paper tape punch on, and typing a "G". The program will dump a full MIK Bug compatible tape with all the features of that format and will automatically stop when done.

Many small programs written on MIK Bug based systems rely heavily on subroutines in MIK Bug to save memory space. Fortunately, there are functionally equivalent subroutines for most of these in the OSI 68A monitor. One often used subroutine which 68A does not have is PDATA1. This is included in the MIK Bug loader/dumper from 1D63 to 1D6D.

The following table lists the commonly used MIK Bug subroutines and the OSI 68A locations of equivalent routines.

Table 1.

Subroutine	MIK Bug Location	OSI 68A 8K Location
OUTCH or OUTEEE	E1D1	FE88
INCH or INEEE	E1AC	FE00
OUTHL	E067	FE7A
OUTHR	E06B	FE7E
OUTS	E0CC	FEA1
PDATA1	E07E	1D67*
CONTROL	E0E3	FEA8
INHEX	E0AA	FE12
BADDR	E047	FE37

*Must be loaded in

Any use of the 128 word buffer memory at A0XX should be relocated to 1EXX.

To summarize the conversion process:

1. The user must change his 68A monitor PROM to a 68A 8K format or similar.

2. The user must locate RAM memory at 1EXX and 1FXX (for 8K systems).

3. The user must convert the subroutine calls of MIK Bug programs as per Table 1.

The user must convert program stack and temporary memory useage from A0XX to 1EXX.

5. The user must have resident in memory PDATA1 and the MIK Bug loader.

An example of programs available in MIK Bug format are the excellent program offerings from Technical Systems Consultants (TSC), Box 2574, West Lafayette, Indiana 47906. Their programs are fully documented including assembler listings. TSC programs can be modified to run on OSI systems in a few minutes using the guidelines above.

Tiny BASIC for the 6800

A remarkable 2K Tiny Basic for the 6800 is available from:

Itty Bitty Computers
P. O. Box 23189
San Jose, California 95153

It is $5.00 postpaid including a ready-to-load paper tape and 24 page manual. This BASIC is quite powerful for the 2K of memory space it occupies as can be seen from the accompanying print out. The prospective Tiny BASIC user should order the RAM version of Tiny BASIC.

The user's 68A must be modified as a 68A 8K or similar (the stack can not be on 01XX) and the user must first load in the MIK Bug loader. Tiny BASIC is then loaded in with the Mik Bug loader.

The following modifications must be made to Tiny BASIC before attempting to run it!

Load locations 0020 and 0021 with the start of the user program space, generally 0900. Load locations 0022 and 0023 with the last location available to a BASIC program (1CFF in an 8K OSI system).

Load 0107 and 0108 with FE00 (INCH), load 010A and 010B with FE88 (OUTCH) and load 010C, 010D, and 010E with 7E 00 D8 (Break Test Enable). Then load the Break Test routine as follows:

	(Location)		(Contents)
00D8		B6	
D9		FC	
DA		00	
DB		47	
DC		24	
DD		06	
DE		B6	
DF		FC	
E0		01	
E1		26	
E2		01	
E3		0C	
E4		39	

Once these modifications have been made, a new tape can be generated with the MIK Bug punch program from 0000 - 0900 so that these modifications will not have to be made again. To run the program, always jump to the warm start (0103) -- not the cold start which will erase the stack and any utilities above the program working space. The first command after warm start should be a clear to initialize the working space. These modifications are all discussed in the BASIC manual, but may not be obvious to the anxious user!

OSI CHECKSUM LOADER DUMP AND PDATA
FOR 8K 6800

```
P 1D00
8D FE 00 81 53 26 F9 8D
FE 00 81 39 27 29 81 31
26 EE 7F 1E 0A BD 1D 4D
80 02 B7 1E 08 BD 1D 3C
BD 1D 4D 7A 1E 08 27 05
A7 00 08 20 F3 7C 1E 0A
27 CE 86 3F BD FE 88 7E
FE B2 02 02 BD 1D 4D B7
1E 0C BD 1D 4D B7 1E 0D
FE 1E 0C 39 02 BD FE 12
48 48 48 48 16 BD FE 12
84 0F 18 16 F8 1E 0A F7
1E 0A 39 BD FE 88 08 A6
00 81 04 26 F6 39 71 FB
0D 0A 00 00 00 00 53 31
04 86 12 BD FE 88 FE 1E
02 FF 1E 0F 86 1E 05 80
1E 10 F6 1E 04 F2 1E 0F
26 04 81 10 25 02 86 0F
88 04 B7 1E 11 80 03 B7
1E 0E CE 1D 70 BD 1D 67
5F CE 1E 11 BD 25 CE 1E
0F BD 20 BD 1E FE 1E 0F
BD 19 7A 1E 0E 26 F9 FF
1E 0F 53 37 30 BD 0C 33
FE 1E 0F 09 BC 1E 04 26
83 20 0E E8 00 7E FE 95
13 0D 0A 14 00 00 00 2A
04 7E FE B2 21 64 40 41
00 51 C1 21 4C 8C 00 28
```