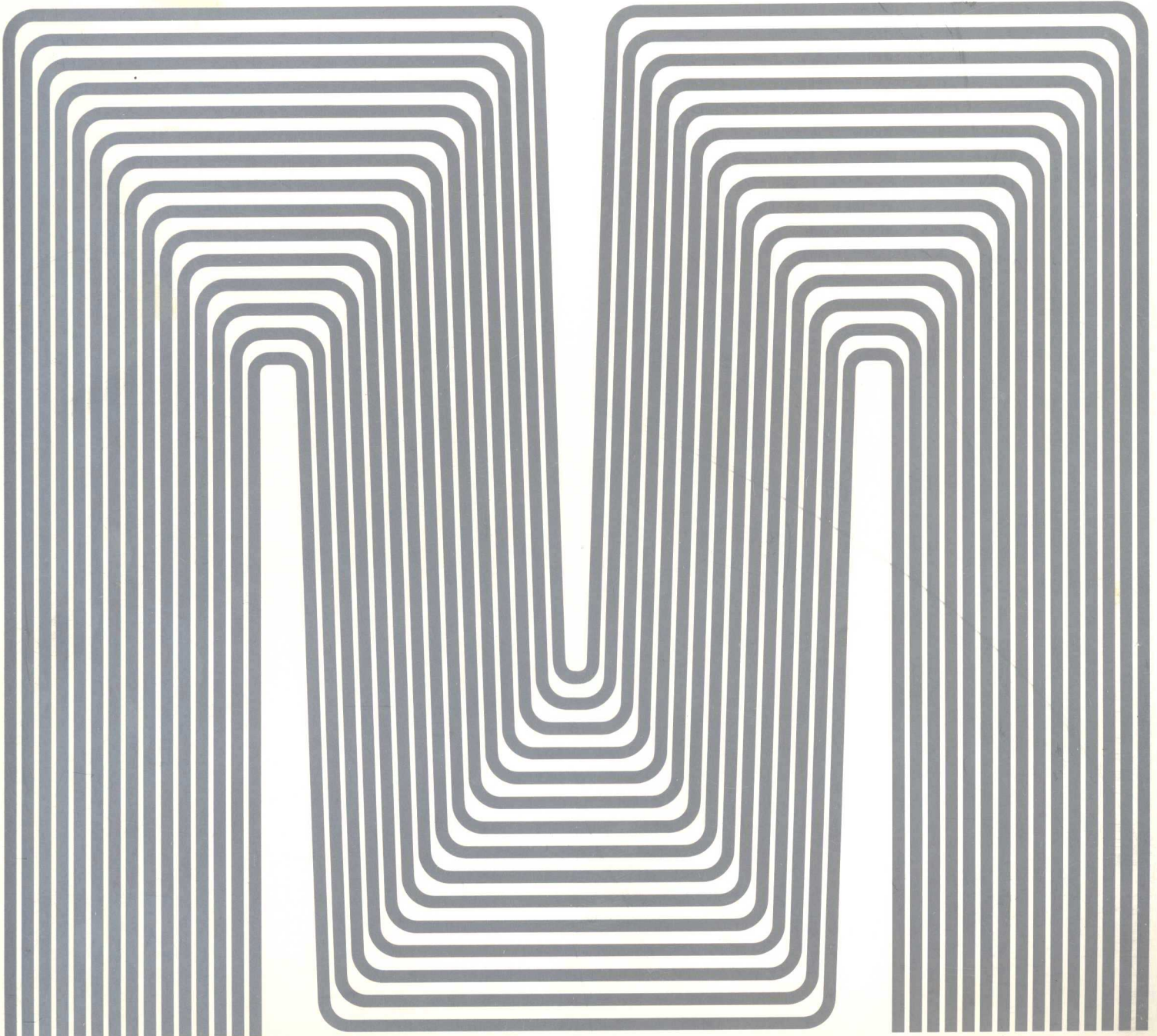


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Micro 810 Computer

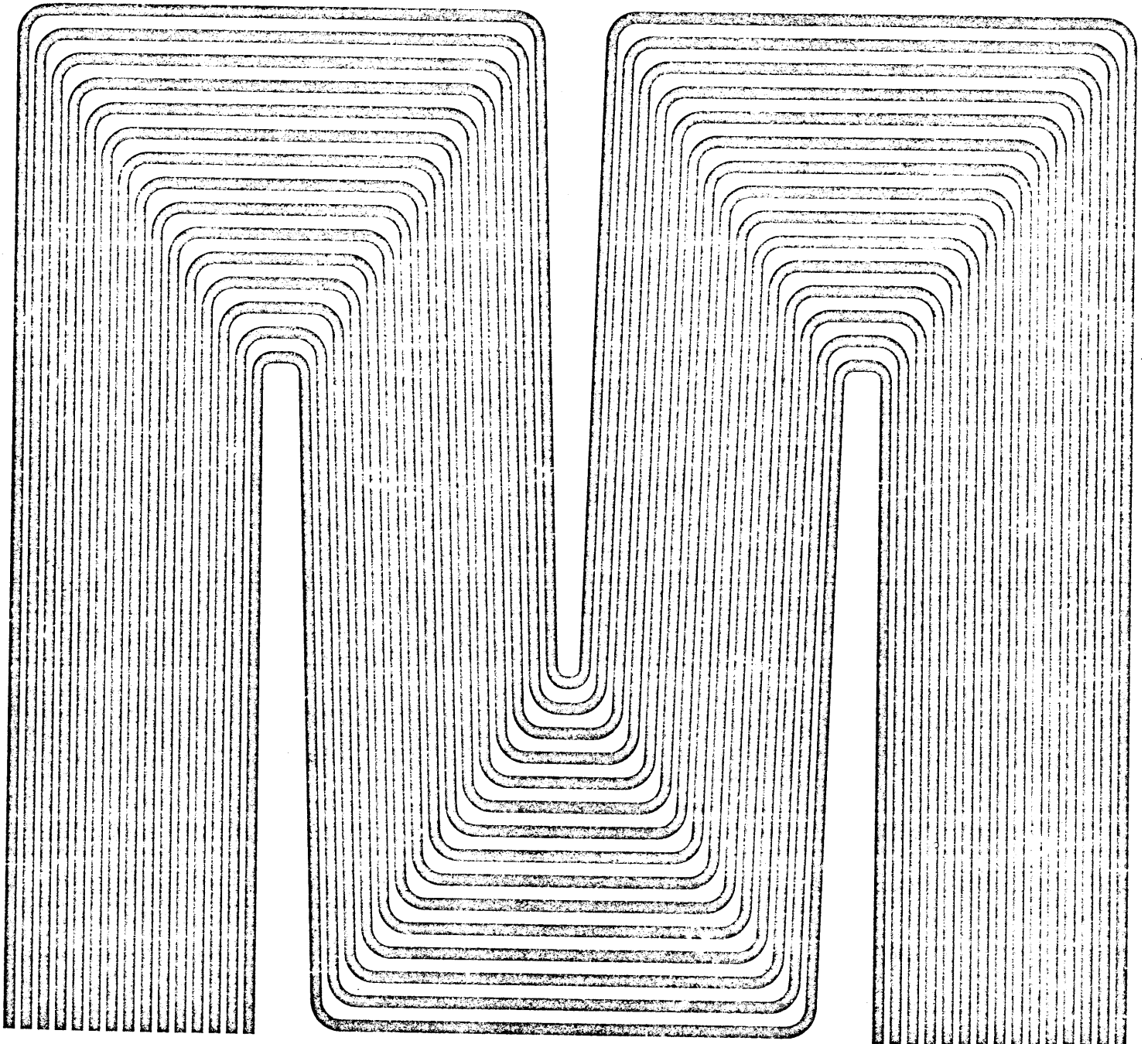


MicroSystems Inc.

Micro 810 Computer

Simulator Operating
System (SOS)

SIM800 Simulator
Program



1. INTRODUCTION

The Simulator Operating System (SOS) is an on-line executive system for controlling the operations of the MICRO 800 simulator (SIM800) and incorporates teletype control of debug, console, and executive functions. The teletype is used rather than any console operations except for the console interrupt, which is used to cause control to return to SOS while the simulator is operating. SIM800 and SOS are always loaded into the MICRO 800 or 811 as a single program because all simulator operations are controlled by SOS.

The following is a list of the features available to the user:

- Display and change the content of a simulated read only memory location.
- Display and change the content of a simulated core memory location.
- Two breakpoints for microprogram debugging.
- Display and change the content of a simulated MICRO 800 element.
- Display the content of all simulated MICRO 800 elements.
- Simulate execution of a microprogram.
- Load a formatted program tape into simulated read only memory.
- Load a formatted tape into simulated core memory.
- Punch the content of simulated read only memory into paper tape.
- Punch the content of simulated core memory into paper tape.

2. INSTRUCTIONS FOR USE

This section provides instructions for using the SOS program.

Loading the SOS and SIM800 by the bootstrap and basic loaders

The SOS is loaded into memory via the basic paper tape loader. This basic loader is in the bootstrap format (1 data byte per frame of tape) and is spliced onto the front of the TOS tape. The splice is made so that the last frame of the loader is followed immediately with the leader of the SOS tape. The microprogrammed bootstrap loader loads the basic loader and transfers control to it. Then the basic loader loads the SOS and, after a successful load, transfers control to the SOS. Following is a procedure for loading a formatted paper tape through the teletype via the bootstrap and basic loaders.

1. Place the TTY in the off-line mode, place the reader control lever to the "free" position and enable the teletype reader. Type control and Q.
2. Place the TTY in the on-line mode and insert the SOS tape in the reader with the first rub-out character at the read station. Set the reader control lever in the stop (center) position.
3. Set the front panel sense switches as follows:
 - Sense switch 1: off for serial TTY interface, on for parallel TTY interface.
 - Sense switch 2: must be off.
 - Sense switch 3: must be off.
 - Sense switch 4: must be on. This selects the bootstrap loader whenever the run switch is selected and was preceded by a reset.

4. Press the reset and the run switches and the system will wait for the teletype reader to be started.
5. Press the TTY reader lever to the start position. When the basic loader is loaded and operating properly, the teletype page printer mechanism will chatter whenever a record separator passes the read station. This is caused by the issuance of reader off and reader on codes between records.

If a checksum error is found, the message 'CE' is typed and the system will halt. Another attempt to properly load the record may be accomplished by backing up the tape to the previous record separator, placing the reader control lever in the stop (center) position, and pressing the run switch on the front console. When the SOS is properly loaded, control will transfer to it, and the teletype bell will ring, and an equal sign will be typed.

Loading the SOS and SIM800 by the R Operator of TOS

Unroll about 30 inches of the program tape to bypass the basic loader and locate the leader (any frame with channel 8 present) of the formatted tape. Insert the tape into the reader with any part of the leader at the read station and set the reader control lever to center position. Typing an R will start the loading. A checksum is calculated for each record loaded and if it doesn't equal the checksum read with the record, the letters "CE" will be typed and control will return to TOS. By backing up the tape to the previous separator and typing an R, another attempt may be made to load the tape.

TOS Operators

All operations which are performed by SOS are initiated by typing a single alphabetic character which designates one of 12 operators. These operators are described in detail in Section 3 and are summarized in Appendix A.

The SOS program is ready to accept an operator designator character at any time after ringing the bell and typing an equal sign. If a character other than a legal operator designator is typed, SOS will reject the character, ring the bell, and type an equal sign again.

NOTE: For the purposes of this manual, all references to the teletype carriage return are shown as; (CR)

Hexadecimal Input/Output

All data and addresses are displayed and entered in hexadecimal. The 16 hexadecimal digits are: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E and F. The hexadecimal values may not

be signed. When entering a two digit memory cell value or a four digit memory address, no spaces or other than hexadecimal characters may be in the digit string. SOS assumes that the hexadecimal digit string is terminated when it receives the first non-hexadecimal character. Therefore, it will not act on an input until the digit string is terminated. If more than the required number of digits are entered, SOS will take the last two or four as required. Leading zero digits need not be typed. If the first non-hexadecimal character is not a space, comma, or carriage return (CR), the data or address value is ignored and the operation is terminated. However, before termination, all valid hexadecimal data or address values that were accepted are retained. When more than one address or data value is typed they may be separated by either a comma or a space. For clarity in this document only commas are shown. When an operator requires an address, it will ignore leading spaces, i.e.,:

W ssss, eeee (CR)

Console Interrupt

The console interrupt is used to interrupt the simulation of a microprogram or to start the computer and bring control to SOS so that teletype control can be exercised. The user should be careful if the simulator is interrupted because complete simulation of the current command may not be complete but the K,L register will be pointing to the next sequential location. The console interrupt address at location 80_{16} is initialized when SOS is loaded.

Halt and Error Returns

If a microcommand halt (1780) is detected, control will return to SOS and an H followed by the content of the K,L register plus one will be typed.

During the simulation of microprograms, various undefined microcommands and system timing violations are checked for and if detected will cause an error return to SOS. The

letter E and a three digit error number will be typed, followed by the content of the K,L register plus one, and control will return to SOS. A list of the error codes and their meaning are contained in Appendix B.

3. OPERATORS

DISPLAY: Dn

The D operation causes the contents of the simulated system element n to be typed out followed by a dash. At this time the contents of the element may be changed by typing in one or two hexadecimal digits. When a comma or space is typed after the data or after the dash, the contents of the next element in sequence will be displayed. The various simulated system elements (n) and their meaning are listed below in sequence. If a (CR) is typed, or if a space or comma is typed after the contents of the panel switches (P) has been displayed, this operator is terminated. All examination must be completed on one line of type.

List of values for "n", in order of their appearance

0 Files 0 through F
.
.
9
A
.
.
F

T T Register
M M Register
N N Register
K (L Register Bits 9,8)
L L Register (Bit 7-0)
U U Register
Z Link flip-flop (1 Bit)
Q R Register (Bits 15-8)
R R Register (Bits 7-0)
S Internal Status Register
I Input bus
O I/O Control Register (3 bits)
P Panel command switches (7-0)

DISPLAY: D (CR)

This mode of the D operator causes all of the simulator system elements to be typed out on two lines. A single space is provided between each element and there is a double space after every fourth element. Sixteen files are contained on line one with thirteen additional elements being displayed on line two in the following manner.

D (CR)

```
00 01 02 03  04 05 06 07  08 09 0A 0B  0C 0D 0E 0F
01 02 03 04  05 06 07 08  09 0A 0B 0C  0D
```

END OF TAPE: E

The E operation punches an end of tape record consisting of a zero record size and an execution address of zero. This ensures that tapes punched by SOS will not contain a load and go address. Following the punching of this record, six inches of trailer will be punched automatically.

GO TO: G ssss, tttt, uuuu (CR)

The G operation causes SOS to set trap operations for read only memory locations tttt and uuuu, and to start simulation at read only memory location ssss. If a (CR) is typed after G, simulation starts at the location contained in the K,L register. If a (CR) is typed after ssss, no traps are set, and if a (CR) is typed after tttt only one trap is set. All traps that are set are automatically cleared when either one is reached or control is transferred to SOS, signalled by the ringing of the teletype bell and the printing of an equal sign. Upon return from a trap, a T, followed by the contents of the K,L registers, is typed out. At this time the command located at the trap location has not been executed. A trap at location zero is not permitted as this value is used by SOS to indicate that a trap has not been set.

INPUT: I

The I operator causes SOS to load a MICRO 800 program tape into simulated read only memory in the same manner as the R operator loads a formatted tape into core memory. The tape may be created by the O operator of SOS or by the MAP800 assembler.

LEADER/TRAILER: L

The L operator will cause the paper tape punching device to punch six inches of tape containing channel eight punches only.

MEMORY: M ssss,

The M operator causes the contents of the simulated memory location specified by ssss to be typed out followed by a dash. At this time the contents of the memory location may be changed by typing in two hexadecimal digits. When a space or comma is typed after the data or after the dash, the contents of the next sequential location is typed by SOS. A (CR) terminates this operator. The actual amount of simulated core memory will vary depending on the size of the actual memory and the amount of simulated read only memory desired. Standard configuration is 768 words of read only memory and 256 bytes of core memory.

OUTPUT: O ssss, eeee (CR)

The O operator causes the contents of the simulated read only storage area starting with ssss and ending with eeee to be written on the standard output device in the same format as with the W operator. Each record will contain 64_{10} commands from read only storage except the last record which will contain a number of commands equal to the total number module 64_{10} . Typing a (CR) following the second address will start the operation.

PRINT ROS: P ssss,

The P operator causes the simulated read only storage address specified by ssss to be typed out on a new line followed by the contents of that location. A dash is typed after the value to indicate that it may be changed by typing in one to four hexadecimal digits. When a space or comma is typed after the new data or after the dash, the next sequential read only storage address and its contents are typed by SOS on a new line. A (CR) terminates this operator.

READ: R

The R operator causes SOS to load a formatted tape into simulated core memory. This operation can be configured for any standard input device, but normally the device will be the teletype paper tape reader. The tape must be inserted in the reader with the leader (any frame with channel 8 present) placed at the read station before the R is typed. When the loader encounters an end of tape record the loading process is terminated and controls are transferred to SOS. If an end of tape record is not read, loading will continue until the computer is halted or until the console interrupt is activated. A checksum is calculated for each record loaded and if it doesn't equal the checksum read with the record, the letters 'CE' will be typed and control will return to SOS. By backing up the tape to the previous separator and typing an R, another attempt may be made to load the tape.

WRITE: W ssss, eeee (CR)

The W operation causes the contents of the simulated memory area starting with ssss and ending with eeee to be written on the standard output device, normally the teletype punch. Each record of the output will contain 128₁₀ data bytes except the last record which will contain a number of bytes equal to the total byte count module 128₁₀. Typing a (CR) following the second address will start the operation.

ZERO FLAGS: Z

The Z operation causes SOS to reset flags used by the simulator for error detection and to simulate the functions performed by the reset switch on the front panel. File zero will be cleared, all internal status bits will be cleared, and the K,L register, I/O control register, and the value of the input bus will be set to zero.

4. PROGRAM TAPE FORMAT

The binary paper tape format, see Figure 1, can be generated by the two pass assembler, and by the output and write subroutines of SOS. This format allows for variable length records of up to 64_{10} sixteen bit microcommands, or 128_{10} eight bit bytes, a record load address, and a record checksum. Each record contains a count of the number of data bytes and the 15 bit address at which data is to be loaded. The record is loaded sequentially starting with this address. When there is a discontinuity in the loading addresses, a new record is started so that a load address may be specified. The last byte of each record is a checksum which is the summation of the byte count, load address, and data bytes formed on an eight bit basis with overflow added into the least significant bit of the sum.

A byte count of zero signifies an end of tape record and if present will be the last record read. The paper tape reader will be stopped and control is returned to SOS.

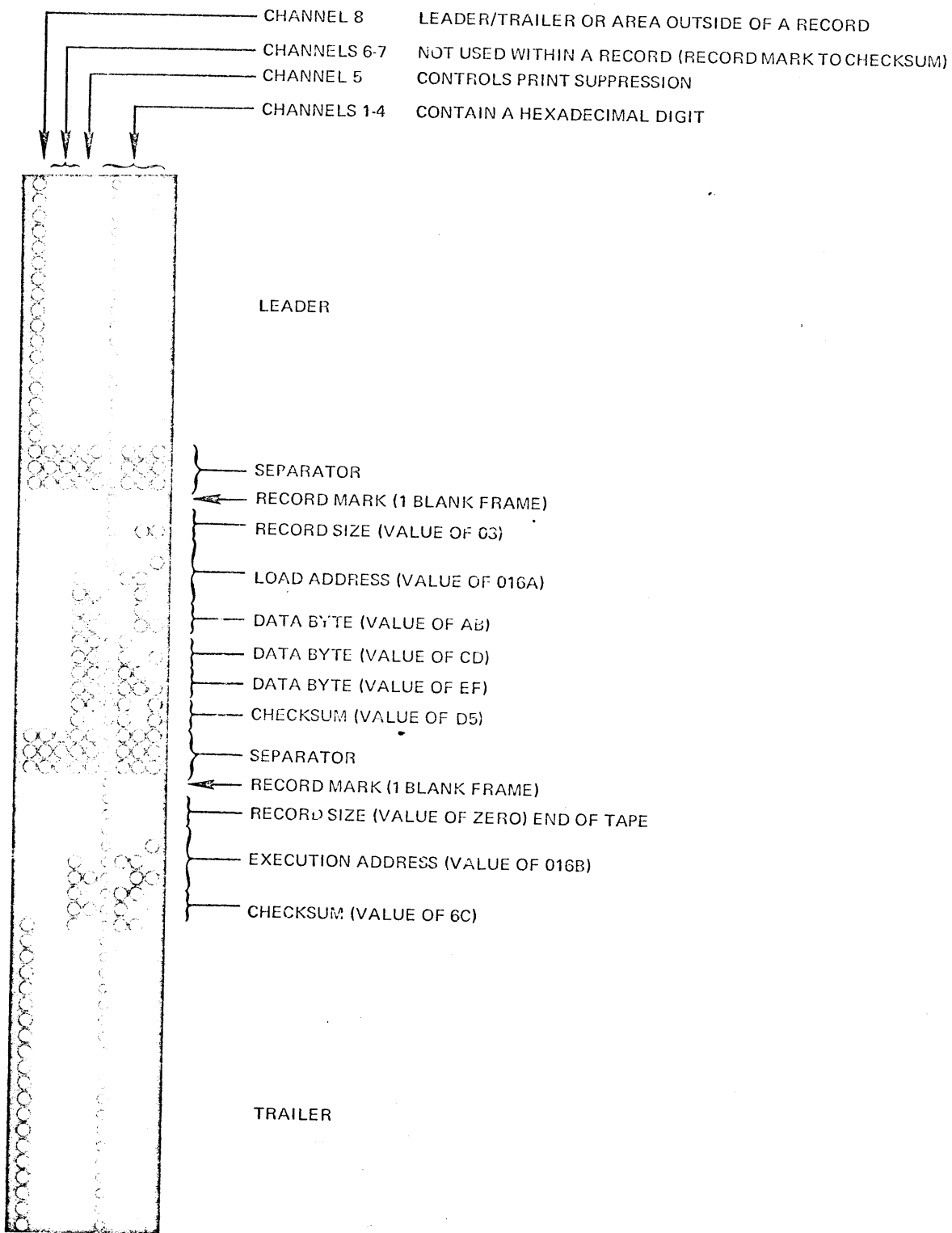


FIGURE 1. BINARY PAPER TAPE FORMAT

APPENDIXES

APPENDIX A

SUMMARY OF SOS OPERATORS

Underlined items are typed out by SOS:

- D1 xx-, xx-nn (CR) Display content of File 1, leave File 1 unaltered and display content of File 2, change the content to nn and terminate the operation.
- D (CR) Display the content of all simulated elements. Line one contains the 16 files and line two contains 13 additional elements.
- E Write an end of tape record into formatted paper tape.
- G (CR) Simulation starts at the location contained in the K,L register.
- G ssss (CR) Simulation starts at location ssss.
- G ssss, tttt (CR) Simulation starts at location ssss, a trap is set for location tttt.
- G ssss, tttt, uuuu (CR) Simulation starts at location ssss, traps are set for locations tttt and uuuu.
- G, tttt (CR) Simulation starts at the location contained in the K,L register, a trap is set for location tttt.
- G, tttt, uuuu (CR) Simulation starts at the location contained in the K,L register, traps are set for locations tttt and uuuu.

APPENDIX A

SUMMARY OF SOS OPERATORS

- I Input a formatted program tape to simulated read only memory. After loading, control returns to SOS.
- L Punch six inches of paper tape leader (channel 8 only)
- M ssss, xx-nn, xx- (CR) Display the contents of simulated memory location ssss and change the contents to nn. Display the contents of location ssss+1, leave the location unaltered and terminate the operation. This operation must be completed on one line of type.
- O ssss, tttt (CR) Output the contents of simulated read only memory from locations ssss through tttt into formatted paper tape.
- P ssss,
ssss xxxx-,
ssss xxxx-nnnn (CR) Print the content of simulated read only memory location ssss, leave the location unaltered and display the content of location ssss+1. Change the content of ssss+1 to nnnn and terminate the operation.
- R Read a formatted paper tape into simulated core memory. After loading, control returns to SOS.
- W ssss, tttt (CR) Write the contents of simulated core locations ssss through tttt into formatted paper tape.
- Z Zero simulator error flags and reset the simulated MICRO 800 system.

APPENDIX B

SIM 800: ERROR MESSAGES

#	Meaning
001	U-Register timing - can't use U during first cycle following its setting.
002	Console command switches - Command preceding 707X control command causes an ROS delay.
003	Memory write full cycle - attempt to set T during second, third or fourth cycle following the memory command.
004	Memory read - T is set without being selected, during the first or second cycle following the memory command.
005	Attempt to load literal with an undefined register destination of 8, 9, A, B, E, or F. Destination 9 is undefined because the memory spare bit option is not simulated.
006	Attempt to load or add literal into file register zero.
007	Attempt to use undefined C-bit combinations 3, 5, or 6 in a control command.
008	Console command switches - file register zero not selected in 707X control command.
009	Address in M and N exceeds available simulated memory.
010	Memory write half cycle - attempt to set T during first or second cycle following the memory command. .
011	Execute command found after U-register OR-ed into instruction.