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The North Star MONITOR

Version 1

Table of Contents

Introduction 2
Limited Warranty 3
Command Format 4
Commands 6
Editing 9
Interrupting the Monitor 11
Hardware Requirements 12
Personalizing the Monitor 13
Example 14

REVISION 1

INTRODUCTION

The North Star Monitor is a program which provides the user with certain maintenance and debugging functions which would normally be provided in a limited way on systems which include a control panel. The Monitor is intended to be used in conjunction with the North Star Disk Operating System (DOS). No license is extended for use of the Monitor in systems without a North Star disk controller board.

Commands to the Monitor are entered via the console using a format consistent with the DOS commands. The console is defined to be the terminal with which the DOS normally communicates - communication is done using the DOS I/O routines. When the Monitor is in command mode, i.e., is ready to accept a command, it will print a > at the beginning of a line on the console. Command editing facilities compatible with the North Star BASIC editing features are included in the Monitor.

The following list summarizes the commands available:

CM - Compare memory block contents
FM - Fill memory block
MM - Move memory block contents
SM - Search memory block
TM - Test memory block
DH - Display memory hexadecimal
DA - Display memory with ASCII interpretation
DS - Display memory and substitute values
JP - Jump to program
OS - Return control to the DOS
IL - Perform initial load from bootstrap PROM
OD - Assign output device number for the Monitor

A detailed description of each command appears in a later section below. All printed output from the Monitor is formatted to fit into sixty-four character lines.

LIMITED WARRANTY

The following limited warranty applies to the North Star Monitor software delivered on diskette. North Star Computers, Inc. warrants that a copy identical to the North Star master copy of the software has been stored on the customer diskette and can be read into computer RAM memory from the diskette by a properly functioning HORIZON computer using the North Star disk controller board and disk drive. If a diskette malfunctions and has not been damaged by the customer and has not been operated with the write-protect tab removed, then North Star will re-write or replace the diskette if it is returned to North Star, prepaid, within three months from date of purchase.

No warranty, expressed or implied, is extended concerning the completeness, correctness, or suitability of the North Star software for any particular application. No consequential damage resulting from use of the software is covered - this warranty is limited to the repair or replacement of the original software diskette.

No action is taken on any command until the command is fully entered and all editing functions are complete (i.e. when a carriage return is typed). Each command is fully checked for syntax errors before any part of the command is performed. Thus, a command aborted because of illegal syntax will have no effect.

The command syntax is quite simple. Each command appears on a single line and begins with a two letter mnemonic name which identifies the command. Upper case (capital) letters must be used for commands. The command name is followed by any required parameters which are separated from the command name and each other by spaces (blanks). Spaces may not appear within a parameter (except within quotation marks as described later). The command is terminated by a carriage return.

Commands may take no parameters or may take one or more of several types of parameters. The parameters required for Monitor commands have the following forms:

number — A number may be any of the following:

1) A hexadecimal number specified by a sequence of one or more hexadecimal digits.

2) A hexadecimal number specified by a sequence of one or more hexadecimal digits followed by the letter H.

3) A decimal number specified by a sequence of one or more decimal digits followed by the letter T.

address — An address is a number in the range from Ø though 65535T (Ø through FFFFH).

block — A block is a contiguous region of memory specified by one of the following:

1) An address alone specifies a one byte block at the given memory address.

2) Two addresses separated by a hyphen (-) specify a block whose first byte is at the first address given and whose last byte is at the second address given (e.g., 2ØØØ-3FFF). The second address may not be less than the first.

3) An address followed by a number separated by a comma specifies a block whose first byte is at the address given and whose length is given by the

number (e.g., 2000,1000). The address of the last byte (address + number - 1) may not exceed 65535T (FFFFH).

byte-value

A byte-value is a parameter whose value fills a single byte. It may be specified by either of two forms:

1) A number in the range 0 though 255T (0 though FFH), or

2) A non-control character in quotation marks (e.g., "A"). A non-control character is any character entered without using the control key or other function keys such as carriage return, line feed, tab, etc.

This section gives a description and example for each Monitor command. An expanded example of the use of the Monitor follows in a later section.

CM block address

Compare the memory area defined by block with the area of the same length starting at address and print the address and contents of all corresponding bytes which are not identical. For example, to compare the contents of the seven bytes starting at 3400H with the seven bytes starting at E385H:
>CM 3400,7 E385

FM block byte-value

Fill each byte of the memory area defined by block with the value specified by the byte-value. For example, to fill the block of memory from 4000H to 5000H with the ASCII blank character:
>FM 4000-5000 " "

MM block address

Move the contents of the memory area defined by block to the corresponding positions in the area of the same size beginning at address. Overlapping areas of memory are allowed and the moves are performed correctly. For example, to move the contents of the one hundred (decimal) byte block starting at address 9000 (decimal) into the area starting at F000H:
>MM 9000T,100T F000

SM block byte-value

Search the area of memory defined by block and print the addresses of all occurrences of the byte-value. For example, to find all bytes in the standard DOS area whose value is one:
>SM 2000-29FF 1

TM block number

Test the memory area defined by block. The number parameter specifies the delay (in seconds) between a write phase of the test and the subsequent verify phase. The delay allows testing memory for failures resulting from gradual decay of data. The number may have a value from 0 to 255T (0 to FFH). For example, to test the 8K memory located at 6000H without delay between the write phase and the verify phase:

>TM 6000H,2000 0

The test operates as follows: Values are written into every

byte in the block (write phase) and then the values are checked (verify phase). In a complete pass, 256 write and verify phases occur, so that every possible value is tested in every byte. The test is designed to catch addressing errors as well as data bit erros. The test requires about 15 seconds per thousand bytes of memory for a complete pass (plus 256 times the delay value). The test will run continuously and can only be halted by typing a control-C. Note that even running the test for a few seconds will perform a quick check on the entire block. After each complete pass, the TM command will print COMPLETE PASS on the terminal. For every memory error detected, the address of the problem is printed in hexadecimal followed by the value stored at that address and the value found at that address.

DH block

Display the contents of the memory area defined by block on the console in a format of two hexadecimal digits per byte with sixteen bytes on each line. For example, to print the contents of memory from 12000 (decimal) to 12099 (decimal) in hexadecimal:
>DH 12000T-100T

DA block

Display the contents of the memory area defined by block in the format of the DH command but with additional lines showing the ASCII character represented by the low order seven bits of each byte positioned immediately under the corresponding hexadecimal digits. A control code is printed as a blank and each character is preceded by a minus-sign if the high order bit of the byte is a one. For example, to print the contents of memory from 12000 (decimal) to 12099 (decimal) in both hexadecimal and as ASCII characters:
>DA 12000T-12099T

DS address

Display the current contents of the memory area starting at address in hexadecimal, one byte at a time, and allow the option of substituting a new value for each byte. After each byte is displayed, if it is desired to modify the contents of the displayed cell, then a new hexadecimal value in the range 0 to FF may be entered. If it is desired to leave the byte unchanged, then type one of the following terminators immediately. Whether or not a new value is entered, the terminator character typed determines the subsequent action:

1) Blank. If a blank is typed then the next byte will be displayed for possible replacement.

2) Comma. If a comma is typed, then the printing of the

next byte is suppressed, and subsequent typing will either replace or leave unmodified that next cell.

3) Carriage return. Typing a carriage return finishes the command and returns to command mode.

Note that the replacement occurs as soon as one of the terminators is typed, so that the line editor may not be used as in other commands. However, a typing error in specifying a new value may be corrected with any of the backspace commands before the terminator is typed. For example, to replace the contents (currently 64H) of the byte at 3233H with a zero (in this example the underlined part is printed by the Monitor):
>DS 3233
3233 64=Ø

JP address

Cause the computer control to jump to the specified address. The Monitor performs a CALL instruction to that address, so that if the program executed at that address later performs a RET and has preserved the stack pointer and not destroyed any of the memory of the Monitor, then control will return to the Monitor for another command. For example, to execute the normal continue location for BASIC:
>JP 2AØ4

OS

Jump to the standard re-entry address of the DOS. This command requires no parameters.

IL

Jump to the bootstrap startup PROM to perform an initial load of the DOS from diskette. This command requires no parameters.

OD number

Set the output device number which is sent to the DOS for Monitor output to number. The value must be in the range of Ø to 7. The output device number is set to zero when the Monitor is entered. When an OD command is executed, the new output device number remains in effect for all output produced by the Monitor until another OD command is typed or the Monitor is re-entered at its initial entry point. For example, to cause output to appear at output device 1:
>OD 1

Command editing provides a facility for easily making corrections to an incorrectly entered command, repetitively executing a command, or entering a series of variations on a command. Editing is always performed using the last command completely typed in as a template which can be modified by inserting, deleting, replacing, or appending new characters or copying old characters from the template. When the Monitor is freshly entered, the template starts out as an empty line.

The editing functions described below include all the control-character editing functions of the North Star BASIC line editor. For those users who do not wish to use these advanced editing features, and for those who do not use a keyboard capable of typing control characters, the elementary commands for character backspace (underline or left-arrow) and line cancel (@) operate as in the DOS and BASIC. Reference to a North Star BASIC manual should be made for an expanded description of the editing features. The following list describes the editing functions which are identical to the BASIC line editor:

Control-G Copy rest of template to the new line.
This command will copy all the characters from the current template position to the end of the template as part of the new line.

Control-A Copy one character from the template.
This command will copy one character from the current position of the template as part of the new line.

Control-O Back up one character.
This command will erase the last character of the new line, and also back up the template position. An under-line (left-arrow on some terminals) will be printed to indicate that this command was typed.

Control-Z Skip one character of the template.
This command is used to ignore undesired characters of the template. A per cent character (%) is printed to indicate that this command was typed.

Control-D Copy up to specified character.
This command requires a second character to be typed before it is executed. The command will copy the contents of the template up to, but not including the next occurrence of the specified character to the new line.

Control-Y Toggle insert mode.
When entering a new line, insert mode is "off". When insert mode is off, then typing normal characters will

replace the corresponding characters of the template. When insert mode is "on", then typing normal characters will add them to the new line but not advance the template position. Thus, insert mode may be used to add some new characters in the middle of the template. A left angle bracket (<) will be printed to indicate entering insert mode, and a right angle bracket (>) will be printed to indicate leaving insert mode. An edit may be finished without actually leaving insert mode. For example, typing control-G after making an edit will complete the edit as if insert mode had been exited.

Control-N Re-edit new line.
This command permits re-editing the new line. The partially complete new line becomes the template for subsequent editing. An at-sign (@) and a return are printed to indicate that this command was typed.

In addition, for those users who have full ASCII console devices, the following standard codes are recognized:

Backspace The ASCII backspace code (also the control-H character) functions like a control-Q but echoes a true backspace character instead of an underline.

Delete The ASCII delete code (rub-out on some keyboards) functions like a control-Z to delete a single character from the current template, except that the delete code is echoed instead of a per cent character.

Cancel The ASCII cancel code (control-X on most keyboards) causes all editing performed since the last completed command entry to be discarded. The template is reset to the contents of the last completed line. This command is similar to control-N, but control-N allows re-editing the current new line, not the old template. A question mark (?) and a return are printed to indicate that this command was typed.

Note that an illegal edit code (any control character not described here) will have no effect other than to output the bell code to the terminal. Note that to check the status of the current line, type control-G (if not already at the end of the line) then a control-N followed by another control-G. This leaves the Monitor ready to execute, re-edit, or cancel the current line.

INTERRUPTING THE MONITOR

Some commands may compute for long periods of time and/or produce substantial amounts of output. The CM (compare memory), SM (search memory), DH (display hexadecimal), DA (display ASCII) and TM (test memory) commands may be interrupted by typing a control-C on the console. This will interrupt the Monitor to allow a new command to be entered.

HARDWARE REQUIREMENTS

Any system operating the North Star DOS and BASIC will execute the Monitor. However, because of its applications, the Monitor is supplied in versions assembled at three different locations. Each version of the Monitor requires 2048 (800H) bytes and has its primary entry point at its origin. The standard versions are:

File name	Origin	Description
M0000	0000H	For systems with memory at origin zero, this version may be in memory along with both DOS and BASIC. It may be re-entered by a simple processor reset.
M2A00	2A00H	This version uses the memory area beginning immediately after the standard DOS. Although this version can not be loaded at the same time as BASIC, it will run on any system which can run the standard version of BASIC.
MF400	F400H	This version is useful for systems which have memory in the F block and which can not conveniently use the address space at zero for the Monitor.

A special fourth version of the Monitor is also supplied:

M5700	5700H	This version of the Monitor is designed primarily for use in testing the RAM memory which normally contains the DOS and Monitor programs. This version of the Monitor is 900H bytes long, and the last 100H bytes contain the standard HORIZON terminal I/O routines. The origin of this version was chosen so that it will reside at the end of a 16K board origined at 2000H. [Note that this version of the Monitor may be conveniently used for personalizing BASIC and the DOS as described in the DOS Manual.]

PERSONALIZING THE MONITOR

The Monitor begins with a series of jump instructions through which it is entered and through which it links to the DOS input/output routines*. If the Monitor is not to be used with a standard-origin DOS, then the appropriate address changes must be made to these jump instructions. Since the Monitor is supplied in several versions, note that the following discussion applies to the version with origin at zero.

Address	Instruction	Purpose
0000H	JMP INIT	This is the initial entry point to the Monitor
0003H	JMP 200DH	Jump to the DOS COUT routine
0006H	JMP 2010H	Jump to the DOS CIN routine
0009H	JMP 2028H	Jump to the DOS re-entry point
000CH	JMP 2016H	Jump to the DOS CONTC routine
000FH	JMP E900H	Jump to the PROM bootstrap address

Please consult the DOS manual for details of the required routines.

Provision has been made for adding as many as four user-defined commands to the Monitor. Approximately 240H bytes after the origin of the Monitor there is a block of seventeen (11H) bytes of zeroes which lies at the end of the Monitor command table. This provides space for adding up to four entries of four bytes each to define user commands and allows for the zero byte which always terminates the command table.

Each command definition requires four bytes: the first pair of bytes contains the two-letter command name. The second pair of bytes contains the address (low-order byte first) of the routine to be called to execute the command. The program to implement the command should preserve the stack pointer and re-enter the Monitor with a RET instruction. No more than 30 bytes should be pushed onto the Monitor stack during execution of the command.

* Except for the M5700 version of the Monitor which has links to the I/O routines in the last 256-byte block (5F00-5FFF).

EXAMPLE

This section will show how the Monitor can be used to modify itself for the addition of a new command. The command will have the name AA, and the code for the command has been generated onto a disk file named CODE, assembled for execution beginning at 800H. The new version of the Monitor will be a version that runs at 0.

*LF M0000 4000	Load the standard version of the origin zero Monitor to RAM.
*LF CODE 4800	Load the code for the new Monitor command immediately after the copy of the Monitor in RAM.
*GO M2A00	Load and execute the standard Monitor.
>SM 4000,800 0	Find the zero block for command table expansion. Locate the first block of seventeen zeroes (assume for this example that the location of the first zero in the block is at address 4241H).
>FM 4241 41 >FM 4242 41 >FM 4244 08	These commands add the command name AA to the command table and set the start address of the code for the command to be 800H.
>OS	Return to the DOS.
*CR NEWMON 10	Create a new file, two blocks larger than the standard Monitor, to contain the modified version of the Monitor.
*TY NEWMON 1 0	Set the type of the new Monitor file to 1 and set the go-address to 0.
*SF NEWMON 4000	Save the expanded new Monitor to disk.
*GO NEWMON	Load and execute the new Monitor
>AA	Test the new command.