



This manual supports the following TEKTRONIX products:

8550 Option	8540 Option	Products
20	20	8550F20 8540F20

This manual supports a software/firmware module that is compatible with:

DOS/50 Version 2 (8550)
OS/40 Version 1 (8540)

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8500
MODULAR MDL SERIES
EXTENDED HEX INTERFACE
USERS MANUAL

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Serial Number _____

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8500 SERIES EXTENDED HEX INTERFACE OPTION

INTRODUCTION

The Extended Hex Interface Option is an option to the TEKTRONIX 8540 Integration Unit and the TEKTRONIX 8550 Microcomputer Development Lab. The Extended Hex Option consists of extensions to your system's existing COM command, and a new command called VH.

In this manual, the term "extended hex software" refers to both the COM extensions and the VH command.

This manual supports both the 8540 version and the 8550 version of the Extended Hex Interface Option. The only difference between the two versions is the medium: the 8540 version is in PROM (Programmable Read-Only Memory), and the 8550 version is on disk. Unless specifically stated otherwise, the discussions in this manual apply to both versions.

The procedures in this manual show you how to install and use the extended hex software.

NOTE

To use the COM extensions with your 8540, you must also have the Communications Interface Package (Option 01) installed.

THE COM COMMAND EXTENSIONS

The COM command extensions allow you to transfer load modules in Intel or Motorola hexadecimal format (in addition to the current Standard and Extended Tekhex formats) between the 8540 (or 8550) and your host computer. Refer to the Intersystem Communication section of your 8540 or 8550 System Users manual for a detailed description of the COM command.

THE VH COMMAND

The new VH command functionally replaces the existing RH command, and provides additional capabilities. The VH command gives you the ability to convert 8-bit or 16-bit hexadecimal code into binary, and load the converted code directly into program or prototype memory. The hexadecimal code can be in Standard Tekhex, Extended Tekhex, Intel, or Motorola hexadecimal format. In addition, VH allows you to load Extended Tekhex symbols.

RELATED MANUALS

You may find the following TEKTRONIX manuals useful:

- 8540 Installation Guide
- 8540 System Users Manual
- 8550 System Users Manual
- 8560 System Users Manual
- 8500 MDL Series 68000 Emulator Specifics Users Manual
- 8500 MDL Series 8086/8088 Emulator Specifics Users Manual

NOTATIONAL CONVENTIONS

The procedures in this manual use the following notational conventions:

- In examples, Underlining identifies a character sequence that is to be entered by you. Explanatory text and messages displayed by the operating systems are not underlined.
- In syntax descriptions, **Boldface** type identifies a character sequence that you must enter exactly as shown. Generally, these character sequences represent command names and options. Parameters that you must supply are not shown in boldface type.

INSTALLING THE EXTENDED HEX SOFTWARE

The following procedures tell you how to install the extended hex software on the 8540 and 8550, and how to let the 8560 know that VH is an 8540 or 8550 command.

8540 INSTALLATION

The PROM that contains the extended hex software must be installed in your 8540 System ROM Board. Your 8540 Installation Guide tells you how to install the PROM.

8550 INSTALLATION

Before you can use the extended hex software, you must install it on your system disk. After this initial installation, the extended hex software will be transferred automatically with each subsequent emulator installation. However, you must install it explicitly in any existing emulator directories.

The following steps show you how to install the extended hex software on your DOS/50 system disk and in any existing emulator directories:

1. Start up your 8550, as described in your 8550 System Users Manual.
2. Insert your system disk in drive 0 and the extended hex software installation disk in drive 1.
3. The extended hex software adds five files, comprising about 16 blocks, to your system disk. Use the DOS/50 L (List directory) command to check the number of free files and free blocks on your system disk. If you do not have enough room, delete some files or get a new system disk. Refer to your 8550 System Users Manual for details.
4. Install the extended hex software on the 8550 system disk, using the following command:

```
> /VOL/HEXLINK/INSTALL
```

The first command in the INSTALL command file, "T,OFF", is displayed before it is executed. This command suppresses subsequent output to your terminal (except error messages) until the installation is complete.

5. After you enter the installation command line, the 8550 responds with a message telling you to ignore certain error messages that have no bearing on the success of the installation. However, if any other error message appears, take the following steps:

-
- a. Make sure that you are using the right disks.
 - b. Make sure that your 8550 system disk is write-enabled.
 - c. Make sure that you have enough room on the system disk. The VH command requires five free files and 16 free blocks.
 - d. Begin the installation procedure again.
6. After approximately five minutes, the installation will complete, and the following message will appear on your terminal screen:

```
*  
* Installation of the Extended Hex Software has been completed.  
*
```

7. If your system disk already has software installed for one or more emulators, then you must also install the extended hex software in each emulator directory, using a command line of the following form:

```
/VOL/HEXLINK/INSTALL emdir
```

where `emdir` is an emulator directory name. For example, the following command line installs the extended hex software in the 8085 emulator directory:

```
> /VOL/HEXLINK/INSTALL 8085
```

After the extended hex software has been installed on your system disk, it will be copied automatically as part of all subsequent emulator installations.

8560 INSTALLATION

If you plan to connect your 8540 (or 8550) to an 8560 and run in TERM mode, you must let the 8560 know that VH is an 8540 or 8550 command. If you do not do this, you will get a "command not found" error when you try to use the VH command in TERM mode.

To link the existing /bin/8540 file on the 8560 to the name /bin/vh, log in to the 8560 as superuser ("root"), and enter the following TNIX commands:

```
# cd /bin <CR>      (move to the /bin directory)  
# ln 8540 vh <CR>   (link the name "vh" to the file "8540")
```

This procedure also identifies VH as an 8550 command because the name /bin/8550 is really just another link to the file /bin/8540.

VERIFYING THE INSTALLATION

The procedure in this discussion verifies that the extended hex software was installed correctly. It also serves to familiarize you with the VH command.

This procedure uses the VH command to enter two hexadecimal records (a data record and a termination record) at the terminal and load them into program memory. The procedure then displays the contents of program memory to verify that the two records were transferred correctly.

1. First, enter the following command line:

```
> vh <CR>
```

Entering the VH command with no parameters indicates that the hexadecimal records will come from the keyboard.

2. Select one of the following three formats. Enter the two records, terminating each one by pressing the RETURN key. These examples assume an 8550. If you have an 8540 connected to an 8560, the prompt will be "\$" instead of ">", and the end-of-file character will be "CTRL-D" instead of "CTRL-Z".

Intel hexadecimal format records:

```
:10000000000102030405060708090A0B0C0D0E0F78 <CR>
:00000001FF <CR>
<CTRL-Z>
>
```

Motorola hexadecimal format records:

```
S1130000000102030405060708090A0B0C0D0E0F74 <CR>
S9030000FC <CR>
<CTRL-Z>
>
```

Tektronix hexadecimal format records:

```
%2768810000102030405060708090A0B0C0D0E0F <CR>
%0781010 <CR>
<CTRL-Z>
>
```

3. Dump the first 16 program memory locations, using the following command line:

```
> d 0 <CR>
      0 1 2 3 4 5 6 7 8 9 A B C D E F
000000 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F .....
>
```

USING THE EXTENDED HEX SOFTWARE

The following discussions describe the COM command extensions, the VH command, and considerations that you should keep in mind when using the extended hex software.

THE COM COMMAND EXTENSIONS

The F parameter to the COM command specifies the message format that the COM command is to use in formatted transfers. The extended hex software adds two new options that allow you to specify whether the Load Module Format is Intel (F=I) or Motorola (F=M).

The COM command is described in detail in the Intersystem Communication section of your 8540 or 8550 System Users Manual.

THE VH COMMAND

The discussions on the next two pages describe the VH command.

SYNTAX

```
vh [-a] [-s] [-g] [-o offset] [sectionname]...
```

PARAMETERS

- a** Add symbols to the end of the existing symbol table. If this parameter is omitted, VH creates a new symbol table, overwriting any existing symbols. Applies to Extended Tekhex only.
- s** Load scalar symbols and symbols that represent addresses. Applies to Extended Tekhex only.
- g** Load global symbols only (no local symbols). Applies to Extended Tekhex only.
- o** Indicates that the first parameter is an offset.
- offset** An expression representing the amount to offset the load address of each data block. The offset parameter does not affect the transfer address. The default offset is 0.
- sectionname** Identifies a section of object code that contains symbols to be loaded. If this parameter is omitted, VH loads symbols from all sections. Applies to Extended Tekhex only.

All parameters except **-o offset** apply to Extended Tekhex format only.

If no parameters are specified, VH reads the hexadecimal code from the standard input into program or prototype memory with no offset.

EXPLANATION

The VH (read Vendor Hexadecimal code) command reads hexadecimal object code from standard input, converts the code to binary, and loads the binary code into program or prototype memory. Each block is loaded into memory starting at the load address plus any offset amount specified in the command line. The emulation mode and the memory map assignments (EM and MAP command settings) determine whether the load address refers to program memory or prototype memory.

The VH command terminates when it detects the end of the file, not when it reads an EOF record. If you are entering the file at the keyboard, you must indicate the end of the file by entering a CTRL-Z (8550) or CTRL-D (8560).

The format of the hexadecimal code (Standard Tekhex, Extended Tekhex, Intel, or Motorola) is specified in the code (i.e., VH knows what it is reading).

The VH command loads program symbols only for Extended Tekhex. The discussion "Tektronix Considerations" lists considerations to keep in mind when loading Extended Tekhex symbols.

EXAMPLES

```
> vh -o 100 <prog.ihex
```

This example reads the Intel-formatted hexadecimal object code from the file prog.ihex, converts it to binary, and loads it into program/prototype memory. The command also adds 100 to each load address. For example, if the load address specified by a data block is 100, the data block is loaded at location 200.

GENERAL CONSIDERATIONS

When using the extended hex software, you should keep the following considerations in mind:

- All file transfers should be done with handshaking ON (controlled by the COM command's HS parameter). When handshaking is OFF, COM does not verify that the data was transferred correctly.
- During formatted transfers (both uploads and downloads), COM displays an asterisk (*) each time a message block is transmitted successfully, and an underscore (_) each time a message block is not transmitted successfully.
- When handshaking is ON, COM retries an unsuccessful transmission. If the block itself is bad (i.e., the unsuccessful transmission was not due to a transmission error), COM will continue to retransmit the bad block, printing an underscore with each transmission. You can abort the transfer by pressing the BREAK key twice. You can exit COM by entering the null character (CTRL-@) followed by the ESC key.
- Before loading a hexadecimal module, make certain that program memory has been allocated for each code segment or block. Refer to the AL (Allocate) command in your 8540 or 8550 System Users Manual.
- On downloads, the extended hex software (both COM and VH) cannot read hexadecimal records that are greater than 256 characters in length (including the End of Line character).
- On uploads (COM only), the default record size for Intel and Motorola records varies, but is never more than 80 characters (including the End of Line character).
- For the purposes of calculating the checksum, lowercase letters (a-f) appearing in hexadecimal data records are treated as uppercase letters (A-F).
- The VH command can download files that contain multiple formats (any combination of Intel, Motorola, Standard Tekhex, and Extended Tekhex records). In this case, the transfer address will be set to the last transfer address that VH sees.

Intel Considerations

In general, the extended hex software supports the following Intel Record Types (refer to your Intel manuals for details on each of these record types):

- Type 00 - Data Record
- Type 01 - End of File Record
- Type 02 - Extended Address Record
- Type 03 - Start Address Record

However, the following considerations apply to Intel files:

- When downloading Intel hexadecimal records for the 8086 into program or prototype memory, VH does not set up the CS or IP registers. You must set the CS and IP registers explicitly, using the S (Set) and G (Go) commands. For example, suppose you have used the VH command to read an 8086 hexadecimal program into memory, and you want to start execution at location 4060. Recall that the address where execution begins is calculated as " $10 * \langle CS \rangle + \langle IP \rangle$ ", where $\langle CS \rangle$ and $\langle IP \rangle$ are the contents of the CS and IP registers, respectively. Therefore, to start execution at location 4060, you enter the following commands:

```
> S CS=400 <CR>      (to set the CS register to 400)
> G 60 <CR>          (to set the IP register to 60 and start execution)
```

- On uploads, COM does not generate a Start Address Record (type 03) unless you specify a transfer address in the command line, in which case the CS and IP values are calculated as follows:
 1. The last four hexadecimal digits (16 bits) of the transfer address are used as the value of "IP".
 2. The value of IP is subtracted from the transfer address. The result is then shifted to the right one hexadecimal digit (4 bits) and used as the value of CS.
- If there is no Start Address Record (type 03), as is the case with 8085 hexadecimal records, VH uses the value in the ZEROES field of the End of File Record (type 01) as the transfer address.
- The End of File Record (type 01) generated during uploads does not contain a transfer address.

Motorola Considerations

In general, the extended hex software supports the following Motorola Record Types (refer to your Motorola manuals for details on each of the record types):

- S0 - header record for each block of data
- S1 - data and 16-bit address at which data is to reside (the "load address")
- S2 - data and 24-bit load address
- S3 - data and 32-bit load address
- S5 - number of records transmitted in a particular block
- S7 - termination record for a block of S3 records; may optionally contain a 32-bit address to which control is transferred (transfer address)
- S8 - termination record for a block of S2 records; may optionally contain a 24-bit transfer address
- S9 - termination record for a block of S1 records; may optionally contain a 16-bit transfer address

However, the following considerations apply to Motorola files:

- On uploads, S0 records never contain data. On downloads, S0 records are ignored.
- On uploads, COM does not generate an S5 record. On downloads, existing S5 records are ignored.
- On uploads, COM does not generate S3 and S7 records unless the address specified in the command line included a memory space designation (i.e., SC:100). If no memory space was specified, COM generates the appropriate S1, S2, S8, and S9 records.
- The VH command interprets the upper eight bits of 32-bit addresses contained in Motorola S3 and S7 records as the memory space byte. Refer to your TEKTRONIX 8500 MDL Series 68000 Emulator Specifics Users Manual for details.
- If no transfer address is specified in the command line, COM generates an S9 record with the transfer address field set to zero. If you specify a transfer address that is less than 64K, COM generates an S9 record. If you specify a transfer address that is greater than 64K, COM generates an S8 record. If you specify a transfer address that contains a memory space designation, COM generates an S7 record.

Tektronix Considerations

When loading Extended Tekhex symbol records, the following considerations apply:

- The VH command does not verify that the address values of symbols are within the address range of the section defined to contain them.
- The VH command does not verify that only one section definition exists for a group of symbols.
- The VH command does not verify that symbol names are defined only once within the same section.
- When you select the -A option, VH does not check for duplicate entries in the symbol table. Therefore, it is possible to load the same symbol more than once.
- Symbolic debug (on the 8540 and 8550) does not distinguish between uppercase and lowercase characters. For example, the label "loop" is considered identical not only to the label "LOOP", but to other variations (LoOp, LOp, etc.) as well.

You should take care to avoid these situations as the results are unpredictable.

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