HP 64756/7

70136/70236 Emulator PC Interface

User's Guide

HEWLETT PACKARD

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Notice

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Using this Manual

This manual covers the following emulators as used with the PC Interface.

- HP 64756F 70136 emulator
- HP 64757F 70236 emulator
- HP 64757G 70236A emulator

For the most part, the 70136, 70236 and 70236A emulators all operate the same way. Differences between the emulators are described where they exist. All of the 70136, 70236 and 70236A emulators will be referred to as the "70136 emulator" in this manual where they are alike. In the specific instances where 70236 or 70236A emulator differs from the 70136 emulator, it will be referred as the "70236 emulator" or "70236A emulator".

This manual:

- Shows you how to use emulation commands by executing them on a sample program and describing their results.
- Shows you how to use the emulator in-circuit (connected to a target system).
- Shows you how to configure the emulator for your development needs. Topics include: restricting the emulator to real-time execution, selecting a target system clock source, and allowing the target system to insert wait states.

This manual will not:

- Show you how to use every PC Interface command and option. The PC Interface is described in the *HP 64700 Emulator's PC Interface: User's Reference.*

Organization

Chapter 1	**"Introduction"-**This chapter lists the 70136 emulator features and describes how they can help you in developing new hardware and software.
Chapter 2	**"Getting Started"-**This chapter shows you how to use emulation commands by executing them on a sample program. This chapter describes the sample program and how to:

- load programs into the emulator
- map memory
- display and modify memory
- display registers
- step through programs
- run programs
- set software breakpoints
- search memory for data
- use the analyzer

Chapter 3	**"In-Circuit Emulation"-**This chapter shows you how to plug the emulator into a target system, and how to use the "in-circuit" emulation features.
Chapter 4	**"Configuring the Emulator"-**You can configure the emulator to adapt it to your specific development needs. This chapter describes the emulator configuration options and how to save and restore particular configurations.
Chapter 5	**"Using the Emulator"-**This chapter describes emulation topics that are not covered in the "Getting Started" chapter (for example, coordinated measurements and storing memory).
Appendix A.	**"File Format Reader"-**This appendix describes how to use the File Format Reader from MS-DOS or PC Interface, load absolute files into the emulator, use global and local symbols with the PC Interface.

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Introduction to the 70136 Emulator

Introduction

The topics in this chapter include:

- Purpose of the emulator
- Features of the emulator
- Limitations and Restrictions of the emulator

Purpose of the Emulator

The 70136 emulator is designed to replace the 70136 microprocessor in your target system to help you debug/integrate target system software and hardware. The emulator performs just like the processor which it replaces, but at the same time, it gives you information about the bus cycle operation of the processor. The emulator gives you control over target system execution and allows you to view or modify the contents of processor registers, target system memory, and I/O resources.

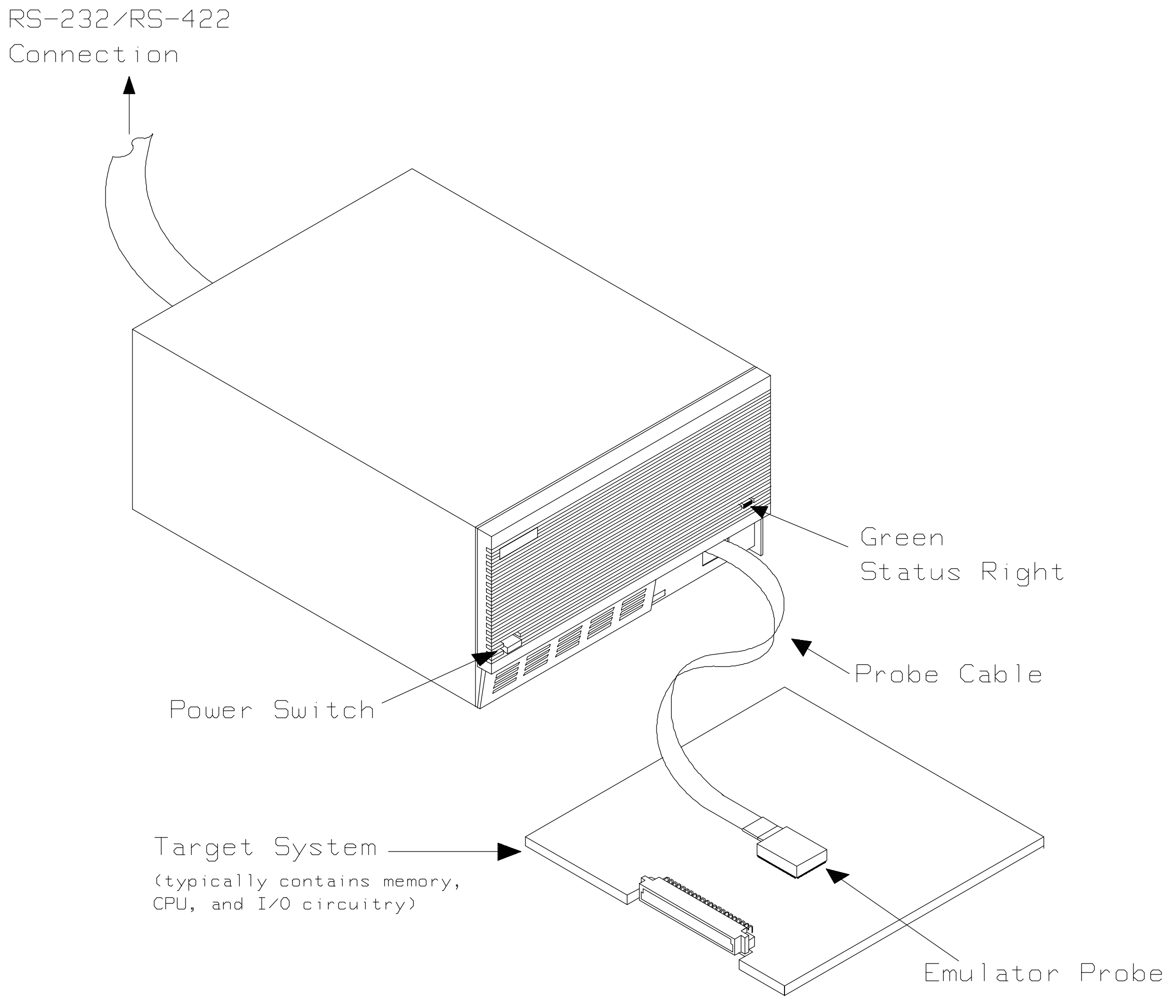


Figure 1-1. HP 64756/7 Emulator for uPD70136/70236

Features of the 70136 Emulator

This section introduces you to the features of the emulator. The chapters which follow show you how to use these features.

Supported Microprocessors

The 70136 emulator probe has a 68-pin PLCC connector. Also provided is the adapter, HP PART No. 64756-61612, that will allow the PLCC probe to connect to the NEC EV-9200G-74 socket which replaces the 74-pin QFP package of 70136 microprocessor.

The HP 64756 emulator supports the following packages of 70136 microprocessor.

- 68-pin PLCC
- 68-pin PGA
  (With using PLCC to PGA adapter; refer to the "In-Circuit Emulation Topics" chapter in this manual)
- 74-pin QFP
  (With using PLCC to QFP adapter (HP PART No. 64756-61612) and NEC EV-9200G-74 socket)

The 70236 and 70236A emulator probe has an 132-pin PGA connector. Also provided is the NEC EV-9500GD-120 adapter that will allow the PGA probe to connect to the NEC EV-9200GD-120 socket which replaces the 120-pin QFP package of 70236 microprocessor.

The HP 64757 emulator supports the following packages of 70236 or 70236A microprocessor.

- 132-pin PGA
- 120-pin QFP
  (With using NEC EV-9500GD-120 adapter and NEC EV-9200GD-120 socket)

Clock Speeds

The 70136 emulator runs with an internal clock speed of 16 MHz (system clock), or with target system clocks from 2-16 MHz.

The 70236 emulator runs with an internal clock speed of 16 MHz (system clock), or with target system clocks from 4-32 MHz.

The 70236A emulator runs with an internal clock speed of 16 MHz (system clock), or with target system clocks from 4-40 MHz.

Emulation memory

The HP 70136 emulator is used with one of the following Emulation Memory Cards.

- HP 64726 128K byte Emulation Memory Card
- HP 64727 512K byte Emulation Memory Card
- HP 64728 1M byte Emulation Memory Card
- HP 64729 2M byte Emulation Memory Card

You can define up to 16 memory ranges (at 256 byte boundaries and at least 256 byte in length). The monitor occupies 4K bytes leaving 124K, 508K, 1020K or 2044K bytes of emulation memory which you may use.You can characterize memory ranges as emulation RAM, emulation ROM, target system RAM, target system ROM, or guarded memory. The emulator generates an error message when accesses are made to guarded memory locations. You can also configure the emulator so that writes to memory defined as ROM cause emulator execution to break out of target program execution.

Analysis

The HP 70136 emulator is used with one of the following analyzers which allows you to trace code execution and processor activity.

- HP 64704 80-channel Emulation Bus Analyzer
- HP 64703 64-channel Emulation Bus Analyzer and 16-channel State Timing Analyzer

The HP 70236/70236A emulator is used with one of the following analyzers which allows you to trace code execution and processor activity.

- HP 64704 80-channel Emulation Bus Analyzer
- HP 64703 64-channel Emulation Bus Analyzer and 16-channel State Timing Analyzer
- HP 64794A/C/D Deep Emulation Bus Analyzer

When you use the HP 70236A emulator over 16MHz, you have to use the HP 64794 Deep Emulation Bus Analyzer.

The Emulation Bus Analyzer monitors the emulation processor using an internal analysis bus. The HP 64703 64-channel Emulation Bus Analyzer and 16-channel State/Timing Analyzer allows you to probe up to 16 different lines in your target system.

Registers

You can display or modify the 70136 internal register contents.

Single-Step

You can direct the emulation processor to execute a single instruction or a specified number of instructions.

Breakpoints

You can set up the emulator/analyzer interaction so that when the analyzer finds a specific state, emulator execution will break to the background monitor.

You can also define software breakpoints in your program. The emulator uses one of 70136 undefined opcode (F1 hex) as software breakpoint interrupt instruction. When you define a software breakpoint, the emulator places the breakpoint interrupt instruction (F1 hex) at the specified address; after the breakpoint interrupt instruction causes emulator execution to break out of your program, the emulator replaces the original opcode.

Reset Support

The emulator can be reset from the emulation system under your control, or your target system can reset the emulation processor.

Configurable Target System Interface

You can configure the emulator so that it honors target system wait requests when accessing emulation memory. You can configure the emulator so that it presents cycles to, or hides cycles from, the target system when executing in background.

Foreground or Background Emulation Monitor

The emulation monitor is a program that is executed by the emulation processor. It allows the emulation controller to access target system resources. For example, when you display target system memory, it is the monitor program that executes 70136 instructions which read the target memory locations and send their contents to the emulation controller.

The monitor program can execute in *foreground*, the mode in which the emulator operates as would the target processor. The foreground monitor occupies processor address space and executes as if it were part of the target program.

The monitor program can also execute in *background*, the emulator mode in which foreground operation is suspended so that emulation processor can be used to access target system resources. The background monitor does not occupy any processor address space.

Real-Time Operation

Real-time operation signifies continuous execution of your program without interference from the emulator. (Such interference occurs when the emulator temporarily breaks to the monitor so that it can access register contents or target system memory or I/O.)

You can restrict the emulator to real-time execution. When the emulator is executing your program under the real-time restriction, commands which display/modify registers, display/modify target system memory or I/O, or single-step are not allowed.

Easy Products Upgrades

Because the HP 64700 Series development tools (emulator, analyzer, LAN board) contain programmable parts, it is possible to reprogram the firmware and some of the hardware without disassembling the HP 64700A/B Card Cage. This means that you'll be able to update product firmware, if desired, without having to call an HP field representative to your site.

Limitations, Restrictions

DMA Support

In the 70136 Emulator, Direct memory access to the emulation memory by DMA controller is not permitted.

In the 70236 and the 70236A Emulator, Direct memory access to the emulator by external DMA controller is not permitted.

User Interrupts

If you use the background monitor in the 70136 emulator, interrupts are suspended or ignored during background operation. NMI is suspended until the emulator goes into foreground operation. INT interrupt is ignored.

If you use the background monitor in the 70236 and the 70236A emulator, interrupts from target system are suspended during background operation. NMI, and INTP0-INTP7 are suspended until the emulator goes into foreground operation.

Interrupts While Executing Step Command

While executing user program code in stepping in the foreground monitor, interrupts are accepted if they are enabled in the foreground monitor program. When using the foreground monitor you will see the following error message, if the interrupts are acknowledged before stepping user program code.

```
ERROR: Stepping failed
```

Although the error message above appears, the code is executed as you expected to do.

Accessing Internal I/O Registers

When you access internal I/O registers of the emulator, you should use the "display/modify register" command with their register name instead of the "display/modify io_port" command.

PC relative addressing in trace list

When you use the following setting in your program, the branch address forming in PC relative addressing may change to a wrong value only in disassemble list.

- The program is running in the extended address mode.
- The effective address for the PC relative addressing is in the other page.
- The order of the pages is not in sequence in extended address.

"BRKXA" and "RETXA" Instructions in Stepping

When the "BRKXA" and "RETXA" instructions are executed in stepping, the emulator reads memory for disassembly after stepping. When you execute "BRKXA" instruction in stepping, the normal address where the "BRKXA" instruction is located is extended to read memory for disassemble after stepping.
When you execute "RETXA" instruction in stepping, the normal address which is extended to point the "RETXA" instruction is not extended to read memory for disassemble after stepping.

Stepping at Software Breakpoint

When you execute step commands in the foreground monitor, you should not step at the address which the "Software Breakpoint" was set; the stepping will be failed.

```
ERROR: Stepping failed
```

Evaluation Chip

Hewlett-Packard makes no warranty of the problem caused by the 70136/70236/70236A Evaluation chip in the emulator.

2

Getting Started

Introduction

This chapter leads you through a basic tutorial that shows how to use the 70136 emulator with the PC Interface.

This chapter will:

- Tell you what to do before you use the emulator in the tutorial.
- Describe the sample program used for this chapter's examples.
- Briefly describe how to enter PC Interface commands and how emulator status is displayed.

This chapter will show you how to:

- Start up the PC Interface from the MS-DOS prompt.
- Define (map) emulation and target system memory.
- Load programs into emulation and target system memory.
- Enter emulation commands to view sample program execution.

Before You Begin

Prerequisites

Before beginning the tutorial presented in this chapter, you must have completed the following tasks:

1. Connected the emulator to your computer. The HP 64700 Series Installation/Service manual shows you how to do this.

2. Installed the PC Interface software on your computer. Software installation instructions are shipped with the media containing the PC Interface software. The *HP 64700 Emulators PC Interface: User's Reference* manual contains additional information on the installation and setup of the PC Interface.

3. In addition, it is recommended, although not required, that you read and understand the concepts of emulation presented in the *Concepts of Emulation and Analysis* manual. The *Installation/Service* also covers HP 64700 Series system architecture. A brief understanding of these concepts may help avoid questions later.

The sample program

The sample program used in this chapter is listed in figure 2-1. The program emulates a primitive command interpreter.

programs;for getting started

We will show you how to use the emulator to:

- load this program into emulation memory
- execute the program
- monitor the program's operation with the analyzer
- simulate entry of different commands using the **M**emory **M**odify emulation command.

```
LOCATION OBJECT CODE LINE     SOURCE LINE

                        1 "70116"
                        2                GLB     Msgs,Init,Cmd_Input,Msg_Dest
                        3
                        4                DATA
    0000                5 Msgs
    0000 436F6D6D61     6 Msg_A          DB      "Command A entered "
    0005 6E64204120
    000A 656E746572
    000F 656420
    0012 436F6D6D61     7 Msg_B          DB      "Command B entered "
    0017 6E64204220
    001C 656E746572
    0021 656420
    0024 496E76616C     8 Msg_I          DB      "Invalid Command   "
    0029 696420436F
    002E 6D6D616E64
    0033 202020
    0036                9 End_Msgs
                       10
                       11                PROG
                       12                ASSUME  DS0:DATA,DS1:COMN
                       13 *****************************************************
                       14 * The following instructions initialize segment
                       15 * regsiters and set up the stack pointer.
                       16 *****************************************************
    0000 B80000        17 Init           MOV     AW,SEG Msg_A
    0003 8ED8          18                MOV     DS0,AW
    0005 B80000        19                MOV     AW,SEG Cmd_Input
    0008 8EC0          20                MOV     DS1,AW
    000A 8ED0          21                MOV     SS,AW
    000C BC00F9        22                MOV     SP,OFFSET Stk
                       23 *****************************************************
                       24 * Clear previous command
                       25 *****************************************************
    000F 26C6060000    26 Rrad_Cmd       MOV     Cmd_Input,#0
    0014 0090
                       27 *****************************************************
                       28 * Read command input byte.  If no command has been
                       29 * entered, continue to scan for command input.
                       30 *****************************************************
    0016 26A00000      31 Scan           MOV     AL,Cmd_Input
    001A 3C00          32                CMP     AL,#0
    001C 74F8          33                BE      Scan
                       34 *****************************************************
                       35 * A command has been entered.  Check if it is
                       36 * command A, command B, or invalid.
                       37 *****************************************************
    001E 3C41          38 Exe_Cmd        CMP     AL,#41H
    0020 7407          39                BE      Cmd_A
    0022 3C42          40                CMP     AL,#42H
    0024 740C          41                BE      Cmd_B
    0026 E91200        42                BR      Cmd_I
                       43 *****************************************************
                       44 * Command A is entered.  CW = the number of bytes in
                       45 * message A.  BP = location of the message.  Jump to
```

Figure 2-1. Sample Program Listing

```
                      * the routine which writes the message.
                      ******************************************************
0029 B91200           Cmd_A           MOV     CW,#Msg_B-Msg_A
002C BE0000                           MOV     IX,OFFSET Msg_A
002F E90F00                           BR      Write_Msg
                      ******************************************************
                      * Command B is entered.
                      ******************************************************
0032 B91200           Cmd_B           MOV     CW,#Msg_I-Msg_B
0035 BE0012                           MOV     IX,OFFSET Msg_B
0038 E90600                           BR      Write_Msg
                      ******************************************************
                      * An invalid command is entered.
                      ******************************************************
003B B91200           Cmd_I           MOV     CW,#End_Msgs-Msg_I
003E BE0024                           MOV     IX,OFFSET Msg_I
                      ******************************************************
                      * Message is written to the destination.
                      ******************************************************
0041 BF0001           Write_MSG       MOV     IY,OFFSET Msg_Dest
0044 F3A4                             REP MOVBKB
                      ******************************************************
                      * The rest of the destination area is filled
                      * with zeros.
                      ******************************************************
0046 C60500           Fill_Dest       MOV     BYTE PTR [IY],#0
0049 47                               INC     IY
004A 81FF0021                         CMP     IY,#Msg_Dest+20H
004E 75F6                             BNE     Fill_Dest
                      ******************************************************
                      * Go back and scan for next command
                      ******************************************************
0050 EBBD                             BR      Read_Cmd

                                      COMN
                      ******************************************************
                      * Command input byte.
                      ******************************************************
0000                  Cmd_Input       DBS     1
                      ******************************************************
                      * Destination of the command message.
                      ******************************************************
0001                  Msg_Dest        DDS     3EH
00F9                  Stk             DWS     1       ; Stack area.
         <0000>                       END     Init
```

Figuer 2-1. Sample Program Listing (Cont’d)

Data Declarations

The "DATA" section defines the messages used by the program to respond to various command inputs. These messages are labeled **Msg_A**, **Msg_B**, and **Msg_I**.

Initialization

The program instructions from the **Init** label to the **Read_Cmd** label perform initialization. The segment registers are loaded and the stack pointer is set up.

Reading Input

The instruction at the **Read_Cmd** label clears any random data or previous commands from the **Cmd_Input** byte. The **Scan** loop continually reads the **Cmd_Input** byte to look for a command (a value other than 0 hex).

Processing Commands

When a command is entered, the instructions from **Exe_Cmd** to **Cmd_A** decide whether the command was "A", "B", or an invalid command.

If the command input byte is "A" (ASCII 41 hex), execution transfers to the instructions at **Cmd_A**.

If the command input byte is "B" (ASCII 42 hex), execution transfers to the instructions at **Cmd_B**.

If the command input byte is neither "A" nor "B", an invalid command was entered, and execution transfers to the instructions at **Cmd_I**.

The instructions at **Cmd_A**, **Cmd_B**, and **Cmd_I** each load register CW with the displayed message's length and register IX with the message's starting location. Then, execution transfers to **Write_Msg**, which writes the appropriate message to the destination location, **Msg_Dest**.

After the message is written, the instructions at **Fill_Dest** fill the remaining destination locations with zeros. (The entire destination area is 20 hex bytes long.) Then, the program jumps back to read the next command.

The Destination Area

The "COMN" section declares memory storage for the command input byte, the destination area, and the stack area.

Assembling and Linking the Sample Program

The sample program is written for the HP 64853 Cross Assembler/Linker.

Use the following command to assemble and link the sample program.

```
C> asm -oe cmd_rds.s > cmd_rds.o <RETURN>


C> lnk -o > cmd_rds.m <RETURN>

object files  cmd_rds.R <RETURN>
library files   <RETURN>
Load addresses: PROG,DATA,COMN 400H,600H,800H <RETURN>
more files (y or n)  N <RETURN>
absolute file name  cmd_rds.X <RETURN>
```

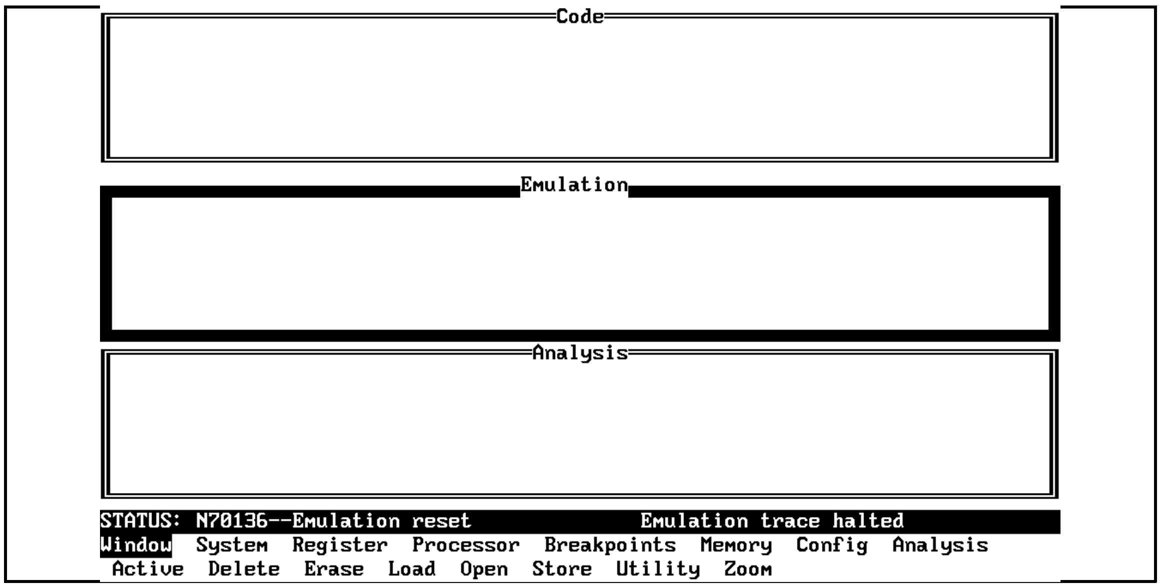
Starting Up the 70136 PC Interface

If you built the emulator device table and set the **HPTABLES** shell environment variable as shown in the *HP 64700 Emulators PC Interface: User's Reference*, you can start up the 70136 PC Interface by entering the following command from the MS-DOS prompt:

```
    C> pcv33 <emulname>
```

where <emulname> is **emul_com1** if your emulator is connected to the COM1 port or **emul_com2** if it is connected to the COM2 port. If you edited the \hp64700\tables\64700tab file to change the emulator name, substitute the appropriate name for <emulname> in the above command.

In the command above, **pcv33** is the command to start the PC Interface; "<emulname>" is the logical emulator name given in the emulator device table. (To start the version of the PC Interface that supports external timing analysis, substitute **ptv33** for **pcv33** in this command.) If this command is successful, you will see the display shown in figure 2-2. Otherwise, you will see an error message and return to the MS-DOS prompt.



```
STATUS: N70136--Emulation reset              Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Active  Delete  Erase  Load  Open  Store  Utility  Zoom
```

Figure 2-2. PC Interface Display

Selecting PC Interface Commands

This manual will tell you to "select" commands. You can select commands or command options by using the left and right arrow keys to highlight the option. Then press the **Enter** key. Or, you can simply type the first letter of that option. If you select the wrong option, press the **ESC** key to retrace the command tree.

When a command or option is highlighted, the bottom line of the display shows the next level of options or a short message describing the current option.

Emulator Status

The emulator status is shown on the line above the command options. The PC Interface periodically checks the status of the emulator and updates the status line.

Mapping Memory

The 70136 emulator contains high-speed emulation memory (no wait states required) that can be mapped at a resolution of 256 bytes.

Note

When you use the NEC uPD72291 coprocessor on your target system connected to 70136 microprocessor, the uPD72291 can access 70136 emulation memory on coprocessor memory read/write cycles. In this case, you should reset the target system to connect the 70136 emulator to the uPD72291 coprocessor before starting emulation session.

Refer to "In-Circuit Emulation Topics" chapter for more information about accesses to emulation memory.

The memory mapper allows you to characterize memory locations. It allows you specify whether a certain range of memory is present in the target system or whether you will be using emulation memory for that address range. You can also specify whether the target system memory is ROM or RAM, and you can specify that emulation memory be treated as ROM or RAM.

Note

Target system accesses to emulation memory are not allowed. Target system devices that take control of the bus (for example, DMA controllers) cannot access emulation memory.

Blocks of memory can also be characterized as guarded memory. Guarded memory accesses will generate "break to monitor" requests. Writes to ROM will generate "break to monitor" requests if the "Enable breaks on writes to ROM?" configuration item is enabled (see the "Configuring the Emulator" chapter).
The memory mapper allows you to define up to 16 different map terms.

Which Memory Locations Should Be Mapped?

Typically, assemblers generate relocatable files and linkers combine relocatable files to form the absolute file. The linker load map listing will show what locations your program will occupy in memory. For example, the HP 64853 linker load map listing for the sample program is shown in figure 2-3.

```
HP 64000+ Linker


FILE/PROG NAME              PROGRAM    DATA       COMMON     ABSOLUTE
-----------------------------------------------------------------------
CMD_RDS.R                   00000400   00000600   00000800

next address                00000452   00000636   000008FB
XFER address = 00000400  Defined by CMD_RDS.R
Absolute file name = CMD_RDS.X
Total number of bytes loaded = 00000183
```

Figure 2-3. Sample Program Load Map Listing

From the load map listing, you can see that the sample program occupies locations in three address ranges. The program area, which contains the opcodes and operands which make up the sample program, occupies locations 400 hex through 451 hex. The data area, which contains the ASCII values of the messages the program displays, is occupies locations 600 hex through 635 hex. The destination area, which contains the command input byte and the locations of the message destination and the stack, occupies locations 800 hex through 8FA hex.

Two mapper terms will be specified for the example program. Since the program writes to the destination locations, the mapper block containing the destination locations should not be characterized as ROM memory.

To map memory for the sample program, select:

```
Config, Map, Modify
```

Using the arrow keys, move the cursor to the "address range" field of term 1. Enter:

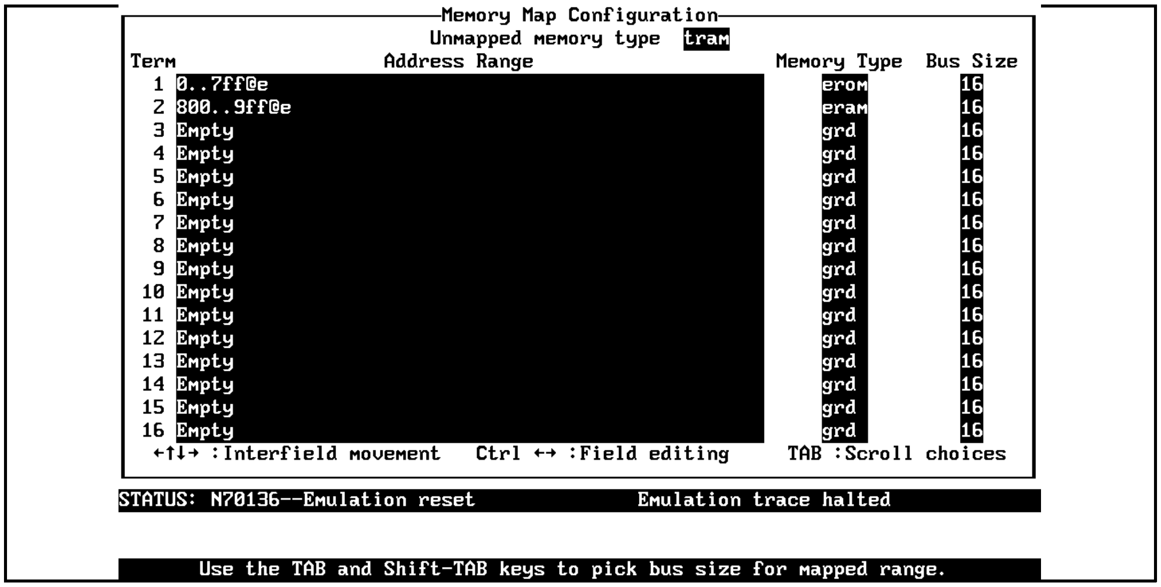
```
0..07ff@e
```

Notice that "@e" must be added in mapping memory; "@e" is the function code to define as an extended address. Refer to the "Address Expression" section in "Using the Emulator" chapter.

Move the cursor to the "memory type" field of term 1, and press the TAB key to select the **erom** (emulation ROM) type. Move the cursor to the "address range" field of term 2 and enter:

```
0800..09ff@e
```

Move the cursor to the "memory type" field of term 2, and press the TAB key to select the **eram** (emulation ROM) type. To save your memory map, use the right arrow key or the **Enter** key to exit the field in the lower right corner. (The **End** key on Vectra keyboards moves the cursor directly to the last field.) The memory configuration display is shown in figure 2-4.



```
                    Memory Map Configuration
                    Unmapped memory type  tram
Term             Address Range                  Memory Type  Bus Size
  1 0..7ff@e                                       erom        16
  2 800..9ff@e                                     eram        16
  3 Empty                                          grd         16
  4 Empty                                          grd         16
  5 Empty                                          grd         16
  6 Empty                                          grd         16
  7 Empty                                          grd         16
  8 Empty                                          grd         16
  9 Empty                                          grd         16
 10 Empty                                          grd         16
 11 Empty                                          grd         16
 12 Empty                                          grd         16
 13 Empty                                          grd         16
 14 Empty                                          grd         16
 15 Empty                                          grd         16
 16 Empty                                          grd         16
   ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing    TAB :Scroll choices

STATUS: N70136--Emulation reset            Emulation trace halted


    Use the TAB and Shift-TAB keys to pick bus size for mapped range.
```

Figure 2-4. Memory Map Configuration

For your programs (not the sample), you may want to map emulation memory locations containing programs and constants (locations that should not be written to) as ROM. This will prevent programs and constants from being written over accidentally, and will cause breaks when instructions attempt to do so.

Note

The memory mapper reassigns blocks of emulation memory after the insertion or deletion of mapper terms. Suppose you modified the contents of 400H-7FFH above, deleted term 1, then displayed locations 400H-7FFH. You'll notice the contents of those locations differ before and after you delete the mapper term.

Loading Programs into Memory

If you have already assembled and linked the sample program, you can load the absolute file by selecting:

```
Memory, Load
```

File Format

Use **Tab** and **Shift-Tab** to select the format of your absolute file. The emulator accepts absolute files in the following formats:

- Intel OMF86 absolute.
- NEC30 absolute.
  - (This absolute file is generated by NEC LK70136 linker for uPD70136.)
- NEC33 absolute.
  - (This absolute file is the extended load module format file which is generated by NEC EL70136 extended mode locator for uPD70136.)
- HP64000 absolute.
- Raw HP64000 absolute.
- Intel hexadecimal.
- Motorola S-records.
- Tektronix hexadecimal.

For this tutorial, choose the HP64000 format.

Target Memory Type for Memory Load

The second field allows you to selectively load the portions of the absolute file which reside in emulation memory, target system memory, both emulation and target system memory.

Since emulation memory is mapped for sample program locations, you can select either "emulation" or "both". Use **Tab** key and **Shift-Tab** to cycle through the choices.

Force the Absolute File to Be Read

This option is only available for the Intel OMF86, NEC30, NEC33, and HP64000 absolute file formats.

It forces the file format reader to regenerate the emulator absolute file (.hpa) and symbol database (.hps) before loading the code. Normally, these files are only regenerated whenever the file you specify (the output of your language tools) is newer than the emulator absolute file and symbol database.

For more information, refer to the File Format Readers appendix.

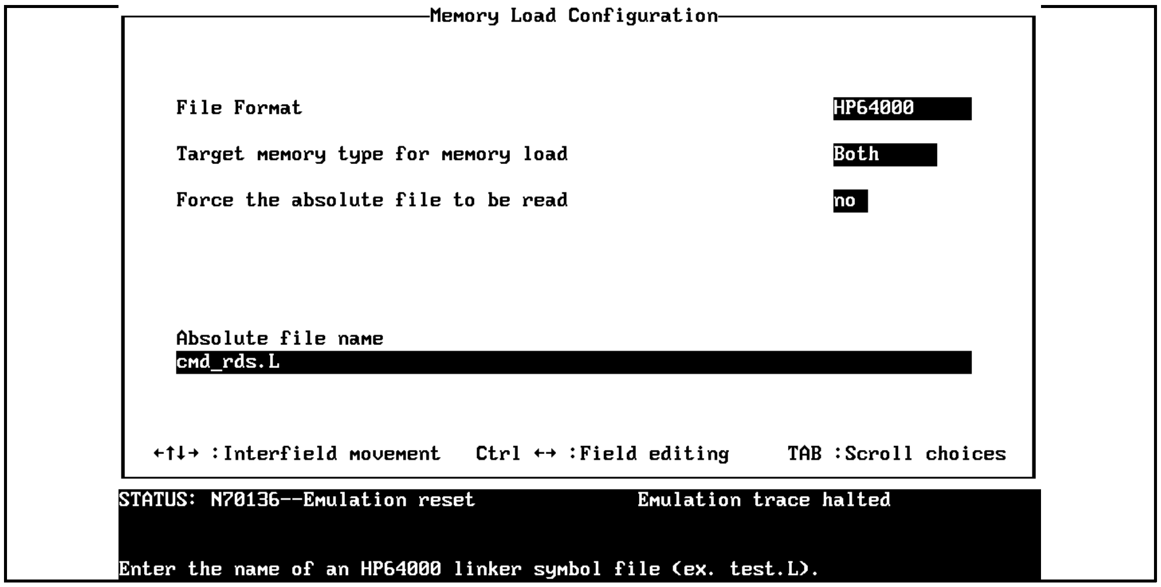
File Format Options

Some of the formats, such as the Intel OMF86 format, have special options.

Refer to the File Format Readers appendix of this manual for more information.

Absolute File Name

For most formats, you enter the name of your absolute file in the last field. The HP64000 format requires the linker symbol filename instead. Type **cmd_rds.l**, and press **Enter** to start the memory load.



```
                    Memory Load Configuration

   File Format                                          HP64000
   Target memory type for memory load                   Both
   Force the absolute file to be read                   no

   Absolute file name
   cmd_rds.L

 ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing     TAB :Scroll choices
STATUS: N70136--Emulation reset              Emulation trace halted

Enter the name of an HP64000 linker symbol file (ex. test.L).
```

Displaying Symbols

Symbol files are created when you generate absolute files with the HP 64000-PC Cross Assembler/Linkers. When you assemble a source file, an assembler symbol file (with the same base name as the source file and a .a extension) is created. The assembler symbol file contains local symbol information. When you link relocatable assembly modules, a linker symbol file (with the same base name as the absolute file and a .l extension) is created. The linker symbol file contains global symbol information and information about the relocatable assembly modules that combine to form the absolute file.

When you load a file using the HP64000 file format, the file format reader collects global symbol information from the linker symbol file and local symbol information from the assembler symbol files. It uses this information to create a single symbol database with the extension .hps.

If you load a file using the following formats, the file format reader obtains all the global and local symbol information from the absolute file and builds a symbol database with extension .hps.

- Intel OMF86 absolute.
- NEC30 absolute.
- NEC33 absolute.

The following pages show you how to display global and local symbols for the sample program. For more information on symbol display, refer to the *PC Interface Reference*.

Displaying Global Symbols

When you load a file using the following formats into the emulator, the corresponding symbol database is also loaded.

- Intel OMF86 absolute.
- NEC30 absolute.
- NEC33 absolute.
- HP64000 absolute.

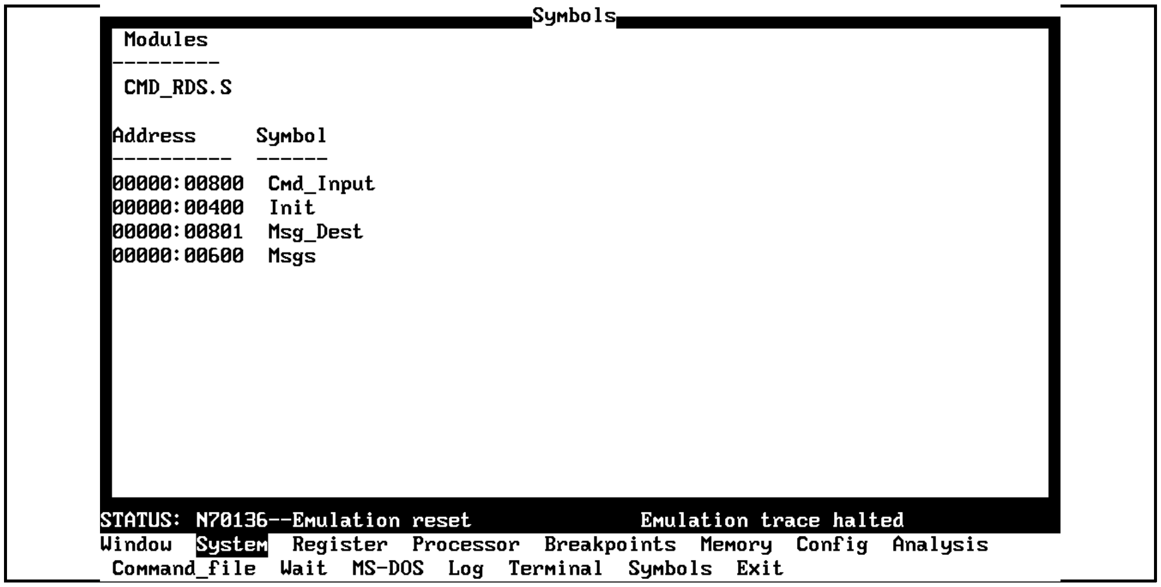
The symbol database also can be loaded with the **S**ystem, **S**ymbols, **G**lobal, **L**oad command. Use this command when you load multiple absolute files into the emulator. You can load the various symbol databases corresponding to each absolute file. When you load a symbol database, information from a previous symbol database is lost. That is, only one symbol database can be present at a time.

After a symbol database is loaded, both global and local symbols can be used when entering expressions. You enter global symbols as they appear in the source file or in the global symbols display.

To display global symbols, select:

System **S**ymbols **G**lobal **D**isplay

The symbols window automatically becomes the active window because of this command. You can press <CTRL>**z** to zoom the window. The resulting display follows.



```
                                  Symbols
 Modules
---------
 CMD_RDS.S

Address     Symbol
----------  ------
00000:00800  Cmd_Input
00000:00400  Init
00000:00801  Msg_Dest
00000:00600  Msgs

STATUS: N70136--Emulation reset              Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Command_file  Wait  MS-DOS  Log  Terminal  Symbols  Exit
```

The global symbols display has two parts. The first part lists all the modules that were linked to produce this object file. These module names are used by you when you want to refer to a local symbol, and are case-sensitive. The second part of the display lists all global symbols in this module. These names can be used in measurement specifications, and are case-sensitive. For example, if you wish to make a measurement using the symbol **Cmd_Input**, you must specify **Cmd_Input**.

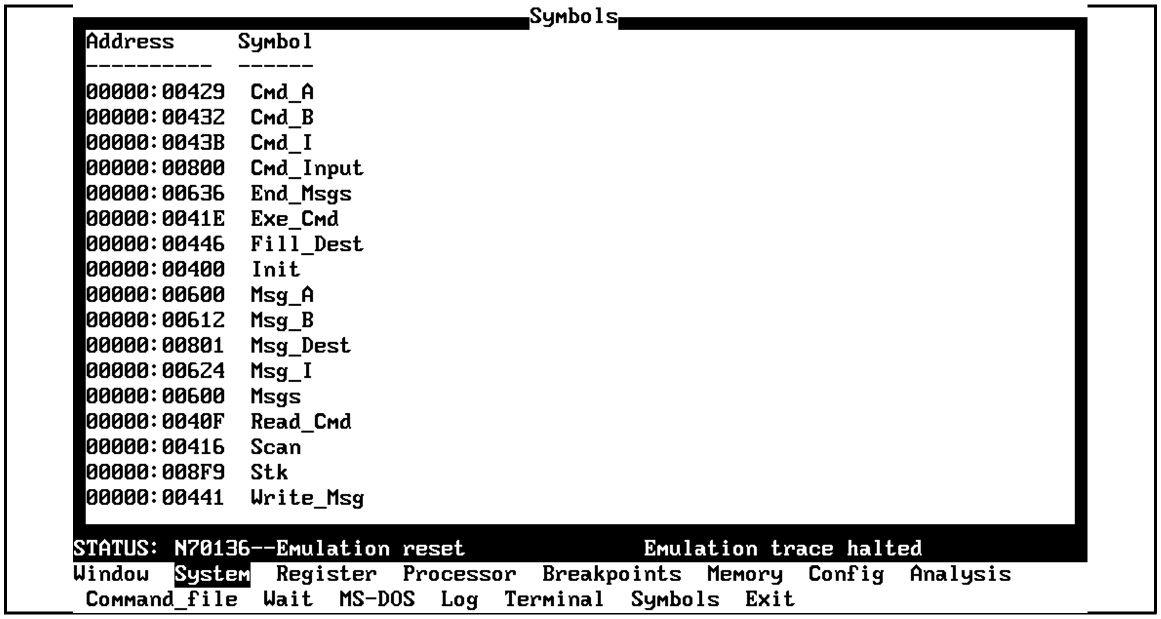
The strings **cmd_input** and **CMD_INPUT** are not valid symbol names here.

Loading and Displaying Local Symbols

To display local symbols, select:

```
System Symbols Local Display
```

Enter the name of the module you want to display (from the first part of the global symbols list; in this case, **CMD_RDS.S**) and press **Enter**. The resulting display follows.



```
                              Symbols
Address     Symbol
----------  ------
00000:00429  Cmd_A
00000:00432  Cmd_B
00000:0043B  Cmd_I
00000:00800  Cmd_Input
00000:00636  End_Msgs
00000:0041E  Exe_Cmd
00000:00446  Fill_Dest
00000:00400  Init
00000:00600  Msg_A
00000:00612  Msg_B
00000:00801  Msg_Dest
00000:00624  Msg_I
00000:00600  Msgs
00000:0040F  Read_Cmd
00000:00416  Scan
00000:008F9  Stk
00000:00441  Write_Msg

STATUS: N70136--Emulation reset              Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Command_file  Wait  MS-DOS  Log  Terminal  Symbols  Exit
```

After you display local symbols with the **S**ystem **S**ymbols **L**ocal **D**isplay command, you can enter local symbols as they appear in the source file or local symbol display. When you display local symbols for a given module, that module becomes the default local symbol module.

If you have not displayed local symbols, you can still enter a local symbol by including the name of the module:

```
module_name:symbol
```

Remember that the only valid module names are those listed in the first part of the global symbols display, and are case-sensitive for compatibility with other systems (such as HP-UX).

When you include the name of an source file with a local symbol, that module becomes the default local symbol module, as with the **S**ystem **S**ymbols **L**ocal **D**isplay command.

Local symbols must be from assembly modules that form the absolute whose symbol database is currently loaded. Otherwise, no symbols will be found (even if the named assembler symbol file exists and contains information).

One thing to note: It is possible for a symbol to be local in one module and global in another, which may result in some confusion. For example, suppose symbol XYZ is a global in module A and a local in module B and that these modules link to form the absolute file. After you load the absolute file (and the corresponding symbol database), entering XYZ in an expression refers to the symbol from module A. Then, if you display local symbols from module B, entering XYZ in an expression refers to the symbol from module B, **not the global symbol**. Now, if you again want to enter XYZ to refer to the global symbol from module A, you must display the local symbols from module A (since the global symbol is also local to that module). Loading local symbols from a third module, if it was linked with modules A and B and did not contain an XYZ local symbol, would also cause XYZ to refer to the global symbol from module A.

Transfer Symbols to the Emulator

You can use the emulator’s symbol-handling capability to improve measurement displays. You do this by transferring the symbol database information to the emulator. To transfer the global symbol information to the emulator, use the command:

```
System Symbols Global Transfer
```

Transfer the local symbol information for all modules by entering:

```
System Symbols Local Transfer All
```

You can find more information on emulator symbol handling commands in the *Emulator PC Interface Reference*.

PGR register

You can configure the 70136 emulator to break to the monitor to read the current value of page registers when the emulation system needs to convert normal address to extended address.

However, the normal address mode is only used in this sample program.

You should change the configuration not to break to the monitor to read page registers in the general emulator configuration. Select:

```
Config, General
```

Use the arrow keys to move the cursor to the "Read PGR register" field, answer [n], press **End** to move to the lower right corner, and press **Enter** to exit the general emulator configuration.

See the "Configuring the Emulator" chapter for a complete description of the emulator configuration.

Displaying Memory in Mnemonic Format

Once you have loaded a program into the emulator, you can verify that the program has indeed been loaded by displaying memory in mnemonic format. To do this, select:

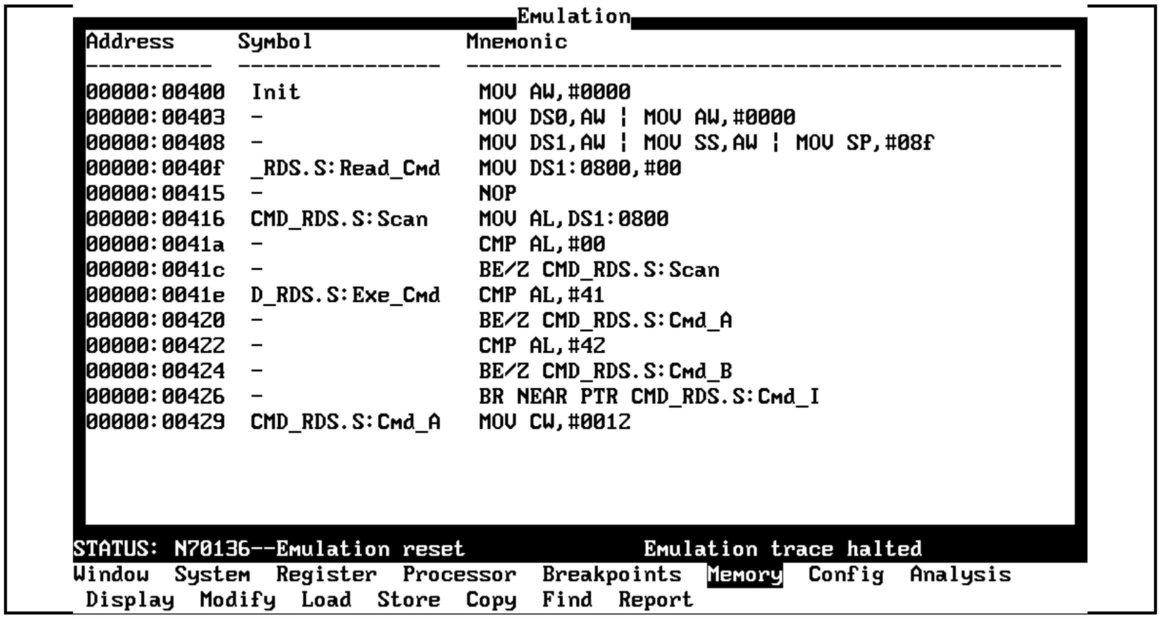
```
Memory, Display, Mnemonic
```

Enter the address range "400H..429H". You could also specify this address range using symbols.

For example,
"**Init..Cmd_A**" or "**Init..Init+29H**".

The Emulation window remains active. You can press <CTRL>**z** to zoom the memory window. The resulting display follows.

If you want to see the rest of the sample program memory locations, you can select "**M**emory, **D**isplay, **M**nemonic" command and enter the range from 42AH to 451H.



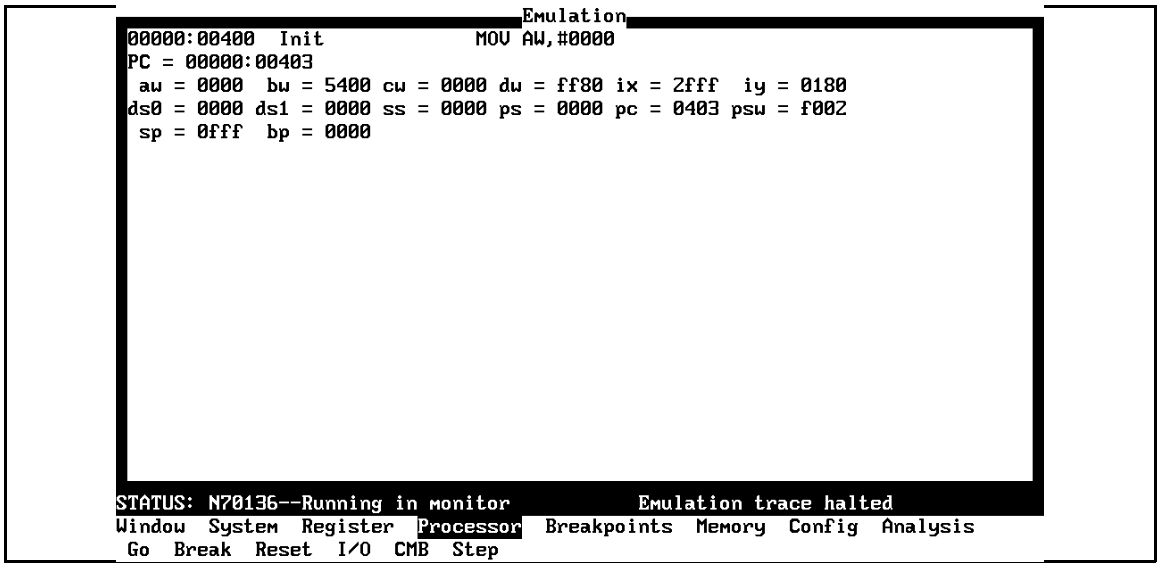
```
                                 Emulation
Address     Symbol           Mnemonic
----------  ---------------- ----------------------------------------------
00000:00400  Init             MOV AW,#0000
00000:00403  -                MOV DS0,AW ¦ MOV AW,#0000
00000:00408  -                MOV DS1,AW ¦ MOV SS,AW ¦ MOV SP,#08f
00000:0040f  _RDS.S:Read_Cmd  MOV DS1:0800,#00
00000:00415  -                NOP
00000:00416  CMD_RDS.S:Scan   MOV AL,DS1:0800
00000:0041a  -                CMP AL,#00
00000:0041c  -                BE/Z CMD_RDS.S:Scan
00000:0041e  D_RDS.S:Exe_Cmd  CMP AL,#41
00000:00420  -                BE/Z CMD_RDS.S:Cmd_A
00000:00422  -                CMP AL,#42
00000:00424  -                BE/Z CMD_RDS.S:Cmd_B
00000:00426  -                BR NEAR PTR CMD_RDS.S:Cmd_I
00000:00429  CMD_RDS.S:Cmd_A  MOV CW,#0012

STATUS: N70136--Emulation reset              Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Display  Modify  Load  Store  Copy  Find  Report
```

Stepping Through the Program

The emulator allows you to execute one instruction or a number of instructions with step command. To begin stepping through the sample program, select:

```
Processor, Step, Address
```

Enter a step count of 1, enter the symbol **Init** (defined as a global in the source file), and press **Enter** to step from program's first address, 400H. The Emulation window remains active. Press <CTRL>**z** to view a full screen of information. The executed instruction, the program counter address (PS:PC), and the resulting register contents are displayed as shown in the following.



```
                                  Emulation
00000:00400  Init            MOV AW,#0000
PC = 00000:00403
 aw = 0000  bw = 5400 cw = 0000 dw = ff80 ix = 2fff  iy = 0180
ds0 = 0000 ds1 = 0000 ss = 0000 ps = 0000 pc = 0403 psw = f002
 sp = 0fff  bp = 0000

STATUS: N70136--Running in monitor          Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Go  Break  Reset  I/O  CMB  Step
```

Note

You cannot display registers if the processor is reset.
Use the "**P**rocessor **B**reak" command to cause the emulator to start executing in the monitor.

You can display registers while the emulator is executing a user program (if execution is not restricted to real-time); emulator execution will temporarily break to the monitor.

Note

There are a few cases in which the emulator can not step. Step command is not accepted between each of the following instructions and the next instruction.

1) Manipulation instructions for sreg :
MOV sreg,reg16; MOV sreg,mem16; POP sreg.

2) Prefix instructions: PS:, SS:, DS0:, DS1:, REPC, REPNC, REP, REPE, REPZ, REPNE, REPNZ, BUSLOCK.

3) EI, RETI, DI.

Note

You cannot use over 100000 hex address in "**P**rocessor **S**tep" command.

To continue stepping through the program, you can select:

```
Processor, Step, Pc
```

After selecting this command, you can change the previous step count. If you wish to step the same number of times, just press **Enter** to start the step.

To save time when single-stepping, you can use the function key macro <F1>, which executes the command:

```
Processor Step Pc 1
```

For more information, see the *Emulator PC Interface Reference* chapter on Function Key Macros.

To repeat the previous command, you can press <CTRL>**r**.

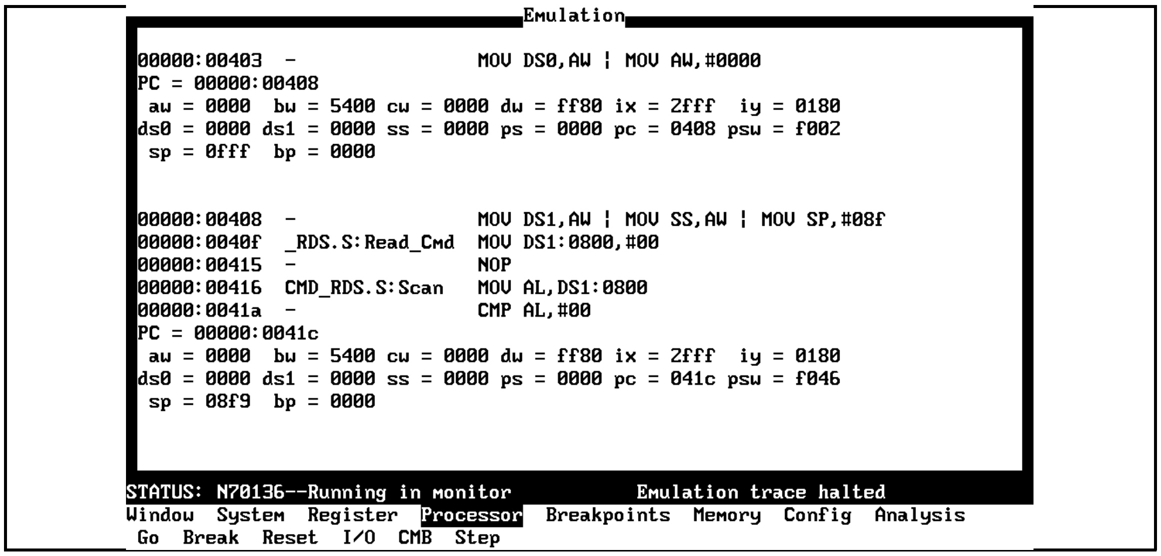
Specifying a Step Count

If you want to step sevral times from the current program counter, select:

```
Processor, Step, Pc
```

The previous step count is displayed in the "number of instructions" field. You can enter a number from 1 through 99 to specify the number times to step. Type 5 into the field, and press **Enter**. The resulting display follows.

When you specify step counts greater than 1, only the last instruction and the register contents after that instruction are displayed.



```
                                   Emulation
00000:00403  -                MOV DS0,AW ¦ MOV AW,#0000
PC = 00000:00408
 aw = 0000  bw = 5400 cw = 0000 dw = ff80 ix = 2fff  iy = 0180
ds0 = 0000 ds1 = 0000 ss = 0000 ps = 0000 pc = 0408 psw = f002
 sp = 0fff  bp = 0000


00000:00408  -                MOV DS1,AW ¦ MOV SS,AW ¦ MOV SP,#08f
00000:0040f  _RDS.S:Read_Cmd  MOV DS1:0800,#00
00000:00415  -                NOP
00000:00416  CMD_RDS.S:Scan   MOV AL,DS1:0800
00000:0041a  -                CMP AL,#00
PC = 00000:0041c
 aw = 0000  bw = 5400 cw = 0000 dw = ff80 ix = 2fff  iy = 0180
ds0 = 0000 ds1 = 0000 ss = 0000 ps = 0000 pc = 041c psw = f046
 sp = 08f9  bp = 0000


STATUS: N70136--Running in monitor           Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Go  Break  Reset  I/O  CMB  Step
```

Modifying Memory

The preceding step commands show the sample program is executing in the **Scan** loop, where it continually reads the command input byte to look for a command.

To simulate the entry of a sample program command, you can modify the command input byte by selecting:

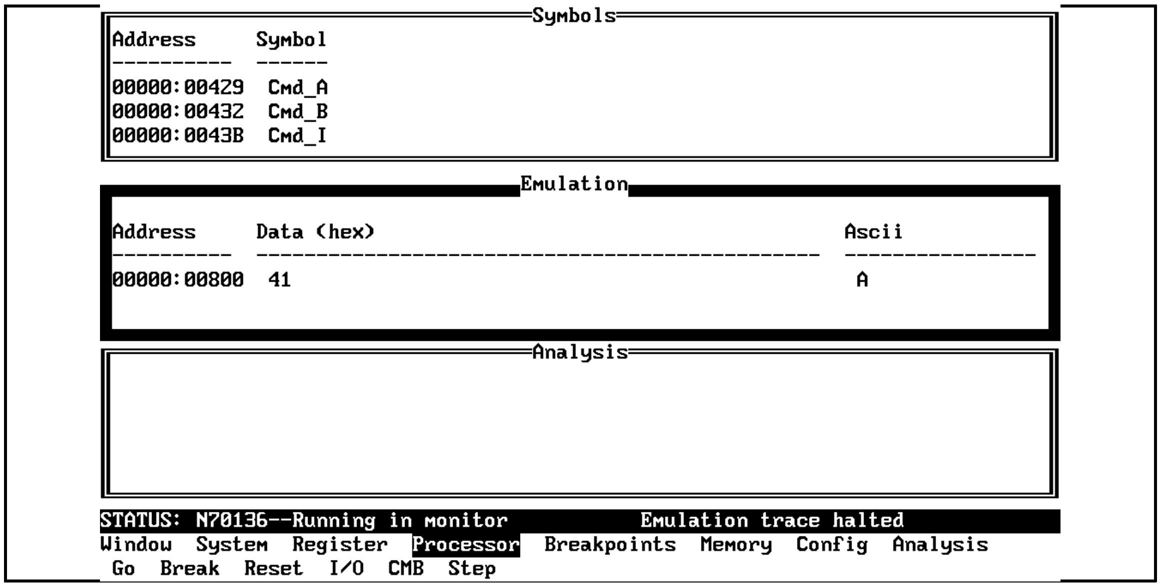
```
Memory, Modify, Byte
```

Now enter the address of the memory location to be modified, an equal sign, and new value of that location, for example, **Cmd_Input="A"**. (The **Cmd_Input** label was defined as a global symbol in the source file.)

To verify that "A" was indeed written to **Cmd_Input** (800 hex), select:

```
Memory, Display, Byte
```

Type the address 800H or the symbol **Cmd_Input**, and press **Enter**. The resulting display is shown below.



```
Symbols
Address     Symbol
----------  ------
00000:00429  Cmd_A
00000:00432  Cmd_B
00000:0043B  Cmd_I

Emulation
Address     Data (hex)                                        Ascii
----------  ------------------------------------------------  ----------------
00000:00800  41                                                A

Analysis

STATUS: N70136--Running in monitor          Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Go  Break  Reset  I/O  CMB  Step
```

You can continue to step through the program as shown earlier in this chapter to view the instructions which are executed when an "A" (41 hex) command is entered.

Running the Program

To start the sample program, select:

```
Processor, Go, Pc
```

The status line will show that the emulator is "Running user program".

Note

You can not use over 100000 hex address in "**P**rocessor **G**o" command.

Searching Memory for Data

You can search the message destination locations to verify that the sample program writes the appropriate messages for the allowed commands. The command "A" (41 hex) was entered above, so the "Command A entered " message should have been written to the **Msg_Dest** locations. Because you must search for hexadecimal values, you will want to search for a sequence of characters which uniquely identify the message, for example,
" A " or 20 hex, 41 hex, and 20 hex. To search the destination memory location for this sequence of characters, select:

```
Memory, Find
```

Enter the range of the memory locations to be searched, "800H..820H", and enter the data " **A** " or 20H, 41H, and 20H. The resulting information in the Emulation window shows you that the message write occurred correctly. The message is:

```
Pattern match at address: 0000808@p
```

To verify that the sample program works for the other allowed commands, you can modify the command input byte to "B" and search for " B " (20 hex, 42 hex, and 20 hex), or you can modify the command input byte to "C" and search for "d C" (64 hex, 20 hex, and 43 hex).

Breaking into the Monitor

To break emulator execution from the sample program to the monitor program, select:

```
Processor, Break
```

The status line shows that the emulator is "Running in monitor".

While the break will occur as soon as possible, the actual stopping point may be many cycles after the break request. This depends on the type of instruction being executed, and whether the processor is in a hold state.

Using Software Breakpoints

Software breakpoints are provided with one of 70136 undefined opcode (F1 hex) as breakpoint interrupt instruction.

When you define or enable a software breakpoint, the emulator will replace the opcode at the software breakpoint address with the breakpoint interrupt instruction.

Caution

Software breakpoints should not be set, cleared, enabled, or disabled while the emulator is running user code. If any of these commands are entered while the emulator is running user code, and the emulator is executing code in the area where the breakpoint is being modified, program execution may be unreliable.

Caution

When you use extended address mode, care should be taken for software breakpoints. If you change the relation between the physical address and the extended address after you set a software breakpoint (ex. change address mode or change the contents of the page register), emulation system may not recognize the software breakpoint.

In this case, the breakpoint interrupt instruction (F1 hex) is left in memory and the software break will not occur at the specified address. When you set a software breakpoint with using symbols, you also should not change the relation between the physical address and the extended address after setting a software breakpoint.

Note

You must only set software breakpoints at memory locations which contain instruction opcodes (not operands or data). If a software breakpoint is set at a memory location which is not an instruction opcode, the software breakpoint instruction will never be executed and the break will never occur.

Note

NMI will be ignored, when software breakpoint and NMI occur at the same time.

Note

Because software breakpoints are implemented by replacing opcodes with the breakpoint interrupt instruction, you cannot define software breakpoints in target ROM. You can use the Terminal Interface **cim** command to copy target ROM into emulation memory (see the *Terminal Interface Reference* manual for information on the **cim** command).

Note

Do not set, clear, enable or disable software breakpoints while the emulator is running user code. If you enter any of these commands while the emulator is executing user code in the area of the breakpoint you are modifying, program execution may be unreliable.

Note

Software breakpoint will be ignored, when software breakpoint and other emulation break (for example, break command, trigger command, etc.) occur at the same time. Refer to *PC Interface: User's Reference* manual.

When software breakpoints are enabled and emulator detects the breakpoint interrupt instruction (F1 hex), it generates a break to background request which as with the "processor break" command. Since the system controller knows the locations of defined software breakpoints, it can determine whether the breakpoint interrupt instruction (F1 hex) is a software breakpoint or opcode in your target program.

If it is a software breakpoint, execution breaks to the monitor, and the breakpoint interrupt instruction is replaced by the original opcode. A subsequent run or step command will execute from this address.

If it is an opcode of your target program, execution still breaks to the monitor, and an "Undefined software breakpoint" status message is displayed.

When software breakpoints are disabled, the emulator replaces the breakpoint interrupt instruction with the original opcode.
Up to 32 software breakpoints may be defined.

Defining a Software Breakpoint

To define a breakpoint at the address of the **Cmd_I** label of the sample program (43B hex), select:

```
Breakpoints, Add
```

Enter the local symbol "Cmd_I". After the breakpoint is added, the Emulation window becomes active and shows that the breakpoint is set.

You can add multiple breakpoints in a single command by separating them with a semicolon. For example, you could type "**2010h;2018h;2052h**" to set three breakpoints.

Run the program by selecting:

```
Processor, Go, Pc
```

The status line shows that the emulator is running the user program. Modify the command input byte to an invalid command by selecting:

```
Memory, Modify, Byte
```

Enter an invalid command, such as "Cmd_Input=75h". The following messages result:

```
ALERT:  Software breakpoint: 00000:0043b
STATUS: Running in monitor
```

To continue program execution, select:

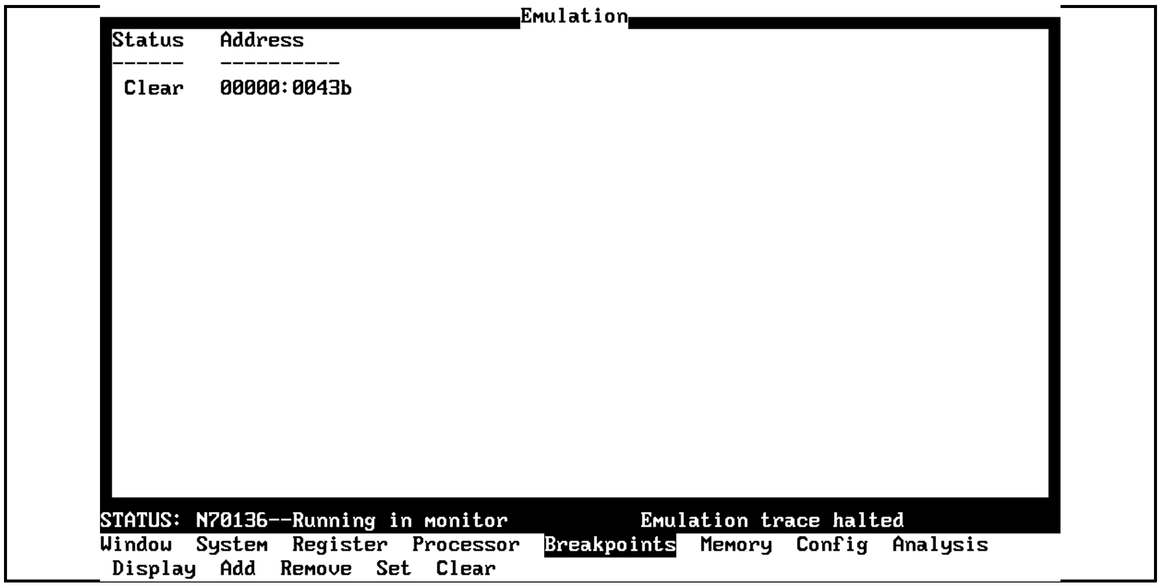
```
Processor, Go, Pc
```

Displaying Software Breakpoints

To view the status of the breakpoint, select:

```
Breakpoints, Display
```

The display shows that the breakpoint was cleared.



```
                                Emulation
Status   Address
------   ----------
 Clear   00000:0043b
















STATUS: N70136--Running in monitor          Emulation trace halted
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Display  Add  Remove  Set  Clear
```

Setting a Software Breakpoint

A breakpoint is disabled when it is hit. To re-enable the software breakpoint, you can select:

Breakpoints, **S**et, **S**ingle

The address of the breakpoint you just added is still in the address field. To set this breakpoint again, press **Enter**.

As with the "**B**reakpoints **A**dd" command, the Emulation window becomes active and shows that the breakpoint is set.

Clearing a Software Breakpoint

If you wish to clear a software breakpoint that does not get hit during program execution, you can select:

Breakpoints, **C**lear, **S**ingle

The address of the breakpoint set in the previous section is still in the address field. To clear this breakpoint, press **Enter**.

Using the Analyzer

The analyzer collects data at each pulse of a clock signal, and saves the data (a trace state) if it meets a "storage qualification" condition.

Note

Emulators which have the optional external analyzer will display the "**Internal/External**" option after commands in the following examples. Select **Internal** to execute the example commands.

Resetting the Analysis Specification

To be sure that the analyzer is in its default or power-up state, select:

```
Analysis, Trace, Reset
```

Specifying a Simple Trigger

Suppose you wish to trace the states of the sample program which follow the read of a "B" (42 hex) command from the command input byte. To do this, you must modify the default analysis specification by selecting:

```
Analysis, Trace, Modify
```

The emulation analysis specification is shown. Use the right allow key to move the "Trigger on" field. Type "a" and press **Enter**.

You’ll enter the pattern expression menu. Press the up arrow key until the **addr** field directly opposite the pattern **a=** is highlighted. Type the address of the command input byte, using either the global symbol **Cmd_Input** or address 800H, and press **Enter**.

The Data field is now highlighted. Type 0XX42 and press **Enter**. "42" is the hexadecimal value of the B command and the "X"s specify "don’t care" values. When 42H is read from the command input byte (800H), a lower byte read is performed because the address is even. If the address is odd, you must specify the data to 42XX.

Now the Status field is highlighted. Use the TAB key to view the status qualifier choices.

Qualifier	Status Bits	Description
bs16	0xx xx1x xxxx xxxxB	Bus size 16
bs8	0xx xx0x xxxx xxxxB	Bus size 16
coproc	0x0 xxxx x101 x0xxB	Co-processor access
cprd	0x0 xxxx x101 x01xB	Co-processor read
cpwr	0x0 xxxx x101 x00xB	Co-processor write
exec	0x0 xxxx x0xx xxxxB	Executed code
extaddr	0xx 1xxx xxxx xxxxB	Extended address mode
extmemrd	0x0 1xxx 1110 x11xB	memory read in extended address mode
extmemwr	0x0 1xxx 1110 x10xB	memory write in extended address mode
fetch	0x0 xxxx 1100 x11xB	Program fetch
grdacc	0xx xxxx 0xxx x1xxB	Guarded access
haltack	0x0 xxxx x111 x00xB	Halt acknowledge
holdack	0x1 xxxx xxxx xxxxB	Hold acknowledge
intack	0x0 xxxx x100 x01xB	Interrupt acknowledge
io	0x0 xxxx x110 x0xxB	I/O access
ioread	0x0 xxxx x110 x01xB	I/O read
iowrite	0x0 xxxx x110 x00xB	I/O write
memory	0x0 xxxx 1110 x1xxB	memory access
memforcp	0x0 xxxx 1101 x1xxB	memory access for cp
memread	0x0 xxxx 1110 x11xB	memory read
memrdcp	0x0 xxxx 1101 x11xB	memory read for cp
memwrite	0x0 xxxx 1110 x10xB	memory write
memwrcp	0x0 xxxx 1101 x10xB	memory write for cp
mon	0xx x0xx xxxx xxxxB	monitor cycle
nmladdr	0xx 0xxx xxxx xxxxB	normal address mode
nmlmemrd	0x0 0xxx 1110 x11xB	memory read in normal address mode
nmlmemwr	0x0 0xxx 1110 x10xB	memory write in normal address mode
read	0x0 xxxx x1xx xx1xB	read cycle
write	0x0 xxxx x1xx xx0xB	write cycle
wrrom	0xx xxx0 xxxx xx0xB	write to ROM

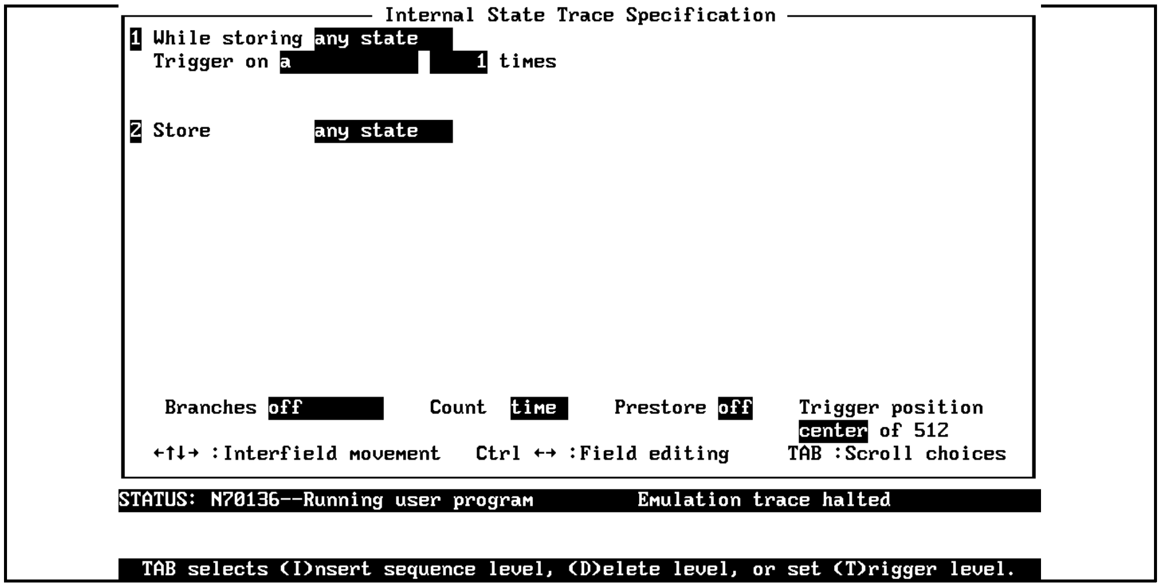
70136 Analysis Status Qualifiers

This trace command example uses the status qualifier "read". The following analysis status qualifiers also can be used with the 70136 emulator.

Qualifier	Status Bits	Description
bs16	1xxx xx1x xxxx xxxxB	bus size 16
bs8	1xxx xx0x xxxx xxxxB	bus size 8
coproc	1xx0 xxxx x101 00xxB	co-processor access
cprd	1xx0 xxxx x101 001xB	co-processor read
cpwr	1xx0 xxxx x101 000xB	co-processor write
dma_mem	1xx0 xxxx x110 11xxB	DMA cycle
dma_memrd	1xx0 xxxx x110 111xB	DMA read cycle
dma_memwr	1xx0 xxxx x110 110xB	DMA write cycle
dma_cscd	0xxx xxxx xxxx xxxxB	DMA cascade
ext_io	1xx0 xxxx x110 00xxB	external I/O access
ext_iord	1xx0 xxxx x110 001xB	external I/O read
ext_iowr	1xx0 xxxx x110 000xB	external I/O write
exec	1xx0 xxxx x0xx xxxxB	executed code
extaddr	1xxx 1xxx xxxx xxxxB	extended address mode
extmemrd	1xx0 1xxx 1110 011xB	memory read in extended address mode
extmemwr	1xx0 1xxx 1110 010xB	memory write in extended address mode
fetch	1xx0 xxxx 1100 011xB	program fetch
grdacc	1xxx xxxx 0xxx xxxxB	guarded access
haltack	1xx0 xxxx x111 000xB	halt acknowledge
holdack	1xx1 xxxx xxxx xxxxB	hold acknowledge
intacki	1xx0 xxxx x100 101xB	interrupt acknowledge (ICU)
intacks	1xx0 xxxx x100 001xB	interrupt acknowledge (SLAVE)
int_io	1xx0 xxxx x110 10xxB	internal I/O access
int_iord	1xx0 xxxx x110 101xB	internal I/O read
int_iowr	1xx0 xxxx x110 100xB	internal I/O write
memory	1xx0 xxxx 1110 01xxB	memory access
memforcp	1xx0 xxxx 1101 01xxB	memory access for cp
memread	1xx0 xxxx 1110 011xB	memory read
memrdcp	1xx0 xxxx 1101 011xB	memory read for cp
memwrite	1xx0 xxxx 1110 010xB	memory write
memwrcp	1xx0 xxxx 1101 010xB	memory write for cp
mon	1xxx x0xx xxxx xxxxB	monitor cycle
nmladdr	1xxx 0xxx xxxx xxxxB	normal address mode
nmlmemrd	1xx0 0xxx 1110 011xB	memory read in normal address mode
nmlmemwr	1xx0 0xxx 1110 010xB	memory write in normal address mode
read	1xx0 xxxx x1xx xx1xB	read cycle
refresh	1xx0 xxxx x100 111xB	refresh cycle
write	1xx0 xxxx x1xx xx0xB	write cycle
wrrom	1xxx xxx0 x1xx xx0xB	write to ROM

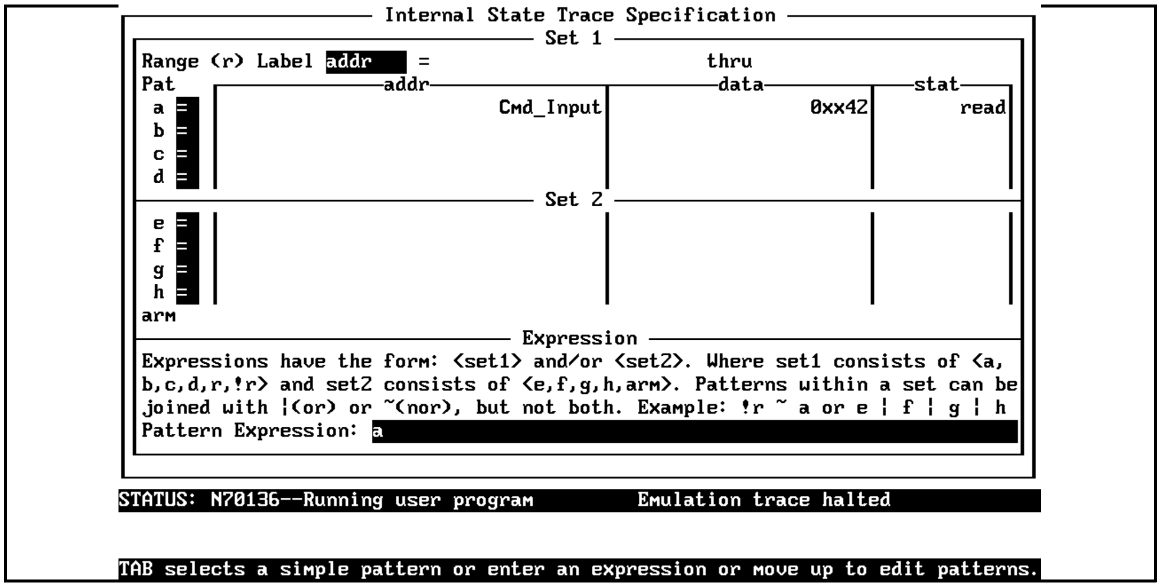
70236 Analysis Status Qualifiers

This trace command example uses the status qualifier "read". The following analysis status qualifiers also can be used with the 70236 emulator.



```
                     Internal State Trace Specification
1 While storing any state
  Trigger on a                 1 times


2 Store         any state










   Branches off         Count  time    Prestore off    Trigger position
                                                       center of 512
  ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing    TAB :Scroll choices
STATUS: N70136--Running user program         Emulation trace halted


  TAB selects (I)nsert sequence level, (D)elete level, or set (T)rigger level.
```

Figure 2-5. Modifying the Trace Specification



```
                     Internal State Trace Specification
                                    Set 1
 Range (r) Label addr   =                       thru
 Pat  ┌──────────────addr─────────────────┬──────────data──────┬────stat──┐
  a = │                          Cmd_Input│               0xx42│      read│
  b = │                                   │                    │          │
  c = │                                   │                    │          │
  d = │                                   │                    │          │
                                    Set 2
  e = │                                   │                    │          │
  f = │                                   │                    │          │
  g = │                                   │                    │          │
  h = │                                   │                    │          │
 arm
                                  Expression
 Expressions have the form: <set1> and/or <set2>. Where set1 consists of <a,
 b,c,d,r,!r> and set2 consists of <e,f,g,h,arm>. Patterns within a set can be
 joined with ¦(or) or ~(nor), but not both. Example: !r ~ a or e ¦ f ¦ g ¦ h
 Pattern Expression: a
STATUS: N70136--Running user program         Emulation trace halted


TAB selects a simple pattern or enter an expression or move up to edit patterns.
```

Figure 2-6. Modifying the Pattern Specification

Note

You can combine qualifiers to form more specific qualifiers. For example, the expression **memory&&read** matches only memory reads. See the *Emulator PC Interface Reference* for more information.

Select the **read** status and press **Enter**.

The resulting analysis specification is shown in figure 2-5. To save the new specification, use **End Enter** to exit the field in the lower right corner. You'll return to the trace specification. Press **End** to move the "trigger position" field. Use the TAB key until it says **center**, then press **Enter** to exit the trace specification.

Starting the Trace

To start the trace, select:

```
Analysis, Begin
```

A message on the status line will show you that the trace is running. You do not expect the trigger to be found, because no commands have been entered. Modify the command input byte to "B" by selecting:

```
Memory, Modify, Byte
```

Enter **Cmd_Input="B".** The status line now shows that the trace is complete. (If you have problems, you may be running in monitor. Select **P**rocessor **G**o **P**c to return to the user program.)

Change the Analyzer Display Format

To change the analyzer display format, enter the command:

```
Analysis Format
```

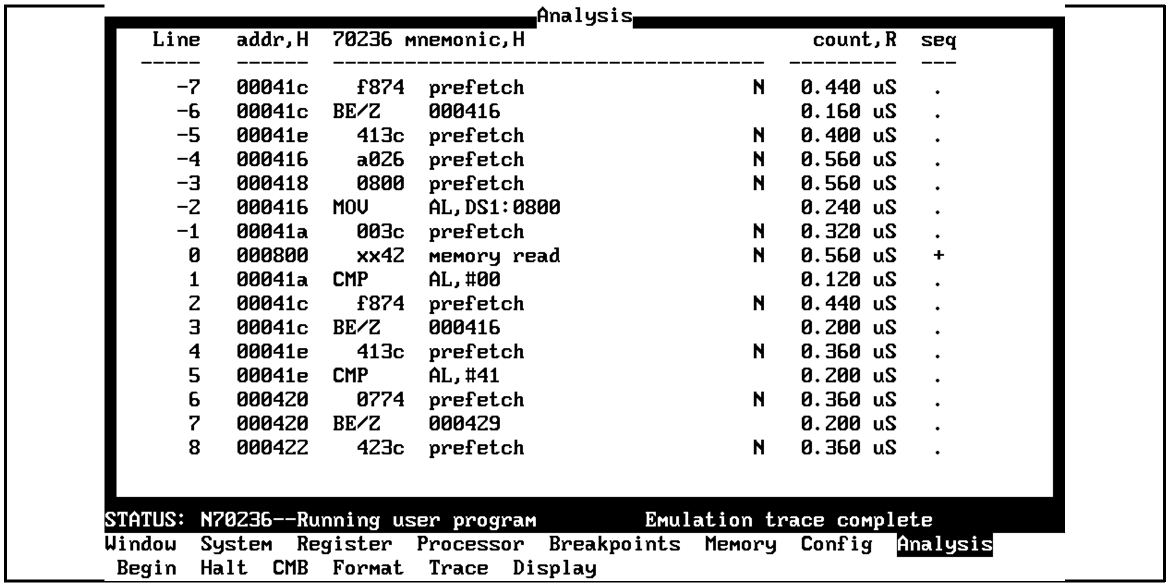
Use the down arrow key to move to the field labeled **addr**. And, use the right arrow key to move the field labeld **Width** above. The default width of the address column is six characters. A width of 17 characters is often wide enough to accommodate most symbol names. Type **17** to change the width of the address column, and press **End**, then **Enter.**

Displaying the Trace

To display the trace, select:

```
Analysis, Display
```

You are now given two fields in which to specify the states to display. Use the **End** key to move the cursor to the "Ending state to display" field. Type 60 into the press **Enter**. The resulting trace is similar to trace shown in the following display (use <CTRL>**z** to zoom the trace window). You may need to press the **Home** key to get to the top of the trace.



```
                                  Analysis
   Line    addr,H  70236 mnemonic,H                      count,R  seq
  -----    ------  ------------------------------------  ---------  ---
     -7    00041c    f874  prefetch                  N   0.440 uS   .
     -6    00041c  BE/Z    000416                        0.160 uS   .
     -5    00041e    413c  prefetch                  N   0.400 uS   .
     -4    000416    a026  prefetch                  N   0.560 uS   .
     -3    000418    0800  prefetch                  N   0.560 uS   .
     -2    000416  MOV     AL,DS1:0800                   0.240 uS   .
     -1    00041a    003c  prefetch                  N   0.320 uS   .
      0    000800    xx42  memory read               N   0.560 uS   +
      1    00041a  CMP     AL,#00                        0.120 uS   .
      2    00041c    f874  prefetch                  N   0.440 uS   .
      3    00041c  BE/Z    000416                        0.200 uS   .
      4    00041e    413c  prefetch                  N   0.360 uS   .
      5    00041e  CMP     AL,#41                        0.200 uS   .
      6    000420    0774  prefetch                  N   0.360 uS   .
      7    000420  BE/Z    000429                        0.200 uS   .
      8    000422    423c  prefetch                  N   0.360 uS   .

STATUS:  N70236--Running user program         Emulation trace complete
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Begin  Halt  CMB  Format  Trace  Display
```

Note

The character displayed in the right side of disassemble list specifies the following information.

Character	Information
N	Normal address mode
E	Extended address mode
M	Monitor cycle (background)

Note

Running in the user program, symbols can not be displayed in the trace list.

Note

When you use the following setting in your program, the branch address forming in PC relative addressing may change to a wrong value in disassemble trace list.

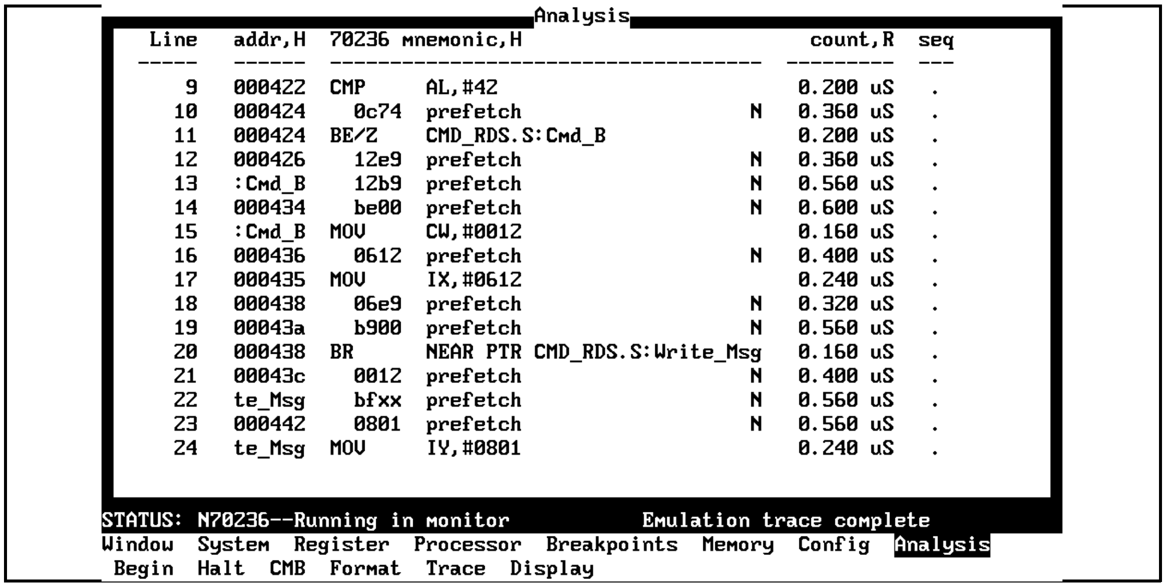
- The program is running in the extended address mode.
- The effective address for the PC relative addressing is in the other page.
- The order of the pages is not in sequence in extended address.

Note

If you choose to dump a complete trace into the trace buffer, it will take a few minutes to display the trace.

Line 0 in the above trace list shows the analyzer trigger state. The trigger state is always on line 0. The other states show the exit from the **Scan** loop and the **Exe_Cmd** instructions.

```
Processor, Break
Analysis, Display
```



```
                                     Analysis
  Line   addr,H  70236 mnemonic,H                          count,R  seq
 -----   ------  ------------------------------------  ---------  ---
     9   000422  CMP     AL,#42                          0.200 uS   .
    10   000424    0c74  prefetch                   N    0.360 uS   .
    11   000424  BE/Z    CMD_RDS.S:Cmd_B                 0.200 uS   .
    12   000426    12e9  prefetch                   N    0.360 uS   .
    13   :Cmd_B    12b9  prefetch                   N    0.560 uS   .
    14   000434    be00  prefetch                   N    0.600 uS   .
    15   :Cmd_B  MOV     CW,#0012                        0.160 uS   .
    16   000436    0612  prefetch                   N    0.400 uS   .
    17   000435  MOV     IX,#0612                        0.240 uS   .
    18   000438    06e9  prefetch                   N    0.320 uS   .
    19   00043a    b900  prefetch                   N    0.560 uS   .
    20   000438  BR      NEAR PTR CMD_RDS.S:Write_Msg    0.160 uS   .
    21   00043c    0012  prefetch                   N    0.400 uS   .
    22   te_Msg    bfxx  prefetch                   N    0.560 uS   .
    23   000442    0801  prefetch                   N    0.560 uS   .
    24   te_Msg  MOV     IY,#0801                        0.240 uS   .

STATUS:  N70236--Running in monitor          Emulation trace complete
Window  System  Register  Processor  Breakpoints  Memory  Config  Analysis
 Begin  Halt  CMB  Format  Trace  Display
```

The resulting display shows the **Cmd_B** instructions, the branch to **Write_Msg**, and the beginning of the instructions that move the Entered B command message to the destination locations.

For a Complete Description

For a complete description of using the HP 64700 Series analyzer with the PC Interface, refer to the *Analyzer PC Interface User’s Guide*.

Copying Memory

You can copy the contents of one range of memory to another. This is a useful feature to test things like the relocatability of programs. To test if the sample program is relocatable within the same segment, copy the program to an unused, but mapped, area of emulation memory. For example, select:

```
Memory, Copy
```

Enter 400H through 452H as the source memory range to be copied, and enter 500H as the destination address.

To verify that the program is relocatable, run it from its new address by selecting:

```
Processor, Go, Address
```

Enter 500H. The status line shows that the emulator is "Running user program". You may wish to trace program execution or enter valid and invalid commands and search the message destination area (shown earlier in this chapter) to verify that the program works correctly at its new address.

Resetting the Emulator

To reset the emulator, select:

```
Processor, Reset, Hold
```

The emulator is reset (suspended) until you enter a "**P**rocessor **B**reak", "**P**rocessor **G**o", or "**P**rocessor **S**tep" command. A CMB execute signal also will run the emulator if reset.

You also can specify that the emulator begin executing in the monitor after reset instead of remaining in the suspended state.

To do this, select:

```
Processor, Reset, Monitor
```

Exiting the PC Interface

There are three different ways to exit the PC Interface. You can exit the PC Interface using the "locked" option which restores the current configuration next time you start the PC Interface. You can select this option as follows.

```
System, Exit, Locked
```

Another way to execute the PC Interface is with the "unlocked" option, which presents the default configuration the next time you start the PC Interface. You can select this option with the following command.

```
System, Exit, Unlocked
```

Or , you can exit the PC Interface without saving the current configuration using the command:

```
System Exit No_Save
```

See the *Emulator PC Interface Reference* for a complete description of the system exit options and their effect on the emulator configuration.

3

In-Circuit Emulation

Introduction

The emulator is *in-circuit* when it is plugged into the target system. This chapter covers topics which relate to in-circuit emulation.

This chapter will:

- Describe the issues concerning the installation of the emulator probe into target systems.
- Show you how to install the emulator probe.
- Show you how to use features related to in-circuit emulation.

Prerequisites

Before performing the tasks described in this chapter, you should be familiar with how the emulator operates in general. Refer to the *Concepts of Emualtion and Analysis* manual and the "Getting Started" chapter of this manual.

Installing the Target System Probe

The 70136 emulator probe has a 68-pin PLCC connector;
the 70236 and 70236A emulator probe has a 132-pin PGA connector.

Caution

OBSERVE THESE PRECAUTIONS TO AVOID EMULATOR CIRCUIT DAMAGE. Take the following precautions while using the 70136 emulator.

Power Down Target System. Turn off power to the user target system and to the 70136 emulator before inserting the user plug to avoid circuit damage resulting from voltage transients or mis-insertion of the user plug.

Verify User Plug Orientation. Make certain that Pin 1 of the target system microprocessor socket and Pin 1 of the user plug are properly aligned before inserting the user plug in the socket. Failure to do so may result in damage to the emulator circuitry.

Protect Against Static Discharge. The 70136 emulator contains devices which are susceptible to damage by static discharge. Therefore, take precautions before handling the user plug to avoid emulator damage.

Protect Target System CMOS Components. If your target system includes any CMOS components, turn on the target system first, then turn on the 70136 emulator. When powering down, turn off the emulator first, then turn off power to the target system.

Pin Protector (70236/70236A Emulator Only)

The target system probe has a pin protector that prevents damage to the probe when inserting and removing the probe from the target system microprocessor socket. **Do not** use the probe without a pin protector installed. If the target system probe is installed on a densely populated circuit board, there may not be enough room for the plastic shoulders of the probe socket. If this occurs, another pin protector may be stacked onto the existing pin protector.

Auxiliary Output Lines

Two auxiliary output lines, "**TARGET BUFFER DISABLE**" and "**SYSTEM RESET**", are provided with the 70136 emulator. The "**TARGET BUFFER DISABLE**" output line is also provided with the 70236 and 70236A emulator.

Caution

DAMAGE TO THE EMULATOR PROBE WILL RESULT IF THE AUXILIARY OUTPUT LINES ARE INCORRECTLY INSTALLED.

When installing the auxiliary output lines into the end of the emulator probe cable, make sure that the ground pins on the auxiliary output lines (labeled with white dots) are matched with the ground receptacles in the end of the emulator probe cable.

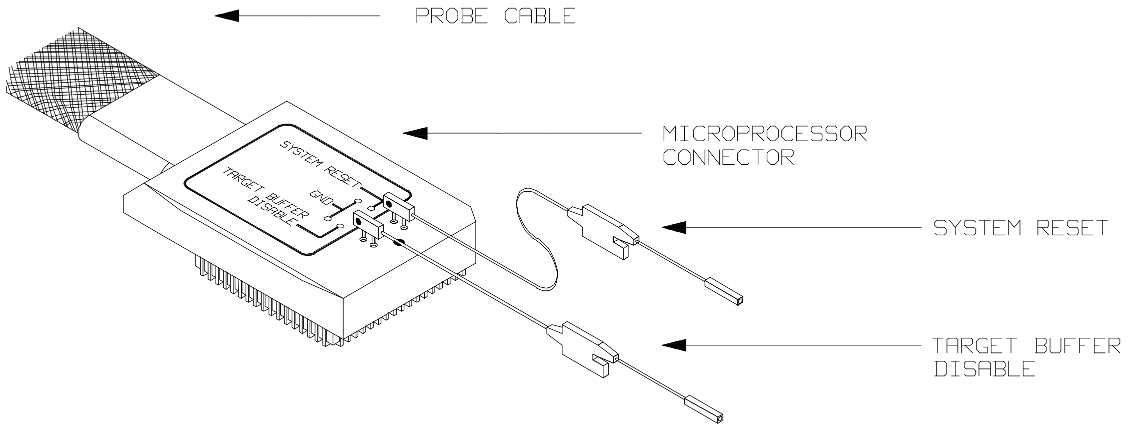
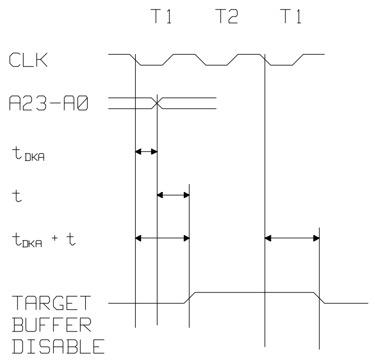


Figure 3-1. Auxiliary Output Lines (70136 Emulator)

TARGET BUFFER DISABLE **---**This active-high output is used when the co-processor memory accesses to emulation memory will be operated. This output is used to tristate (in other words, select the high Z output) any target system devices on the 70136 data bus. Target system devices should be tristated because co-processor memory reads from emulation memory will cause data to be output on the user probe.

This "TARGET BUFFER DISABLE" output will be driven with the following timing in the co-processor memory access cycle.



```
The time ´t´ is

        26 nsec MIN.
        56.8 nsec MAX.
        (70136 Emulator)

        26 nsec MIN.
        61.8 nsec MAX.
        (70236 Emulator)
```

SYSTEM RESET (70136 only) **---**This active-high, CMOS output should be used to synchronously reset the emulator and the target system.

Installing into a 70136 PLCC Type Socket

To connect the microprocessor connector to the target system, proceeded with the following instructions.

- Remove the 70136 microprocessor (PLCC type) from the target system socket. Note the location of pin 1 on the microprocessor and on the target system socket.
- Store the microprocessor in a protected environment (such as antistatic form).
- Install the microprocessor connector into the target system microprocessor socket.

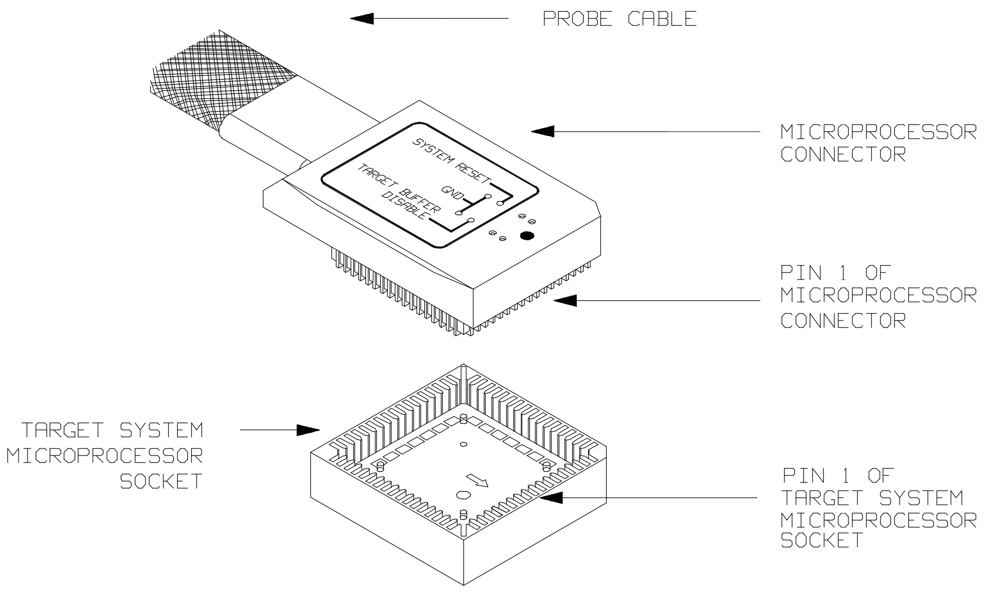

PROBE CABLE
MICROPROCESSOR CONNECTOR
SYSTEM RESET
GND
TARGET BUFFER DISABLE
PIN 1 OF MICROPROCESSOR CONNECTOR
TARGET SYSTEM MICROPROCESSOR SOCKET
PIN 1 OF TARGET SYSTEM MICROPROCESSOR SOCKET

Figure 3-2. Installing into a 70136 PLCC type socket

Installing into a 70136 PGA Type Socket

The 70136 emulator is provided with an AMP 821574-1 socket and a pin protector in order to plug into the target system socket of an PGA type. You may use this AMP socket with the pin protector to connect the microprocessor connector to the target system.
To connect the microprocessor connector to the target system, proceeded with the following instructions.

- Remove the 70136 microprocessor (PGA type) from the target system socket. Note the location of pin A1 on the microprocessor and on the target system socket.
- Store the microprocessor in a protected environment (such as antistatic form).
- Place the microprocessor connector with an AMP socket and a pin protector (see figure 3-3), attached to the end of the probe cable, into the target system microprocessor socket.

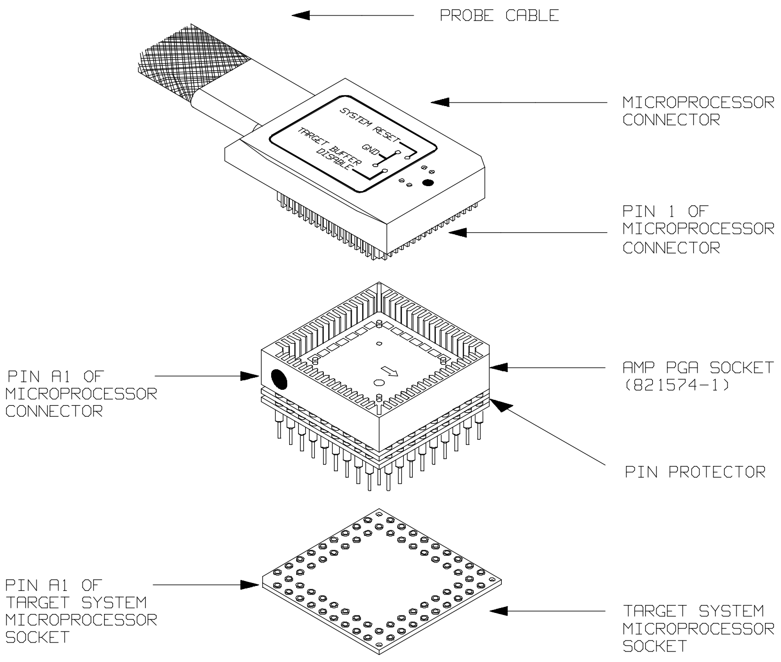

PROBE CABLE
MICROPROCESSOR CONNECTOR
SYSTEM RESET
GND
TARGET BUFFER DISABLE
PIN 1 OF MICROPROCESSOR CONNECTOR
PIN A1 OF MICROPROCESSOR CONNECTOR
AMP PGA SOCKET (821574-1)
PIN PROTECTOR
PIN A1 OF TARGET SYSTEM MICROPROCESSOR SOCKET
TARGET SYSTEM MICROPROCESSOR SOCKET

Figure 3-3. Installing into a 70136 PGA type socket

Installing into a 70136 QFP Type Socket

To connect the 70136 emulator microprocessor connector to the NEC EV-9200G-74 socket on the target system, you should use the adapter, HP PART NO. 64756-61612, that will allow the PLCC microprocessor connector to connect to the QFP socket.

To connect the microprocessor connector to the target system, proceeded with the following instructions.

- Note the location of pin 1 on the NEC EV-9200G-74 socket on the target system.
- Place the microprocessor connector with the adapter (see figure 3-4), attached to the end of the probe cable, into the target system microprocessor socket.

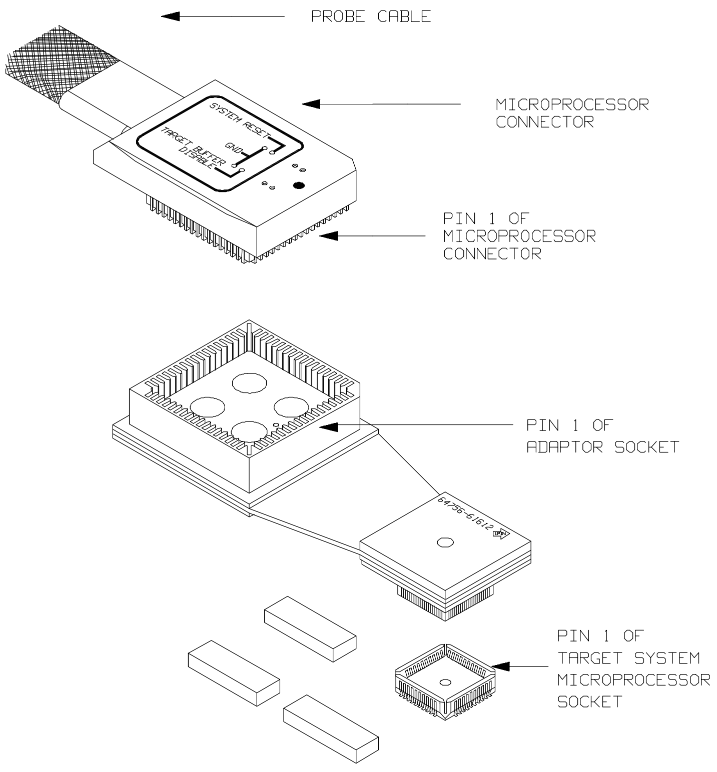


Figure 3-4. Installing into a 70136 QFP type socket

Installing into a 70236/236A PGA Type Socket

To connect the microprocessor connector to the target system, proceeded with the following instructions.

- Remove the 70236 or 70236A microprocessor (PGA type) from the target system socket. Note the location of pin A1 on the microprocessor and on the target system socket.
- Store the microprocessor in a protected environment (such as antistatic form).
- Install the microprocessor connector into the target system microprocessor socket with a pin protector (see figure 3-5).

Caution

DO NOT use the microprocessor connector without using a pin protector. The pin protector is provided to prevent damage to the microprocessor connector when connecting and removing the microprocessor connector from the target system PGA socket.

Installing into a 70236/70236A QFP Type Socket

To connect the 70236 or 70236A emulator microprocessor connector to the NEC EV-9200GD-120 socket on the target system, you should use the NEC EV-9500GD-120 adapter that will allow the PGA microprocessor connector to connect to the QFP socket.

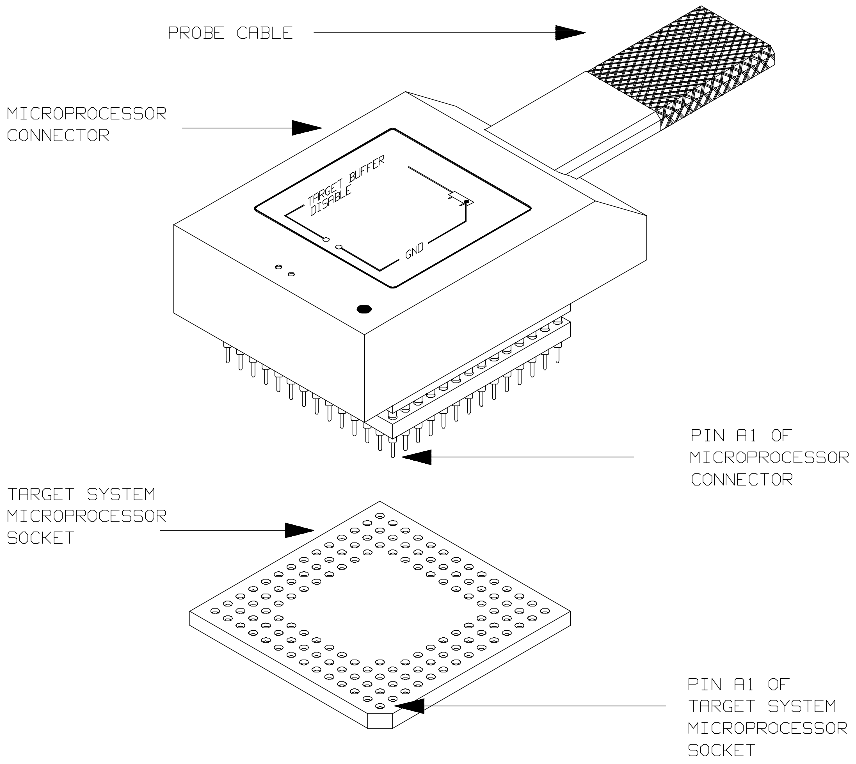

PROBE CABLE
MICROPROCESSOR CONNECTOR
TARGET BUFFER DISABLE
GND
PIN A1 OF MICROPROCESSOR CONNECTOR
TARGET SYSTEM MICROPROCESSOR SOCKET
PIN A1 OF TARGET SYSTEM MICROPROCESSOR SOCKET

Figure 3-5. Installing into a 70236 PGA type socket

In-Circuit Configuration Options

The 70136 emulator provide configuration options for the following in-circuit emulation issues. Refer to the chapter on "Configuring the Emulator" for more information on these configuration options.

Using the Target System Clock Source

The default 70136, 70236 and 70236A emulator configuration selects the internal 16 MHz (system clock speed) clock as the emulator clock source.

You should configure the emulator to select an external target system clock source for the "in-circuit" emulation.

Allowing the Target System to Insert Wait States

High-speed emulation memory provides no-wait-state operation. However, the emulator may optionally respond to the target system ready line while emulation memory is being accessed.

Note

When you use the NEC uPD72291 coprocessor on your target system connected to 70136 microprocessor, the uPD72291 can access 70136 emulation memory on coprocessor memory read/write cycles.

In this case, you should reset the target system to connect the 70136 emulator to the uPD72291 coprocessor before starting emulation session.

Enabling NMI and RESET Input from the Target System

You can configure whether the emulator should accept or ignore the NMI and RESET signals from the target system.

Running the Emulator from Target Reset

You can specify that the emulator begins executing from target system reset. When the target system RESET line becomes active and then inactive, the emulator will start reset sequence (operation) as actual microprocessor.

At First, you must specify the emulator responds to RESET signal by the target system (see the "Enable RESET Input From Target?" configuration in Chapter 4 of this manual).

To specify a run from target system reset, select:

```
Processor Go Reset <RESET>
```

The status now shows that the emulator is "Awaiting target reset". After the target system is reset, the status line message will change to show the appropriate emulator status.

Pin State in Background (70136)

While the emulator is running in the background monitor, probe pins are in the following state.

Address Bus	Same as foreground
Data Bus	Always high impedance except accessing target. When accessing target by background monitor, same as foreground.
$R/\overline{W}$,$M/\overline{IO}$ BUSST0	Always high level except accessing target. When accessing target by background monitor, same as foreground.
BUSST1	Always low level except accessing target. When accessing target by background monitor, same as foreground.
Other	Same as foreground

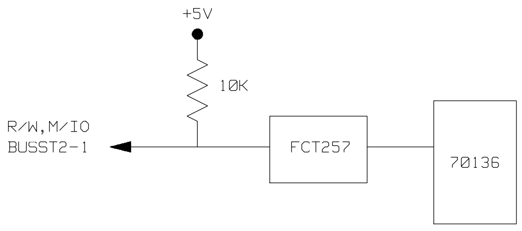
Pin State in Background (70236/70236A)

While the emulator is running in the background monitor, probe pins are in the following state.

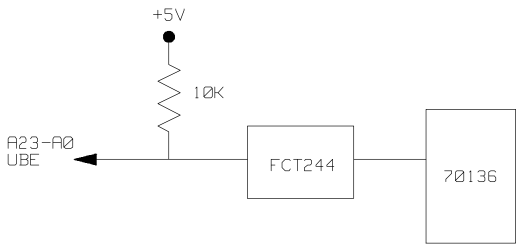
Address Bus	Same as foreground
Data Bus	Always high impedance except accessing target. When accessing target by background monitor, same as foreground.
R/$\overline{\text{W}}$, M/$\overline{\text{IO}}$, $\overline{\text{IORD}}$, $\overline{\text{IOWR}}$, $\overline{\text{MWR}}$	Always high level except accessing target. When accessing target by background monitor, same as foreground.
$\overline{\text{MRD}}$	Same as foreground except for emulation memory write. When accessing emulation memory write, low.
Other	Same as foreground

Target System Interface (70136)

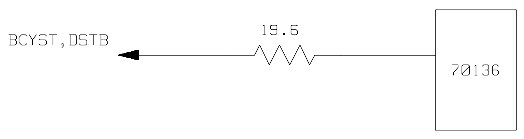
R/$\overline{\text{W}}$ M/$\overline{\text{IO}}$ BUSST2-1	These singals are connected to 70136 through FCT257 and 10K ohm pull-up register.



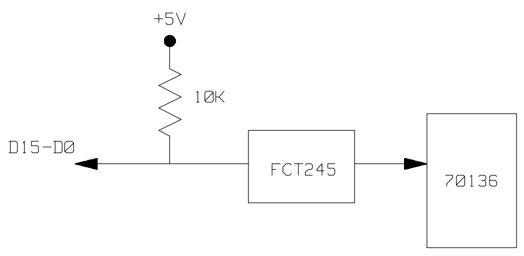
A23-A0 $\overline{\text{UBE}}$	These singals are connected to 70136 through FCT244 and 10K ohm pull-up register.



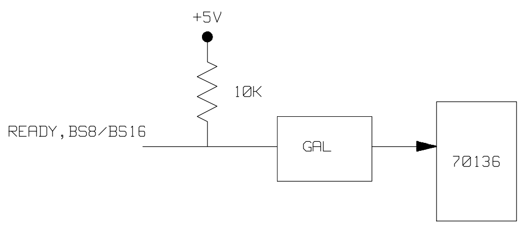
$\overline{\text{BCYST}}$ $\overline{\text{DSTB}}$ These singals are connected to 70136 through 19.6 ohm.



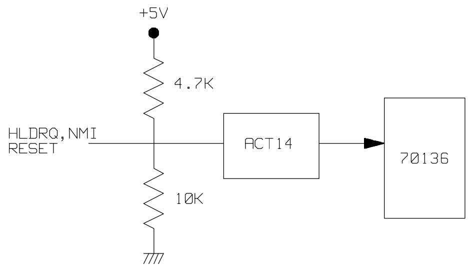
D15-D0 These singals are connected to 70136 through FCT245 and 10K ohm pull-up register.



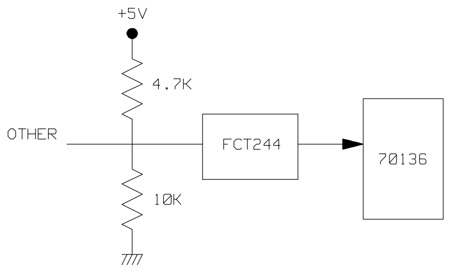
$\overline{\text{READY}}$
$\overline{\text{BS8}}$/BS16 These singals are connected to 70136 through GAL and 10K ohm pull-up register.



HLDRQ $\overline{\text{NMI}}$ $\overline{\text{RESET}}$	These singals are connected to 70136 through ACT14 and 4.7K ohm pull-up and 10K ohm pull-down registers.

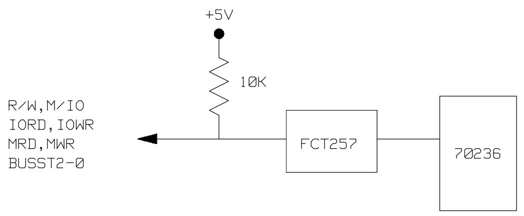


OTHER	These singals are connected to 70136 through FCT244 and 4.7K ohm pull-up and 10K ohm pull-down registers.

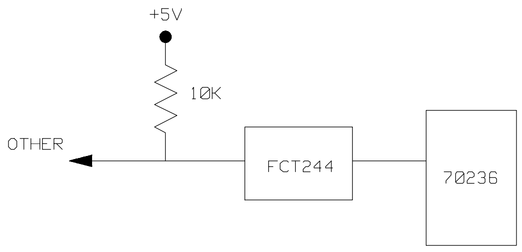


Target System Interface (70236/70236A)

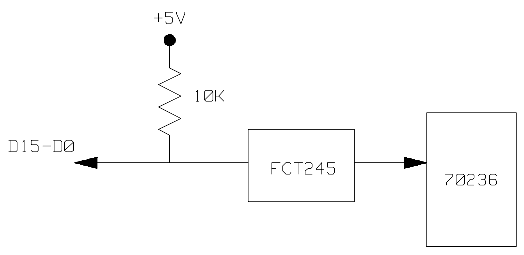
$R/\overline{W}$ $M/\overline{IO}$ $\overline{IORD}$ $\overline{IOWR}$ $\overline{MRD}$ $\overline{MWR}$ BUSST2-0	These singals are connected to 70236/70236A through FCT257 and 10K ohm pull-up register.



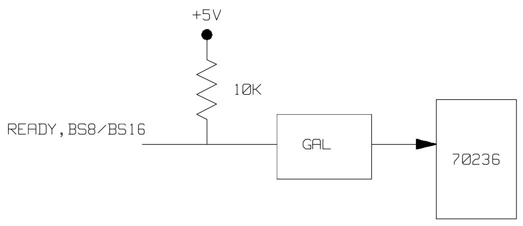
OTHER(INPUT)	These singals are connected to 70236/70236A through FCT244 and 10K ohm pull-up register.



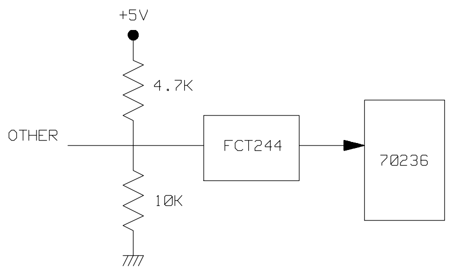
D15-D0	These singals are connected to 70236/70236A through FCT245 and 10K ohm pull-up register.



$\overline{\text{READY}}$ $\overline{\text{BS8}}$/BS16	These singals are connected to 70236/70236A through GAL and 10K ohm pull-up register.



OTHER(OUTPUT)	These singals are connected to 70236/70236A through FCT244 and 4.7K ohm pull-up and 10K ohm pull-down registers.



4

Configuring the 70136 Emulator

Introduction

Your 70136 emulator can help you in all stages of target system development. For instance, you can run the emulator out-of-circuit when developing target system software and in-circuit when integrating software with hardware. You can use the emulator's internal clock or your target system clock. Emulation memory can be used with your target system memory, and it can be mapped as RAM or ROM. You can execute your target programs in real-time or allow emulator execution to be diverted into the monitor when commands request access of target system resources (target system memory, register contents, etc.)

The emulator is a versatile instrument and may be configured to suit your needs at any stage of the development process. This chapter describes the emulator configuration options.

This chapter will:

- Show you how to access the emulator configuration options.
- Describe the emulator configuration options.
- Show you how to save a particular emulator configuration, and load it again at a later time.

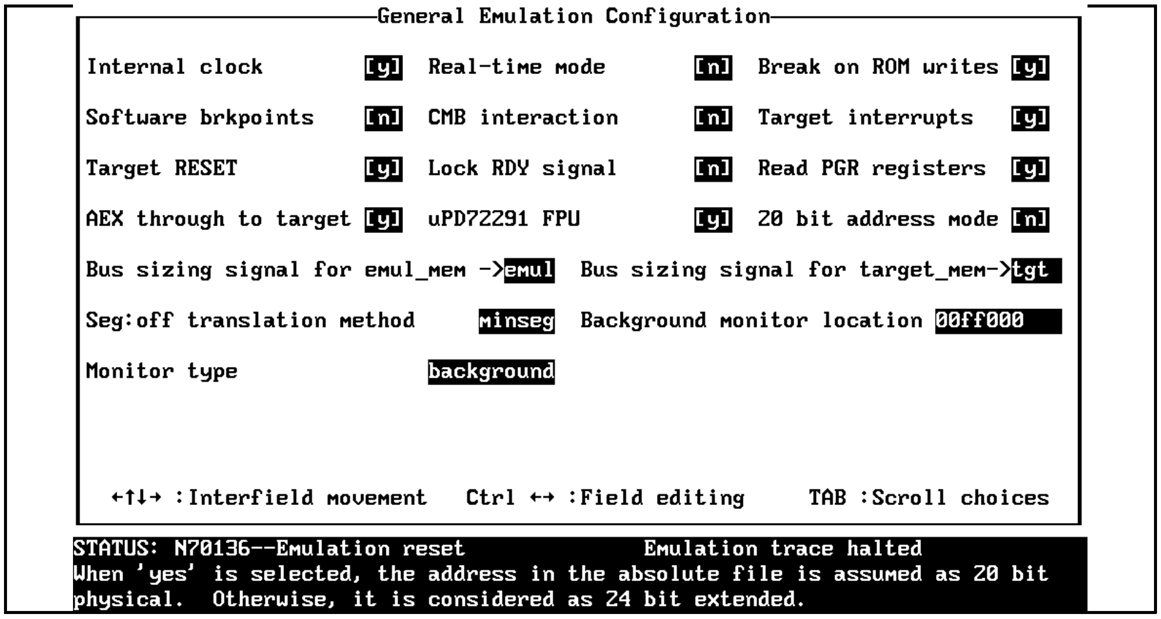
Prerequisites

Before performing the tasks described in this chapter, you should be familiar with how the emulator operates in general. Refer to the *HP 64700 Emulators: Concepts of Emulation and Analysis* manual and the "Getting Started" chapter of this manual.

Accessing the Emulator Configuration Options

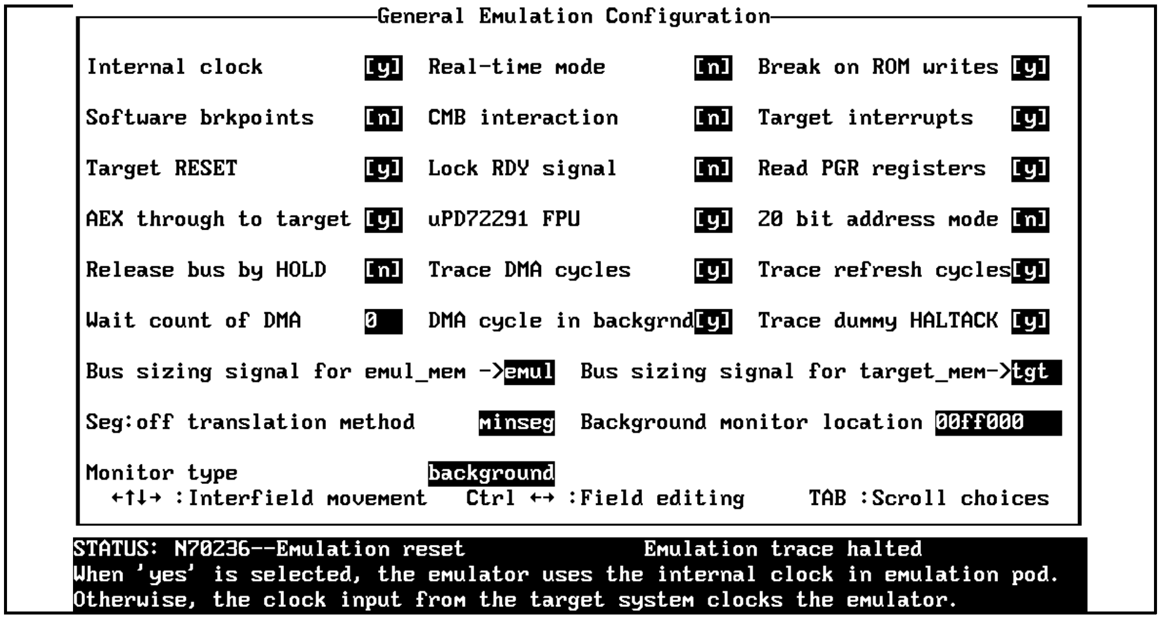
Select:
Config, **G**eneral

When you position the cursor to a configuration item, a brief description of the item appears at the bottom of the display.



```
                    General Emulation Configuration
Internal clock        [y] Real-time mode      [n] Break on ROM writes [y]

Software brkpoints    [n] CMB interaction     [n] Target interrupts   [y]

Target RESET          [y] Lock RDY signal     [n] Read PGR registers  [y]

AEX through to target [y] uPD72291 FPU        [y] 20 bit address mode [n]

Bus sizing signal for emul_mem ->emul  Bus sizing signal for target_mem->tgt

Seg:off translation method   minseg  Background monitor location 00ff000

Monitor type              background



 ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing    TAB :Scroll choices
STATUS: N70136--Emulation reset              Emulation trace halted
When 'yes' is selected, the address in the absolute file is assumed as 20 bit
physical.  Otherwise, it is considered as 24 bit extended.
```

Figure 4-1. General Emulator Configuration (70136)



```
                      General Emulation Configuration
Internal clock        [y]  Real-time mode        [n]  Break on ROM writes [y]

Software brkpoints    [n]  CMB interaction       [n]  Target interrupts   [y]

Target RESET          [y]  Lock RDY signal       [n]  Read PGR registers  [y]

AEX through to target [y]  uPD72291 FPU          [y]  20 bit address mode [n]

Release bus by HOLD   [n]  Trace DMA cycles      [y]  Trace refresh cycles[y]

Wait count of DMA     0    DMA cycle in backgrnd[y]  Trace dummy HALTACK [y]

Bus sizing signal for emul_mem ->emul  Bus sizing signal for target_mem->tgt

Seg:off translation method     minseg  Background monitor location 00ff000

Monitor type               background
  ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing     TAB :Scroll choices

STATUS: N70236--Emulation reset              Emulation trace halted
When 'yes' is selected, the emulator uses the internal clock in emulation pod.
Otherwise, the clock input from the target system clocks the emulator.
```

Figure 4-2. General Emulator Configuration (70236)

Note

You can use the System Terminal window to modify the emulator configuration. If you do this, some PC Interface features may no longer work properly. We recommend that you modify the emulator configuration using only the PC Interface.

Internal Clock

This configuration item allows you to select whether the emulator will be clocked by the internal clock source or by a target system clock source.

Yes	Selects the internal clock oscillator as the emulator clock source. The internal clock speed of the 70136, 70236 and 70236A are 16 MHz (system clock). This is the default.
No	An external target system clock is the emulator clock source. In the 70136 emulator, external clock sources must be within the range of 2-16 MHz. In the 70236 emulator, external clock sources must be within the range of 4-32 MHz. In the 70236A emulator, external clock sources must be within the range of 4-40 MHz.

Note

When the 70136 emulator is plugged into the target system, you should use the external target system clock source to synchronize the emulator with the target system.

Note

Changing the clock source drives the emulator into the reset state.

Real-Time Mode

The "Real-Time mode" question lets you configure the emulator to refuse commands that cause an emulator break to monitor during user program runs.

No	All commands, whether or not they require a break to the emulation monitor, are accepted by the emulator.
Yes	When runs are restricted to real-time and the emulator is running the user program, all commands that cause a break (except "**P**rocessor **R**eset", "**P**rocessor **B**reak", "**P**rocessor **G**o", and "**P**rocessor **S**tep") are refused. For example, the following commands are not allowed when runs are restricted to real-time:

- Display/modify registers.
- Display/modify target system memory.
- Display/modify I/O.

Caution

Restrict emulator to real-time runs with certain target systems. If your target system circuitry depends on constant program execution, you should restrict the emulator to real-time runs. This helps avoid target system damage. Remember that you still can execute the "**P**rocessor **R**eset", "**P**rocessor **B**reak", and "**P**rocessor **S**tep" commands. You should use caution when executing these commands.

Note

When program execution should take place in real-time and the emulator should break to the monitor to read page registers (refer to "Read PGR registers" section in this chapter), the following commands are not allowed with using physical or <segment>:<offset> address expression.

- Display/modify emulation memory.

Break on ROM Writes

This question allows you to specify that the emulator break to the monitor upon attempts to write to memory space mapped as ROM. The emulator will prevent the processor from writing to memory mapped as emulation ROM. It cannot prevent writes to target system RAM locations mapped as ROM, though the write to ROM break is enabled.

Yes	Causes the emulator to break into the emulation monitor whenever the user program attempts to write to a memory region mapped as ROM.
No	The emulator will not break to the monitor upon a write to ROM.

Note

The **wrrom** analysis specification status option allows you to use write to ROM cycles as trigger and storage qualifiers.

Software Breakpoints

This question allows you to enable or disable the software breakpoints feature.
When you define (add) a breakpoint, software breakpoints are automatically enabled.

No	The software breakpoints feature is disabled. This is the default emulator configuration, so you must change this item before you can use software breakpoints.
Yes	Allows you to use the software breakpoints feature. The emulator detects the breakpoint interrupt instruction (F1 hex), it generates a break to background request which as with the "processor break" command.

When you define or enable a software breakpoint to a specified address, the emulator will replace the opcode with one of 70136 undefined opcode (F1 hex) as breakpoint interrupt instruction. When the emulator detects the breakpoint interrupt instruction (F1 hex), user program breaks to the monitor, and the original opcode will be replaced at the software breakpoint address. A subsequent run or step command will execute from this address.

Since the system controller knows the locations of defined software breakpoints, it can determine whether the breakpoint interrupt instruction (F1 hex) is a software breakpoint or opcode in your target program.

If it is a software breakpoint, execution breaks to the monitor,and the breakpoint interrupt instruction is replaced by the original opcode. A subsequent run or step command will execute from this address.

If it is an opcode of your target program, execution still breaks to the monitor, and an "Undefined software breakpoint" status message is displayed.

Refer to the "Getting Started" for information on using software breakpoints.

CMB Interaction

Coordinated measurements are measurements made synchronously in multiple emulators or analyzers. Coordinated measurements can be made between HP 64700 Series emulators that communicate over the Coordinated Measurement Bus (CMB).

Multiple emulator start/stop is one type of coordinated measurement. The CMB signals READY and /EXECUTE are used to perform multiple emulator start/stop.

This configuration item allows you to enable/disable interaction over the READY and /EXECUTE signals. (The third CMB signal, TRIGGER, is unaffected by this configuration item.)

No The emulator ignores the /EXECUTE and READY lines, and the READY line is not driven.

Yes Multiple emulator start/stop is enabled. If you enter the

```
Processor, CMB, Go, ...
```

command, the emulator will start executing code when a pulse on the /EXECUTE line is received. The READY line is driven false while the emulator is running in the monitor. It goes true whenever execution switches to the user program.

Note

CMB interaction also will be enabled when you enter the

```
Processor, CMB, Execute
```

command.

Target Interrupts

This configuration option specifies whether or not the emulation processor accepts to NMI signal generated by the target system.

Yes	The emulator accepts NMI signal generated by the target system. When the NMI signal is accepted, the emulator calls the NMI procedure as actual microprocessor.
No	The emulator ignores NMI signal from target system completely.

Note

You should not use "**P**rocessor **S**tep" command if target system can generates NMI.

When the emulator accepts NMI input in stepping, the following error message will be shown.

```
    ERROR : Stepping failed
```

In this case, you should configure that the emulator ignores NMI input from the target system with this configuration.

Target RESET

The 70136 emulator can respond or ignore target system reset while running in user program or waiting for target system reset (refer to "**P**rocessor **G**o **R**eset" command in "In-circuit Emulation" chapter). While running in background monitor, the 70136 emulator ignores target system reset completely independent on this setting.

Yes	Specify that, this is a default configuration, make the emulator to respond to reset from target system. In this configuration, emulator will accept reset and execute from reset vector (0FFFF0 hex) as same manner as actual microprocessor after reset is inactivated.
No	If disabled, the emulator completely ignores the reset signal from target system. This is true if the emulator is in foreground (executing user program).

Lock RDY Signal

High-speed emulation memory provides no-wait-state operation. However, the emulator may optionally respond to the target system ready lines while emulation memory is being accessed.

No	When the ready relationship is not locked to the target system, emulation memory accesses ignore ready signals from the target system (no wait states are inserted).
Yes	When the ready relationship is locked to the target system, emulation memory accesses honor ready signals from the target system (wait states are inserted if requested).

Read PGR Registers

This configuration item allows you to specify whether the emulator should break to the monitor to read page registers or whether the emulator should use the copy of page registers when the emulation system will convert logical address to extended address in the following commands.

- Display/modify memory with entering physical, <SEGMENT>:<OFFSET>, or no function code address expression.
- Modify software breakpoints.

Yes Specifies that the emulator should break to the monitor to get the current value of page registers on accesses to emulation/target memory.

No Specifies that the emulator should use the copy of page registers which is renewed at breaking to the monitor or changing the value of page registers with using the following PC Interface command.

```
Register Modify <pgr 1 .. pgr 64>
```

You should select this configuration when you only use the normal address mode in your program or the value of page registers is not changed after initializing while executing your program.

AEX Through to Target

This configuration option allows you to select the **AEX** (Address Extension) signal level which is driven to the target system while in the background monitor cycles.

Yes	Specifies that the emulator will drive the **AEX** signal with the level dependent on the address mode in background monitor cycles. When you use the extended address in an emulation command, the **AEX** signal will be driven to high level in background monitor.
No	Specifies that the emulator will hold the **AEX** signal with the level dependent on the last foreground address mode just before entering background monitor. When the program is running on normal address mode, the emulator will hold the **AEX** signal level low in background monitor.

uPD72291 FPU

This configuration option allows you to select the assembler mnemonics for FPU (Floating Point Unit) to display memory.

Yes	Specifies that mnemonics for NEC uPD72291 floating point processor will be used to display memory.
No	Specifies that mnemonics for Intel 80287 numeric processor extension will be used to display memory.

20 Bit Address Mode

This configuration option allows you to specify the load address of an absolute file in "**M**emory **L**ord" command.

No	Specify that the emulator will interpret address in absolute file as 24-bit extended address.
Yes	Specifies that the emulator will interpret address in absolute file as 20-bit physical address.

Release bus by HOLD

(70236/70236A Emulator only) This configuration allows you to specify whether or not the emulator accepts HLDRQ (Hold Request) signal generated by the target system in background.

No	The emulator ignores HLDRQ signal from target system completely in background.
Yes	The emulator accepts HLDRQ signal. When the HLDRQ is accepted, the emulator will respond as actual microprocessor.

Trace DMA Cycles

(70236/70236A Emulator only) This question allows you to specify whether or not the analyzer trace the emulation processor’s internal DMA cycles.

Yes	Specifies that the analyzer will trace the internal DMA cycles.
No	Specifies that the analyzer will not trace the internal DMA cycles.

Trace Refresh Cycles

(70236/70236A Emulator only) This question allows you to specify whether or not the analyzer trace the emulation processor's refresh cycles.

Yes	Specifies that the analyzer will trace the refresh cycles.
No	Specifies that the analyzer will not trace the refresh cycles.

Wait count of DMA

(70236/70236A Emulator only) When you want to trace internal DMA cycles correctly with using the emulator, you must set the number of wait count for internal DMA cycles.

The number is the same as the value of DMAW (Wait for the DMA cycle) of the WCY4 (programmable wait, cycle 4) register (I/O address FFF6 hex). See the "Trace DMA Cycles" in this chapter.

DMA cycle in Background

(70236/70236A Emulator only) This configuration allows you to specify whether or not the emulation processor's internal DMA is allowed while in background.

Yes	The internal DMA is allowed while in background.
No	The internal DMA is not allowed while in background.

Trace Dummy HALTACK

(70236 Emulator only) This question allows you to specify whether or not the analyzer trace the emulation processor’s dummy HALT acknowledge cycles.

Whenever breaks occur during the emulation processor is HALTed, the HALT acknowledge cycle will be occurred one more time. This configuration specifies that the analyzer trace or not this HALT acknowledge cycles.

No	Specifies that the analyzer will not trace the dummy HALT acknowledge cycles.
Yes	Specifies that the analyzer will trace the dummy HALT acknowledge cycles.

Bus Sizing Signal for Emul_mem

emul	Specifies that the bus size of emulation memory is selected from the setting of the map configuration. Refer to the "Mapping Memory" command description in "Using the Emulator" chapter.
tgt	Specifies that the bus size of emulation memory is defined from the BS8/BS16 input of the target system.

Bus Sizing Signal for Target_mem

tgt	Specifies that the bus size of target memory is defined from the $\overline{\text{BS8}}$/BS16 input of the target system.
emul	Specifies that the bus size of target memory is selected from the setting of the map configuration. Refer to the "Mapping Memory" command description in "Using the Emulator" chapter.

Note

The data bus size of I/O accesses is only defined from the $\overline{\text{BS8}}$/BS16 input of the target system.

Seg:off Translation Method

The run and step commands allow you to enter addresses in either logical form (segment:offset, e.g., 0F000H:0000H) or physical form (e.g., 0F000H). When a physical address (non-segmented) is entered with either a run or step command, the emulator must convert it to a logical (segment:offset) address.

minseg Specifies that the physical run address is converted such that the low 16 bits of the address become the offset value. The physical address is right-shifted 4 bits and ANDed with 0F000H to yield the segment value.

```
logical_addr = ((phys_addr >> 4) & 0xf000):(phys_addr & 0xffff)
```

maxseg Specifies that the low 4 bits of the physical address become the offset. The physical address is right-shifted 4 bits to yield the segment value.

```
logical_addr =  (phys_addr >> 4):(phys_addr & 0xf)
```

curseg Specifies that the value entered with either a run or step command (0 thru 0ffff hex) becomes the offset. In this selecting, the current segment value is not changed.

```
logical_addr = (current segment):(entered value)
```

If you use logical addresses other than the three methods which follow, you must enter run and step addresses in logical form.

Background Monitor Location

You can relocate the monitor from the default monitor location to any 4K byte boundary. When entering monitor block addresses, you must only specify addresses on 4K byte boundaries; otherwise, an invalid syntax message is displayed. The location of background monitors may be important because background cycles of the 70136 emulator can be visible to the target system.

In default, the monitor is located on 0FF000 hex through 0FFFFF hex.

Note

If your target system have some circuitry which monitors bus activities to detect illegal access to resources, You may need to relocate monitor address.

Monitor Type

This configuration option allows you to select and use a foreground emulation monitor program. The default monitor is background monitor.

Note

Halt instructions will cause "processor halted" emulation status.

In this status, the emulator cannot break to the monitor.

In this case, you should enter the "reset" command to reset the emulator first.

background	Specify monitor type as background monitor. When you select background monitor, you can specify the background monitor location.

Note ☝

While running in background monitor, the 70136 emulator ignores target system reset.

foreground	Specify monitor type as foreground monitor. When you select foreground monitor, you must specify correct foreground monitor start address with next configuration question (foreground monitor address). After you completed the configuration setting, you need to load foreground monitor program to the emulator with "**M**emory, **L**oad" feature. The foreground monitor program must already assembled and linked with appropriate location specification. Refer to the *HP 64756 70136 Emulator Terminal Interface User's Guide* for more information.

Note ☝

You must **not** use the foreground monitor if you wish to perform coordinated measurements.

Note ☝

If you select a foreground monitor, a 4 kilobyte block is automatically mapped at the address specified by the next question.

Foreground Monitor Address?

The location of the foreground monitor is important because it will occupy part of the processor address space. Foreground monitor location must not overlap the location of target system programs. The default foreground monitor location is "0F0000H".

When entering monitor block addresses, you must only specify addresses on 4K byte boundaries; otherwise, an invalid syntax message is displayed.

Note

Relocating the monitor causes all memory mapper terms to be removed.

Note

You should not load the foreground monitor provided with the 70136 emulator at the base address 0 or 0ff000 hex; the 70136 microprocessor’s vector table is located.

And, You can not load the foreground monitor at the base address over 100000 hex.

Storing an Emulator Configuration

The PC Interface lets you store a particular emulator configuration so that it may be re-loaded later. The following information is saved in the emulator configuration.

- Emulator configuration items.
- Key macro specifications.
- Memory map.
- Break conditions.
- Trigger configuration.
- Window specifications.

To store the current emulator configuration, select:

```
Config, Store
```

Enter the name of a file in which to save the emulator configuration.

Loading an Emulator Configuration

If you want to reload a previously stored emulator configuration, select:

```
Config, Load
```

Enter the configuration file name and press **Enter**. The emulator will be reconfigured with the values specified in the configuration file.

Notes

5

Using the Emulator

Introduction

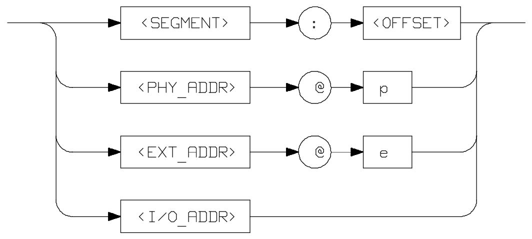
In the "Getting Started" chapter, you learned how to use the basic features of the 70136 emulator. This chapter describes the more in-depth features of the emulator.

This chapter shows you how to:

- Address syntax in emulation commands.
- Address expression in emulation commands.
- Register names and classes.
- Make coordinated measurements.
- Store the contents of memory into absolute files.

Address Syntax

Syntax



The address used in emulation commands may be specified as a segment:offset address, physical address, or as an extended address (though a physical address in run commands (see table 5-1) is converted to a <segment>:<offset> address and a extended address in memory commands (see table 5-1) is converted to a value of the page register and a <segment>:<offset> address by the emulation system).

The physical and extended address specifications are of the following form. "@e" and "@p" are the function codes to define as an extended or a physical address.

Extended address	EXT_ADDR@e
Physical address	PHY_ADDR@p

Expressions are defined in the *HP 64700 Emulators Terminal Interface: User’s Reference* manual.

Parameters

<SEGMENT>	This expression (0-0FFFF hex) is the segment portion of the logical address. The value specified is placed in the 70136 PS register.
<OFFSET>	This expression (0-0FFFF hex) is the offset portion of the logical address. The value specified is placed in the 70136 PC register.
<PHY_ADDR>	This expression (0-0FFFFF hex) with "@p" function code is a physical address in the 70136 address range. In run commands (see table 5-1), the emulation system converts this physical address to a <segment>:<offset> address as specified by the "Seg:off translation method" configuration option in "Configuring the 70136 Emulator" chapter.
<EXT_ADDR>	This expression (0-0FFFFFF hex) with "@e" function code is a extended address in the 70136 address range. In memory commands (see table 5-1), the emulation system converts this extended address to a value of the page register and a <segment>:<offset> address to access the memory.
<I/O_ADDR>	This expression (0-0FFFF hex) with no function code is a 70136 I/O address. This expression should be used in I/O command (see table 5-1).

Address Expression

Table 5-1 is the address expression matrix used in emulation commands.

Table 5-1. Address expression syntax

Command group		<EXT_ADDR> (@e)	<PHY_ADDR> (@p)	<SEGMENT>:<OFFSET>	No function code
Memory commands		OK	OK(*1)	OK(*1)	same as <PHY_ADDR>
Run commands (*2)	maxseg	ERROR	OK	OK	same as <PHY_ADDR>
	minseg	ERROR	OK	OK	same as <PYH_ADDR>
	curseg	ERROR	ERROR	OK	<OFFSET> (0-0FFFFH)
I/O command		ERROR	ERROR	ERROR	OK (0-0FFFFH)
Map command		OK	ERROR	ERROR	ERROR
Breakpoints command		OK	OK(*1)	OK(*1)	same as <PHY_ADDR>

*1 : Emulator breaks to the monitor on accesses to emulation memory (refer to the "Read PGR registers" in "Configuring the 70136 Emulator" chapter.)

*2 : Refer to "Seg:off Translation Method" in "Configuring the 70136 Emulator" chapter.

Memory Commands

The following commands are included in memory commands.

`Memory, Display`
`Memory, Modify`
`Memory, Store`
`Memory, Copy`
`Memory, Find`

You can use the following address expression in memory commands (refer to "Read PGR registers" configuration item in "Configuring the 70136 Emulator" chapter).

	<EXT_ADDR>	<PHY_ADDR>	<SEGMENT>:<OFFSET>
Read PGR : YES	OK	OK*	OK*
Read PGR : NO	OK	OK	OK

(* - Emulator breaks into the monitor on accesses to emulation memory)

When you set the emulator to read PGR on address translation, the emulator should break to the monitor to get the current value of page register on address translation.

When you set the emulator not to read PGR on address translation, the emulator should use the copy of page registers which is renewed at breaking to the monitor or changing the value of page registers. In this case, the emulator does not break to the monitor.

Note

You may answer "NO" to "Read PGR registers" configuration item when you only use normal address mode in your program or the value of page registers is not changed after initializing while executing your program.

Note

When program execution should take place in real-time (refer to "Configuring the 70136 Emulator" chapter) and the emulator should break to the monitor to read page registers, the commands showing above which need physical to extended address conversion are not allowed in running user program. If you entered, the following error message will be shown:

```
ERROR:  Restricted to real time runs
```

Load/Dump Address

When you download programs into memory using "**M**emory **L**oad" command, the emulator will interpret an address in the absolute file owing to the following configuration setting (refer to "20 bit address mode" configuration item in "Configuring the 70136 Emulator" chapter).

```
--------------------------------------------------
|  configuration            |  address mode      |
|---------------------------|--------------------|
| 20 bit address mode : no  |  extended address  |
| 20 bit address mode : yes |  physical address  |
--------------------------------------------------
```

When you dump memory to a host file using "**M**emory **S**tore" command, the address information saved to host file is defined from the address expression used in the "**M**emory **L**oad" command.

```
------------------------------------------------
| Address expression   |  address information  |
| (in dump command)    |  (to a host file)     |
|----------------------|-----------------------|
|  <EXT_ADDR> ("@e")   |  extended address     |
|  <PHY_ADDR> ("@p")   |  physical address     |
|  <SEGMENT>:<OFFSET>  |  physical address     |
|  No function code    |  physical address     |
------------------------------------------------
```

Note

When you download the host file made by "**M**emory **S**tore" command before, you should set the same "Address mode for file loading" configuration item that you enter the "**M**emory **S**tore" command. Otherwise, the memory image is not the same as when you enter the "**M**emory **S**tore" command to make the host file.

Note

When you download the host file with physical address information made by "**M**emory **S**tore" command, you should set up the same value to page registers (PGR 1 **-** PGR 64) that you enter the "**M**emory **S**tore" command. Otherwise, the memory image is not same as when you enter the "**M**emory **S**tore" command to make the host file.

Run Commands

The following commands are included in run commands.

```
Processor, Go, Address
Processor, CMB, Go, Address
Processor, Step, Address
```

You can use the following address expression in run commands.

(refer to "Seg:off translation method" configuration item in "Configuring the 70136 Emulator" chapter)

	<EXT_ADDR>	<PHY_ADDR>	<SEGMENT>:<OFFSET>	No function code
Seg:off maxseg	ERROR	OK	OK	SAME AS <PHY_ADDR>
Seg:off minseg	ERROR	OK	OK	SAME AS <PHY_ADDR>
Seg:off curseg	ERROR	ERROR	OK	<OFFSET>

You should not use the extended address expression in run commands.

If you use extended address expression, the following error messages will be shown.

```
ERROR:  Extended address can not be used
```

I/O Command

The following command is included in I/O command.

```
Processor, I/O
```

You can only use the I/O address expression ; this expression (0-0ffff hex) with no function code defines a 70136 I/O address.

Note

You should not access 70136 page registers (PGR 1 - PGR 64) with using "**P**rocessor, **I**/O" command. You should use "**R**egister" command to access page registers.

Map Command

The following command is included in map command.

```
Config, Map, Modify
```

You can only use the extended address expression ; this expression (0-0ffffff hex and with "@e" function code) defines a 70136 extended address.

Define the data bus size

The data bus size for memory accesses can be defined in map command. For example, enter the following command to map memory (The extended address expression should be used in map command).

```
Config, Map, Modify
```

Using the arrow keys, move the cursor to the "Address range" field of term 1. Enter:

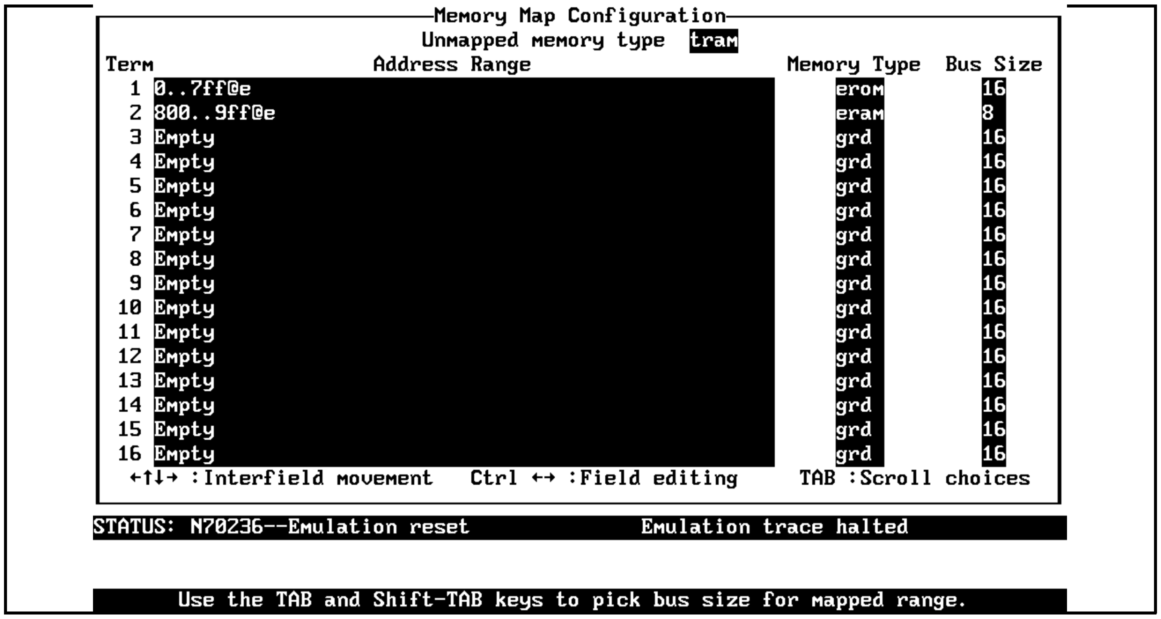
```
0..7ff@e
```

Move the cursor to the "Memory type" field of term 1, and press the TAB key to select the **erom** (emulation ROM) type. Move the cursor to the "Bus size" field of term 1, and enter "16" to map this emulation ROM with 16-bit data bus. Move the cursor to the "address range" field of term 2 and enter:

```
800..9ff@e
```

Move the cursor to the "memory type" field of term 2, and press the TAB key to select the **eram** (emulation ROM) type. Move the cursor to the "Bus size" field of term 2, and enter "8" to map this emulation RAM with 8-bit data bus.

To save your memory map, use the right arrow key or the **Enter** key to exit the field in the lower right corner. (The **End** key on Vectra keyboards moves the cursor directly to the last field.) The memory configuration display is shown in below.



```
                         Memory Map Configuration
                        Unmapped memory type  tram
Term                 Address Range                     Memory Type  Bus Size
  1 0..7ff@e                                             erom        16
  2 800..9ff@e                                           eram        8
  3 Empty                                                grd         16
  4 Empty                                                grd         16
  5 Empty                                                grd         16
  6 Empty                                                grd         16
  7 Empty                                                grd         16
  8 Empty                                                grd         16
  9 Empty                                                grd         16
 10 Empty                                                grd         16
 11 Empty                                                grd         16
 12 Empty                                                grd         16
 13 Empty                                                grd         16
 14 Empty                                                grd         16
 15 Empty                                                grd         16
 16 Empty                                                grd         16
  ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing    TAB :Scroll choices

STATUS: N70236--Emulation reset            Emulation trace halted


     Use the TAB and Shift-TAB keys to pick bus size for mapped range.
```

The other memory ranges are mapped as target RAM with 16-bit data bus (if the data bus size is not specified in **map** command, the address ranges will be mapped with 16-bit data bus by default).

Note

The data bus size for memory accesses also can be defined from the BS8/BS16 input of the target system.

Refer to "Bus size signal for emulation/target memory" configuration items in "Configuring the 70136 Emulator" chapter.

Note

The data bus size of I/O accesses (external I/O only) is defined from the $\overline{\text{BS8}}$/BS16 input of the target system.

Breakpoints Command

The following commands are included in breakpoints command.

```
    Breakpoints
```

You can use the following address expression in breakpoints command (refer to "Read PGR registers" configuration item in "Configuring the 70136 Emulator" chapter).

	<EXT_ADDR>	<PHY_ADDR>	<SEGMENT>:<OFFSET>
Read PGR : YES	OK	OK*	OK*
Read PGR : NO	OK	OK	OK

(* - Emulator breaks into the monitor on accesses to emulation memory)

When you set the emulator to read PGR on address translation, the emulator should break to the monitor to get the current value of page register to convert logical address to extended address using in emulation system.

When you set the emulator not to read PGR on address translation, the emulator should use the copy of page registers which is renewed at breaking to the monitor or changing the value of page registers. In this case, the emulator does not break to the monitor.

Note

You may answer "NO" to "Read PGR registers" configuration item when you only use normal address mode in your program or the value of page registers is not changed after initializing while executing your program.

REGISTER NAMES and CLASSES (70136 Emulator)

The following register names and classes are used with the "**R**egister **D**isplay/**M**odify" commands in 70136 emulator.

BASIC(*) class

Register name	Description
aw, bw	BASIC registers.
cw, dw	
bp, ix, iy	
ds0, ds1, ss	
sp, pc, ps, psw	

NOCLASS

Register name	Description
al, ah, bl, bh	
cl, ch, dl, dh	

PGR class

(page registers)

Register name	Description
pgr1	PGR 1 register
pgr2	PGR 2 register
:	:
:	:
pgr63	PGR 63 register
pgr64	PGR 64 register
xam	XAM register (Read only)

REGISTER NAMES and CLASSES (70236/70236A Emulator)

The following register names and classes are used with the "**R**egister **D**isplay/**M**odify" commands in 70236 emulator.

BASIC(*) class

Register name	**Description**
aw, bw	BASIC registers.
cw, dw	
bp, ix, iy	
ds0, ds1, ss	
sp, pc, ps, psw	

NOCLASS

Register name	**Description**
al, ah, bl, bh	
cl, ch, dl, dh	

PGR class

(Page registers)

Register name	**Description**
pgr1	PGR 1 register
pgr2	PGR 2 register
:	:
:	:
pgr63	PGR 63 register
pgr64	PGR 64 register
xam	XAM register (Read only)

SIO class

(System I/O registers)

Register name	Description
bsel	Bank selection register
badr	Bank address register
brc	Baud rate counter
wmb0	Programmable wait, memory boundary 0 register
wcy1	Programmable wait, cycle 1 register
wcy0	Programmable wait, cycle 0 register
wac	Programmable wait, memory address control register
tcks	Timer clock selection register
sbcr	Stand-by control register
refc	Refresh control register
wmb1	Programmable wait, memory boundary 1 register
wcy2	Programmable wait, cycle 2 register
wcy3	Programmable wait, cycle 3 register
wcy4	Programmable wait, cycle 4 register
sula	SCU low address register
tula	TCU low address register
iula	ICU low address register
dula	DMAU low address register
opha	On-chip peripheral high address register
opsel	On-chip peripheral selection register
sctl	System control register

ICU class

(Interrupt Control Unit registers)

Register name	Description	
imkw	Interrupt mask word register	
irq	Interrupt request register	(Read only)
iis	Interrupt in-service register	(Read only)
ipol	Interrupt polling register	(Read only)
ipfw	Interrupt priority and finish word register	(Write only)
imdw	Interrupt mode word register	(Write only)
iiw1	Interrupt initialize word 1 register	(Write only)
iiw2	Interrupt initialize word 2 register	(Write only)
iiw3	Interrupt initialize word 3 register	(Write only)
iiw4	Interrupt initialize word 4 register	(Write only)

Caution

When **ipol** register is displayed, interruptis are suspended until the FI command is published.

TCU class

(Timer Control Unit registers)

Register name	Description	
tct0	Timer/counter 0 register	
tst0	Timer status 0 register	(Read only)
tct1	Timer/counter 1 register	
tst1	Timer status 1 register	(Read only)
tct2	Timer/counter 2 register	
tst2	Timer status 2 register	(Read only)
tmd	Timer/counter mode register	(Write only)

SCU class

(Serial Control Unit registers)

Register name	Description	
srb	Serial receive data buffer	(Read only)
sst	Serial status register	(Read only)
stb	Serial transmit data buffer	(Write only)
scm	Serial command register	(Write only)
smd	Serial mode register	(Write only)
simk	Serial interrupt mask register	(Write only)

DMA71 class

(DMA Control Unit registers (for uPD71071 mode)

Register name	Description	
dicm	DMA initialize register	(Write only)
dch	DMA channel register	
dbc/dcc0	DMA base/current count register channel 0	
dbc/dcc1	DMA base/current count register channel 1	
dbc/dcc2	DMA base/current count register channel 2	
dbc/dcc3	DMA base/current count register channel 3	
dba/dca0	DMA base/current address register channel 0	
dba/dca1	DMA base/current address register channel 1	
dba/dca2	DMA base/current address register channel 2	
dba/dca3	DMA base/current address register channel 3	
dmd0	DMA mode control register channel 0	
dmd1	DMA mode control register channel 1	
dmd2	DMA mode control register channel 2	
dmd3	DMA mode control register channel 3	
ddc	DMA device control register	
dst	DMA status register	(Read only)
dmk	DMA mask register	

DMA37 class

(DMA Control Unit register (for uPD71037 mode)

Register name	Description
cmd	DMA read status/write command register
bank0	DMA bank register channel 0
bank1	DMA bank register channel 1
bank2	DMA bank register channel 2
bank3	DMA bank register channel 3
adr0	DMA current address register channel 0
adr1	DMA current address register channel 1
adr2	DMA current address register channel 2
adr3	DMA current address register channel 3
cnt0	DMA current count register channel 0
cnt1	DMA current count register channel 1
cnt2	DMA current count register channel 2
cnt3	DMA current count register channel 3
sfrq	Software DMA write request register (Write only)
smsk	DMA write single mask register (Write only)
mode	DMA write mode register
clbp	DMA clear byte pointer F/F (Write only)
init	DMA initialize register (Write only)
cmsk	DMA clear mask register (Write only)
amsk	DMA write all mask register bit (Write only)

Making Coordinated Measurements

Coordinated measurements are measurements synchronously made in multiple emulators or analyzers. Coordinated measurements can be made between HP 64700 Series emulators, which communicate over the Coordinated Measurement Bus (CMB). Coordinated measurements can also be made between an emulator and another instrument connected to the BNC connector.

This chapter will describe coordinated measurements made from the PC Interface which involve the emulator. These types of coordinated measurements are:

- Running the emulator on reception of the CMB /EXECUTE signal.
- Using the analyzer trigger to break emulator execution into the monitor.

Three signal lines on the CMB are active and serve the following functions:

/TRIGGER	Active low. The analyzer trigger line on the CMB and on the BNC serve the same logical purpose. They provide a means for the analyzer to drive its trigger signal out of the system, or for external trigger signals to arm the analyzer or break the emulator into its monitor.
READY	Active high. This line is for synchronized, multi-emulator start and stop. When you enable CMB run control interaction, all emulators must break to background on receipt of a false READY signal and will not return to foreground until this line is true.
/EXECUTE	Active low. This line serves as a global interrupt signal. On receipt of an enabled /EXECUTE signal, each emulator is to interrupt whatever it is doing and execute a previously defined process, such as run the emulator or start a trace measurement.

Running the Emulator at /EXECUTE

Before you can specify that the emulator run on receipt of the /EXECUTE signal, you must enable CMB interaction. To do this, select:

```
Config, General
```

Use the arrow keys to move the cursor to the "CMB Interaction? [n]" question, and type "y". Use the **Enter** key to exit out of the lower right-hand field in the configuration display.

To begin executing a program on receipt of the /EXECUTE signal, select:

```
Processor, CMB, Go
```

Now you may select either the current program counter ("Pc", in other words, the current PS:PC), or a specific address.

The command you enter is saved, and is executed when the /EXECUTE signal becomes active. Also, you will see the message "ALERT: CMB execute; run started".

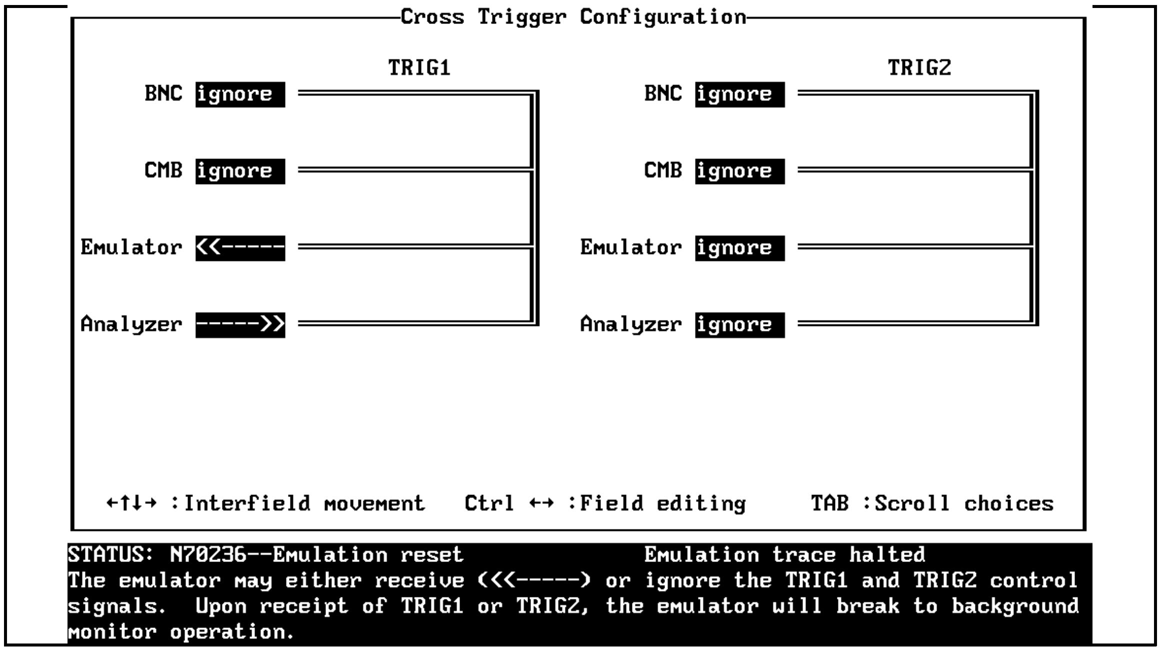
Breaking on the Analyzer Trigger

To break emulator execution into the monitor when the analyzer trigger condition occurs, you modify the trigger configuration. To access the trigger configuration, select:

```
Config, Trigger
```

The trigger configuration display contains two diagrams, one for each internal TRIG1 and TRIG2 signal.

To use the internal TRIG1 signal to connect the analyzer trigger to the emulator break line, move the cursor to the highlighted "Analyzer" field in the TRIG1 portion of the display. Use the **TAB** key to select the "----->>" arrow pointing from the analyzer to TRIG1. Next, move the cursor to the highlighted "Emulator" field and use the **TAB** key to select the arrow pointing toward the emulator (<<-----). This specifies that emulator execution will break into the monitor when the TRIG1 signal is driven. The trigger configuration display appears as follows:


```
                         Cross Trigger Configuration

                       TRIG1                                   TRIG2
     BNC ignore                              BNC ignore

     CMB ignore                              CMB ignore

Emulator <<-----                        Emulator ignore

Analyzer ----->>                        Analyzer ignore


   ←↑↓→ :Interfield movement   Ctrl ←→ :Field editing    TAB :Scroll choices
STATUS: N70236--Emulation reset              Emulation trace halted
The emulator may either receive (<<-----) or ignore the TRIG1 and TRIG2 control
signals.  Upon receipt of TRIG1 or TRIG2, the emulator will break to background
monitor operation.
```

Storing Memory Contents to an Absolute File

The "Getting Started" chapter shows you how to load absolute files into emulation or target system memory. You can also store emulation or target system memory to an absolute file with the following command.

```
Memory, Store
```

When you store memory using "**M**emory, **S**tore" command, the address information saved to an absolute file is defined from the address expression used in the "**M**emory **S**tore" command. refer to "Address Expression in Emulation Commands" section in this chapter.

Note

The first character of the absolute file name must be a letter. You can name the absolute file with a total of 8 alphanumeric characters. You also can include an extension of up to 3 alphanumeric characters. If the file is stored in HP 64000 format, its extension must be ".X".

Caution

The "**M**emory **S**tore" command writes over an existing file if it has the same name that is specified with the command. You may wish to verify beforehand that the specified filename does not already exist.

A

File Format Readers

Introduction

The 70136 PC Interface is provided with the following "reader".

- Intel Object Module Format (OMF86) Reader
  - (This Reader is for the Intel OMF86 absolute file)
- NEC30 Reader
  - (This Reader is for the load module format file which is generated by NEC LK70136 linker for uPD70136)
- NEC33 Reader
  - (This Reader is for the extended load module format file which is generated by NEC EL70136 extended mode locator for uPD70136)
- HP64000 Reader

The Reader converts the file(s) into two files that are usable with the HP 64756 emulator. This means that you can use available language tools to create absolute files, then load those files into the emulator using the 70136 PC Interface.

The Reader can operate from within the PC Interface or as a separate process. When operating the Reader, it may be necessary to execute it as a separate process if there is not enough memory on your personal computer to operate the PC Interface and Reader simultaneously. You can also operate the reader as part of a "make file".

Using the OMF86, NEC30, NEC33 Reader

What the Reader Accomplishes

The Reader accepts as input an absolute file in the form "<file>.<ext>", and creates two new files that are used by the PC Interface: an "absolute" file, and an ASCII symbol file.

The Absolute File

During execution of the Reader, an absolute file (<file>.HPA) is created. This absolute file is a binary memory image which is optimized for efficient downloading into the emulator.

The ASCII Symbol File

The ASCII symbol file (<file>.HPS) produced by the Reader contains global symbols, module names, local symbols, and, when using applicable development tools such as a "C" Compiler, program line number. Local symbols evaluate to a fixed (static, not stack relative) address.

Note

You must use the required options for your specific language tools to include symbolic ("debug") information in the absolute file. The Reader will only convert symbol information that is present in the input absolute file.

The symbol file contains symbol and address information in the following form:

```
 module_name1
 module_name2
 ...
 module_nameN
global_symbol1  0100:1234
global_symbol2  0100:5678
...
global_symbolN  0100:ABCD
|module_name|# 1234         0200:0872
|module_name|local_symbol1  0200:0653
|module_name|local_symbol2  0200:0872
...
|module name|local_symbolN  0200:0986
```

The space preceding module names is required. A single tab separates symbol and address.

Each of the symbols is sorted alphabetically in the order: module manes, global symbols, and local symbols.

The local symbols are scooped. This means that to access a variable named "count" in a function named "foo" in a source file module named "main.c", you would enter "main.c:foo.count". See table A-1.

Table A-1. How to Access Variables

Module Name	Function Name	Variable Name	You Enter:
MAIN.C	FOO	COUNT	MAIN.C:FOO.COUNT
MAIN.C	BAR	COUNT	MAIN.C:BAR.COUNT
MAIN.C	line number 23		MAIN.C: line 23

Line numbers will appear similar to a local symbol except that "local_symbolX" will be replaced by "#NNNNN" where NNNNN is a five digit decimal number. Line numbers should appear in ascending order.

Note

When the line number symbol is displayed in the emulator, it appears in brackets. Therefore, the symbol "modname:# 345" will be displayed as "modname:[345]" in mnemonic memory and trace list displays.

Line number symbols are accessed by entering the following on one line in the order shown:

module name
colon (:)
space
the word "line"
space
the decimal line number

For example:

```
MAIN.C: line 23
```

Location of the Reader Program

The Reader is located in the directory named **\hp64700\bin** by default, along with the PC Interface. This directory must be in the environment variable PATH for the Reader and PC Interface to operate properly. This is usually defined in the "\autoexec.bat" file. **The following examples assume that you have "\hp64700\bin" include in your PATH variable. If not, you must supply the directory name when executing the Reader program.**

Using the Reader from MS-DOS

The command names for the Reader are shown below.

Intel OMF86 Reader	RDOMF86.EXE
NEC30 Reader	RDNEC30.EXE
NEC33 Reader	RDNEC33.EXE

You can execute the Reader from the command line with the following command syntax:

```
C:\HP64700\BIN\<READER> [-q] [-u] [-m]
<filename> <RETURN>
```

<READER>	is the name of the command name for the Reader
[-q]	Specifies the "quiet" mode. This option suppress the display of messages.
[-u]	Specifies that the first leading underscore ("_") of a symbol is not removed.
[-m]	(RDOMF86.EXE only) Specifies that the OMF86 Reader removes duplicate module names generated by some construction tools. Some tools enclose all of the functions and variables in a module within a block (or function) whose name is the same as that of the module (or source file). When this option is used, the Intel OMF86 Reader will ignore the first enclosing block in a module is its name matches the module name.
<filename>	Specifies the same of the file containing the absolute program. You can include an extension in the file name.

The following commands will create the files "TESTPROG.HPA" and "TESTPROG.HPS".

```
ENTER: RDOMF86 TESTPROG.ABS
ENTER: RDNEC30 TESTPROG.LNK
ENTER: RDNEC33 TESTPROG.EXL
```

Using the Reader from the PC Interface

The 70136 PC Interface has a file format option under the "**M**emory **L**oad" command.

After you select OMF86 as the file format, the Intel OMF86 Reader will operate on the file you specify. After the Reader completes successfully, the 70136 PC Interface will load the absolute and symbol files produced by the Reader.

To use the Reader from the PC Interface, follow these steps:

1. Start up the 70136 PC Interface.

2. Select "**M**emory, **L**oad". The memory load menu will appear.

3. Specify the file format as "OMF86". This will appear as the default file format.

4. Specify the memory to be loaded (emulation, target, or both).

5. Specify to force the file format reader to regenerate the emulator absolute file (.HPA) and symbol database (.HPS) before loading the code. Normally, these files are only regenerated whenever the file you specify (the output of your language tools) is newer than the emulator absolute file and symbol database.

6. Specify that the OMF86 Reader removes duplicate module names generated by some construction tools. Some tools enclose all of the functions and variables in a module within a block (or function) whose name is the same as that of the module (or source file). When this option is used, the Intel OMF86 Reader will ignore the first enclosing block in a module is its name matches the module name.

7. Specify that the first leading underscore ("_") of a symbol is not removed.

8. Specify a file in Intel OMF86 format ("TESTFILE.OMF", for example). **The file extension can be something other than ".OMF", but ".HPA" or ".HPS" cannot be used.**

Using the Intel OMF86 file that you specify (TESTFILE.OMF, for example), the PC Interface performs the following:

- It checks to see if two files with the same base name and extensions .HPS and .HPA already exist (for example, TESTFILE.HPS and TESTFILE.HPA).
- If TESTFILE.HPS and TESTFILE.HPA don't exist, the Intel OMF86 Reader produces them. The new absolute file, TESTFILE.HPA, is then loaded into the emulator.
- If TESTFILE.HPS and TESTFILE.HPA already exist but the create dates and times are earlier than the Intel OMF86 file creation date/time, the Intel OMF86 Reader recreates them. The new absolute file, TESTFILE.HPA, is then loaded into emulator.
- If TESTFILE.HPS and TESTFILE.HPA already exist but the dates and times are later than the creation date/time for the Intel OMF86 file, the current absolute file, TESTFILE.HPA, is then loaded into the emulator.

Note

Date/time checking only done within the PC Interface. When you run the Reader at the MS-DOS command line prompt, the Reader will always update the absolute and symbol files.

When the Reader operates on a file, a status message will be displayed indicating that it is reading an absolute file. When the Reader completes its processing, another message will be displayed indicating the absolute file is being loaded.

Note

When you use NEC33 Reader and load an absolute file, you should configure that the emulator interprets address in the absolute file as extended address. Refer to "20 Bit Address Mode" section in "Configuring the 70136 Emulator" chapter.

If the Reader Won't Run

If your program is very large, the PC Interface may run out of memory while attempting to create the database file. If this occurs, exit the PC Interface and execute the Reader program at the MS-DOS command prompt.

Including Reader in a Make File

You may want to incorporate the "RDOMF86", "RDNEC30", or "RDNEC33" process as the last step in your "make" file, or as a step in your construction process, so as to eliminate the possibility of having to exit the PC Interface due to space limitations describe above. If the file with "-.HPA" and "-.HPS" extensions are not current, loading an absolute file will automatically create them.

Using the HP 64000 Reader

An HP 64000 “reader” is provided with the PC Interface. The HP 64000 Reader converts the files into two files that are usable with your emulator. This means that you can use available language tools to create HP 64000 absolute files, then load those files into the emulator using the PC Interface.

The HP 64000 Reader can operate from within the PC Interface or as a separate process. When operating the HP 64000 Reader, it may be necessary to execute it as a separate process if there is not enough memory on your personal computer to operate the PC Interface and HP 64000 Reader simultaneously. You can also operate the reader as part of a “make file.”

What the Reader Accomplishes

Using the HP 64000 files (<file.X>, <file.L>, <scr1.A>, <scr2.A>, ...) the HP 64000 Reader will produce two new files, an “absolute” file and an ASCII symbol file, that will be used by the PC Interface. These new files are named: “<file>.hpa” and “<file>.hps.”

The Absolute File

During execution of the HP 64000 Reader, an absolute file (<file>.hpa) is created. This absolute file is a binary memory image which is optimized for efficient downloading into the emulator.

The ASCII Symbol File

The ASCII symbol file (<file>.hps) produced by the HP 64000 Reader contains global symbols, module names, local symbols, and, when using applicable development tools such as a “C” compiler, program line numbers. Local symbols evaluate to a fixed (static, not stack relative) address.

Note

You must use the required options for your specific language tools to include symbolic (“debug”) information in the HP 64000 symbol files. The HP 64000 Reader will only convert symbol information present in the HP 64000 symbol files (<file.L>, <src1.A>, <src2.A>, ...).

The symbol file contains symbol and address information in the following form:

```
 module_name1
 module_name2
 ...
 module_nameN
global_symbol1  0100:1234
global_symbol2  0100:5678
...
global_symbolN  0100:ABCD
|module_name1|# 1234         0200:0872
|module_name1|local_symbol1  0200:0653
|module_name1|local_symbol2  0200:0872
...
|module_name1|local_symbolN  0200:0986
```

Each of the symbols is sorted alphabetically in the order: module names, global symbols, and local symbols.

Line numbers will appear similar to a local symbol except that “local_symbolX” will be replaced by “#NNNNN” where NNNNN is a five digit decimal line number. The addresses associated with global and local symbols are specific to the processor for which the HP 64000 files were generated.

Note

If your emulator can store symbols internally, symbols will appear in disassembly. When the line number symbol is displayed in the emulator, it appears in brackets. Therefore, the symbol "MODNAME: line 345" will be displayed as "MODNAME:[345]" in mnemonic memory and trace list displays.

The space preceding module names is required. Although formatted for readability here, a single tab separates symbol and address.

The local symbols are scooped. This means that to access a variable named "count" in a source file module named "main.c," you would enter "MAIN.C:COUNT" as shown below.

Table A-2. How to Access Variables

Module Name	Variable Name	You Enter:
MAIN.C	COUNT	MAIN.C:COUNT
MAIN.C	line number 23	MAIN.C: line 23

You access line number symbols by entering the following on one line in the order shown:

module name
colon (:)
space
the word "line"
space
the decimal line number

For example:

```
MAIN.C: line 23
```

Location of the HP 64000 Reader Program

The HP 64000 Reader is located in the directory named \hp64700\bin by default, along with the PC Interface. This directory must be in the environment variable PATH for the HP 64000 Reader and PC Interface to operate properly. The PATH is usually defined in the “\autoexec.bat” file.

The following examples assume that you have “\hp64000\bin” included in your PATH variable. If not, you must supply the directory name when executing the Reader program.

Using the Reader from MS-DOS

The command name for the HP 64000 Reader is **RHP64000.EXE**. To execute the Reader from the command line, for example, enter:

```
RHP64000 [-q] <filename>
```

[-q]	This option specifies the “quiet” mode, and suppresses the display of messages.
<filename>	This represents the name of the HP 64000 linker symbol file (file.L) for the absolute file to be loaded.

The following command will create the files “TESTPROG.HPA”and “TESTPROG.HPS”

```
RHP64000 TESTPROG.L
```

Using the Reader from the PC Interface

The PC Interface has a file format option under the “**M**emory **L**oad” command. After you select HP64000 as the file format, the HP 64000 Reader will operate on the file you specify. After this completes successfully, the PC Interface will accept the absolute and symbol files produced by the Reader.

To use the Reader from the PC Interface:

1. Start up the PC Interface.
2. Select “**M**emory **L**oad.” The memory load menu will appear.
3. Specify the file format as “HP64000.” This will appear as the default file format.
4. Specify the name of an HP 64000 linker symbol file (TESTFILE.L for example).

Using the HP 64000 file that you specify (TESTFILE.L, for example), the PC Interface performs the following:

- It checks to see if two files with the same base name and extensions .HPS and .HPA already exist (for example, TESTFILE.HPS and TESTFILE.HPA).
- If TESTFILE.HPS and TESTFILE.HPA don't exist, the HP 64000 Reader produces them. The new absolute file, TESTFILE.HPA, is then loaded into the emulator.
- If TESTFILE.HPS and TESTFILE.HPA already exist but the create dates and times are earlier than the HP 64000 linker symbol file creation date/time, the HP 64000 Reader recreates them. The new absolute file, TESTFILE.HPA, is then loaded into the emulator.
- If TESTFILE.HPS and TESTFILE.HPA already exist but the dates and times are later than the creation date and time for the HP 64000 linker symbol file, the HP 64000 Reader will not recreate TESTFILE.HPA. The current absolute file, TESTFILE.HPA, is then loaded into the emulator.

Note

Date/time checking is only done within the PC Interface. When running the HP 64000 Reader at the MS-DOS command line prompt, the HP 64000 Reader will always update the absolute and symbol files.

When the HP 64000 Reader operates on a file, a status message will be displayed indicating that it is reading an HP 64000 file. When the HP 64000 Reader completes its processing, another message will be displayed indicating the absolute file is being loaded.

The PC Interface executes the Reader with the "**-q**" (quiet) option by default.

If the Reader Won't Run

If your program is very large, the PC Interface may run out of memory while attempting to create the database file. If this occurs, you will need to exit the PC Interface and execute the program at the MS-DOS command prompt to create the files that are downloaded to the emulator.

Including RHP64000 in a Make File

You may wish to incorporate the "RHP64000" process as the last step in your "make file," as a step in your construction process, to eliminate the possibility of having to exit the PC Interface due to space limitations describe above. If the files with ".HPA" and ".HPS" extensions are not current, loading an HP 64000 file will automatically create them.

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