User's Guide for the Terminal Interface

HP 64751
68340 Emulator and
Emulation Bus Analyzer

Notice

Printing History

New editions are complete revisions of the manual. The date on the title page changes only when a new edition is published.

A software code may be printed before the date; this indicates the version level of the software product at the time the manual was issued. Many product updates and fixes do not require manual changes, and manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual revisions.

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Safety, Certification and Warranty

Safety and certification and warranty information can be found at the end of this manual on the pages before the back cover.

68340 Emulation and Analysis

The HP 64751 68340 Emulator replaces the 68340 microprocessor in your embedded microprocessor system, also called the *target system*, so that you can control execution and view or modify processor and target system resources.

The emulator can be used with the HP 64704 Emulation Bus Analyzer or the HP 64794 Deep Memory Emulation Bus Analyzer which capture 80 channels of emulation processor bus cycle information synchronously with the processor's clock signal. This analyzer is called the *emulation analyzer*.

With the Emulator, You Can ...

- Plug into 68340 target systems with Pin Grid Array (PGA) sockets.
- Download programs into emulation memory or target system RAM.
- Display or modify the contents of processor registers and memory resources.
- Run programs at clock speeds up to 25 MHz (with active probe boards 64751-66508 and higher — up to 16.78 MHz with boards 64751-66506 and lower), set up software breakpoints, step through programs, and reset the emulation processor.

With the Analyzer, You Can ...

- Trigger the analyzer when a particular bus cycle state is captured. You can also trigger the analyzer after a state has occurred a specified number of times. States are stored relative to the trigger state.
- Qualify which states get stored in the trace.
- Prestore certain states that occur before each qualified store state.
- Trigger the analyzer after a sequence of up to 8 different events have occurred.
- Capture data on signals of interest in the target system.
- Cause the emulator to stop program execution when the analyzer finds its trigger condition.

With the HP 64700 Card Cage, You Can ...

- Use the RS-422 capability of the serial port and an RS-422 interface card on the host computer (for example, the HP 98659 for the HP 9000 or the HP 64037 for the PC) to provide upload/download rates of up to 230.4K baud.
- Easily upgrade HP 64700 firmware by downloading to flash memory.

With Multiple HP 64700s, You Can ...

- Start and stop up to 16 emulators at the same time (up to 32 if modifications are made).
- Use the analyzer in one HP 64700 to arm (that is, activate) the analyzers in other HP 64700 card cages or to cause emulator execution in other HP 64700 card cages to break.
- Use the HP 64700's BNC connector to trigger an external instrument (for example, a logic analyzer or oscilloscope) when the analyzer finds its trigger condition, or you can allow an external instrument to arm the analyzer or break emulator execution.

In This Book

This book describes the HP 64751 68340 emulator and the HP 64704 analyzer. It is organized into five parts whose chapters are described below.

Part 1. Quick Start Guide

    Chapter 1 presents an overview of emulation and analysis and quickly shows you how to use the emulator and analyzer.

Part 2. User's Guide

    Chapter 2 shows you how to plug the emulator into target systems.
    Chapter 3 shows you how to enter Terminal Interface commands and display HP 64700 system information.
    Chapter 4 shows how to use the emulator.
    Chapter 5 shows how to use the analyzer in the "easy" configuration.
    Chapter 6 shows how to use the analyzer in the "complex" configuration.
    Chapter 7 shows how to make coordinated measurements.

Part 3. Reference

    Chapter 8 describes Terminal Interface commands.
    Chapter 9 describes the error messages that can occur while using the Terminal Interface and provides recovery information.
    Chapter 10 lists the emulator specifications and characteristics.

Part 4. Concept Guide

    Chapter 11 contains conceptual (and more detailed) information on various topics.

Part 5. Installation Guide

    Chapter 12 shows you how to install emulator and analyzer boards into the HP 64700 Card Cage and how to connect the HP 64700 to a host computer or terminal.
    Chapter 13 shows you how to install or update emulator firmware. Follow these instructions if you have ordered the HP 64751 emulator and the HP 64748C emulation control card separately.

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Part 1

Quick Start Guide

Part 1

1

Quick Start

The 68340 Emulator — At a Glance

```
U>t1 -od -edt 31
 Line  addr,H   68340 Mnemonic                          count,R seq
 -----  ------   -------------------------------------   -------- ---
    0   main     LINK.W   A6,#$FF9C                          ---   +
        =00047fe4   stck sdata wr:$00047FF8
    4   000009b4 MOVE.L   A2,-(A7)                        2.840 uS  .
        =00047f7c   dest sdata wr:$00000006
    5   000009b6 MOVE.L   D2,-(A7)                        0.720 uS  .
        =00047f78   dest sdata wr:$0000FFDC
    8   000009b8 MOVEA.L  #$00000984,A2                   2.160 uS  .
   13   000009be LEA      ($FF9C,A6),A0                   3.560 uS  .
   15   000009c2 MOVEA.L  #$00000A62,A1                   1.440 uS  .
   18   000009c8 MOVEQ    #$00000020,D1                   2.160 uS  .
   19   000009ca MOVE.B   (A1)+,(A0)+                     0.720 uS  .
        =0000a62    src  sdata rd:$43
        =00047f80   dest sdata wr:$43
   20   000009cc DBF      D1,$000009CA TAKEN              0.720 uS  .
   24   000009ca MOVE.B   (A1)+,(A0)+                     3.440 uS  .
        =0000a63    src  sdata rd:$6F
        =00047f81   dest sdata wr:$6F
   25   000009cc DBF      D1,$000009CA NOT TAKEN          0.720 uS  .
   29   000009d0 incomplete instr.: /41EE/????/          3.120 uS  .
   30   00000a64 $6D---       supr data byte rd (ds16)    0.680 uS  .
U>
```

Terminal
Interface

HP 9000
Series 300/400
Host Computer

LAN
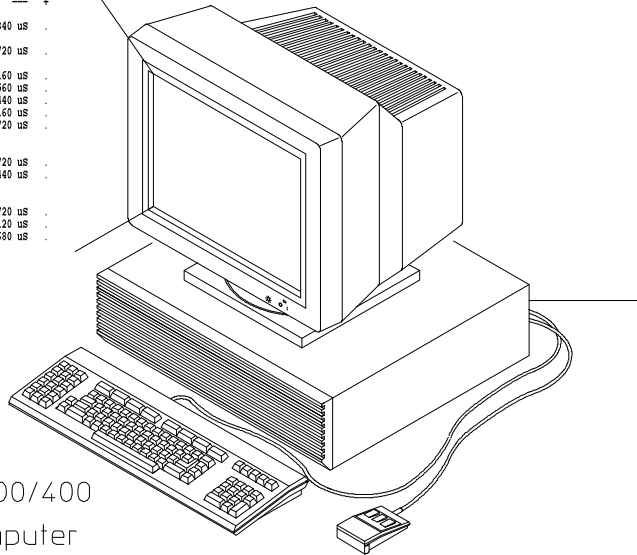
HP 64700 Card Cage
Contains:
– HP 64751 68340
   Emulator
– HP 64704A Emulation
   Bus Analyzer
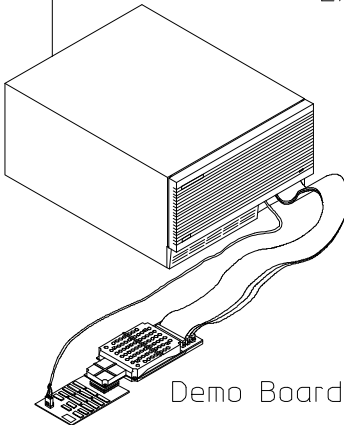
Demo Board

64751E07

The tutorial examples presented in this chapter make the following assumptions:

- The HP 64700 is connected to the same LAN as an HP 9000 Series 300 host computer (refer to the "Installation" chapter).

- Networking software is installed on your HP 9000 Series 300 host computer (primarily telnet and ftp software).

- You have installed the HP 64751 emulator and HP 64704 analyzer into the HP 64700 card cage, and plugged the emulator probe into the demo target system.

Step 1. Log in to the emulator

- Use the **telnet** command on the host computer to connect to the HP 64700.

```
$ telnet hostname
```

Where "hostname" is the name of the emulator. Or, you could use the Internet Protocol (IP) address (or internet address) in place of the hostname:

```
$ telnet 15.35.226.210
```

You should see messages similar to:

```
Trying...
Connected to 15.35.226.210
Escape character is '^]'.
```

After you connect to the emulator, you should see a prompt similar to:

```
R>
```

Step 2. Set up the quick start demo program

Make sure you begin this tutorial with the emulator in its default, power-up state by initializing the emulator.

- Initialize all configuration items, define a new memory map, and load the quick start demo program and its symbols by entering the **demo** command.

```
R>demo
R>
```

Notice that the emulation status character is "R" after the command. This shows that the emulator is in its reset state.

Step 3. Display the memory map

1 View the resulting memory map by entering the **map** command with no parameters.

```
R>map
  # remaining number of terms   : 7
  # remaining emulation memory  : 40000h bytes
  map   000000000..000000fff     eram dp           # term 1
  map   other  grd
```

The "other" term in the memory map specifies that unmapped memory ranges are treated as guarded memory.

Step 4. Display the program symbols

1 Display the symbols with the **sym** command.

```
R>sym
  sym Int_Cmd=00000042a
  sym demo:Cmd_Input=000000500
  sym demo:Top_of_Stack=000001000
  sym demo:Loop=00000040e
  sym demo:Main=000000400
  sym demo:Stack=000000f00
  sym demo:EndLoop=000000428
  sym demo:Call_Int=00000041c
  sym handle_msg:Cmd_B=00000044c
  sym handle_msg:Msg_Dest=000000533
  sym handle_msg:Cmd_I=00000045a
  sym handle_msg:Again=00000046e
  sym handle_msg:Fill_Dest=000000474
  sym handle_msg:Msg_A=000000502
  sym handle_msg:End_Msgs=000000533
  sym handle_msg:Msg_B=000000513
  sym handle_msg:Print_Msg=000000468
  sym handle_msg:Cmd_A=00000043e
  sym handle_msg:Msg_I=000000524
```

Step 5. Display the demo program in memory

The **m** command lets you display and modify memory locations. When displaying
memory, the **-dm** option causes the contents of memory locations to be
disassembled and displayed in assembly language mnemonic format.

• Display the demo program in memory by entering the following **m -dm** command.

```
R>m -dm demo:Main..
  000000400  demo:Main        MOVEA.L  #$00001000,A7
  000000406  -                MOVE.B   #$00,demo:Cmd_Input
  00000040e  demo:Loop        MOVE.B   demo:Cmd_Input,D0
  000000414  -                BNE.W    demo:Call_Int
  000000418  -                BRA.W    demo:EndLoop
  00000041c  demo:Call_Int    BSR.W    Int_Cmd
  000000420  -                MOVE.B   #$00,demo:Cmd_Input
  000000428  demo:EndLoop     BRA.B    demo:Loop
  00000042a  Int_Cmd          CMPI.B   #$41,D0
  00000042e  -                BEQ.W    handle_msg:Cmd_A
  000000432  -                CMPI.B   #$42,D0
  000000436  -                BEQ.W    handle_msg:Cmd_B
  00000043a  -                BRA.W    handle_msg:Cmd_I
  00000043e  andle_msg:Cmd_A  LEA      handle_msg:Msg_A,A0
  000000444  -                MOVEQ    #$00000010,D1
  000000446  -                BSR.W    handle_msg:Print_Msg
  00000044a  -                RTS
  00000044c  andle_msg:Cmd_B  LEA      handle_msg:Msg_B,A0
  000000452  -                MOVEQ    #$00000010,D1
  000000454  -                BSR.W    handle_msg:Print_Msg
  000000458  -                RTS
  00000045a  andle_msg:Cmd_I  LEA      handle_msg:Msg_I,A0
  000000460  -                MOVEQ    #$0000000E,D1
  000000462  -                BSR.W    handle_msg:Print_Msg
  000000466  -                RTS
  000000468  e_msg:Print_Msg  LEA      handle_msg:Msg_Dest,A1
  00000046e  andle_msg:Again  MOVE.B   (A0)+,(A1)+
  000000470  -                DBEQ     D1,handle_msg:Again
  000000474  e_msg:Fill_Dest  MOVE.B   #$00,(A1)+
  000000478  -                CMPA.W   #$0553,A1
  00000047c  -                BNE.B    handle_msg:Fill_Dest
  00000047e  -                RTS
```

Step 6. Set up initial values for SSP and PC

After emulator initialization, the "reset values" configuration item (**cf rv**) sets the initial values for the supervisor stack pointer and program counter to 1 and 0FFFFFFFFH, respectively. Since you cannot run the emulator when the supervisor stack pointer and program counter are odd, you must use the **cf rv** command to set up appropriate values.

The values you assign to the **rv** configuration item are placed into the supervisor stack pointer and program counter on the entrance to the emulation monitor from an emulation initiated RESET state (the R> prompt).

• Set the supervisor stack pointer to address 1000H and the program counter to 400H by entering the following commands.

```
R>cf rv=1000,400
```

Upon the first transition from emulation reset into the emulation monitor, the supervisor stack pointer register (A7) is set to 1000H and the program counter (PC) is set to 400H.

Step 7. Run the demo program

The **r <addr>** command causes the emulator to run from a particular address. The entry address of the demo program is 400H and is specified by the symbol "demo:Main".

- Execute the demo program by entering the **r <addr>** command.

```
R>r demo:Main
U>
```

Before the **r** command, the emulation status character (in the Terminal Interface prompt) was "M" indicating that the emulator was in the monitor state. After the **r** command, the emulation status character is "U" which indicates the emulator is running the user program.

Step 8. Trace demo program execution

The **t** (trace) command tells the analyzer to look at the data on the emulation processor's bus and control signals at each clock cycle. The information seen at a particular clock cycle is called a state.

When one of these states matches the "trigger state" you specify, the analyzer stores states in trace memory. When trace memory is filled, the trace is said to be "complete."

The default trigger state specification is any state, so the **t** command will cause the analyzer to "trigger" on the first state it sees and store the following states in trace memory.

1 Specify the trigger state as the first instruction in the quick start demo program loop by entering the following **tg** command.

```
U>tg addr=demo:Loop
```

2 Start the trace by entering the **t** command.

```
U>t
  Emulation trace started
```

3 View the status of the trace by entering the **ts** command.

```
U>ts
  --- Emulation Trace Status ---
  NEW User trace complete
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 512 (512) 0..511
  Sequence term 2
  Occurrence left 1
```

Notice that the trace is complete and that 512 states have been stored.

4 List the first twenty states stored in the trace (-t 20), with instructions disassembled (-d) and symbols and addresses stored in the addr column (-e), by entering the following **tl** command.

```
                      U>tl -e -d -t 20

  Line    addr,H    68340 Mnemonic                            count,R  seq
  -----   --------  --------------------------------------    ---------  ---
     0    emo:Loop  MOVE.B    demo:Cmd_Input,D0                   ---    +
     1    00000410  $0000          supr prgm word rd (ds16)    0.720 uS  .
     2    00000412  $0500          supr prgm word rd (ds16)    0.720 uS  .
     3    00000414  BNE.W     demo:Call_Int                   0.720 uS  .
     4    md_Input  $00--          supr data byte rd (ds16)    0.720 uS  .
     5    00000416  $0006          supr prgm word rd (ds16)    0.680 uS  .
     6    00000418  BRA.W     demo:EndLoop                    0.960 uS  .
     7    0000041a  $000E          supr prgm word rd (ds16)    0.720 uS  .
     8    :EndLoop  BRA.B     demo:Loop                       1.080 uS  .
     9    Int_Cmd   incomplete instr.: /0C00/????/            0.720 uS  .
    10    emo:Loop  MOVE.B    demo:Cmd_Input,D0               0.720 uS  .
    11    00000410  $0000          supr prgm word rd (ds16)    0.720 uS  .
    12    00000412  $0500          supr prgm word rd (ds16)    0.720 uS  .
    13    00000414  BNE.W     demo:Call_Int                   0.680 uS  .
    14    md_Input  $00--          supr data byte rd (ds16)    0.720 uS  .
    15    00000416  $0006          supr prgm word rd (ds16)    0.720 uS  .
    16    00000418  BRA.W     demo:EndLoop                    0.960 uS  .
    17    0000041a  $000E          supr prgm word rd (ds16)    0.720 uS  .
    18    :EndLoop  BRA.B     demo:Loop                       1.080 uS  .
    19    Int_Cmd   incomplete instr.: /0C00/????/            0.720 uS  .
```

The first column in the trace list contains the line number. The trigger state is always on line number 0.

The second column contains the address information associated with the trace states. Addresses in this column may be locations of instruction opcodes on fetch cycles, or they may be sources or destinations of operand cycles. The **-e** option in the **tl** command causes both addresses and symbols to appear in this column.

The third column shows mnemonic information about the emulation bus cycle. The **-d** option in the **tl** command causes instructions to be disassembled.

The fourth column shows the count information (**time** is counted by default). The "R" indicates that each count is relative to the previous state.

The fifth column contains information about the analyzer's sequencer. Whenever a "+" appears in this column, it means the state caused a sequencer branch.

5 Display the dequeued trace by including the **-od** option in the **tl** command.

```
                      U>tl -od -e -d -t 20

  Line    addr,H    68340 Mnemonic                            count,R  seq
  -----   --------  --------------------------------------    ---------  ---
     0    emo:Loop  MOVE.B    demo:Cmd_Input,D0                   ---    +
          =md_Input  src  sdata rd:$00
     3    00000414  BNE.W     demo:Call_Int NOT TAKEN         2.160 uS  .
     6    00000418  BRA.W     demo:EndLoop                    2.360 uS  .
```

```
 8   :EndLoop  BRA.B    demo:Loop                     1.800 uS   .
10    emo:Loop  MOVE.B   demo:Cmd_Input,D0             1.440 uS   .
     =md_Input   src  sdata rd:$00
13    00000414  BNE.W    demo:Call_Int NOT TAKEN       2.120 uS   .
16    00000418  BRA.W    demo:EndLoop                  2.400 uS   .
18   :EndLoop  BRA.B    demo:Loop                     1.800 uS   .
```

The lines in the trace that are prefixed with the equal sign show the data accesses associated with instructions.

Step 9. Stop (break from) program execution

The **b** command switches the emulator from the "running user program" state (or from the reset state) to the monitor state.

When the emulator is in the monitor state, it can access microprocessor registers and target system or single-port emulation memory.

- Break emulator execution out of the demo program and into the monitor state by entering the **b** command.

```
U>b
M>
```

Notice that the emulation status character becomes "M" which indicates that the emulator is in the monitor state.

Step 10. Set a software breakpoint

Software breakpoints provide a way to accurately stop the execution of your program at selected locations.

1 Enable the software breakpoints feature by entering the **bc -e bp** command.

```
M>bc -e bp
```

2 Use the **bp <addr>** command to set a software breakpoint at the address "handle_msg:Cmd_B".

```
M>bp handle_msg:Cmd_B
```

3 Run the program from the current program counter address.

```
M>r
U>
```

4 Simulate the entry of the "B" command by modifying the "demo:Cmd_Input" memory location.

```
U>m -db demo:Cmd_Input="B"
!ASYNC_STAT  615! Software breakpoint: 00000044c@sp
M>
```

Step 11. Display processor registers

- Display the contents of the basic processor registers by entering the **reg** command.

```
M>reg
```

```
reg pc=0000044c st=2714 d0=ffffff42 d1=ffffffff d2=ffffffff d3=ffffffff
reg d4=ffffffff d5=ffffffff d6=ffffffff d7=ffffffff a0=ffffffff a1=ffffffff
reg a2=ffffffff a3=ffffffff a4=ffffffff a5=ffffffff a6=ffffffff a7=00000ffc
reg usp=18bc8c1d ssp=00000ffc vbr=00000000 sfc=00 dfc=00
```

Step 12. Step through program execution

The **s** command lets you step through user program execution. You can step single
instructions or a number of instructions at a time.

1 Step one instruction in the user program by entering the **s** command.

```
M>s
  00000044c@sp  andle_msg:Cmd_B  LEA       handle_msg:Msg_B,A0
  PC = 000000452@sp
```

2 Step eight instructions in the user program by entering the **s 8** command.

```
M>s 8
  000000452@sp  -               MOVEQ   #$00000010,D1
  000000454@sp  -               BSR.W   handle_msg:Print_Msg
  000000468@sp  e_msg:Print_Msg LEA     handle_msg:Msg_Dest,A1
  00000046e@sp  andle_msg:Again MOVE.B  (A0)+,(A1)+
  000000470@sp  -               DBEQ    D1,handle_msg:Again
  000000470@sp  -               DBEQ    D1,handle_msg:Again
  000000470@sp  -               DBEQ    D1,handle_msg:Again
  000000470@sp  -               DBEQ    D1,handle_msg:Again
  PC = 000000470@sp
```

Step 13. Reset the emulator

- Reset the emulator by entering the **rst** command.

```
M>rst
R>
```

Notice that the emulation status character is "R" which shows that the emulator is being held in a reset state.

If the emulator status character is unfamiliar

The "R", "U", and "M" emulation prompt status characters are described in this chapter. If you see other emulation status characters, enter the **es** command for more information about the emulator status.
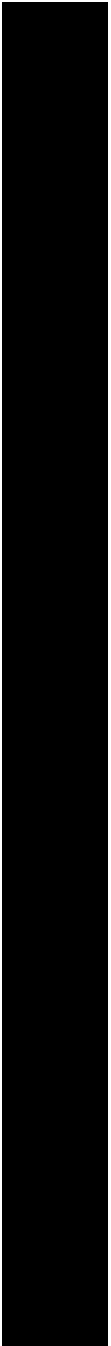
- Display the emulator status information by entering the **es** command.

```
R>es
  M68340--Emulation reset
```

Part 2

User's Guide

Part 2

2

Plugging into a Target System

Plugging the Emulator into a Target System

This chapter describes the tasks you perform when plugging the emulator into a target system. These tasks are grouped into the following sections:

- Connecting the emulator to the target system.

- Configuring the emulator for operation with your target system.

- Selecting the emulation monitor.

Connecting the Emulator to the Target System

This section describes the steps you must perform when connecting the emulator to a target system:

1   Turn OFF power.

2   If the emulator is currently connected to the demo target system or a different target system, unplug the emulator probe.

3   Select the emulator clock source.

4   Plug the emulator probe into the target system.

5   Turn ON power (first the HP 64700, then the target system).

CAUTION   **Possible Damage to the Emulator Probe.** The emulation probe contains devices that are susceptible to damage by static discharge. Therefore, precautionary measures should be taken before handling the microprocessor connector attached to the end of the probe cable to avoid damaging the internal components of the probe by static electricity.

We STRONGLY suggest using a ground strap when handling the emulator probe. A ground strap is provided with the emulator.

Step 1. Turn OFF power

CAUTION

Possible Damage to the Emulator. Make sure target system power is OFF and make sure HP 64700 power is OFF before removing or installing the emulator probe into the target system.

Do not turn HP 64700 power OFF while the emulator is plugged into a target system whose power is ON.

1 If the emulator is currently plugged into a different target system, turn that target system's power OFF.

2 Turn emulator power OFF.

Step 2. Unplug probe from demo target system

• If the emulator is currently connected to a different target system, unplug the emulator probe; otherwise, disconnect the emulator probe from the demo target system.

Step 3. Select the emulator clock source

For 64751-66506 and lower numbered active probe printed-circuit boards, the selection of the internal or external clock source is made with the **cf clk** configuration command as described in the "Configuring for Operation with Your Target System" section of this chapter.

For 64751-66508 and higher numbered active probe printed-circuit boards, the selection of the internal or external clock source is made by positioning a jumper module on the board.

If your active probe board number is 64751-66506 or lower, go on to Step 4; otherwise, perform the following steps.

1 Remove plastic rivets that secure the plastic cover on the top of the emulator probe, and remove the cover.

TO INSTALL RIVET:
PUSH DOWN ON
RIVET HEAD

TO REMOVE RIVET:
PUSH UP ON
CENTER SHAFT

ADD PLASTIC
WASHERS TO
THESE TWO
POSITIONS ONLY
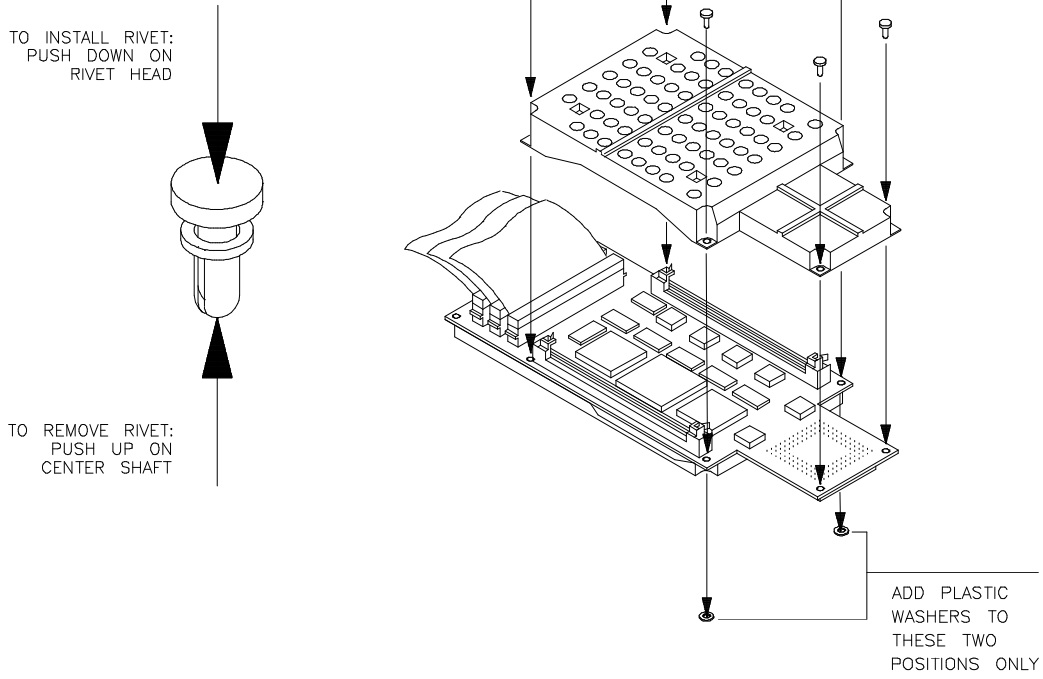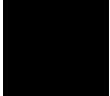
2 To select the 32.768 KHz crystal internal to the emulator, insert the jumper module such that pin 1 of the module aligns with pin 1 of the socket. The target system MUST drive MODCK high (or allow a pullup resistor in the emulator to pull it high) during reset to enable the 68340 VCO and programmable clock mode.

To select an external (target system) TTL oscillator, rotate the jumper module 180 degrees such that pin 8 of the module aligns with pin 1 of the socket. The target system MUST drive MODCK low during reset to enable the 68340 to use the EXTAL signal as the clock source.
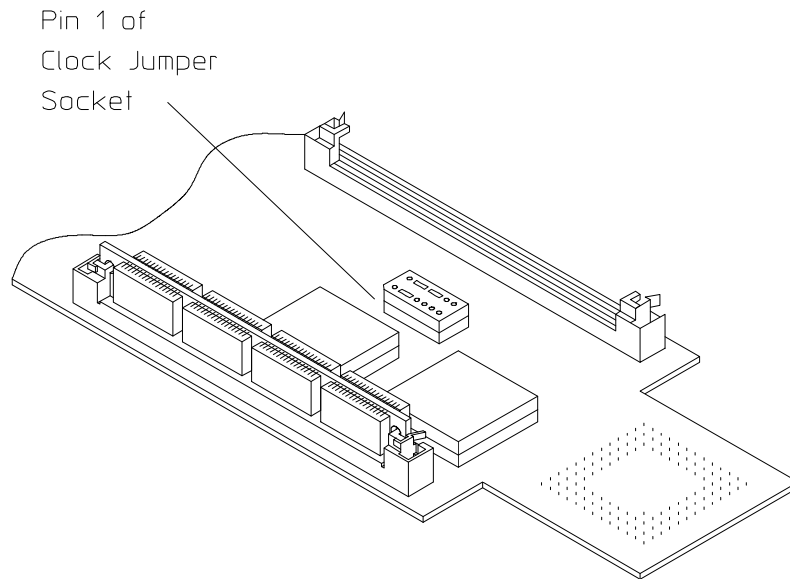
Pin 1 of
Clock Jumper
Socket

64751E01

3 Replace the plastic cover, and insert new plastic rivets (supplied with the emulator) to secure the cover.

TO INSTALL RIVET:
PUSH DOWN ON
RIVET HEAD

TO REMOVE RIVET:
PUSH UP ON
CENTER SHAFT

ADD PLASTIC
WASHERS TO
THESE TWO
POSITIONS ONLY
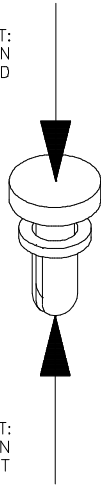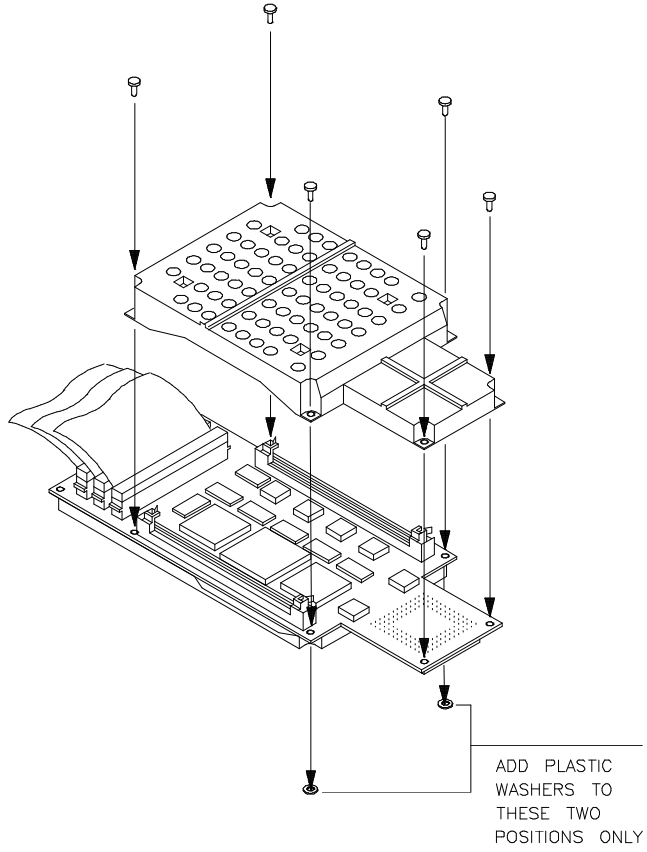
You can also replace the jumper with a prototyping socket on which a crystal and any capacitors or tank circuitry are assembled. (One such prototyping socket is part number 20314-36-455 from Electronic Molding Corp., 96 Mill Street, Woonsocket RI.) The figure below shows the connections that are made to the socket.

Emulator +5v	1	14	(Do Not Connect Anything to This Pin)
EXTAL Side of Emulator 32.768 KHz Crystal	2	13	XTAL Side of Emulator 32.768 KHz Crystal
68340 EXTAL	3	12	68340 XTAL
Target EXTAL	4	11	Target XTAL
NC	5	10	NC
NC	6	9	NC
NC	7	8	Emulator +5v

64751B01
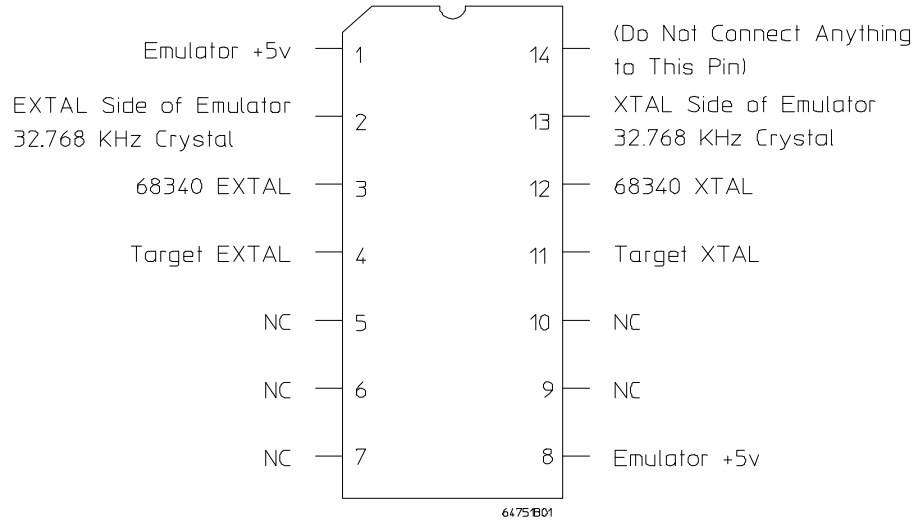
Step 4. Plug the 68340 emulator probe into the target system

The emulator supports connections to PGA, QFP, and TQFP package types for the MC64340. The following sections will describe connecting to these package types.

Connecting to a 68340 PGA package

CAUTION

Possible Damage to the Emulator Probe. The emulator probe is provided with a pin extender. **Do not use the probe without a pin extender installed**. Replacing a broken pin extender is much less expensive than replacing the emulator probe.

The use of more than one pin extender is discouraged, unless it is necessary for mechanical clearance reasons, because pin extenders cause signal quality degradation.

- Install the emulator probe into the target system socket. Make sure that pin 1 of the connector aligns with pin 1 of the socket. **Damage to the emulator will result if the probe is incorrectly installed.** Go on to Step 5 on page 56.

68340
Emulator
probe

Pin A1

Target
system

PGA socket

64751e08
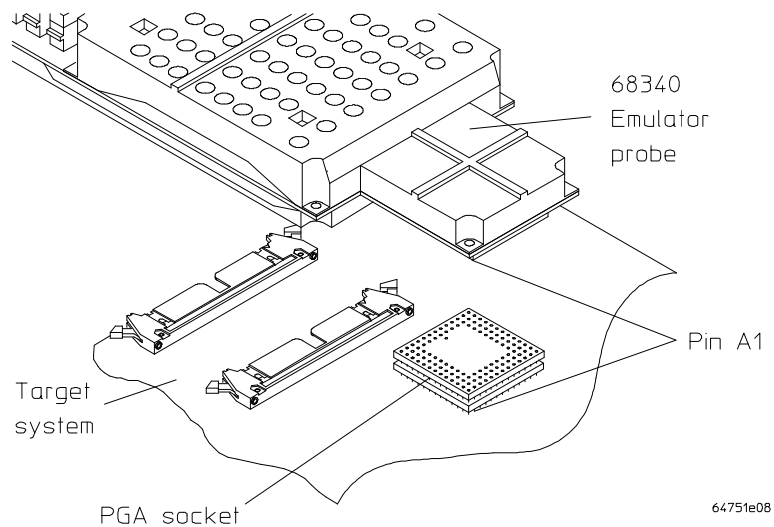
Connecting to a QFP package

The HP QFP Surface Mount Adapter Assembly provides a connection for the Motorola MC68340 QFP microprocessor. The Surface Mount Adapter is soldered onto the target board in place of the microprocessor. A PGA Transition Socket allows the emulator to be connected.
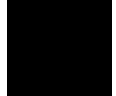
Equipment Supplied

The QFP Surface Mount Adapter Assembly (HP part number E2424B option 1CC) consists of the following:

- A Surface Mount Adapter for the MC68340 QFP package with a pin protector installed.
- An Extender for increased clearance (must always be used).
- A clear, plastic Bearing Plate.
- A PGA Transition Socket.
- A 3/32 allen wrench.
- A 1/16 allen wrench.
- This User's Guide

Tools and Equipment Required

The following tools and equipment are required for connecting to the target system:

- Soldering tools (very small soldering iron if hand soldered).
- Small, wide-blade screwdriver.
- Flex Cable (HP part number 64751-61601) is recommended.

Installing the QFP adapter assembly on the target system

If possible, mount the Surface Mount Adapter with normal production-line SMT processes. The installation procedure for the surface mount adapter assembly includes the following steps:

Emulator

Pin A1

Flexible Cable
64751-61601

64XXX-6XXX
TARGET
END
68XXX

PGA Transition
Socket

Pin A1

Extender

Bearing Plate

Orange Dots

Surface Mount Adapter

Pin 1

64751e09
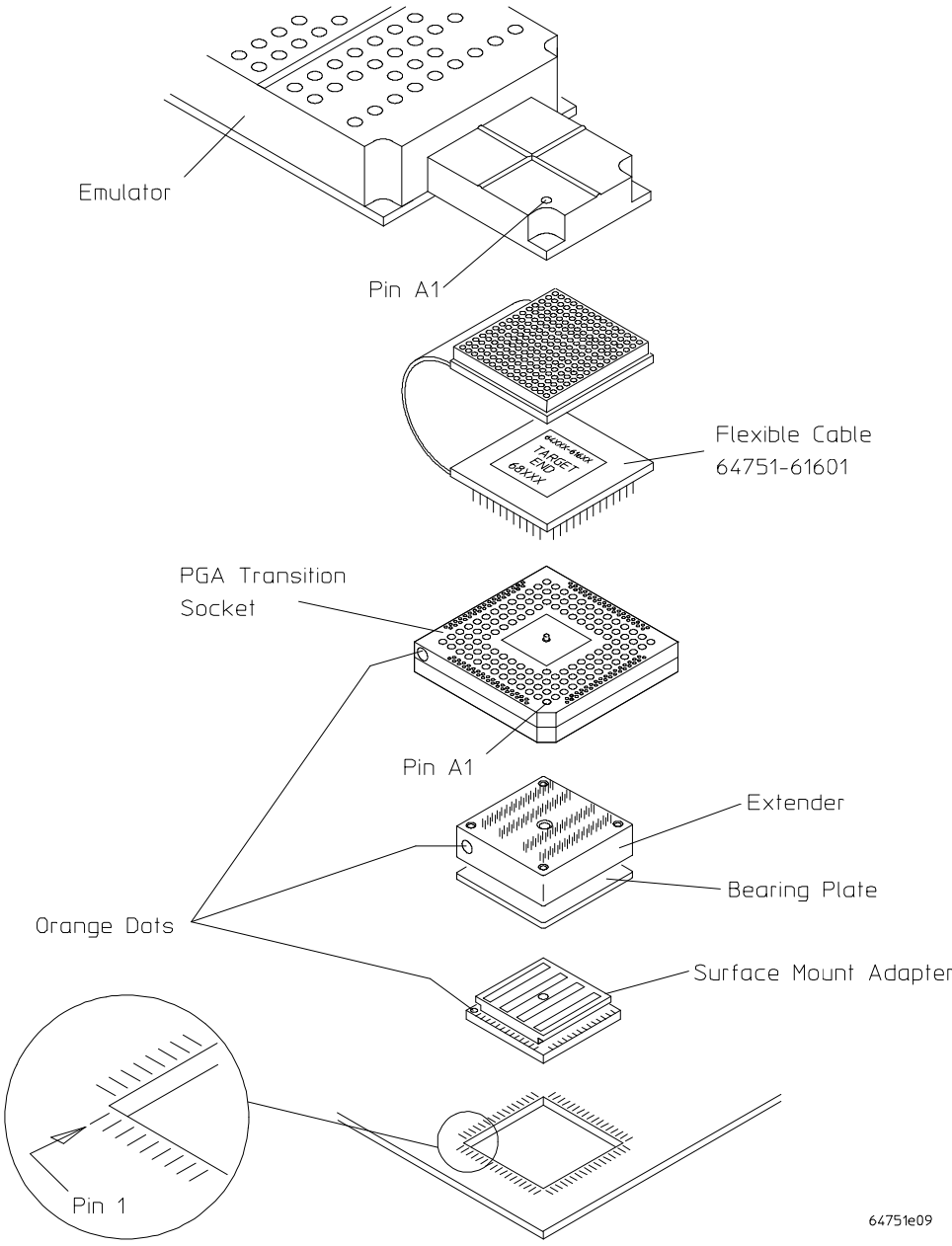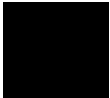
Connecting a QFP surface mount adapter assembly

CAUTION   Ensure that the microprocessor type shown on the PGA Transition Socket label matches the microprocessor to be probed.

1   Start with a new target board that does not have a microprocessor installed. Place the board on a stable, flat, horizontal surface, with all power off. Ensure that the area under the microprocessor pad is fully supported.

2   Prepare the microprocessor pad on the target board with RMA flux. Allow the flux to become slightly sticky; the flux will hold the Surface Mount Adapter in place during soldering.

CAUTION   Incorrect alignment of pin 1 can result in damage to the target board, preprocessor interface, or emulator.

The orange dot marks the pin 1 location for the QFP pattern; the PGA pin A1 is not at the same corner (see figure on page 51). Use pin 1 to orient the PGA Transition Socket with the Surface Mount Adapter and the target system. Use pin A1 to orient the emulator with the PGA Transition Socket.

3   With the pin protector still installed on the Surface Mount Adapter, solder the Surface Mount Adapter onto the target board in place of the microprocessor, ensuring that pin 1 is properly aligned. There is a colored dot next to pin 1 on the Surface Mount Adapter.

To solder the Surface Mount Adapter, carefully align it with the microprocessor pad (with pin 1 properly oriented), apply a slight pressure and solder the four corners first. After the corners are soldered, check the registration to ensure all contacts are aligned, then solder the rest of the pins. For soldering, it is best to contact the Surface Mount Adapter and PC-board pad simultaneously with a drop of solder on the iron tip. Draw the solder down and away from the Surface Mount Adapter, along the PC-board and trace.

4   After soldering, inspect the connections for solder bridges. Remove any bridges with ultra-fine solderwick brade.

CAUTION   There are fine traces on top of the Surface Mount Adapter. To avoid damaging these traces, soften the sharp edges of the screwdriver, and cover the blade with Avery label or tape.

5   Using a small, wide-bladed screwdriver, gently remove the pin protector from the Surface Mount Adapter. Apply a slight pressure to each side consecutively, until the pin protector is free.

6   Place the plastic Bearing Plate over the pins on the Surface Mount Adapter.

The plastic Bearing Plate provides a surface for the set screws to push against, if you ever need to remove the Surface Mount Adapter.

CAUTION   Installing the PGA Transition Socket directly on the Surface Mount Adapter will apply excessive mechanical force and may cause damage.

7   Ensure that the four set screws in the Extender are not protruding past either side of the Extender. Very carefully align the pins on the Extender with the pins on the Surface Mount Adapter, and gently position the Extender on the Surface Mount Adapter (over the Bearing Plate), again ensuring that pin 1 (orange dot) is properly aligned. The Extender will be firmly seated when the PGA Transition Socket is installed. The Extender must always be used.

CAUTION   Do not use excessive force. If you encounter resistance, check the pin orientation and the alignment of the set screw with the PGA Transition Socket.

8   Extend the center dowel pin on the PGA Transition Socket approximately 1/16" into the top of the PGA Transition Socket. The dowel pin helps align the PGA Transition Socket with the Extender. Noting the alignment of pin 1 on the PGA Transition Socket (colored dot) and the Extender, place the PGA Transition Socket on top of the Extender, using the dowel pin for centering. Gently press down, seating the PGA Transition Socket pins into the Extender. As the PGA Transition Socket becomes seated, the Extender will also seat onto the Surface Mount Adapter.

9   Electrically check to ensure there are no shorts between Vcc and ground.

CAUTION   Ensure that the emulator probe is aligned with pin A1 when connecting to the PGA Transition Socket. Pin A1 is used to orient the emulator with the PGA Transition Socket; the orange dot indicates pin 1 for the QFP pattern, and is not the same as pin A1 (see figure on page 51).

10   Install the emulator probe into the PGA socket on the PGA Transition Socket. The Flex Cable is recommended to decrease the stresses associated with the additional weight. See the figure on page 51 for correct alignment of the emulator, with respect to pin A1. Go on to Step 5 on page 56.

Removing the Extender

Removing the Extender at a later time is not recommended, as it may crack the Surface Mount Adapter. If you do need to remove the Extender, use the following procedure:
- Gently remove the PGA Transition Board.
- Gently screw the four set screws, about two turns each in consecutive order. This will create a rocking effect, which will slowly back the Extender off of the Surface Mount Adapter.

CAUTION   Never pry the Extender off of the Surface Mount Adapter or try to pull it off with a tool.

- Always inspect the Surface Mount Adapter connections after the Extender is removed. If cracks have occurred, you may need to resolder.

Replaceable Parts for the QFP Surface Mount Adapter Assembly

The table below lists some mechanical parts which may be replaced if they are lost, damaged, or used up.

Part Number	Description
64751-87603	Surface Mount Adapter Assembly
64751-87604	Extender
64751-87605	Surface Mount Adapter for MC68340 footprint

Connecting to a 144-pin TQFP package

You will need to order the following HP Elastomeric Probing System parts to probe a 144-pin TQFP package:

- E5336A   Probe Adapter
- E5338A   Flexible Adapter
- E5358A   Transition Socket

Use the following steps to connect the emulator to a TQFP on the target system.

CAUTION

Equipment damage. Serious damage to the target system or emulator can result from incorrect connection. Ensure proper alignment of all parts. The connections between the emulator probe, probe adapter, and MC6833x microprocessor are delicate and must be done with care.

1 Select the orientation (shown on the next page) that best suits your target system. Note the following indicators on the illustration:

- position of Pin 1 on the microprocessor
- position of little pin on the retainer
- position of little hole on the probe adapter
- color/bar code on both ends of the flexible adapter
- position of indicator on the transition socket
- position of Pin A1 on the emulator

2 Flexible adapters can be installed in one of four orientations as shown in the following illustration. This allows flexibility in attaching the emulator probe when target system components interfere.

3 Refer to the installation guide supplied with the HP Elastomeric Probing System to adhere the retainer to the TQFP and install the adapter. Make sure to follow the orientation you selected in steps 1 and 2 above.

4 Connect the flexible adapter, transition socket, and emulator following the orientation selected.

(a)
68340 Emulator probe

Pin 1 corner

PGA transition socket

Alignment tab

Flexible adapter

Blue

Blue

Little pin/hole

Pin 1 of 68340 144-pin TQFP

Elastomeric probe adapter

(b)
Pin 1 corner

Alignment tab

Yellow

Little pin/hole

Pin 1

(c)
Pin 1 corner

Alignment tab

Purple

Little pin/hole

Pin 1

(d)
Pin 1 corner

Alignment tab

Red

Little pin/hole

Pin 1
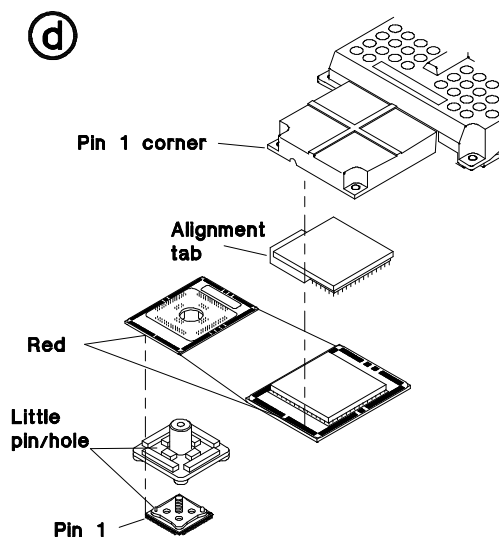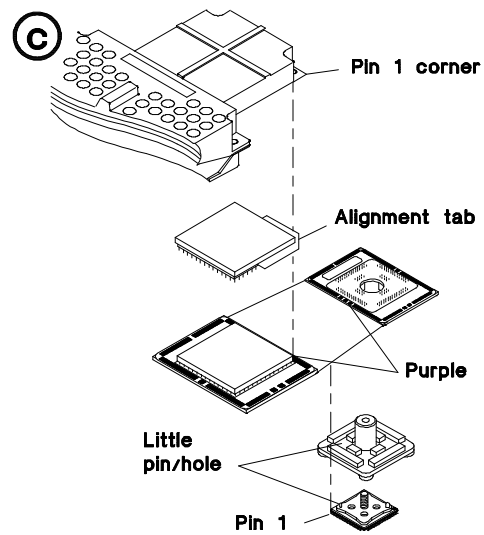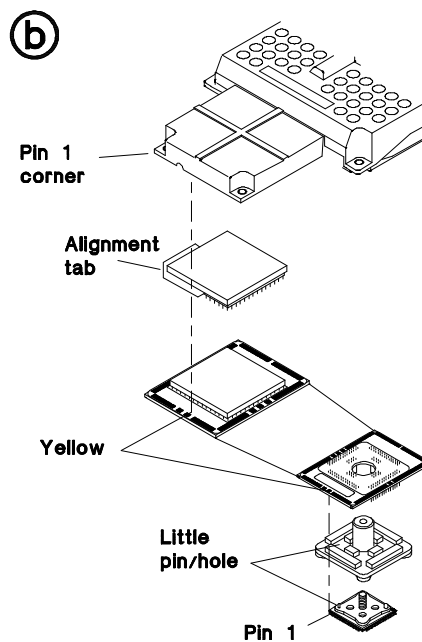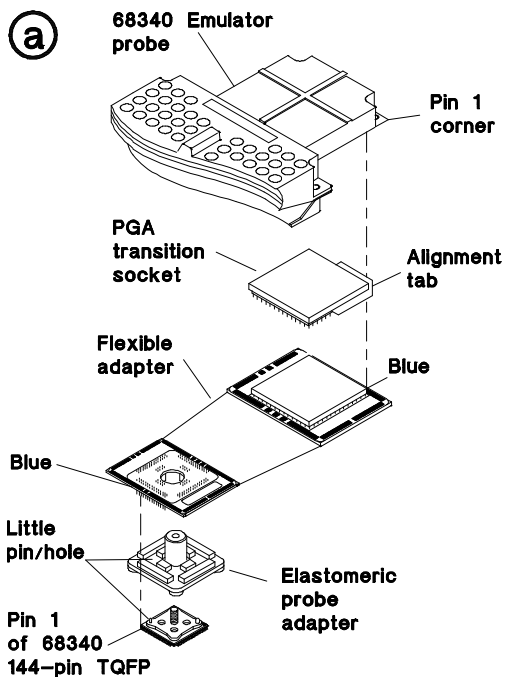
64751e10

Connecting the HP Elastomeric Probing System

Step 5. Turn ON power

1 Turn emulator power ON.

2 Turn target system power ON.

Configuring for Operation with Your Target System

After you plug the emulator into a target system and turn on power to the HP 64700, you need to configure the emulator so that it operates properly with your target system.

Before the emulator can operate in your target system, you must:

Map memory. Because the emulator can use target system memory or emulation memory (or both), it is necessary to map ranges of memory so that the emulator knows where to direct its accesses. Refer to the "Mapping Memory" section in the "Using the Emulator" chapter.

Select the emulator's clock source.

Also, the emulator needs to know the following things:

Is there circuitry in the target system that requires programs to run in real-time? Some emulator commands cause temporary breaks to the monitor state, typically to access microprocessor register values, single-port emulation memory, or target system memory. If the target system requires that programs run in real-time, you must restrict the emulator to real-time runs.

Should the emulator respond to target system interrupts when running in the monitor program? If so, you must use a foreground monitor program since target system interrupts are always ignored during background operation (refer to the "Selecting the Emulation Monitor" section later in this chapter). If it's not important that the emulator respond to target system interrupts when running in the monitor, you can use the background monitor.
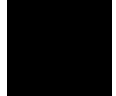
This section shows you how to:

- Select the emulator's clock source.

- Set the initial value of the supervisor stack pointer (SSP) and program counter (PC) after emulation reset.

- Restrict to real-time runs.

- Turn OFF the restriction to real-time runs.

To select the emulator's clock source

For 64751-66508 and higher numbered active probe printed-circuit boards, the selection of the internal or external clock source is made by positioning a jumper module on the board as described in the "Connecting the Emulator to the Target System" section of this chapter.

For 64751-66506 and lower numbered active probe printed-circuit boards, the selection of the internal or external clock source is made with the **cf clk** configuration command.

- Enter the **cf clk=ext** command to select the external target system crystal or TTL oscillator.

- Enter the **cf clk=int** command to select the internal 32.768 KHz crystal.

    If **clk=int**, the emulator will use the internal 32.768 KHz crystal. The target system MUST drive MODCLK high (or allow a pullup resistor in the emulator to pull it high) during reset to enable the 68340 voltage-controlled oscillator (VCO).

    If **clk=ext**, the emulator will use the crystal or TTL oscillator in the target system. MODCLK should be driven appropriately.

To set the initial SSP and PC values

- Enter the **cf rv=<ssp_value,pc_value>** command.

The supervisor stack pointer must be set to an address in emulation or target system RAM in order for the emulator to transition into the run state, to step, or to perform other functions after emulation reset.

The **cf rv=<ssp_value,pc_value>** command sets the initial SSP and PC values after emulation reset. Upon the transition from emulation reset into the emulation monitor, the supervisor stack pointer register and the program counter are set to the 32-bit hexadecimal even address values specified.

If a run from reset command is given, this configuration item has no affect and the initial supervisor stack pointer and program counter will be retrieved from reset vector in the vector table.

If a target system reset occurs while running in the background monitor, the supervisor stack pointer and program counter are unaffected.

To restrict to real-time runs

- Enter the **cf rrt=en** command.

While running programs, temporary breaks to the monitor state are not allowed. The emulator refuses the following commands:

- **reg** (register display/modification).

- **m** (memory display/modification), **bp** (software breakpoints), **cp** (copy memory block), **load** (load memory), **dump** (dump memory), or **ser** (search memory for data) commands that access single-port emulation memory and target system memory.

  The emulator contains one 4 Kbyte block of dual-port emulation memory which can be accessed while runs are restricted to real-time. This block of dual-port emulation memory is reserved for foreground monitor programs when they are used.

- **sync** (synchronize emulator configuration registers).

CAUTION

Target system damage could occur! If your target system circuitry is dependent on constant execution of program code, the following commands still cause breaks from running programs even when you have restricted the emulator to real-time runs:

- **rst** (reset).

- **r** (run).

- **b** (break to monitor).

- **s** (step).

Use caution in executing these commands.

To turn OFF the restriction to real-time runs

- Enter the **cf rrt=dis** command.

Temporary breaks to the monitor while running programs are allowed, and the emulator accepts commands normally.

Selecting the Emulation Monitor

This section shows you how to:

- Select the background monitor (implemented with the 68340 Background Debug Mode (BDM)).

- Select a foreground monitor program.

- Use a custom foreground monitor program.

When you power up the emulator, or when you initialize it, the background monitor is selected. You can also configure the emulator to use a foreground monitor. Before the background and foreground monitors are described, you should understand the foreground and background emulator modes as well as the function of the emulation monitor.

Background

Background is the emulator mode in which emulation processor execution is suspended.

Foreground

Foreground is the mode in which the emulator executes as if it were a real microprocessor. The emulator is in foreground when it is running user programs or is running in the foreground monitor.

Function of the Monitor

The monitor is the interface between the emulation system controller (which accepts and executes emulation commands) and the target system. The monitor uses the emulation microprocessor because that's the only way to access registers, single-port emulation memory, and target system memory.

When the emulation system controller recognizes that a command requires the monitor, it writes a command code to a communications area and "breaks" emulator execution into the monitor. The monitor reads this command (and any associated parameters), makes the appropriate accesses, places the values in the communication area, and returns emulator execution to its previous state.

Background Monitor

When a background monitor is selected, the Background Debug Mode (BDM) of the 68340 processor is used. The BKPT line is asserted to enter the monitor.

Foreground Monitor

The foreground monitor is an assembly language program that is executed by the 68340 emulation microprocessor in its normal operating mode.

When a foreground monitor is selected, the foreground monitor or downloaded custom monitor is loaded into dual-ported emulation memory and consumes a 4K byte block of the 68340's address range.

The foreground monitor program is included with the emulator on a floppy disk: it can be assembled with the HP AxLS 68000/10/20 Assembler/Linker/Librarian or with the Microtec Research 68000 assembler and linker.

You may customize the foreground monitor if necessary; however, you must maintain the basic communications protocol between the monitor and the emulation system controller. Comments in the monitor program source file detail sections that cannot be changed.

Comparison of Background and Foreground Monitor Programs		
Monitor Program Characteristic	**Background**	**Foreground**
Takes up processor memory space	No	Yes, 4 Kbytes
Allows the emulator to respond to target system interrupts during monitor execution	No	Yes
Can be customized	No	Yes
Resident in emulator firmware	68340 emulation processor's BDM	Yes, (custom monitor must be assembled, linked, and loaded)

To select the background monitor

1 Enter the **cf mon=bg** command.

2 Re-map memory.

When a background monitor is selected, the Background Debug Mode (BDM) of the 68340 processor is used. The BKPT line is asserted to enter the monitor.

During background monitor operation, there will be no bus cycle activity except for memory reads and writes that result from memory display or modify commands.

Changing the monitor configuration resets the memory map, so you must re-map memory.

To select a foreground monitor program

1 Enter the **cf mon=fg** command to select a foreground monitor.

2 Enter the **cf monaddr=<addr>** command to select the base address of the monitor program.

3 Enter the **cf mondsi** command to specify whether monitor cycles should be synchronized to the target system.

4 Enter the **cf monintr=<0..7>** command to select the interrupt priority level for the monitor program.

5 Re-map memory.

6 Set the initial supervisor stack pointer and program counter values.

7 Load the user program absolute file.

8 Modify the TRACE exception vector to point to the TRACE_ENTRY symbol in the monitor program so the emulator can single-step.

Selecting the Foreground Monitor

Entering the the **cf mon=fg** command causes the current memory map to be deleted, and a new map term is added for the monitor program. The starting address of the monitor block is set with the **monaddr** configuration item, and the **mondsi** configuration item determines whether the **dsi** (/DSACK interlock) memory attribute is added.

When you select a foreground monitor, the emulator automatically loads the default program, resident in emulator firmware, into dual-ported emulation memory. The foreground monitor is reloaded every time the emulator breaks into the monitor state from the reset state.

Unlike the background monitor, the foreground monitor runs within the same address space as the target program consuming a 4 Kbyte block of the 68340's address range. The foreground monitor can run with target interrupts enabled (see "Selecting the Interrupt Priority Level").

The emulator breaks into the foreground monitor by using the emulation processor's background debug mode (BDM) except for single-stepping, which uses the trace exception. The time spent in BDM is approximately 350 microseconds. An exception stack frame of 7 to 13 words will be temporarily pushed onto the user's master and/or interrupt stack(s) during monitor entry.

Selecting the Monitor's Base Address

The **cf monaddr=<addr>** command defines the starting address of the 4 Kbyte block of dual-ported emulation memory reserved for the foreground monitor. The address must reside on a 4 Kbyte boundary (in other words, an address ending in 000H) and must be specified in hexadecimal. Also, the foreground monitor's base address must have no function code specified.

When you enter the **cf monaddr=<addr>** command, the current memory map will be deleted, and a new map term is added for the monitor.

This configuration item has no meaning when a background monitor is selected.

Specifying Target Synchronization

If you wish to synchronize monitor cycles to the target system (that is, interlock the emulation and target system /DSACK on accesses to the monitor memory block), enter the **cf mondsi=en** command; otherwise, enter the **cf mondsi=dis** command.

When interlocking is enabled, cycle termination of accesses to foreground monitor memory will not occur until the target system provides a /DSACK. If the monitor is placed in an address range for which the target system does not generate a /DSACK, the emulator will be unable to break into the monitor and a "CPU in wait state" status will result.

When interlocking is disabled, accesses to foreground monitor memory will be terminated by a /DSACK signal generated by the emulator. Any cycle termination signals generated by the target system during monitor memory accesses, including /BERR, will be ignored.

Modifying this configuration item will reset the processor and controls whether the **dsi** (/DSACK Interlock) memory attribute is used in the foreground monitor memory map term.

This configuration item has no meaning when a background monitor is selected.

Selecting the Interrupt Priority Level

The default foreground monitor can be configured to run at a lowered interrupt priority level to allow critical target system interrupts to be processed during monitor execution.

At the point it is safe to lower the interrupt priority level, the foreground monitor will set the interrupt priority mask to the value of **monintr** or the interrupt level that was in effect before monitor entry, whichever is greater.

During background monitor operation, all target system interrupts, including level 7 non-maskable interrupts, are blocked.

Modifying this configuration item will reset the processor.

Re-Mapping Memory

When you configure the emulator for a foreground monitor program, the memory map is reset, and a 4 Kbyte block of emulation memory is automatically mapped for the monitor program. You must re-map other memory ranges before loading user programs.
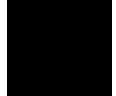
Modifying the TRACE Exception Vector

In order for single stepping to operate with the foreground monitor, the trace vector in the target system's exception table (VBR plus 24H) must point to the TRACE_ENTRY address in the monitor. This address is equal to the value of **monaddr** plus 800h in the default foreground monitor.

To use a custom foreground monitor program

1 Edit the monitor program source file, and locate its base address on a 4 Kbyte boundary.

2 Assemble and link the foreground monitor program.

3 Enter the **cf mon=fg** command to select a foreground monitor.

4 Enter the **cf monaddr=<addr>** command to select the base address of the monitor program.

5 Enter the **cf mondsi** command to specify whether monitor cycles should be synchronized to the target system.

6 Enter the **cf monintr=<0..7>** command to select the interrupt priority level for the monitor program.

7 Re-map memory.

8 Set the initial supervisor stack pointer and program counter values.

9 Load the custom monitor program.

10 Load the user program absolute file.

11 Modify the TRACE exception vector to point to the TRACE_ENTRY symbol in the monitor program so the emulator can single-step.

Using a custom foreground monitor program is the same as selecting the default foreground monitor, except that the customized monitor program must be assembled, linked, and loaded into emulation memory.

A custom foreground monitor must be assembled and linked starting at the 4 Kbyte boundary specified as the monitor's base address (see the **monaddr** configuration item). An ORG statement in the foreground monitor source file defines the base address. Refer to the foreground monitor source provided with the emulator for more information.

A custom foreground monitor is downloaded using the **load -f** command. The custom foreground monitor is saved in the emulator (until the monitor type is changed) and reloaded every time the emulator breaks into the monitor state from the reset state.

Examples

The following examples of how to set up and use a custom foreground monitor program make the following assumptions:

- The HP 64700 is connected to the same LAN as an HP 9000 Series 300 host computer.

- The HP AxLS 68000/10/20 Assembler/Linker/Librarian and the HP 64855 RS-232 Transfer products are installed on the HP 9000 Series 300 host computer.

- The foreground monitor program source file exists on the host computer.

To edit the monitor program source file to specify its base address, 2000H in this example, you must modify the ORG statement near the top of the file:

```
ORG $00002000H  ; link monitor on 4k boundary
```

Notice that the ORG statement is indented from the left margin; if it is not indented, the assembler will interpret the ORG as a label and will generate an error when processing the address portion of the statement.

To assemble and link the monitor program, enter the following commands:

```
$ as68k -Lh fm64751.s > fm64751.lis <RETURN>
```

```
$ ld68k -c fm64751.k -Lh > fm64751.map <RETURN>
```

Where the "fm64751.k" linker command file contains:

```
name fm64751
load fm64751.o
end
```

To configure the emulator to use a foreground monitor program:

R>**cf mon=fg**

To specify the monitor's base address:

R>**cf monaddr=2000**

To disable synchronization of accesses to the monitor memory block with the target system:

R>**cf mondsi=dis**

The memory map is reset and a 4 Kbyte block of emulation memory (range 2000H through 2FFFH) is mapped for the foreground monitor program.

To configure the foreground monitor to run at the lowest interrupt priority level:

R>**cf monintr=0**

To map memory for the emulator demo program:

R>**map 0..0fff erom**
R>**map 40000..47fff eram**
R>**map 60000..64fff eram**

To set the value of the supervisor stack pointer and program counter after emulation reset:

R>**cf rv=48000,400**

To load the monitor program and user program absolute files, enter the following commands from the host computer:

```
$ ftp 15.35.226.210
Connected to 15.35.226.210.
220 User connected to HP64700
Name (15.35.226.210:guest): <RETURN>
Password (15.35.226.210:guest): <RETURN>
ftp> binary
200 Type set to I
ftp> put fm64751.X -h
200 Port     ok
150
226-
R>
226 Transfer completed
3332 bytes sent in 0.20 seconds (16.27 Kbytes/sec)
ftp> put cmd_rdr.X -h
200 Port     ok
150
226-
R>
226 Transfer completed
3332 bytes sent in 0.20 seconds (16.27 Kbytes/sec)
ftp> quit
221 Goodbye
$
```

To modify the TRACE exception vector to point to the TRACE_ENTRY symbol in the monitor program (so that the emulator can single-step):

```
M>m -dl 24=2800
```

Now, you are ready to use the emulator.

3

Using the Terminal Interface

Using the Terminal Interface

This chapter describes general tasks you may wish to perform while using the Terminal Interface, in other words, tasks that don't necessarily relate to using the emulator or the analyzer. These tasks are grouped into two sections:

- Accessing HP 64700 system information.

- Entering commands.

Accessing HP 64700 System Information

The HP 64700's Terminal Interface provides access to two types of system-wide information:

• Help information for the Terminal Interface commands.

• Software version number information for the products installed in the HP 64700 Card Cage.
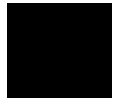
To access on-line help information

• Use the **help** or **?** commands.

The HP 64700's Terminal Interface provides an on-line help command to provide you with quick information on the various commands and command syntax. From any system prompt, you can enter **help** or **?** as shown below.

Commands are grouped into various classes. To see the commands grouped into a particular class, you can use the **help** command with that group. Viewing the group help information in short form will cause the commands or the grammar to be listed without any description.

Help information exists for each command. Additionally, there is help information for each of the emulator configuration items. For example, to access the help information for the **rrt** configuration item, you can enter the **help cf rrt** command).

Examples

To display information on the help command:

```
M>help

  help  - display help information

    help <group>        - print help for desired group
    help -s <group>     - print short help for desired group
    help <command>      - print help for desired command
    help                - print this help screen

  --- VALID <group> NAMES ---
    gram    - system grammar
    proc    - processor specific grammar

    sys     - system commands
    emul    - emulation commands
    trc     - analyzer trace commands
    *       - all command groups
```

To display information on the grammar used in the Terminal Interface:

```
M>help gram
```

```
gram - system grammar
-----------------------------------------------------------------------
--- SPECIAL CHARACTERS ---
  #  - comment delimiter    ;  - command separator    Ctl C - abort signal
  {} - command grouping     "" - ascii string         ``    - ascii string
  Ctl R - command recall    Ctl B - recall backwards

--- EXPRESSION EVALUATOR ---
  number bases:  t-ten   y-binary   q-octal   o-octal   h-hex
  repetition and time counts default to decimal - all else default to hex
  operators:     ()  ~  *  /  %  +  -  <<  <<<  >>  >>>  &  ^  |  &&

--- PARAMETER SUBSTITUTION ---
  &token& - pseudo-parameter included in macro definition
          - cannot contain any white space between & pairs
          - performs positional substitution when macro is invoked
  Example
     Macro definition:  mac getfile={load -hbs"transfer -t &file&"}
     Macro invocation:  getfile MYFILE.o
     Expanded command:  load -hbs"transfer -t MYFILE.o"
```

To display information specific to the 68340 processor:

```
M>help proc
```

```
--- Address format ---
  32 bit address for memory with optional function codes
  address format is either XXXXXXXX or XXXXXXXX@fc
  where XXXXXXXX is a 32 bit address and
  where fc may be any of the following function codes
  x  - no function codes               cpu - CPU
  sp - supervisor program              s   - supervisor
  sd - supervisor data                 u   - user
  up - user program                    p   - program
  ud - user data                       d   - data

--- Address range format ---
  32 bit address thru 32 bit address with optional function codes
  address range format is XXXXXXXX..XXXXXXXX or XXXXXXXX..XXXXXXXX@fc
  where XXXXXXXX is a 32 bit address and
  where fc may be any of the Address format function codes

--- Emulation Status Characters ---
  R - emulator in reset state          c - no target system clock
  U - running user program             r - target system reset active
  M - running monitor program          h - processor halted
  W - waiting for CMB to become ready   b - no bus cycles
  w - CPU in wait state                g - bus granted
  ? - No monitor communication         p - no target power
```

To display information on the emulator commands:

```
M>help emul
```

```
emul - emulation commands
----------------------------------------------------------------------------
b......break to monitor  demo...demo program     r......run user code
bc.....break condition   dump...dump memory      reg....registers
bp.....breakpoints       es.....emulation status rst....reset
cf.....configuration     io.....input/output     rx.....run at CMB execute
cim....copy target image load...load memory      s......step
cmb....CMB interaction   m......memory           ser....search memory
cov....coverage          map....memory mapper     sync...synchronize emulator
cp.....copy memory       mo.....modes
```

To display information on the **cf** command:

M>**help cf**

```
cf - display or set emulation configuration

  cf                 - display current settings for all config items
  cf <item>          - display current setting for specified <item>
  cf <item>=<value>  - set new <value> for specified <item>
  cf <item> <item>=<value> <item> - set and display can be combined

help cf <item>   - display long help for specified <item>

--- VALID CONFIGURATION <item> NAMES ---
  clk    - select internal or external emulation clock
  lfc    - select 68340 function codes for file loading
  mon    - select foreground or background monitor
  monaddr - select the base address of the monitor
  mondsi - enable or disable monitor /DSACK interlocking
  monintr - select interrupt priority level for foreground monitor
  rrt    - enable or disable restriction to real-time runs
  rv     - select SSP and PC when monitor is entered from emulation reset
  regfmt - select single register format
```

To display information on the **rrt** configuration item:

M>**help cf rrt**

```
Enable or disable restriction to real-time runs

  cf rrt=en      enable
  cf rrt=dis     disable

  When enabled and while the emulator is running the user program, any
    command that requires a break to the monitor will be rejected except
    'rst', 'b', 'r' or 's'.
  When disabled, commands that require a break to the monitor will
    always be accepted.
```

To display version information

- Use the **ver** command.

The Terminal Interface provides the **ver** command if you need to check the software version numbers of the HP 64700 system and other products in the HP 64700.

Examples   To display version information:

```
M>ver
```

```
                Copyright (c) Hewlett-Packard Co. 1987
All Rights Reserved.  Reproduction, adaptation, or translation without prior
written permission is prohibited, except as allowed under copyright laws.

  HP64700B Series Emulation System
    Version:   B.01.00 20Dec93
    Location:  Flash
    System RAM:1 Mbyte

  HP64751A Motorola 68340 Emulator
    Version:   A.00.00 21Apr92
    Control:   HP64748C  Emulation Control Board
    Speed:     16.7 MHz
    Memory:    260 Kbytes
      Bank 0:  HP64171A 256 Kbyte 35ns Memory Module

  HP64740 Emulation Analyzer
    Version:   A.02.02 13Mar91
```

Entering Commands

This section describes tasks that are related to entering commands. Entering commands is easy: use the keyboard to type in the command and press the carriage return key. However, the Terminal Interface provides other features that make entering commands even easier. For example, you can:

- Enter multiple commands on one line.

- Recall commands.

- Edit commands.

- Repeat commands.

- Define macros, which save a set of commands for later execution.

- Use command files over LAN.

To enter multiple commands on one command line

- Separate the commands with semicolons (;).

More than one command may be entered in a single command line if the commands are separated by semicolons (;).

Examples   To step the next instruction and display the registers:

```
M>s;reg

000000a00@sp  -                NOP
PC = 000000a02@sp
reg pc=00000a02 st=2714 d0=00000000 d1=0000ffff d2=00000000 d3=00000000
reg d4=00000000 d5=00000000 d6=00000000 d7=00000000 a0=00047fe3 a1=00000ac5
reg a2=00000984 a3=00000000 a4=00000000 a5=00068054 a6=00047fe4 a7=00047f78
reg usp=00000001 ssp=00047f78 vbr=00000000 sfc=00 dfc=00
```

To recall commands

• Press <CTRL>r.

You can press <CTRL>r to recall the commands that have just been entered. If you go past the command of interest, you can press <CTRL>b to move forward through the list of saved commands.

Examples   To recall and execute the last command press <CTRL>r and then press <RETURN>.

To edit commands

1 Use the **cl -e** command to enable the command line editor.

2 Use <CTRL>r to recall previous commands, or if you wish to edit the current command or search for a previous command, press <ESC> to enter the editing mode.

The Terminal Interface provides a command line editing feature. The editing mode commands are as follows.

Command	Description
<ESC>	enter command editing mode
i	insert before current character
a	insert after current character
x	delete current character
r	replace current character
dd	delete command line
D	delete to end of line
A	append to end of line
$	move cursor to end of line
0	move cursor to start of line
^	move cursor to start of line
h	move left one character
l	move right one character
k	fetch previous command
j	fetch next command
/<string>	find previous command in history matching <string>
n	fetch previous command matching <string>
N	fetch next command matching <string>

To repeat commands

- Use the **rep** command.

The **rep** command is helpful when entering commands repetitively. You can repeat the execution of macros as well as commands.

Examples   To cause the **s** and **reg** commands to be executed two times.

> M>**rep 2 {s;reg}**

```
000000a08@sp  -                   BEQ.B    $00000A00
PC = 000000a00@sp
reg pc=00000a00 st=2714 d0=00000000 d1=0000ffff d2=00000000 d3=00000000
reg d4=00000000 d5=00000000 d6=00000000 d7=00000000 a0=00047fe3 a1=00000ac5
reg a2=00000984 a3=00000000 a4=00000000 a5=00068054 a6=00047fe4 a7=00047f78
reg usp=00000001 ssp=00047f78 vbr=00000000 sfc=00 dfc=00
000000a00@sp  -                   NOP
PC = 000000a02@sp
reg pc=00000a02 st=2714 d0=00000000 d1=0000ffff d2=00000000 d3=00000000
reg d4=00000000 d5=00000000 d6=00000000 d7=00000000 a0=00047fe3 a1=00000ac5
reg a2=00000984 a3=00000000 a4=00000000 a5=00068054 a6=00047fe4 a7=00047f78
reg usp=00000001 ssp=00047f78 vbr=00000000 sfc=00 dfc=00
```

To enter multiple commands with macros

1 Define the macro with the **mac** command.

2 Execute the defined macro.

If you wish to enter the same set of commands at various times while you use the
emulator, you can assign these commands to a macro and enter the macro instead of
the set of commands.

Examples   To define a macro that will display registers after every step, enter the following
command.

> M>**mac st={s;reg}**

To execute the macro, enter it as you would any other command.

> M>**st**

```
# s ; reg
000000a02@sp  -                   MOVE.B   Cmd_Input,D2
PC = 000000a08@sp
reg pc=00000a08 st=2714 d0=00000000 d1=0000ffff d2=00000000 d3=00000000
reg d4=00000000 d5=00000000 d6=00000000 d7=00000000 a0=00047fe3 a1=00000ac5
reg a2=00000984 a3=00000000 a4=00000000 a5=00068054 a6=00047fe4 a7=00047f78
reg usp=00000001 ssp=00047f78 vbr=00000000 sfc=00 dfc=00
```

To use command files over LAN

1 Using **ftp -in** and the ftp command "cd <parameter>", copy information from the HP 64700 to the host computer.

2 Using **ftp -in** and the ftp command "cd <parameter>", copy information from the host computer to the HP 64700.

The **ftp** software in the HP 64700 responds to the ftp command "cd <parameter>" by executing the parameter as a Terminal Interface command.

By using **ftp -in** (refer to the **ftp** documentation for option details), you can send multiple Terminal Interface commands to a HP 64700 on the LAN.

For example, when entered from a UNIX workstation on the same LAN as the HP 64700 named *hostname*, the following command will display emulator version information:

```
$ echo "open hostname\nverbose\ncd ver\nquit" | ftp -in
```

If the Terminal Interface command you wish to execute has arguments, you must enclose the command and its arguments in quotes. For example:

```
$ echo "open hostname\nverbose\ncd \"help ver\"\nquit" | ftp -in
```

In order for these commands to work properly, there must not be an open telnet connection to the HP 64700.

Examples

The following example assumes the HP 64700 is connected to the same LAN as the UNIX host computer.
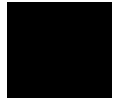
To save the emulator configuration, memory map, and other emulator settings, create a configuration file by entering the following commands on the UNIX workstation:

```
$ echo "open hostname" > cfg_file
$ echo "open hostname\nverbose\ncd cf\ncd map\ncd equ\ncd mac\nquit"
| ftp -in | grep '^  ' | awk '{printf "cd \"%s\"\n", $0}' >> cfg_file
$ echo "quit" >> cfg_file
```

To restore the emulator configuration information saved in "cfg_file", enter the following command:

```
$ ftp -in < cfg_file
```

4

Using the Emulator

Using the Emulator

This chapter describes general tasks you may wish to perform while using the emulator. These tasks are grouped into the following sections:

- Initializing the emulator.

- Using the emulator configuration registers.

- Mapping emulation and target system memory.

- Loading absolute files.

- Loading and using symbols.

- Executing user programs (starting, stopping, stepping, and resetting the emulator).

- Using software breakpoints.

- Enabling and disabling break conditions.

- Accessing registers.

- Accessing memory.

Initializing the Emulator

This section shows you how to:

- Initialize the emulator.

- Display emulator status information.

To initialize the emulator

- Enter the **init** command.

The **init** command with no options causes a limited initialization. A limited initialization does not affect system configuration. However, the **init** command will reset emulator and analyzer configurations. The **init** command:

- Resets the memory map.

- Resets the emulator configuration items.

- Resets the break conditions.

- Clears breakpoints.

The **init** command does not:

- Clear any macros.

- Clear any emulation memory locations; mapper terms are deleted, but if you re-specify the mapper terms, you will find that the emulation memory contents are the same.

The **-c** option specifies a complete initialization (except system verification tests are not run).

The **-p** option specifies a complete initialization with system verification tests. The **-p** initialization sequence includes emulator, analyzer, system controller, communications port, LAN interface, and flash EPROM initialization.

The **-r** option specifies a complete initialization with system verification tests (as with **-p**), but all optional products are ignored. Do not use flash ROM.

Examples

To perform a limited initialization:

```
R>init
  # Limited initialization completed
```
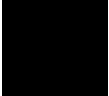
To display emulator status information

- Enter the **es** command.

  or

- Enter the **help proc** command.

  The Terminal Interface prompt displays an emulator status character. You can find the meaning of the emulator status character in one of two ways: with the **help proc** command or with the **es** command.

Examples   To use the **help proc** command:

```
R>help proc
.
.
.

  --- Emulation Status Characters ---
   R - emulator in reset state              c - no target system clock
   U - running user program                 r - target system reset active
   M - running monitor program              h - processor halted
   W - waiting for CMB to become ready      b - no bus cycles
   w - CPU in wait state                    g - bus granted
   ? - No monitor communication             p - no target power
.
.
.
```

To use the **es** command:

```
R>es
  M68340--Emulation reset
```

Using the Emulator Configuration Registers

The 68340 processor contains a System Integration Module (SIM) which has the external bus interface, four chip selects, input/output ports, and other circuitry to reduce external logic in a typical microprocessor system. The SIM can be programmed or configured in a variety of ways to suit the need of various systems.

The HP 64751A emulator contains circuitry that accommodates the flexibility of the 68340 SIM and maintains consistent emulation features.
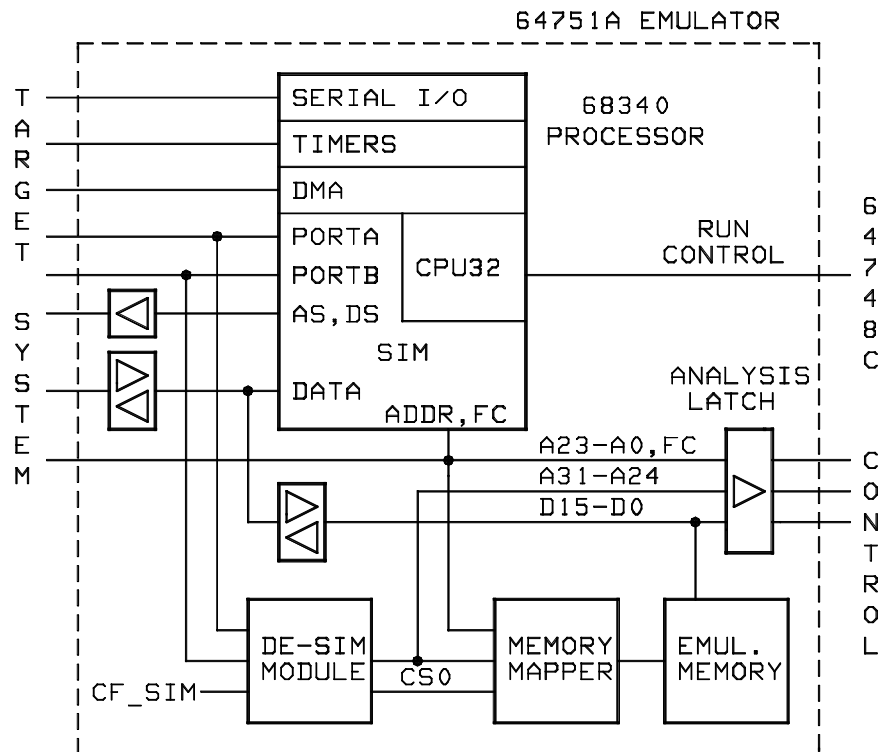
In the previous figure, there is a block labeled DE-SIM module. It receives as inputs from the 68340:

- Port A which can be address lines 31-24, interrupt acknowledge inputs, or general purpose I/O lines.
- Port B which can be interrupt requests, chip selects, or general purpose I/O lines.

The DE-SIM module provides as outputs:

- Address lines A31-A24 to the memory mapper and the analyzer.
- A qualified chip select 0 (CS0) to the memory mapper.

The 68340 SIM is configured through the registers in the **sim** register class; these registers control how the 68340 uses external signal lines to access memory.

The emulator's DE-SIM module is configured through the registers in the **cf_sim** register class. The DE-SIM module controls how the emulator interprets the signals from the 68340 when accessing emulation memory and passing information to the analysis trace.

Normally, the **sim** and **cf_sim** registers should be programmed with the same values so they will be working together.

One of the primary functions of the DE-SIM is to provide A31-A24 to the memory mapper and analyzer so they will have the complete 32-bit address bus. This is easy if Port A of the 68340 is programmed as address lines; however, if it's programmed as an input port, for example, the upper address lines are not available external to the 68340 (this is the case following reset). The four chip selects, however, have access to the full 32 bit address inside the 68340. You can therefore locate memory using a chip select at an address that is not possible to decode externally. If properly programmed, the DE-SIM can use information in the programming of the chip selects to re-create the upper address lines. This provides the ability to map emulation memory at these addresses and also provides a correct address in the analysis trace so that symbolic debugging is possible.

Normally, the DE-SIM would be programmed through the **cf_sim** registers to match the programming of the 68340 SIM as it will exist after all of the boot-up configuration is complete. This can be done before the boot-up code is run. In fact, the programming of the **cf_sim** registers is part of the configuration and will be loaded along with the memory map and other configuration items when a configuration file is loaded.

The default programming of the DE-SIM matches the reset values of the 68340 SIM (refer to the Motorola *MC68340 Integrated Processor User's Manual* for specific values).

If desired, the programming of the DE-SIM can be transferred into the 68340 SIM with the **sync cf** command. This happens automatically each time a break to the monitor from emulation reset occurs. This ensures that the 68340 is prepared to properly access memory when a program is downloaded to the emulator.

Alternatively, the emulator's DE-SIM can be programmed from the 68340 SIM with the **sync sim** command. This is useful if initialization code that configures the 68340 SIM exists, but you don't what its values are. In this case, you can use the default configuration, run from reset (either **r rst** or **rst** followed by **r**) to execute the initialization code, and use the **sync sim** command to configure the emulator to match the 68340 SIM.

At any time, you can verify if the SIM and DE-SIM are programmed the same with the **sync diff** command. Any differences between the two register sets will be listed.

It should be noted that the DE-SIM module is programmed solely from the **cf_sim** register set and is therefore static with respect to the application program. No attempt is made to update the programming of the DE-SIM by tracking instructions that will program the 68340 SIM.

This section shows you how to:

• View the SIM register differences.

• Synchronize to the 68340 SIM registers.

• Synchronize to the emulator configuration registers.

To view the SIM register differences

- Enter the **sync diff** command.

  Before displaying the SIM configuration register differences, make sure the
  contents of the **mbar** register is valid (in other words, its least significant bit should
  be 1).

Examples

To display the SIM register differences:

```
M>sync diff
!ERROR  149! Register mbar valid bit not set
M>reg mbar=40001
M>sync diff
  mbar    =    40001  cf_mbar    =   100001
  cs0mask = ffffffff  cf_cs0mask = 0000fffd
  cs0addr = 18515e60  cf_cs0addr = ff000000
  cs1mask = fffffffb  cf_cs1mask = 00000000
  cs1addr = 8830fcc8  cf_cs1addr = 00000000
  cs2mask = fff7ffff  cf_cs2mask = 00000000
  cs2addr = e41cff24  cf_cs2addr = 00000000
  cs3mask = fffffffd  cf_cs3mask = 00000000
  cs3addr = 54005ca0  cf_cs3addr = 00000000
```
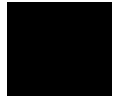
To synchronize to the 68340 SIM registers

- Enter the **sync sim** command.

The contents of the 68340 SIM registers are copied to the emulator's configuration registers. The contents of the **mbar** register must be valid (that is, its least significant bit should be 1).

To synchronize to the emulator configuration registers

- Enter the **sync cf** command.

The contents of the emulator's configuration registers are copied to the 68340 SIM registers. The contents of the **cf_mbar** register must be valid (that is, its least significant bit should be 1).

Mapping Memory

Because the emulator can use target system memory or emulation memory (or both), it is necessary to map ranges of memory so that the emulator knows where to direct its accesses.

Up to 7 ranges of memory can be mapped, and the resolution of mapped ranges is 256 bytes (that is, the memory ranges must begin on 256 byte boundaries and must be at least 256 bytes in length).

The emulator contains 4 Kbytes of dual-port emulation memory and provides two slots for additional emulation memory modules:

- HP 64171A 256 Kbyte Memory Modules or HP 64171B 1 Mbyte Memory Modules (0 wait state emulation memory through 16.7 MHz, 1 wait state above 16.7 MHz).

- HP 64172A 256 Kbyte Memory Modules or HP 64172B 1 Mbyte Memory Modules (0 wait state emulation memory through 25 MHz).

- HP 64173A 4 Mbyte Memory Modules (0 wait state emulation memory through 22 MHz, 1 wait state above 22 MHz).

(The 68340 processor is programmed for the correct number of wait states by user code.) If memory modules are mixed, the performance characteristics of the slower module should be used.

Emulation memory is made available to the mapper in blocks. When you map an address range to emulation memory, at least one block is assigned to the range. When a block of emulation memory is assigned to a range, it is no longer available, even though part of the block may be unused.

Emulation memory in bank 0 of the emulator probe is divided into 4 equal blocks, and memory in bank 1 is divided into 2 equal blocks. The 4 Kbyte block of dual-port emulation memory is 1 block.

When you map ranges of emulation memory, blocks are allocated so as to leave the greatest amount of emulation memory available. For example, if you map the range 0 through 0FFH as emulation memory, the 4 Kbyte block of dual-port memory is used if possible; if that block has already been used, the next smallest available block is used.
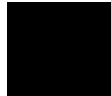
You should map all memory ranges used by your programs before loading programs into memory.

Using Emulation Memory to Substitute for 8-Bit Memory

Emulation memory is 16-bit wide memory. However, you can use emulation memory to substitute for 8-bit memory by using one of the chip selects and generating internal DSACKx signals for an 8-bit port. You must place the appropriate values into the emulator configuration (**cf_sim**) versions of the chip select address and mask registers so that emulation memory is accessed correctly.

Using Chip Selects to Access Emulation Memory

When using chip selects to access emulation memory, the DSACKx signals can be generated internally or externally.

If the DSACKx signals are generated externally (as defined by the **cf_cs**x**mask** register), emulation memory must be interlocked with the target system (use the **dsi** attribute when mapping the emulation memory range); otherwise, there will be no DSACKx response.

Fast Termination Mode

Emulation memory does not support the fast termination mode (-1 wait state) that can be defined in the chip select registers. If a chip select is programmed for this mode, it will override the mapper and force access to the target system.

External DMA Access to Emulation Memory

External direct memory access (DMA) to emulation memory is not permitted.

The HP 64751 emulator supports operation of the two 68340 on-chip DMA channels in both single- and dual-address modes. Dual-address transfers can access emulation memory; single-address transfers must be between peripherals and memory in the target system only.

To map memory ranges

- Use the **map <range> <type> <attrib>** command.

The <type> parameter allows you to characterize the memory range as emulation RAM, emulation ROM, target system RAM, target system ROM, or as guarded memory.

Guarded memory accesses will cause emulator execution to break into the monitor program.

Writes to locations characterized as ROM will cause emulator execution to break into the monitor program if the **rom** break condition is enabled (**bc -e rom**).

Even though execution breaks into the monitor, the memory location is modified if it's in emulation ROM or target system RAM mapped as ROM.

The <attrib> parameter can be:

dp	Dual-port emulation memory.
	One emulation memory range, up to 4 Kbytes in length, can be given the **dp** attribute. The **dp** attribute specifies that the range be mapped to the 4 Kbyte block of dual-port emulation memory. If a foreground monitor program is selected, the **dp** attribute is automatically assigned to the memory range reserved for the monitor program.
dsi	Interlock emulation memory and target system /DSACK.
	The **dsi** attribute specifies that accesses in that range of emulation memory be synchronized with the target system. This means the termination of accesses in the range will not occur until the target system provides a /DSACK. If the target system does not generate a /DSACK, the emulator will be unable to break into the monitor and a "CPU in wait state" status will result.
	When interlocking is disabled, accesses to emulation memory will be terminated by a /DSACK signal generated by the emulator. Any cycle termination signals generated by the target system during emulation memory accesses, including /BERR, will be ignored.
cs0	Use 68340 chip select 0.

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The **cs0** attribute allows you to emulate the 68340's global chip
select operation. One memory range, either target or emulation,
can be given this attribute. Refer to the "To emulate global chip
select operation" task description at the end of this section.

Examples   Consider the following section summary from the linker load map output listing.

```
SECTION SUMMARY
---------------

SECTION     ATTRIBUTE               START      END        LENGTH     ALIGN

            ABSOLUTE DATA           00000000   0000002F   00000030   0 (BYTE)
0           NORMAL                  00000030   00000030   00000000   2 (WORD)
env         NORMAL CODE             00000400   0000097C   0000057D   2 (WORD)
prog        NORMAL CODE             0000097E   00000A61   000000E4   2 (WORD)
const       NORMAL ROM              00000A62   00000AC4   00000063   2 (WORD)
lib         NORMAL CODE             00000AC6   00000E27   00000362   2 (WORD)
libc        NORMAL CODE             00000E28   00000E7B   00000054   2 (WORD)
libm                                00000E7C   00000E7C   00000000   0 (BYTE)
mon         NORMAL CODE             00000E7C   00000FC5   0000014A   2 (WORD)
stack       NORMAL DATA             00040000   00047FFF   00008000   4 (LONG)
envdata     NORMAL DATA             00060000   00060053   00000054   4 (LONG)
data        NORMAL DATA             00060054   00060074   00000021   2 (WORD)
idata                               00060075   00060075   00000000   0 (BYTE)
udata                               00060075   00060075   00000000   0 (BYTE)
libdata     NORMAL DATA             00060078   0006007B   00000004   4 (LONG)
libcdata    NORMAL DATA             0006007C   00060106   0000008B   2 (WORD)
mondata     NORMAL DATA             00060108   0006012B   00000024   2 (WORD)
heap        NORMAL DATA             0006012C   00064129   00003FFE   4 (LONG)
```

Notice the ABSOLUTE DATA, CODE, and ROM sections occupy locations 0
through 0FC5H. Because the contents of these sections will eventually reside in
target system ROM, this area should be characterized as ROM when mapped. This
will prevent these locations from being written over accidentally. If the **rom** break
condition is enabled, instructions that attempt to write to these locations will cause
emulator execution to break into the monitor.

Also, notice the DATA sections occupy locations 40000H through 47FFFH and
60000H through 64129H. Since these sections are written to, they should be
characterized as RAM when mapped.

To map emulation memory for the above program, you would enter the following
map commands.

R>**map 0..0fff erom**

R>**map 40000..47fff eram**

```
R>map 60000..64fff eram
```

To display the memory map

- Enter the **map** command with no parameters.

Examples   To view the memory map, enter the **map** command with no parameters.

```
R>map
 # remaining number of terms   : 4
 # remaining emulation memory   : 20000h bytes
 map   000000000..000000fff   erom              # term 1
 map   000040000..000047fff   eram              # term 2
 map   000060000..000064fff   eram              # term 3
 map   other tram
```

To characterize unmapped ranges

- Enter the **map other** command.

The default characterization for unmapped memory ranges are treated as target system RAM.

The "other" term cannot be mapped as emulation memory.

Examples   To characterize unmapped ranges as target RAM:

```
R>map other tram
```

To characterize unmapped ranges as guarded memory:

```
R>map other grd
```

To delete memory map ranges

- Enter the **map -d** command.

Note that programs should be reloaded after deleting mapper terms. The memory mapper may re-assign blocks of emulation memory after the insertion or deletion of mapper terms.

Examples

To delete term 1 in the memory map:

R>**map -d 1**

To delete all map terms:

R>**map -d ***

To map memory ranges that use function codes

- Specify function codes with address ranges when mapping memory.

The function code can be:

> **x** (no function code is used — absolute files are loaded into memory ranges that have been mapped without function codes).
> **s** (supervisor space).
> **u** (user space).
> **p** (program space).
> **d** (data space).
> **sp** (supervisor program space).
> **sd** (supervisor data space).
> **up** (user program space).
> **ud** (user data space).

If you specify a function code when mapping a range of memory, you must include the function code when referring to locations in that range. If you don't include the function code, an "ambiguous address" error message is displayed.

If you use different function codes, it's possible to map address ranges that overlap. When address ranges with different function codes overlap, you must load a separately linked module for the space associated with each function code. The modules are linked separately because linker errors occur when address ranges overlap.

When address ranges are mapped with different function codes, and there are no overlapping ranges, your program modules may exist in one absolute file. However, you have to use multiple load commands—one for each function code specifier. This is necessary to load the various sections of the absolute file into the appropriate function code qualified memory ranges. When you do this, be sure that all address ranges not mapped (that is, the "other" memory mapper term) are mapped as target RAM. When "other" is mapped as guarded, guarded memory access errors (from the attempt to load the absolute file sections that are outside the specified function code range) can prevent the absolute file sections that are inside the specified function range from being loaded.

Examples

Suppose you're developing a system with the following characteristics:

- Input port at 100 hex.

- Output port at 400 hex.

- Supervisor program from 1000 through 1fff hex.

- Supervisor data from 2000 through 2fff hex.

- User program from 3000 through 3fff hex.

- User data from 3000 through 3fff hex.

Notice that the last two terms have address ranges that overlap. You can use function codes to cause these terms to be mapped to different blocks of memory.

Suppose also that the only things that exist in your target system at this time are the input and output ports and some control logic; no memory is available. You can reflect this by mapping the I/O ports to target system memory space and the rest of memory to emulation memory space:

```
R>map -d *
R>map 0..0fff tram
R>map 1000..1fff@sp erom
R>map 2000..2fff@sd eram
R>map 3000..3fff@up eram
R>map 3000..3fff@ud eram
R>map
  # remaining number of terms   : 2
  # remaining emulation memory  : 10000h bytes
  map  000000000..000000fff     tram             # term 1
  map  000001000..000001fff@sp  erom             # term 2
  map  000002000..000002fff@sd  eram             # term 3
  map  000003000..000003fff@up  eram             # term 4
  map  000003000..000003fff@ud  eram             # term 5
  map  other tram
```

Notice that the mapper reserved two different spaces for the user program and user data areas even though the addresses are the same.

To display a byte of memory at 1000H:

```
R>b
M>m -db 1000
!ERROR  312! Ambiguous address: 000001000
M>m -db 1000@sp
  000001000@sp  00
```

To emulate global chip select operation

1 Use the **cs0** attribute when mapping the boot ROM address range.

2 Make sure the cf_mbar register is valid, and modify the cf_cs0addr and cf_cs0mask registers to the appropriate values.

Or:

Load a previously saved configuration from a command file that has the appropriate values of cf_mbar, cf_cs0addr, and cf_cs0mask.

3 If the you're emulating boot ROM with emulation memory, load the boot ROM code.

4 Run from reset.

The advantages are:

- You can put the boot ROM contents in emulation memory.

- The base address of the boot ROM does not have to be at address 0 to fetch vectors from reset.

- If boot ROM is already in the target system, you can prevent guarded memory accesses when running from reset.

Limitations:

The maximum amount of emulation memory that can be mapped is half the amount of memory installed in bank 1 or one quarter the amount of memory installed in bank 0, whichever is larger.

Examples

This example shows how to use the **cs0** memory map attribute to emulate the 68340's global chip select operation. First, initialize the emulator:

```
R>init
  # Limited initialization complete
```

To map the boot ROM address range in emulation memory:

```
R>map 80000..8ffff erom cs0
```

You can map all other addresses as guarded memory to show that the fetches of the supervisor stack pointer and program counter values after reset really come from the boot ROM address range.

```
R>map other grd
```

To modify the emulator configuration registers so appropriate information is sent to the analyzer:

```
R>reg cf_mbar=100001
R>reg cf_cs0addr=80001
R>reg cf_cs0mask=0fffd
```

To load the supervisor stack pointer and program counter values that will be fetched from the boot ROM after reset:

```
R>m -dl 80000=0,81000
M>
```

To load the boot ROM program into emulation memory (NOP, NOP, BRA.B 81000H):

```
M>m -dw 81000=4e71,4e71,60fa
```

To trace execution after reset:

```
M>t
  Emulation trace started
```

To run from reset:

```
M>r rst
```

To display the trace:

```
U>tl
```

```
 Line   addr,H    68340 Mnemonic                              count,R  seq
 -----  --------  -------------------------------------       ---------  ---
    0   00000000  $0000          supr prgm long rd (ds16)          ---    +
    1   00000002  $0000          supr prgm word rd (ds16)       0.720 uS   .
    2   00000004  $0008          supr prgm long rd (ds16)       0.720 uS   .
    3   00000006  $1000          supr prgm word rd (ds16)       0.720 uS   .
    4   00081000  $4E71          supr prgm word rd (ds16)       0.840 uS   .
    5   00081002  $4E71          supr prgm word rd (ds16)       0.720 uS   .
    6   00081004  $60FA          supr prgm word rd (ds16)       0.720 uS   .
    7   00081006  $0000          supr prgm word rd (ds16)       0.720 uS   .
    8   00081000  $4E71          supr prgm word rd (ds16)       0.680 uS   .
    9   00081002  $4E71          supr prgm word rd (ds16)       0.720 uS   .
```

Notice the supervisor stack pointer and program counter values that were loaded at 80000H and 80004H are fetched from memory locations 0 through 7 and the program begins running at 81000H.

Suppose your boot ROM is at a higher address:

```
U>init
  # Limited initialization complete
R>map 0ff000000..0ff00ffff erom cs0
R>map other grd
R>reg cf_mbar=100001
R>reg cf_cs0addr=0ff000001
R>reg cf_cs0mask=0fffd
R>m -dl 0ff000000=0,0ff001000
M>m -dw 0ff001000=4e71,4e71,60fa
M>t
  Emulation trace started
M>r rst
U>tl
```

```
Line   addr,H    68340 Mnemonic                                count,R  seq
-----  --------  ---------------------------------------       ---------  ---
   0   ff000000  $0000          supr prgm long rd (ds16)            ---    +
   1   ff000002  $0000          supr prgm word rd (ds16)      0.720 uS    .
   2   ff000004  $FF00          supr prgm long rd (ds16)      0.720 uS    .
   3   ff000006  $1000          supr prgm word rd (ds16)      0.720 uS    .
   4   ff001000  $4E71          supr prgm word rd (ds16)      0.840 uS    .
   5   ff001002  $4E71          supr prgm word rd (ds16)      0.680 uS    .
   6   ff001004  $60FA          supr prgm word rd (ds16)      0.720 uS    .
   7   ff001006  $0000          supr prgm word rd (ds16)      0.720 uS    .
   8   ff001000  $4E71          supr prgm word rd (ds16)      0.720 uS    .
   9   ff001002  $4E71          supr prgm word rd (ds16)      0.720 uS    .
```

Notice the supervisor stack pointer and program counter values that were loaded at
0FF000000H appear to be fetched from memory locations 0FF000000H through
0FF000007H when they are really fetched from locations 0 through 7. This is
because the upper 8 bits of the cf_cs0addr register are sent to the analyzer instead
of A31-A24 (this is true even if Port A is set up to be address lines).
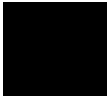
Loading Absolute Files

This section describes the tasks related to loading absolute files into the emulator. You can load absolute files when using the serial connection or when using the LAN connection:

- When using the serial connection, the HP 64700 is connected to a host computer and accessed via a terminal emulation program. In this configuration, you can load absolute files by downloading from the same port.

- When using the LAN connection, the HP 64700 is connected to the same LAN as a computer that has the ARPA Services File Transfer Protocol (ftp) software. In this configuration, you can use the **ftp** command to load absolute files over the LAN.

The Terminal Interface's **load** command will accept absolute files in the following formats:

- HP absolute.

- Intel hexadecimal.

- Extended Tektronix hexadecimal.

- Motorola S-records.

The HP AxLS software development tools generate IEEE-695 format or HP format absolute files.

To load absolute files over the serial port

- Load the file over the "command" port.

  If the emulator is connected to a host computer, and you are accessing the emulator from the host computer via a terminal emulation program, you can also download files with the **load** command. However, in the remote configuration, files are loaded from the same port that commands are entered from.

Examples   To download a Tektronix hexadecimal file from a Vectra personal computer:

```
R>load -t <RETURN>
```

After you have entered the **load** command, exit from the terminal emulation program to the MS-DOS operating system. Then, copy your hexadecimal file to the port connected to the emulator, for example:

```
C:\copy thexfile com1: <RETURN>
```

Now you can return to the terminal emulation program and verify that the file was loaded (for example, by displaying memory in mnemonic format).

To load absolute files over the LAN

- Use the **ftp** command on your local host computer to transfer files to the remote HP 64700.

  When connecting to the HP 64700's ftp interface, you can use either the HP 64700's hostname or the Internet Protocol (IP) address (or internet address). When you use the HP 64700's hostname, the ftp software on your computer will look up the internet address in the hosts table, or perhaps a name server will return the internet address.

Examples   To connect to the emulator's ftp interface, enter the following command (use any name and password):

```
$ ftp 15.35.226.210
Connected to 15.35.226.210.
220 User connected to HP64700
Name (15.35.226.210:guest):
Password (15.35.226.210:guest):
230-
                        NOTICE

   This utility program is unsupported. It is provided at no cost.
   Hewlett-Packard makes no warranty on its quality or fitness for
   a particular purpose.

 FTP on the HP64700 serves as a means for downloading absolute files to the
 emulation environment. The file transfer can be be performed as follows:

 1. The data mode type must be set to IMAGE (binary)

 2. Store the file using options to indicate the file format.  The following
 example uses PUT as the host command for sending the file. This may be
 different for your ftp implementation.

 put <file_name> <options>
     <file_name> - host file to be loaded.
     <options>   - The options are preceded by a minus (-). The available
     options vary for individual emulators. All support HP OLS, Intel hex,
     Motorola S-records, and Extended Tek Hex.  Emulator specific options can
     be viewed by issuing a Terminal Mode help for the load command.

     put hpfile.X  -h  #to download an HP OLS file
     put intelfile -i  #to download an Intel Hex file
     put motfile   -m  #to download a Motorola S-record file
     put tekfile   -t  #to download an Extended Tek Hex file

230
```

To set up ftp for binary file transfers:

```
ftp> binary
200 Type set to I
```

To download the HP 64000 format absolute file into the emulator:

```
ftp> put cmd_rdr.X -h
200 Port      ok
150
226-
R>
226 Transfer completed
3332 bytes sent in 0.20 seconds (16.27 Kbytes/sec)
```

To exit out of the ftp interface:

```
ftp> quit
221 Goodbye
$
```

To load absolute files into memory mapped with function codes

1 Enter the **cf lfc=<function_code>** command.

2 Load the absolute file.

3 Repeat steps 1 and 2 for each range mapped with a different function code.

Absolute files are only loaded into the address ranges that are mapped with the function code specified. For example, if you enter the **cf lfc=s** command, subsequent **load** commands only load the absolute file into memory ranges designated as "supervisor" space (that is, mapped with **map <address>..<address>@s** commands).

The function code can be:

> **x** (no function code is used — absolute files are loaded into memory ranges that have been mapped without function codes).

> **s** (supervisor space).

> **u** (user space).

> **p** (program space).

> **d** (data space).

> **sp** (supervisor program space).

> **sd** (supervisor data space).

> **up** (user program space).

ud (user data space).

Refer to the previous "To load absolute files ..." task descriptions for more information on loading absolute files.

To simplify loading of many modules, you can include the above sequence in macros defined with the **mac** command or in host computer resident command files.

Examples

To load the portions of the absolute file that reside in supervisor memory space:

```
M>cf lfc=s
M>load -hbs "transfer -tb absfile.X"<ESC>g
```

Loading and Using Symbols

The emulator supports the use of symbolic references. The symbols can be loaded from an ASCII text file on a host computer or defined with the **sym** command.

This section describes the tasks related to loading ASCII symbol files into the emulator. ASCII symbol files must be loaded from a host computer.

Symbols will be shown when you display memory in mnemonic format. Also, you can use the **-s** or **-e** options to the trace list command (**tl**) to have symbolic information included in the trace list.

You can typically use symbol table information from a linker map file when creating the ASCII symbol file; however, you need to make sure the information is in the following format.

```
#
:global_sybmol
module:local_symbol
.
.
.
#
```

This section describes how to:

- Load symbol files over the serial port.

- Load symbol files over the LAN.

- Define user symbols.

- Display symbols.

- Remove symbols.

To load symbol files over the serial port

- Use the **load -S** command.

ASCII symbol files are loaded into the emulator with the **load -S** command.

Examples   Suppose the "cmd_rdr.sym" file below exists on a Vectra personal computer.

```
#
:Cmd_Input                     00060054
:Msg_Dest                      00060055
:Write_Msg                     00000984
:main                          000009B0
atexit:__exec_funcs            00000E54
atexit:__top_of_func_stack     000600FC
atexit:_atexit                 00000E28
cmd_rdr:_Cmd_Input             00060054
cmd_rdr:_Msg_Dest              00060055
cmd_rdr:_Write_Msg             00000984
cmd_rdr:_main                  000009B0
crt1:__exit                    0000047E
crt1:_exit                     0000046A
crt1:entry                     00000400
data_gen:__infinity            00000E74
data_gen:__malloc_init         00060106
data_gen:__rand_seed           000600FE
data_gen:_errno                00060102
disp_msg:XEnv_68k_except       0006002E
disp_msg:__display_message     000004FA
disp_msg:end_of_program        00000528
fperror:__fp_control           0006007A
fperror:__fp_error             00000AC6
fperror:__fp_errorf            00000AC6
fperror:__fp_errori            00000AC6
fperror:__fp_status            00060078
getmem:__getmem                000005BA
getmem:nextblk                 00060030
mon_stub:JSR_ENTRY             00000FC2
mon_stub:MONITOR_MESSAGE       00060128
sysheap:TopOfHeap              0006412A
sysheap:heap                   0006012C
sysstack:TopOfStack            00048000
sysstack:stack                 00040000
systrap:trap                   000005E4
#
```

To load symbols from the ASCII file above:

`R>`**`load -S`** `<RETURN>`

After you have entered the **load** command, exit from the terminal emulation program to the MS-DOS operating system. Then, copy your symbols file to the port connected to the emulator, for example:

```
C:\copy cmd_rdr.sym com1: <RETURN>
```

To load symbols over the LAN

- Use the **ftp** command on your local host computer to transfer files to the remote HP 64700.

Loading symbol files over the LAN is the same as loading absolute files over the LAN, except that a different option is used with the "put" command in ftp.

Examples   To connect to the emulator's ftp interface, enter the following command (use any name and password):

```
$ ftp 15.35.226.210
Connected to 15.35.226.210.
220 User connected to HP64700
Name (15.35.226.210:guest):
Password (15.35.226.210:guest):
230-
                            NOTICE

  This utility program is unsupported. It is provided at no cost.
  Hewlett-Packard makes no warranty on its quality or fitness for
  a particular purpose.

.
.
.
```

To set up ftp for binary file transfers:

```
ftp> binary
200 Type set to I
```

To download the symbol file into the emulator:

```
ftp> put cmd_rdr.sym -S
200 Port      ok
150
226-
R>
```

```
226 Transfer completed
1789 bytes sent in 4.78 seconds (0.37 Kbytes/sec)
```

To exit out of the ftp interface:

```
ftp> quit
221 Goodbye
$
```

To define user symbols

• Use the **sym <name>=<addr>** command.

You can use the **sym** command to define new symbols.

Examples   To define the symbol "while_statement" for the address 0A00H:

```
M>sym while_statement=0a00
```

To display symbols

• Use the **sym** command.

After symbols are loaded, you can use the **sym** command to display and delete symbols, as well as to define new symbols.

Examples   To display all the symbols:

```
M>sym
  sym while_statement=000000a00
  sym Cmd_Input=000060054
  sym Msg_Dest=000060055
  sym Write_Msg=000000984
  sym main=0000009b0
  sym atexit:__exec_funcs=000000e54
  sym atexit:__top_of_func_stack=0000600fc
  sym atexit:_atexit=000000e28
```

```
sym cmd_rdr:_Cmd_Input=000060054
sym cmd_rdr:_Msg_Dest=000060055
sym cmd_rdr:_Write_Msg=000000984
sym cmd_rdr:_main=0000009b0
sym crt1:__exit=00000047e
sym crt1:_exit=00000046a
sym crt1:entry=000000400
sym data_gen:__infinity=000000e74
sym data_gen:__malloc_init=000060106
sym data_gen:__rand_seed=0000600fe
sym data_gen:_errno=000060102
sym disp_msg:XEnv_68k_except=00006002e
sym disp_msg:__display_message=0000004fa
sym disp_msg:end_of_program=000000528
sym fperror:__fp_control=00006007a
sym fperror:__fp_error=000000ac6
sym fperror:__fp_errorf=000000ac6
sym fperror:__fp_errori=000000ac6
sym fperror:__fp_status=000060078
sym getmem:__getmem=0000005ba
sym getmem:nextblk=000060030
sym mon_stub:JSR_ENTRY=000000fc2
sym mon_stub:MONITOR_MESSAGE=000060128
sym sysheap:TopOfHeap=00006412a
sym sysheap:heap=00006012c
sym sysstack:TopOfStack=000048000
sym sysstack:stack=000040000
sym systrap:trap=0000005e4
```

To display all the global symbols:

```
M>sym -g
  sym Cmd_Input=000060054
  sym Msg_Dest=000060055
  sym Write_Msg=000000984
  sym main=0000009b0
```

To display all the local modules:

```
M>sym -l
  sym atexit:
  sym cmd_rdr:
  sym crt1:
  sym data_gen:
  sym disp_msg:
  sym fperror:
  sym getmem:
  sym mon_stub:
  sym sysheap:
  sym sysstack:
  sym systrap:
```

To display all the user-defined symbols:

```
M>sym -u
  sym while_statement=000000a00
```
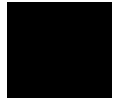
To remove symbols

- Use the **sym -d** command.

  You can use the **sym -d** command to delete symbols.

Examples   To delete all user symbols:

```
R>sym -du
```

To delete all global symbols:

```
R>sym -dg
```

To delete all local symbols in all modules:

```
R>sym -dl
```

To delete all symbols:

```
R>sym -d
```

Executing User Programs

This section describes how to:

- Start the emulator running the user (target system) program.

- Stop (break from) user program execution.

- Step through user programs.

- Reset the emulation processor.
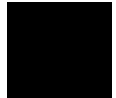
To run (execute) user programs

- Use the **r** command.

The run command causes the emulator to execute the user program. When the emulator is executing the user program, the "U" emulator status character is shown in the Terminal Interface prompt.

The **r** command by itself runs from the current program counter value.

The **r rst** (run from reset) command resets the emulation processor and lets the emulator run and fetch its stack pointer and program counter value from memory.

A **rst** (reset) command followed by a **r** command will load the
cf rv=<ssp_value>,<pc_value> values into the emulation processor and run from the loaded program counter value. This is true for both background and foreground monitors.

Examples   To run from the current program counter:

```
M>r
U>
```

To run from address 400H:

```
M>r 400
U>
```

To stop (break from) user program execution

- Use the **b** command.

You can use the break command (**b**) command to generate a break to the monitor.

If the user program executes a STOP or LPSTOP instruction, you cannot break to the emulator's monitor state while the processor is in the stopped state. The break command uses the emulation processor background debug mode (BDM), and the processor must be executing instructions in order to enter the BDM. An interrupt from the target system will cause the 68340 to exit the stopped state; then, the break command will work normally.

The "Using Software Breakpoints" section of this chapter describes how to stop execution at particular points in the user program.

Examples   To break execution into the monitor:

```
U>b
M>
```

To break from reset into the monitor:

```
R>b
M>
```

To step through user programs

- Use the **s** command.

The emulator allows you to step through the user program. You can step from the current program counter (in other words, instruction pointer) or from a particular address. You can step a single instruction or a number of instructions.

A step count of 0 will cause the stepping to continue "forever" (until some break condition, such as "write to ROM", is encountered, or until you enter <CTRL>c).

If a foreground monitor is selected, the target system trace vector must point to TRACE_ENTRY in the foreground monitor code for single step to function properly.

Examples

To step one instruction from the current program counter:

```
M>s
  000000a08@sp   –                    BEQ.B    $00000A00
  PC = 000000a00@sp
```

To step a number of instructions from the current program counter:

```
M>s 8
  000000a00@sp   –                    NOP
  000000a02@sp   –                    MOVE.B   Cmd_Input,D2
  000000a08@sp   –                    BEQ.B    $00000A00
  000000a00@sp   –                    NOP
  000000a02@sp   –                    MOVE.B   Cmd_Input,D2
  000000a08@sp   –                    BEQ.B    $00000A00
  000000a00@sp   –                    NOP
  000000a02@sp   –                    MOVE.B   Cmd_Input,D2
  PC = 000000a08@sp
```
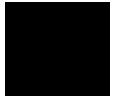
To step a number of instructions from a specified address:

```
M>s 16 main
  0000009b0  main               LINK.W   A6,#$FF9C
  0000009b4@sp  -               MOVE.L   A2,-(A7)
  0000009b6@sp  -               MOVE.L   D2,-(A7)
  0000009b8@sp  -               MOVEA.L  #$00000984,A2
  0000009be@sp  -               LEA      ($FF9C,A6),A0
  0000009c2@sp  -               MOVEA.L  #$00000A62,A1
  0000009c8@sp  -               MOVEQ    #$00000020,D1
  0000009ca@sp  -               MOVE.B   (A1)+,(A0)+
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  PC = 0000009cc@sp
```

To step until <CTRL>c:

```
M>s 0
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  0000009cc@sp  -               DBF      D1,$000009CA
  .
  .
  .
<CTRL>c

  .
  .
  .
  000000a02@sp  -               MOVE.B   Cmd_Input,D2
  000000a08@sp  -               BEQ.B    $00000A00
  000000a00@sp  -               NOP
  000000a02@sp  -               MOVE.B   Cmd_Input,D2
  000000a08@sp  -               BEQ.B    $00000A00
  PC = 000000a02@sp
!STATUS  685! Stepping aborted
```

To reset the emulation processor

• Use the **rst** command.

The **rst** command causes the processor to be held in a reset state until a **b** (break), **r** (run), or **s** (step) command is entered. A CMB execute signal will also cause the emulator to run if reset. Also, a request to access memory or registers while reset will cause a break into the monitor.

The **-m** option to the **rst** command specifies that the emulator begin executing in the monitor after reset.

Examples

To reset the emulation processor:

```
U>rst
R>
```

To reset the emulation processor and break into the monitor:

```
U>rst -m
M>
```

Using Software Breakpoints

Software breakpoints provide a way to accurately stop the execution of your program at selected locations.

When you set a software breakpoint at an address, the instruction at that address is replaced with a BGND instruction. When the BGND instruction is executed, the emulator enters its monitor state, and the original instruction is restored in the user program.

In order to successfully set a software breakpoint, the emulator must be able to write to the memory location specified. Therefore, software breakpoints cannot be set in target ROM.

Another way to break user program execution at a certain point is to break on the analyzer trigger.

This section shows you how to:

- Enable the breakpoints feature.

- Set software breakpoints.

- Display software breakpoints.

- Enable software breakpoints.

- Disable software breakpoints.

- Remove software breakpoints.

- Disable the breakpoints feature.

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.

To enable the breakpoints feature

- Enter the **bc -e bp** command.

Currently defined breakpoints are not automatically enabled when you enable the breakpoints feature; you must explicitly enable the software breakpoints.

To set software breakpoints

- Use the **bp <addr>** command.

Note that you must only set software breakpoints at memory locations which contain instruction opcodes (not operands or data).

Examples   To set a software breakpoint at address 0A00H:
```
M>bp 0a00
```

To display software breakpoints

- Enter the **bp** command with no options.

The **bp** command with no options displays the software breakpoints list. Also, it shows whether the breakpoint feature is enabled or disabled.

Examples   To display the software breakpoint list:
```
M>bp
  ### BREAKPOINT FEATURE IS ENABLED ###
  bp 000000a00 # enabled
```

To enable software breakpoints

- Use the **bp -e <addr>** command.

When a breakpoint is hit, it becomes disabled. You can use the **-e** option to the **bp** command to re-enable the software breakpoint.

Examples   To enable the software breakpoint at 0A00H:

```
M>bp -e 0a00
```

To enable all software breakpoints:

```
M>bp -e *
```

To disable software breakpoints

- Use the **bp -d <addr>** command.

When a breakpoint is hit, it becomes disabled. You can also disable breakpoints before they are hit (while they are enabled) by using the **-d** option to the **bp** command.

Examples   To disable the software breakpoint at 0A00H:

```
M>bp -d 0a00
```

To remove software breakpoints

- Use the **bp -r <addr>** command.

You can remove existing breakpoints by using the **-r** option to the **bp** command.

Examples　　　To remove the software breakpoint at 0A00H from the breakpoint list:

```
M>bp -r 0a00
```

To disable the breakpoints feature

- Enter the **bc -d bp** command.

All breakpoints are disabled, but they remain defined.

Using Break Conditions

Break conditions allow you to specify breaks in the user program when certain events occur during emulation processor execution. (You can also break user program execution when certain events occur in another HP 64700; these break conditions are described in the "Making Coordinated Measurements" chapter.)

The **bc** command lets you enable or disable breaks on the following conditions:

- Writes to ROM.

- Analyzer trigger.

To break on writes to ROM

- Enter the **bc -e rom** command.

When the **rom** break condition is enabled, the emulator will break from user program execution when a write occurs to a memory location mapped as ROM.

Even though execution breaks into the monitor, the memory location is modified if it's in emulation ROM or target system RAM mapped as ROM.

Examples To enable breaks on writes to ROM:

M>**bc -e rom**

To disable breaks on writes to ROM:

M>**bc -d rom**

To break on an analyzer trigger

1 Specify internal signal for analyzer to drive.

2 Enable the emulator break on the internal signal.

Use the **tgout** (trigger output) command to specify which signal is driven when the emulation analyzer triggers.

Either the "trig1" or the "trig2" internal signals can be driven on the trigger.

Note that the actual break may be several cycles after the analyzer trigger.

After the break occurs, the analyzer will stop driving the **trig** line that caused the break. Therefore, if **trig2** is used both to break and to drive the CMB TRIGGER (for example), TRIGGER will go true when the trigger is found and then will go false after the emulator breaks. However, if **trig2** is used to cause the break and **trig1** is used to drive the CMB TRIGGER, TRIGGER will stay true after the trigger until the trace is halted or until the next trace starts.

Examples   To break on the emulation analyzer trigger (over the internal trig2) signal:

```
M>tg any
M>tgout trig2
M>bc -e trig2
M>r 400
U>t
  Emulation trace started
!ASYNC_STAT  619! trig2 break
M>
```

To disable breaks on the internal trig2 signal:

```
M>bc -d trig2
```

Accessing Registers

This section describes tasks related to displaying and modifying emulation processor registers.

You can display the contents of an individual register or of all the registers.

This section shows you how to:

- Display register contents.

- Display a register in expanded format.

- Modify register contents.

Refer to the **reg** command description in the "Commands" chapter for a description of the 68340 registers.

To display register contents

- Use the **reg** command.

When displaying registers, you can display classes of registers and individual registers.

When register values are shown as asterisks (*), it means the register is a "write-only" register and that its contents cannot be displayed.

The least significant bit of the emulation processor's **mbar** register must be a 1 (which means the **mbar** contents are valid) before you can display or modify registers in the **sim**, **dma1**, **dma2**, **serial**, **timer1**, or **timer2** register classes.

Examples   To display the basic register contents:

>   M>**reg**

```
reg pc=00000a08 st=2704 d0=00000000 d1=0000ffff d2=0000ff00 d3=00000000
reg d4=00000000 d5=00000000 d6=00000000 d7=00000000 a0=00047fe3 a1=00000ac5
reg a2=00000984 a3=00000000 a4=00000000 a5=00068054 a6=00047fe4 a7=00047f78
reg usp=00000001 ssp=00047f78 vbr=00000000 sfc=06 dfc=00
```

To display the 68340 system integration module (SIM) register contents:

>   M>**reg sim**
>   !ERROR 149! Register mbar valid bit not set
>   !ERROR 631! Unable to read registers in class: sim
>   M>**reg mbar=100001**
>   M>**reg sim**

```
reg mbar=00100001 sim_mcr=608f syncr=3f08 avr=00 rsr=80 porta=ff ddra=00
reg ppara1=ff ppara2=00 portb=ff portb1=ff ddrb=00 pparb=ff swiv=0f sypcr=00
reg picr=000f pitr=0000 swsr=00 cs0mask=0000fffd cs0addr=ff000000
reg cs1mask=00000000 cs1addr=00000000 cs2mask=00000000 cs2addr=00000000
reg cs3mask=00000000 cs3addr=00000000
```

To display the DMA module 1 register contents:

>   M>**reg dma1**

```
reg dma_mcr1=0080 intr1=000f ccr1=8080 csr1=00 fcr1=80 sar1=fffffe0
reg dar1=dff4e821 btc1=fffffe1
```

To display the serial module register contents:

>   M>**reg serial**

```
reg serial_mcr=0080 ilr=00 ivr=0f mr1a=00 sra=00 csra=** cra=** rba=00 tba=**
reg ipcr=33 acr=** isr=00 ier=** mr1b=00 srb=00 csrb=** crb=** rbb=00 tbb=**
reg ip=03 opcr=** op_set=** op_rst=** mr2a=00 mr2b=00
```

Notice that asterisks (*) appear for "write-only" registers.

To display the timer module 2 register contents:

>   M>**reg timer2**

```
reg timer_mcr2=0080 ir2=000f cr2=0000 sr2=00ff cntr2=0000 prel12=ffff
reg prel22=ffff com2=0000
```

To display the emulator's system integration module (SIM) register contents:

>   M>**reg cf_sim**

```
reg cf_mbar=00000000 cf_sim_mcr=608f cf_ppara1=ff cf_ppara2=00
reg cf_cs0mask=00000000 cf_cs0addr=00000000 cf_cs1mask=00000000
reg cf_cs1addr=00000000 cf_cs2mask=00000000 cf_cs2addr=00000000
reg cf_cs3mask=00000000 cf_cs3addr=00000000
```

To display a register in expanded format

1 Enter the **cf regfmt=exp** command.

2 Use the **reg** command to display the contents of a single register.

The **cf regfmt=exp** command causes some individual register displays to contain expanded information about the fields within the register. The fields are decoded, and the contents of the bits or fields within the register are described.

The **cf regfmt=norm** command returns to the default register displays which show only the hexadecimal contents of the register.

Refer to the 68340 microprocessor users manual for complete information about fields within individual registers and their meanings.

Examples To display the SIM module configuration register:

```
M>cf regfmt=exp
M>reg mbar=100001
M>reg sim_mcr
  reg sim_mcr=0608f  FRZ1 SW DIS, FRZ0 INTR DIS, FIRQ 4 INTR 4 EXT CS
                     SHEN1-0 DIS, SUPV, IARB3-0=0f
```

To modify the SIM module configuration register and display it again:

```
M>reg sim_mcr=600f
M>reg sim_mcr
  reg sim_mcr=0600f  FRZ1 SW DIS, FRZ0 INTR DIS, FIRQ 4 INTR 4 EXT CS
                     SHEN1-0 DIS, USER, IARB3-0=0f
```

Notice that the expanded information now contains USER instead of SUPV due to the change in bit 7 of the register.

To return to the normal register display:
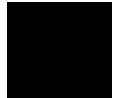
```
M>cf regfmt=norm
M>reg sim_mcr
  reg sim_mcr=0600f
```

To modify register contents

- Use the **reg <reg>=<value>** command.

Examples   To modify register d7 to contain the value 0FFFF1234H:

M>**reg d7=0ffff1234**

Accessing Memory

This section describes the tasks related to displaying, modifying, copying, and searching the contents of memory locations.

You can display and modify the contents of memory in byte, word, and long word lengths. You can also display the contents of memory in assembly language mnemonic format.

When displaying memory, the *display mode* specifies the format of the memory display. When modifying memory, the display mode specifies the size of the location to be modified.

When accessing target memory locations, the *access mode* specifies the type of microprocessor cycles that are used to read or write the value(s).

This section describes the following tasks:

- Setting the display and access modes.

- Displaying memory contents.

- Modifying memory contents.

- Copying memory contents.

- Searching memory for data.

To set the display and access modes

- Use the **mo** command.

When displaying memory, the display mode specifies the format of the memory display.

When modifying memory, the display mode specifies the size of the memory location that gets accessed. For example, suppose you modify a memory location with the value 41H; in the byte display mode, the value is 41H, but in the word

display mode, the value is 0041H, and in the long word display mode the value is 00000041H.

When accessing target system memory locations, the access mode specifies the type of microprocessor cycles that are used to read or write the value(s). For example, when the access mode is byte and a target system location is modified to contain the value 12345678H, byte instructions are used to write the byte values 12H, 34H, 56H, and 78H to target system memory.

You can also specify the display mode in the **m** command, which is used to display and modify memory locations.

Examples

To display the display and access mode settings:

```
M>mo
  mo -ab -dw
```

To specify the long word display mode:

```
M>mo -dl
```

To specify the word access mode:

```
M>mo -aw
```

To display memory contents

- Use the **m** command.

The **m** command displays the contents of the address or address range specified. Also, you can specify the display mode with the **-d** option.

For viewing code in memory, the **m -dm** command displays memory contents in disassembled mnemonic format.

Examples

To display the byte contents of a memory location:

```
M>m -db Msg_Dest
  000060055  00
```

To display the contents of a range of memory locations:

```
M>m -dw Msg_Dest..Msg_Dest+1f
  000060055  0000 0000 0000 0000 0000 0000 0000 0000
  000060065  0000 0000 0000 0000 0000 0000 0000 0000
```

To display the range "main" through "main+7" in mnemonic format:

```
M>m -dm main..main+7
  0000009b0  main              LINK.W   A6,#$FF9C
  0000009b4  -                 MOVE.L   A2,-(A7)
  0000009b6  -                 MOVE.L   D2,-(A7)
```

To modify memory contents

• Use the **m <addr>=<value>** command.

You can modify the contents of a memory location or a range of memory locations. Also, you can specify the display mode with the **-d** option.

You cannot modify odd memory locations with word or long values because the 68340 doesn't support misaligned operand transfers.

Examples

To modify the location "Cmd_Input" with a byte value of 41H:

```
M>m -db Cmd_Input=41
M>m -db Cmd_Input
  000060054  41
```

To modify the range of locations from "Msg_Dest" through "Msg_Dest+1FH" with byte values of 41H, 42H, 43H, and 44H:

```
M>m -db Msg_Dest..Msg_Dest+1f=41,42,43,44
M>m -db Msg_Dest..Msg_Dest+1f
  000060055  41 42 43 44 41 42 43 44 41 42 43 44 41 42 43 44
  000060065  41 42 43 44 41 42 43 44 41 42 43 44 41 42 43 44
```

To copy memory contents

• Use the **cp** command.

The **cp** (copy memory) command gives you the ability to copy the contents of one range of memory to another.

Examples

To copy the range of memory locations from 400H through 0FC5H to 1000H:

```
R>cp 1000=400..0fc5
```
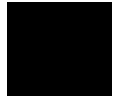
To search memory

• Use the **ser** command.

The **ser** command allows you to search for data in a range of memory locations. If any part of the data specified in the **ser** command is not found, no match is displayed.

Examples

To search the range of memory from 60000H through 64FFFH for the ASCII string "Command A Entered":

```
M>ser 0..0fff="Command A Entered"
  pattern match at address: 000000a62
M>ser 0..0fff="Command A EntereD"
M>
```

Notice that if the string is not found, no information is returned.

5

Using the Emulation Analyzer - Easy Configuration

Using the Emulation Analyzer - Easy Configuration

This chapter describes tasks you may wish to perform while using the emulation analyzer in its "easy" configuration (the "Using the Emulation Analyzer - Complex Configuration" chapter describes how to access and use the full capability of the analyzer). These tasks are grouped into the following sections:

- Initializing the analyzer.

- Qualifying the analyzer clock.

- Starting and stopping trace measurements.

- Displaying trace lists.

- Qualifying trigger and store conditions.

- Using the sequencer.

Initializing the Analyzer

This section describes how to:

- Initialize the analyzer.

- Display trace activity.

To initialize the analyzer

- Enter the **tinit** command.

The **tinit** command initializes the analyzer to its default or power-up state.

Examples

To initialize the analyzer:

U>**tinit**

To display trace activity

- Enter the **ta** command.

The **ta** (trace activity) command allows you to display the current status of the analyzer trace signals. The trace activity display shows the status of trace signals at any time, regardless of whether a pending trace is completed or not.

The trace signals are displayed in sets of sixteen. Pod 1 represents emulation analyzer trace signals 0 through 15 (the least significant bit is on the right). Pod 2 represents emulation analyzer trace signals 16 through 31, and so on.

A trace signal is displayed as a low (0), high (1), or moving (?).

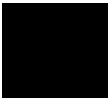**Examples** To display the activity on the analyzer trace signals:

```
U>ta
  Pod 5         = 00??1111 1???1??1
  Pod 4         = 11111111 11111110
  Pod 3         = ??????? ???????
  Pod 2         = 00000000 00000??0
  Pod 1         = 0??????? ???????
```

Qualifying the Analyzer Clock

The emulator/analyzer interface looks at the data on the emulation processor's bus and control signals at each clock cycle. This interface generates clocks to the analyzer. Address, data, and status fields which are then clocked into the analyzer.

You can qualify the analyzer clock so that the analyzer only looks at background cycles.

This section describes how to:

- Qualify the analyzer clock to trace background cycles.

To trace background cycles

- Enter the **tck -b** command.

By default, the analyzer traces foreground cycles; this is specified by the **-u** option to the **tck** command. However, when using the background monitor it is possible to trace the memory cycles used by the 68340 background debug mode (BDM); this is specified by the **-b** option to the **tck** command.

You can trace both user and background code by specifying the **-ub** option in a single **tck** command.

Examples   To trace background cycles:

```
U>tck -b
U>tck
  tck -r L -b -s S
```

Notice that the user/background option is a switch in the clock specification. Changing the option as shown above does not affect the rest of the trace clock specification.
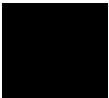
To trace foreground and background cycles:

```
U>tck -ub
U>tck
  tck -r L -ub -s S
```

To return to tracing foreground execution:

```
U>tck -u
U>tck
  tck -r L -u -s S
```

Starting and Stopping Traces

This section describes the tasks that relate to starting and stopping trace measurements.

When you start a trace measurement, the analyzer begins looking at the data on the emulation processor's bus and control signals on each analyzer clock signal. The information seen on a particular clock is called a state.

When one of these states matches the "trigger state" you specify, the analyzer stores states in trace memory. When trace memory is filled, the trace is said to be "complete."

The default trigger state specification is "any state," so when you start a trace measurement after initializing the analyzer, the analyzer will "trigger" on the first state it sees and store the following states in trace memory.

Once you start a trace measurement, you can view the progress of the measurement by displaying the trace status.

In some situations, for example, when the trigger state is never found or when the analyzer hasn't filled trace memory, the trace measurement does not complete. In these situations, you can halt the trace measurement.

This section describes how to:

* Start trace measurements.

* Display the trace status.

* Halt trace measurements.
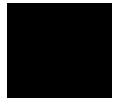
To start a trace measurement

- Enter the **t** command.

The **t** (trace) command tells the analyzer to begin monitoring the states which appear on the trace signals. You will see a message which confirms that a trace is started.

After the emulator is powered-up or initialized, the analyzer is in its simplest configuration. The default condition will trigger on any state, and store all captured states. You can simply issue a trace command (**t**) to trace the states currently executing.

Examples

To start a trace measurement after analyzer initialization:

```
U>tinit
U>t
  Emulation trace started
```

To trace a program as it starts up:

```
U>rst
R>t
  Emulation trace started
R>r crt1:entry
U>
```

To display the trace status

- Enter the **ts** command.

The **ts** (trace status) command lets you view what the analyzer is doing (or what the analyzer has done if the trace has completed).

The first line of the emulation trace status display shows whether the user trace has been "completed"; other possibilities are that the trace is still "running" or that the trace has been "halted". The word "NEW" indicates that the most recent trace has not been displayed. The word "User" indicates that the trace was taken in response to a **t** command; the other possibility is that a "CMB" execute signal started the trace.

The second line of the **ts** display contains information on the arm condition. If the **tarm** condition is specified as **always**, the message "Arm ignored" is displayed. If the **tarm** condition is specified as one of the internal signals, either the message "Arm not received" or "Arm received" is displayed. The display indicates if the arm condition happened any time since the most recent trace started, even if it happened after the trace was halted or became complete.

When an arm condition has been specified with the **tarm** command, the "Arm to trigger" line displays the amount of time between the arm condition and the trigger. The time displayed will be from -0.04 microseconds to 41.943 milliseconds, less than -0.04 microseconds, or greater than 41.943 milliseconds. If the arm signal is ignored or the trigger is not in memory, a question mark (?) is displayed.

The "States" line shows the number of states that have been stored (out of the number that is possible to store) and the line numbers that the stored states occupy. (The trigger state is always stored on line 0.)

The "Sequence term" line of the trace status display shows the number of the term the sequencer was in when the trace completed. Because a branch **out of the last sequence term** constitutes the trigger, the number displayed is what would be the next term (2 in the example below) even though that term is not defined. If the trace is halted, the sequence term number just before the halt is displayed; otherwise, the current sequence term number is displayed. If the current sequence term is changing too quickly to be read, a question mark (?) is displayed.

The "Occurrence left" line of the trace status display shows the number of occurrences remaining before the primary branch can be taken out of the current

sequence term. If the occurrence left is changing too quickly to be read, a question mark (?) is displayed.

Examples   To display the trace status:

```
U>ts
 --- Emulation Trace Status ---
 NEW User trace complete
 Arm ignored
 Trigger in memory
 States 512 (512) 0..511
 Sequence term 2
 Occurrence left 1
```

To halt a trace measurement

- Enter the **th** command.

The **th** (trace halt) command allows you to halt a trace measurement. When the **th** command is entered, the message "Emulation trace halted" is displayed.

Examples   To halt a trace measurement:

```
U>th
  Emulation trace halted
```

Displaying Traces

When states are stored in trace memory, you can display these states in the trace list. Also, you can change the format of the trace list. This section describes how to:

- Display the trace list.

- Change the format of the trace list.

To display the trace

- Use the **tl** command.

The **tl** (trace list) command displays the trace data.

Examples

The trace list displayed in the following examples was set up with the following commands.

```
U>sym for_loop=0a7a
U>tg addr=for_loop
U>t
  Emulation trace started
U>ts
  --- Emulation Trace Status ---
  NEW User trace complete
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 512 (512) 0..511
  Sequence term 2
  Occurrence left 1
```

To display the trace list:

U>**tl**

```
Line    addr,H    68340 Mnemonic                              count,R  seq
-----   --------  --------------------------------------      ---------  ---
   0    00000a7a  $2605         supr prgm word rd (ds16)            ---   +
   1    00000a7c  $2A02         supr prgm word rd (ds16)       0.720 uS   .
   2    00000a7e  $4EB9         supr prgm word rd (ds16)       0.720 uS   .
   3    00000a80  $0000         supr prgm word rd (ds16)       0.720 uS   .
   4    00000a82  $1052         supr prgm word rd (ds16)       0.720 uS   .
   5    00000a84  $2400         supr prgm word rd (ds16)       0.720 uS   .
   6    00047fd0  $0000         supr data long wr (ds16)       0.680 uS   .
   7    00047fd2  $0A84         supr data word wr (ds16)       0.720 uS   .
   8    00001052  $2039         supr prgm word rd (ds16)       0.720 uS   .
   9    00001054  $0006         supr prgm word rd (ds16)       0.720 uS   .
```

The first column in the trace list contains the line number. The trigger state is always on line number 0.

The second column contains the address information associated with the trace states. Addresses in this column may be locations of instruction opcodes on fetch cycles, or they may be sources or destinations of operand cycles.

The third column shows mnemonic information about the emulation bus cycle.

The fourth column shows the count information (**time** is counted by default). The "R" indicates that each count is relative to the previous state.

The fifth column contains information about the analyzer's sequencer. Whenever a "+" appears in this column, it means the state caused a sequencer branch.

The default number of states to display is 10.

To display the top 10 states in disassembled format:

U>**tl -d -t 10**

```
Line   addr,H    68340 Mnemonic                                 count,R  seq
-----  --------  --------------------------------------------   ---------  ---
   0   00000a7a  MOVE.L   D5,D3                                       ---   +
   1   00000a7c  MOVE.L   D2,D5                                  0.720 uS   .
   2   00000a7e  JSR      $00001052                              0.720 uS   .
   3   00000a80  $0000          supr prgm word rd (ds16)         0.720 uS   .
   4   00000a82  $1052          supr prgm word rd (ds16)         0.720 uS   .
   5   00000a84  MOVE.L   D0,D2                                  0.720 uS   .
   6   00047fd0  $0000          supr data long wr (ds16)         0.680 uS   .
   7   00047fd2  $0A84          supr data word wr (ds16)         0.720 uS   .
   8   00001052  MOVE.L   $000604DA,D0                           0.720 uS   .
   9   00001054  $0006          supr prgm word rd (ds16)         0.720 uS   .
```

To display the top 10 states with symbols and absolute addresses in the address column:

U>**tl -e -t 10**

```
Line   addr,H    68340 Mnemonic                                 count,R  seq
-----  --------  --------------------------------------------   ---------  ---
   0   for_loop  MOVE.L   D5,D3                                       ---   +
   1   00000a7c  MOVE.L   D2,D5                                  0.720 uS   .
   2   00000a7e  JSR      rand:_rand                             0.720 uS   .
   3   00000a80  $0000          supr prgm word rd (ds16)         0.720 uS   .
   4   00000a82  $1052          supr prgm word rd (ds16)         0.720 uS   .
   5   00000a84  MOVE.L   D0,D2                                  0.720 uS   .
   6   00047fd0  $0000          supr data long wr (ds16)         0.680 uS   .
   7   00047fd2  $0A84          supr data word wr (ds16)         0.720 uS   .
   8   nd:_rand  MOVE.L   data_gen:__rand_seed,D0                0.720 uS   .
   9   00001054  $0006          supr prgm word rd (ds16)         0.720 uS   .
```

To display the top 10 states dequeued:

U>**tl -od -t 10**

```
Line   addr,H    68340 Mnemonic                                 count,R  seq
-----  --------  --------------------------------------------   ---------  ---
   0   for_loop  MOVE.L   D5,D3                                       ---   +
   1   00000a7c  MOVE.L   D2,D5                                  0.720 uS   .
   2   00000a7e  JSR      rand:_rand                             0.720 uS   .
      =00047fd0  stck sdata wr:$00000A84
   8   nd:_rand  MOVE.L   data_gen:__rand_seed,D0                4.280 uS   .
      =and_seed  src  sdata rd:$9F5E2001
```

To display the top 10 states with dequeuing turned OFF:

U>**tl -on -t 10**

```
 Line   addr,H   68340 Mnemonic                            count,R  seq
 -----  --------  ---------------------------------------  --------- ---
    0   for_loop  MOVE.L   D5,D3                                 ---  +
    1   00000a7c  MOVE.L   D2,D5                             0.720 uS  .
    2   00000a7e  JSR      rand:_rand                        0.720 uS  .
    3   00000a80  $0000         supr prgm word rd (ds16)     0.720 uS  .
    4   00000a82  $1052         supr prgm word rd (ds16)     0.720 uS  .
    5   00000a84  MOVE.L   D0,D2                             0.720 uS  .
    6   00047fd0  $0000         supr data long wr (ds16)     0.680 uS  .
    7   00047fd2  $0A84         supr data word wr (ds16)     0.720 uS  .
    8   nd:_rand  MOVE.L   data_gen:__rand_seed,D0           0.720 uS  .
    9   00001054  $0006         supr prgm word rd (ds16)     0.720 uS  .
```

To display instructions only (no operands) from the top 10 states:

U>**tl -oi -t 10**

```
 Line   addr,H   68340 Mnemonic                            count,R  seq
 -----  --------  ---------------------------------------  --------- ---
    0   for_loop  MOVE.L   D5,D3                                 ---  +
    1   00000a7c  MOVE.L   D2,D5                             0.720 uS  .
    2   00000a7e  JSR      rand:_rand                        0.720 uS  .
    5   00000a84  MOVE.L   D0,D2                             2.160 uS  .
    8   nd:_rand  MOVE.L   data_gen:__rand_seed,D0           2.120 uS  .
```

To return to displaying instructions and operands:

U>**tl -oa -t 10**

```
 Line   addr,H   68340 Mnemonic                            count,R  seq
 -----  --------  ---------------------------------------  --------- ---
    0   for_loop  MOVE.L   D5,D3                                 ---  +
    1   00000a7c  MOVE.L   D2,D5                             0.720 uS  .
    2   00000a7e  JSR      rand:_rand                        0.720 uS  .
    3   00000a80  $0000         supr prgm word rd (ds16)     0.720 uS  .
    4   00000a82  $1052         supr prgm word rd (ds16)     0.720 uS  .
    5   00000a84  MOVE.L   D0,D2                             0.720 uS  .
    6   00047fd0  $0000         supr data long wr (ds16)     0.680 uS  .
    7   00047fd2  $0A84         supr data word wr (ds16)     0.720 uS  .
    8   nd:_rand  MOVE.L   data_gen:__rand_seed,D0           0.720 uS  .
    9   00001054  $0006         supr prgm word rd (ds16)     0.720 uS  .
```

To display the states at line 100:

U>**tl 100**

```
Line   addr,H    68340 Mnemonic                              count,R  seq
-----  --------  -------------------------------------       --------- ---
 100   00047fbc  $0000       supr data long rd (ds16)        0.720 uS   .
 101   00047fbe  $0A9A       supr data word rd (ds16)        0.680 uS   .
 102   00060324  $0000       supr data long wr (ds16)        0.720 uS   .
 103   00060326  $0A9A       supr data word wr (ds16)        0.720 uS   .
 104   000009a0  $4E5E       supr prgm word rd (ds16)        0.720 uS   .
 105   000009a2  $4E75       supr prgm word rd (ds16)        0.720 uS   .
 106   00047fb4  $0004       supr data long rd (ds16)        0.720 uS   .
 107   00047fb6  $7FC4       supr data word rd (ds16)        0.720 uS   .
 108   000009a4  $4E71       supr prgm word rd (ds16)        0.720 uS   .
 109   00047fb8  $0000       supr data long rd (ds16)        0.680 uS   .
```

To change the trace display format

- Use the **tf** command.

  You can change the format of the trace information with the **tf** (trace format) command.

  The **tf** command primarily allows you to arrange the columns of trace information in a different manner. However, you can include any trace label in the trace. Also, the trace label information can be displayed in various number bases, and counts can be displayed relative or absolute.

Examples

To view the trace display format:

```
U>tf
  tf addr,H mne count,R seq
```

To change the trace format so that the address column is 11 characters wide:

```
U>tf addr,h,11 mne count,r seq
U>tl -t
```

```
  Line   addr,H       68340 Mnemonic                                   count,R   seq
  -----  -----------  --------------------------------------------    ---------  ---
      0   for_loop    MOVE.L   D5,D3                                        ---   +
      1   00000a7c    MOVE.L   D2,D5                                   0.720 uS   .
      2   00000a7e    JSR      rand:_rand                              0.720 uS   .
      3   00000a80    $0000            supr prgm word rd (ds16)        0.720 uS   .
      4   00000a82    $1052            supr prgm word rd (ds16)        0.720 uS   .
      5   00000a84    MOVE.L   D0,D2                                   0.720 uS   .
      6   00047fd0    $0000            supr data long wr (ds16)        0.680 uS   .
      7   00047fd2    $0A84            supr data word wr (ds16)        0.720 uS   .
      8   rand:_rand  MOVE.L   data_gen:__rand_seed,D0                 0.720 uS   .
      9   00001054    $0006            supr prgm word rd (ds16)        0.720 uS   .
```

Qualifying Trigger and Store Conditions

This section describes tasks relating to the qualification of trigger and storage states.

You can trigger on, or store, specific states or specific values on a set of trace signals (which are identified by trace labels).

Also, you can *prestore* states. The prestore qualifier is a second storage qualifier used for storing states that occur before the normally stored states. Prestore is useful for capturing entry points to procedures or for identifying where global variables are accessed from.

This section describes how to:

- Qualify the trigger state.

- Trigger on a number of occurrences of some state.

- Change the trigger position in the trace.

- Qualify states stored in the trace.

- Activate and qualify prestore states.

- Change the count qualifier.

Expressions in Trace Commands

Expressions are used in commands which qualify the trace. Expressions may be specified in the following forms (the pound sign, #, appears before comments):

```
any/all                                 # special tokens
never/none
arm

label=<value>
label!=<value>
label=<value> and label=<value> ...     # this condition
label!=<value> or label!=<value> ...     # not this condition
label=<value>..<value>                   # this range
label!=<value>..<value>                  # not this range
```

Note that if you wish to specify an expression such as "label=<value> and label!=<value>", you must configure the analyzer so that you have access to its full capability (refer to the "Using the Emulation Analyzer - Complex Configuration" chapter).

Note also that only one range resource is available. You can, however, use this range (or "not this range") in more than one trace command.

Tokens The tokens **any** or **all** specify any or all conditions; you can use these tokens interchangeably. The tokens **never** or **none** specify false conditions; they are used to turn off qualifiers. The **never** and **none** tokens may also be used interchangeably. The **arm** token represents a condition external to the analyzer. Arm conditions are described in the "Making Coordinated Measurements" chapter.

Trace Labels Labels may be predefined trace labels or labels which you define with the **tlb** (trace label) command. Trace labels can be up to 31 characters long. When you define a trace label, you assign trace signals to the label name. The emulation analyzer trace signals are described in the table that follows.

Emulation Analyzer Trace Signals		
Trace Signals	**Signal Name**	**Signal Description**
0-31	A0-A31	Address Lines 0-31.
32-47	D0-D15	Data Lines 0-15.
64	BKG_L	Background Debug Mode (BDM) active. This signal is used to qualify the analyzer clock for tracing only foreground or only background cycles.
65 66 67	FC0 FC1 FC2	Function Codes 0-2. These lines to the analyzer are derived from the 68340 processor's function code lines. The function code meanings are: 001 - User Data Space 010 - User Program Space 101 - Supervisor Data Space 110 - Supervisor Program Space 111 - CPU Space
68	R/*W	Read/write signal.
69 70	SIZ0 SIZ1	Number of bytes remaining to be transferred.
71	CS_BYTE_L	Chip select byte/word signal.
72 73	DS0_L DS1_L	Data size acknowledge. Note that the 68340 SIM can be programmed to internally generate the DSACKx signals for external accesses; in this case, the DSACKx values do not show up on these trace signals.
74	BERR_L	Bus error active.
75	HALT_L	Halt active.
76	CODE_L	Instruction execution active.
77	FLUSH_L	Instruction pipeline flush active.
78	FC3	Function code 3. This can be set by the 68340 DMA controller for DMA transfers; however
79	CS0_L	Chip select 0 active.

Predefined Trace Labels To see the trace labels which have been predefined, enter the **tlb** (trace label) command with no options.

```
U>tlb
  #### Emulation trace labels
  tlb addr 0..31
  tlb data 32..47
  tlb stat 64..79
```

These predefined trace labels represent emulation processor signals as described below.

addr Represents the trace signals (0 through 31) which monitor the emulation processor's address pins.

data Represents the trace signals (32 through 47) which monitor the emulation processor's data pins.

stat Represents the trace signals (64 through 79) which monitor other emulation processor signals.

Values Values can be numeric constants (in several bases), symbols, or equates. Values can also be constants, symbols, and equates combined with operators. (Refer to the <value> description in the "Commands" chapter for information on constants and operators.)

Predefined Equates The **equ** (specify equates) command allows you to equate values with names. Equates for common trace label values are predefined. To view the equates, enter the **equ** command with no options. (These status equates are also listed in the **help proc** information.)

Predefined Equates for Analyzer Status		
Equate	**Value**	**Description**
berr	0xxxx x0xx xxxx xxxxy	/BERR active
code	0xxx0 xxxx xxxx xxxxy	code execution cycles
code_tfr	0xx00 xxxx xxxx xxxxy	first instruction following a pipeline flush
cpu	0xxxx xxxx xxxx 111xy	CPU space function code
csx_byte	0xxxx xx11 0xxx xxxxy	byte data transfer, chip select active ($\overline{\text{DSACKx}}$ not internally generated)
csx_word	0xxxx xx11 1xxx xxxxy	word data transfer, chip select active ($\overline{\text{DSACKx}}$ not internally generated)
data	0x0xx xxxx xxxx x01xy	data cycle
dma	0x1xx xxxx xxxx xxxxy	DMA space function code (if used by DMA controller module)
ds_byte	0xxxx xx10 xxxx xxxxy	byte data transfer
ds_word	0xxxx xx01 xxxx xxxxy	word data transfer
prog	0x0xx xxxx xxxx x10xy	program space function code
read	0xxxx xxxx xxx1 xxxxy	memory read
rerun	0xxxx 00xx xxxx xxxxy	/BERR and /HALT active (retry)
siz_3byte	0xxxx xxxx x11x xxxxy	3 byte access
siz_byte	0xxxx xxxx x01x xxxxy	byte access
siz_long	0xxxx xxxx x00x xxxxy	long word access
siz_word	0xxxx xxxx x10x xxxxy	word access
sup	0x0xx xxxx xxxx 1xxxy	supervisor space function code
supdata	0x0xx xxxx xxxx 101xy	supervisor data space function code
supprog	0x0xx xxxx xxxx 110xy	supervisor program space function code
user	0x0xx xxxx xxxx 0xxxy	user space function code
userdata	0x0xx xxxx xxxx 001xy	user data space function code
userprog	0x0xx xxxx xxxx 010xy	user program space function code
write	0xxxx xxxx xxx0 xxxxy	memory write

These predefined equates may be used to specify values for the **stat** trace label when qualifying trace conditions. For example:

```
stat=write
```

is the same as:

```
stat=0xxxxxxxxxxx0xxxxy
```

Equates, either predefined or user-defined, are translated to their actual values when used. Re-defining an equate will not affect commands in which the equate was previously used. For example, if you enter the commands **equ count=100; tg any count; equ count=5**, the occurrence count in the trigger specification is still 100.

To qualify the trigger state

• Use the **tg** command.

The **tg** (specify simple trigger) command allows you to specify when the analyzer should begin storing states.

Examples

Suppose you want to look at the execution of the analyzer demo program after the branch to the first instruction in the demo program's "for" loop (0A7AH), and, therefore, you would like to begin storing states after address 0A7AH occurs. To do this you could enter the commands shown below.

```
U>tinit
U>sym for_loop=0a7a
U>tg addr=for_loop
U>t
  Emulation trace started
U>ts
  --- Emulation Trace Status ---
  NEW User trace complete
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 512 (512) -1..510
  Sequence term 2
  Occurrence left 1
U>tl -de
```

Line	addr,H	68340 Mnemonic	count,R	seq
-1	00000b12	incomplete instr.: /FF68/????/	---	.
0	for_loop	MOVE.L D5,D3	1.040 uS	+
1	00000a7c	MOVE.L D2,D5	0.720 uS	.
2	00000a7e	JSR rand:_rand	0.720 uS	.
3	00000a80	$0000 supr prgm word rd (ds16)	0.720 uS	.
4	00000a82	$1052 supr prgm word rd (ds16)	0.720 uS	.
5	00000a84	MOVE.L D0,D2	0.720 uS	.
6	00047fd0	$0000 supr data long wr (ds16)	0.720 uS	.
7	00047fd2	$0A84 supr data word wr (ds16)	0.720 uS	.
8	nd:_rand	MOVE.L data_gen:__rand_seed,D0	0.680 uS	.

To trigger on a number of occurrences of some state

• Use the **tg <qualifier> <occurrence count>** command.

When specifying a simple trigger, you can include an occurrence count. The occurrence count specifies that the analyzer trigger on the Nth occurrence of some state.

The default base for an occurrence count is decimal. You may specify occurrence counts from 1 to 65535.

Examples

To trigger on the 100th occurrence of the branch to the first instruction after the analyzer demo program's for loop (0A7AH):

```
U>sym for_loop=0a7a
U>tg addr=for_loop 100
U>t
  Emulation trace started
U>ts
  --- Emulation Trace Status ---
  NEW User trace complete
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 512 (512) -1..510
  Sequence term 2
  Occurrence left 1
```
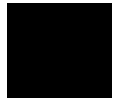
To change trigger position in the trace

- Use the **tp** command.

The **tp** (trigger position) command changes the trigger position in the trace.

The trigger position default is **tp s**, which specifies that the trigger appears at the start of the trace. You can also specify that the trigger appear in the center of the trace with the **tp c** command, or that the trigger appear at the end of the trace with the **tp e** command.

Additionally, you can specify a certain number of states to appear before (**tp -b 10**) or after (**tp -a 1014**) the trigger in the trace.

When the analyzer counts time or states, the actual trigger position is within +/- 1 state of the number specified. When counts are turned OFF, the actual trigger position is within +/- 3 states of the number specified.

Examples

To place the trigger state in the center of the trace:

```
U>tp c
U>t
  Emulation trace started
U>ts
  --- Emulation Trace Status ---
  NEW User trace complete
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 512 (512) -257..254
  Sequence term 2
  Occurrence left 1
```

Notice in the trace status information that states are stored before and after the trigger.

To qualify states stored in the trace

- Use the **tsto** command.

By default, all captured states are stored; however, you can qualify which states get stored with the **tsto** (trace storage qualifier) command.

Examples

To store only the states which write random numbers to the Results area in the analyzer demo program, enter the following commands.

```
U>tsto addr=Results..Results+3ff
U>tg any
U>t
  Emulation trace started
U>tl
```

Line	addr,H	68340 Mnemonic	count,R	seq
0	00001068	$0006 supr prgm word rd (ds16)	---	+
1	000602f0	$0000 supr data long wr (ds16)	69.84 uS	.
2	000602f2	$7E4C supr data word wr (ds16)	0.720 uS	.
3	0006016c	$0000 supr data long wr (ds16)	109.0 uS	.
4	0006016e	$1BC2 supr data word wr (ds16)	0.720 uS	.
5	00060184	$0000 supr data long wr (ds16)	109.3 uS	.
6	00060186	$1CF2 supr data word wr (ds16)	0.720 uS	.
7	0006035c	$0000 supr data long wr (ds16)	109.0 uS	.
8	0006035e	$7172 supr data word wr (ds16)	0.720 uS	.
9	0006041c	$0000 supr data long wr (ds16)	109.0 uS	.

Notice that the trigger state (line 0) is included in the trace list; trigger states are always stored.

To activate and qualify prestore states

- Use the **tpq <qualifier>** command.

Prestore allows you to save up to two states which precede a normal store state. Prestore is turned off by default. However, you can use the **tpq** command to specify a prestore qualifier.

Prestore is useful when you want to find the cause of a particular state. For example, if a variable is accessed from many different places in the program, you can qualify the trace so that only accesses of that variable are stored. Then, you can turn on prestore to find out from where accesses of that variable originate.

States which satisfy the prestore qualifier and the storage qualifier at the same time are stored as normal states.

The analyzer uses the same resource to save prestore states as it does to save count tags. Consequently, the "prestore" string is shown in the "count" column of the trace list. Notice that the time counts are relative to the previous normal storage state. Turning off the count qualifier does not turn off prestore: however, the "prestore" string cannot be seen in the "count" column of the trace list.

Examples

To prestore LINK A6,#0 instructions (which is the first instruction in the Caller functions and whose opcode is 4E56H) on writes to the range Results through Results+3ff:

```
U>tsto addr=Results..Results+3ff
U>tpq data=4e56
U>tg any
U>t
  Emulation trace started
U>tl -de
```

```
  Line    addr,H    68340 Mnemonic                                    count,R  seq
  -----   --------   ---------------------------------------          ---------  ---
    0    00000a80  incomplete instr.: /0000/????/                          ---    +
    1    Caller_0  incomplete instr.: /4E56/????/                     prestore    .
    2    rite_Num  incomplete instr.: /4E56/????/                     prestore    .
    3    0006040c   $0000          supr data long wr (ds16)           87.04 uS    .
    4    0006040e   $5B00          supr data word wr (ds16)           0.720 uS    .
    5    Caller_0  incomplete instr.: /4E56/????/                     prestore    .
    6    rite_Num  incomplete instr.: /4E56/????/                     prestore    .
    7    000603f4   $0000          supr data long wr (ds16)           109.3 uS    .
    8    000603f6   $24D1          supr data word wr (ds16)           0.680 uS    .
    9    Caller_1  incomplete instr.: /4E56/????/                     prestore    .
```

To turn off prestore states:

```
U>tpq none
```

To change the count qualifier

- To count time, use the **tcq time** command.

- To count states, use the **tcq <qualifier>** command.

• To turn OFF counting, use the **tcq none** command.

After initializing the analyzer, the default count qualifier is **time**, which means that the time between states is saved. When time is counted, up to 512 states can be stored in the trace.

When you count states, the counter is incremented each time the state is captured (not necessarily stored) by the analyzer. When a state is counted, up to 512 states can be stored in the trace.

When you turn OFF counting, up to 1024 states can be stored in the trace.

Examples

Suppose you want to know how many loops of the program occur between writes to the memory location Results+0C4H. You can use the **tcq** command to count a state that occurs once for each loop of the program.

First, set up the analyzer so that only writes to Results+0C4H are stored:

```
U>tsto addr=Results+0c4 and stat=write
```

Next, specify the count qualifier as the first instruction after the analyzer demo program's "for" loop (0A7AH):

```
U>sym for_loop=0a7a
U>tcq addr=for_loop
```
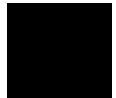
Finally, set up to trigger on any state, start the trace, change the trace format to display relative and absolute counts, and display the trace:

```
U>tg any
U>t
  Emulation trace started
U>tl
```

```
  Line    addr,H    68340 Mnemonic                                   count,R  seq
  -----   --------  --------------------------------------------     ---------  ---
      0   00060151  $--00           supr data byte rd (ds16)            ---    +
      1   00060118  $00--           supr data byte wr (ds16)              0    .
      2   00060118  $00--           supr data byte wr (ds16)              0    .
      3   00060118  $00--           supr data byte wr (ds16)              0    .
      4   00060118  $0000           supr data long wr (ds16)             37    .
      5   00060118  $0000           supr data long wr (ds16)            471    .
      6   00060118  $0000           supr data long wr (ds16)             81    .
      7   00060118  $0000           supr data long wr (ds16)             16    .
      8   00060118  $0000           supr data long wr (ds16)           1106    .
      9   00060118  $0000           supr data long wr (ds16)             61    .
```

The trace listing above shows that the program executes a different number of times for each time a random number is written to Results+0C4H. Where counts of 0 are seen, the analyzer demo program is executing the qsort function which sorts the values written to the results area.

To return to counting time:

```
U>tcq time
```

Using the Sequencer

By using the sequencer, you can trigger after a sequence of states instead of just one state. The sequencer has several levels, called *sequence terms*.

Each sequence term can search for two states at a time: a primary state and a secondary state. The primary state may have an occurrence count specified. If the primary state occurs the number of times specified, the sequencer branches to the next term. If the secondary state is found before the primary state occurs the number of times specified, the sequencer branches back to the first term.

The same secondary branch condition is used for all sequence terms, and secondary branches are always back to the first term; therefore, the secondary branch is called the *global restart*.

The last sequence term defines the trigger state. A branch out of this term constitutes the trigger.

This section describes how to:

- Reset the sequencer.

- Display the sequencer specification.

- Specify primary and secondary branch conditions.

- Add or insert sequence terms.

- Delete sequence terms.

The Default Sequencer Specification

After power-up, initialization, or sequencer reset, the sequencer consists of one term.

```
SECONDARY  BRANCHES                         PRIMARY  BRANCHES

                          ┌─────────┐
      telif  never        │  TERM1  │        tif  1  any
      (NO  SECONDARY      └─────────┘
      BRANCHES)                                (PRIMARY  BRANCH  ON  ANY  STATE)


                                              (TRIGGER  =  BRANCH  OUT  OF  TERM1)


                                              tsto  all
                                              (ALL  CAPTURED  STATES  ARE  STORED)
```
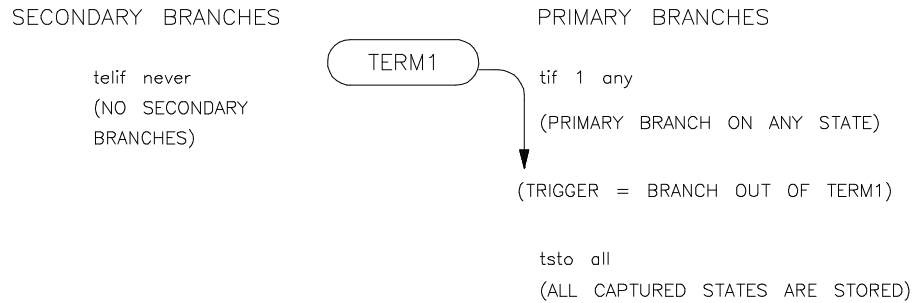
It may be helpful to think of the **tif** (primary branch expression) command as a conditional statement. For example, "If (some state occurs), then branch".

Because sequence term 1 is the last term and a branch out of the last term constitutes the trigger, the primary branch expression (**any**) of term 1 specifies the trigger condition. The expression **any** says that any captured trace state will cause a branch. Therefore, the trigger will occur immediately after the **t** (trace) command is issued (if instructions are being executed).

The **tsto** (trace storage qualifier) command specifies that **all** captured states are stored. The trace storage qualifier is a global; that is, it applies to all sequence terms. In addition to states which satisfy the trace storage qualifier, any state which causes a branch is stored in trace memory. Also, prestore states can be saved before states which satisfy the trace storage qualifier.

The **telif** command is used to specify the secondary branch expression for every sequence term; this expression is called the *global restart*. It may be helpful to think of the **telif** command as an "else if" conditional statement. For example, "Else if (some state occurs before) then branch to term 1".

The global restart in the default sequencer specification is **never**. This means no trace state can cause a secondary branch.

Simple Trigger and the Sequencer

The simple trigger command used previously in this chapter has the following effect on the sequencer:

```
U>sym for_loop=0a7a
U>tinit
U>tg addr=for_loop
U>tsq
  tif 1 addr=for_loop
  tsto all
  telif never
```

Notice that only the primary branch expression of the first sequence term (the trigger condition) is different than the default sequencer specification. The address 0A7AH is the first address inside the demo program's "for" loop. An address value of 0AE8H will trigger the analyzer, causing trace memory to be filled with states and stop.

When the **tg** command is entered with no options, the primary branch expression of the first sequence term is displayed. This is the trigger condition only when one term exists in the sequencer.

To reset the sequencer

• Enter the **tsq -r** command.

To reset the sequencer to its default, power-up state use the **-r** option to the **tsq** (trace sequencer) command.

Examples   To reset the sequencer:

```
U>tsq -r
```

To display the sequencer specification

- Enter the **tsq** command with no options.

To display the sequencer specification, enter the **tsq** command with no options.

Examples

```
U>tsq
  tif 1 any
  tsto all
  telif never
```

The **tif 1 any** part of the sequencer specification says that any state will cause a branch out of term 1. The **tsto all** says all states will be stored, and the **telif never** says that the global restart is turned off.

To specify primary and secondary branch expressions

- Use the **tif** and **telif** commands.

The **tif** command lets you qualify the states searched for by sequence terms.

The **telif** command lets you qualify the state that will cause a global restart (sequencer branch back to term 1).

Examples

You can use sequence terms to trace a specific combination of events. For example, Caller_3 can be used to write any random number, but suppose you want to trace only the situation where Caller_3 is used to write a random number to address Results+0C4H.

First, set up the sequencer so that it first searches for the call to Caller_3 by specifying the address of Caller_3 (0A04H) as the primary branch expression of the first sequence term.

```
U>tif 1 addr=Caller_3
```

After Caller_3 is found, the sequencer should then search for the write to address Results+0C4H. You can do this by specifying the address Results+0C4H, qualified by the "write" status, as the primary branch expression of the second sequence term.

```
U>tif 2 addr=Results+0c4 and stat=write
```

However, if the program executes the RTS instruction of the Caller_3 function (address 0A1AH) before the write to Results+0C4H, you know that Caller_3 is not used to write the random number this time, and the sequencer should start over. You can specify the global restart expression to do this.

```
U>telif addr=0a1a
```

If the write to address Results+0C4H occurs before the program executes the RTS instruction at 0A1AH, the sequencer will take a primary branch out of the last term and trigger the analyzer. Set up the analyzer so that only sequencer branches are stored.

```
U>tsto never
```

The resulting sequencer specification is shown below.

```
U>tsq
  tif 1 addr=Caller_3
  tif 2 addr=Results+0c4 and stat=write
  tsto never
  telif addr=0a1a
```

The sequencer specification above is represented in the following figure. The primary branch expression of the first sequence term is the address associated with Caller_3 (0A04H). The primary branch expression for the second sequence term is the specific write condition we would like to trace; it is also the trigger condition. The primary branch out of the second term constitutes the trigger.

SECONDARY BRANCHES   PRIMARY BRANCHES

```
                    ┌─────────────┐
                    │    TERM1     │
                    └─────────────┘
(ELSE IF PROGRAM                      (IF "CALLER_3" OCCURS,
RETURNS FROM                          BRANCH TO TERM2)
Caller_3 FUNCTION
BEFORE A RANDOM     ┌─────────────┐
NUMBER IS WRITTEN   │    TERM2     │
TO Results+0c4      └─────────────┘
THEN RESTART THE                      (IF RANDOM NUMBER IS WRITTEN TO
SEQUENCE.)                            Results+0c4, THEN TRIGGER)

                                      (TRIGGER = BRANCH OUT OF TERM2)


                                      (ONLY SEQUENCER BRANCHES ARE STORED)
```
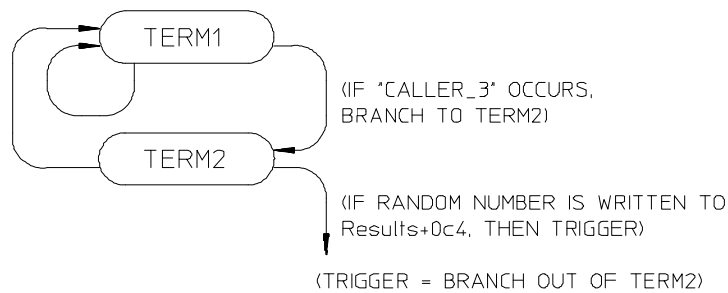
The sequencer works like this: After the trace is started, the first sequence term searches for the call to Caller_3. When the call to Caller_3 state is found, the sequencer branches to term 2. Now, the second sequence term searches for the address Results+0C4H. If address Results+0C4H is found before the state which satisfies the secondary branch expression (the return at address 0A1AH), the analyzer is triggered, causing the analyzer memory to be filled with states before the analyzer stops. If the RTS instruction at address 0A1AH is executed before the primary branch (in either the first or second terms), the sequencer branches back to the first sequence term.

The following commands position the trigger state in the center of the trace, start the trace, and display the trace status.

```
U>tp c
U>t
  Emulation trace started
U>ts
  --- Emulation Trace Status ---
  NEW User trace running
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 258 (512) -257..0
  Sequence term 3
  Occurrence left 1
```

The "seq" column in the trace list contains information about the sequencer. A "+" in the "seq" column indicates the state satisfied a branch condition.

Listing the trace will result in the following display.

```
U>tl -de -7
```

```
 Line   addr,H   68340 Mnemonic                             count,R  seq
 -----  -------- ---------------------------------------  ---------  ---
   -7   Caller_3  incomplete instr.: /4E56/????/             834.6 uS  +
   -6   00000a1a  RTS                                        44.00 uS  +
   -5   Caller_3  incomplete instr.: /4E56/????/             615.0 uS  +
   -4   00000a1a  RTS                                        44.00 uS  +
   -3   Caller_3  incomplete instr.: /4E56/????/             725.1 uS  +
   -2   00000a1a  RTS                                        44.00 uS  +
   -1   Caller_3  incomplete instr.: /4E56/????/             175.8 uS  +
    0   00060118   $0000          supr data long wr (ds16)   35.28 uS  +
    1
```

Remember, the primary branch out of the last term constitutes the trigger.
Also, a primary branch always advances to the next higher term. A secondary
branch from any term is always made back to the first sequence term (global
restart).

To add or insert sequence terms

- Use the **tsq -i** command.

The sequencer may have a total of 4 terms. You can add or insert sequence terms
with the **tsq** (trace sequencer) command using the **-i** (insert) option. If the term
number specified already exists, the new sequence term is inserted before the
existing term; otherwise, the new sequence term is added.

Examples
To insert a second sequence term:

```
U>tsq
  tif 1 addr=Caller_3
  tif 2 addr=Results+0c4 and stat=write
  tsto never
  telif addr=0a1a
U>tsq -i 2
U>tsq
  tif 1 addr=Caller_3
  tif 2 any
  tif 2 addr=Results+0c4 and stat=write
  tsto never
  telif addr=0a1a
```

To delete sequence terms

- Use the **tsq -d** command.

You delete sequence terms using the **-d** option to the **tsq** (trace sequencer specification) command.

After a term is deleted, the remaining terms are renumbered.

Examples

To delete the second sequence term:

```
U>tsq
  tif 1 addr=Caller_3
  tif 2 any
  tif 2 addr=Results+0c4 and stat=write
  tsto never
  telif addr=0a1a
U>tsq -d 2
U>tsq
  tif 1 addr=Caller_3
  tif 2 addr=Results+0c4 and stat=write
  tsto never
  telif addr=0a1a
```

6

Using the Emulation Analyzer - Complex Configuration

Using the Emulation Analyzer - Complex Configuration

This chapter describes how to use the emulation analyzer in its "complex" configuration (the "Using the Emulation Analyzer - Easy Configuration" chapter describes how to use the emulation analyzer in its easy-to-use configuration).

The basic differences between the easy configuration and the complex configuration are in the sequencer and the expressions used to qualify states. Therefore, this chapter describes the following tasks:

- Switching into the complex configuration.

- Using complex expressions.

- Using the sequencer.

Switching into the Complex Configuration

This section describes how to:

- Switch into the complex configuration

- Switch back into the easy configuration

To switch into the complex analyzer configuration

- Enter the **tcf -c** command.

To enter the "complex" analyzer configuration, use the **-c** option to the **tcf** (trace configuration) command. This will cause the analyzer to be initialized to its default "complex" configuration state.

To switch back into the easy analyzer configuration

- Enter the **tcf -e** command.

The **tcf -e** command will place the analyzer back into the "easy" configuration. Changing the analyzer configuration to "easy" will reset the trace pattern specifications, the trigger position, and the count and prestore qualifiers.

Using Complex Expressions

In the "complex" configuration, up to eight pattern resources and one range resource may be used in trace commands wherever state qualifier expressions were used in the "easy" configuration. In fact, state qualifiers are assigned to the pattern and range resources.

The additional capability allowed in the "complex" configuration is that these patterns may be used in combinations to specify more complex qualifiers. The pattern and range resources are divided into two sets, and you can combine resources with the set operators.

This section describes how to:

- Assign state qualifiers to trace patterns.

- Assign state qualifiers to the trace range.

- Combine pattern and range qualifiers.

To assign state qualifiers to trace patterns

- Use the **tpat** command.

Up to eight trace patterns can be specified with the **tpat** (trace pattern) command. The trace pattern names are **p1**, **p2**, ..., **p8**.

The expression associated with a trace pattern can be the keywords **all**, **any**, **none**, or **never**, or the expression may be trace labels equated to values (which can be ANDed together) or trace labels not equal to values (which can be ORed together).

Consider whether or not you will be using global set operators (**and** or **or**) with any of the patterns; if so, make sure those patterns are in different sets.

Examples   To assign to pattern p1 the state where the address value equals 520H, the data value equals 0XXAA1234H, and the status is a memory write:

U>**tpat p1 addr=520 and data=0xxaa1234 and stat=write**

To assign to pattern p1 any state except where the address value equals 5C2H, the data value equals 0XX3X5678H, and the status is a memory write:

U>**tpat p1 addr!=5c4 or data!=0xx3x5678 or stat!=write**

To assign state qualifiers to the trace range

- Use the **trng** command.

One trace range can be specified with the **trng** (trace range) command. The range name is **r**, and **!r** specifies "not in range".

The expression associated with a trace range can be the keywords **all**, **any**, **none**, or **never**, or the expression may be a trace label equated to a range of values.

Examples   To assign the address range 500H through 5FFH to the range resource:

U>**trng addr=500..5ff**

To assign the data range 80H through 8FH to the range resource:

U>**trng data=0080..008f**

To combine pattern and range resources

- Use the set operators.

The eight patterns (**p1**..**p8**), the range (**r** for "in range" or **!r** for "not in range"), and the **arm** qualifier (described in the "Making Coordinated Measurements" chapter) are grouped into the two sets shown below.

Set 1: **p1**, **p2**, **p3**, **p4**, **r**, and **!r**.

Set 2: **p5**, **p6**, **p7**, **p8**, and **arm**.

Resources within a set may be combined using one of the intraset operators, **|** (OR) or **~** (NOR).

The two sets can be combined with the **and** and **or** interset (between set) operators. Interset operators are also called global set operators.

The intraset (within a set) operators (~, |) are evaluated first; then, the interset operators are evaluated. You cannot use interset operators on patterns in the same set.

Though only the OR (|) and NOR (~) logical operators are available as intraset operators, you can create the AND and NAND operators by applying DeMorgan's law (the "/" character is used to represent a logical NOT):

```
AND       A and B = /(/A and /B)      NOR
NAND   /(A and B) = /A or /B          OR
```

Examples

Some valid intraset combinations follow.

```
U>tsto p1 | p2 | p3 | r
U>tsto p5 ~ p6 ~ arm
```

The following expression is invalid because you cannot use both **|** (OR) and **~** (NOR) operators within the same set.

```
U>tsto p1 | p2 ~ p3
!ERROR 1249! Invalid qualifier expression: ~ p3
```

The following expression is invalid because you cannot combine resources from different sets with the **|** (OR) or **~** (NOR) operators.

```
U>tsto p1 ~ p2 ~ p5
!ERROR 1249! Invalid qualifier expression: p5
```

Some valid combinations of the two sets follow.

```
U>tsto p1 ~ p2 and p5 | p6
U>tsto p3 | p4 | !r or p7
U>tsto p8 ~ arm and p1 ~ p2
```

The following set combination is invalid because **p1** and **p2** are in the same set.

```
U>tsto p1 and p2
!ERROR 1249! Invalid qualifier expression: p2
```

Note that "p1 ~ p1" is allowed; this type of expression may occasionally be useful if you are running out of pattern resources and wish to specify a logical NOT of some existing pattern. For example, consider the following commands:

```
tpat p1 addr=0
tif 1 p1
tif 2 p1 ~ p1
```

The primary branch of term 2 will be taken when "addr!=0".

An example of using DeMorgan's law to create the AND operator follows.

Suppose you want to specify the following storage qualifier:

```
U>tsto p1 & p2 or p5 & p6
!ERROR 1241! Invalid qualifier resource or operator: &
```

The error occurs because the **&** operator is not a valid intraset operator. If the specifications for the trace patterns are:

```
tpat p1 addr=5f0
tpat p2 data=39xxxxxx and stat=write
tpat p5 addr=500
tpat p6 data=0xx39xxxx and stat=write
```

you can enter an equivalent expression to the one which caused the error by making the following changes to the trace patterns and using the NOR (~) operator in the **tsto** command.

```
U>tpat p1 addr!=5f0
U>tpat p2 data!=39xxxxxx or stat!=write
U>tpat p5 addr!=500
U>tpat p6 data!=0xx39xxxx or stat!=write
U>tsto p1 ~ p2 or p5 ~ p6
```

Using the Sequencer

This section describes how to use the sequencer in the "complex" configuration. The differences between using the sequencer in the "easy" configuration and in the "complex" configuration are summarized in the following table.

Differences Between the "Easy" and "Complex" Analyzer Configurations		
Analyzer Feature	**In the "easy" configuration . . .**	**In the "complex" configuration . . .**
sequence terms and the trigger (**tsq**)	You can insert or delete terms from the sequencer, and the branch out of the last sequence term constitutes the trigger.	There are always eight terms in the sequencer. Any of the sequence terms except the first may be specified as the *trigger term*. Entry into the trigger term constitutes the trigger.
simple trigger (**tg**)	The simple trigger command (**tg**) sets up a one term sequencer, and the expression specified with the **tg** command becomes the primary branch expression of the first sequence term.	The simple trigger command (**tg**) sets the primary branch expression of sequence term 1, and specifies the second sequence term as the trigger term.
primary branch expressions (**tif**)	Primary branches are always made to the next higher sequence term.	Primary branches may be made to any sequence term.
secondary branch expressions (**telif**)	The secondary branch expression is a global restart. In other words, the secondary branch expression applies to all sequence terms, and the branch is always back to the first sequence term.	Secondary branch expressions may be specified for each sequence term. Also, secondary branches can be made to any sequence term.
storage qualifiers (**tsto**)	The trace storage qualifier is "global" and applies to all sequence terms.	A storage qualifier is associated with each sequence term; however, the **tsto** command still allows you to specify storage qualifiers globally.

In the complex configuration, you perform the same tasks as are performed in the easy configuration. However, in the complex configuration, you have more sequence terms, you can specify destination terms for primary and secondary branches, and you can specify storage qualifiers for each sequence term.

This section describes how to:

- Reset the sequencer.

- Specify a simple trigger condition.

- Specify primary and secondary branches.

- Specify the trigger term.

- Specify storage qualifiers.

- Trace windows of execution.

To reset the sequencer

- Enter the **tsq -r** command.

After entering the "complex" analyzer configuration, the sequencer is in its default reset state.

If the analyzer is already in the "complex" configuration, you can reset the sequencer to its default state with the **tsq -r** command.

Examples   To reset the sequencer:

```
U>tsq -r
```

To display the default sequencer specification:

```
U>tsq
  tif 1 any 2
  tif 2 any 3
  tif 3 any 4
  tif 4 any 5
  tif 5 any 6
  tif 6 any 7
  tif 7 any 8
```

```
tif 8 never
tsq -t 2
tsto 1 all
tsto 2 all
tsto 3 all
tsto 4 all
tsto 5 all
tsto 6 all
tsto 7 all
tsto 8 all
telif 1 never
telif 2 never
telif 3 never
telif 4 never
telif 5 never
telif 6 never
telif 7 never
telif 8 never
```

There are eight terms in the "complex" configuration sequencer. By default, the primary branch expression for each term (except term 8) is **any**, the secondary branch expression for each term is **never**, and the storage qualifier for each term is **all**. The trigger term is the second sequence term. This sequencer specification will result in the same trace data as the default sequencer specification in the "easy" configuration (except that there will be more sequencer branches after the trigger). A diagram of the default sequencer specification is shown in the figure below.

SECONDARY BRANCHES   PRIMARY BRANCHES

                                                        tsto 1 all
                                 TERM1
telif 1 never   tif 1 any 2
                                             tsq -t 2 (TRIGGER TERM)

                                                        tsto 2 all
                                 TERM2
telif 2 never   tif 2 any 3

                                                        tsto 3 all
                                 TERM3
telif 3 never   tif 3 any 4

                                                        tsto 4 all
                                 TERM4
telif 4 never   tif 4 any 5

                                                        tsto 5 all
                                 TERM5
telif 5 never   tif 5 any 6

                                                        tsto 6 all
                                 TERM6
telif 6 never   tif 6 any 7

                                                        tsto 7 all
                                 TERM7
telif 7 never   tif 7 any 8

                                                        tsto 8 all
                                 TERM8
telif 8 never   (ALL STATES STORED)
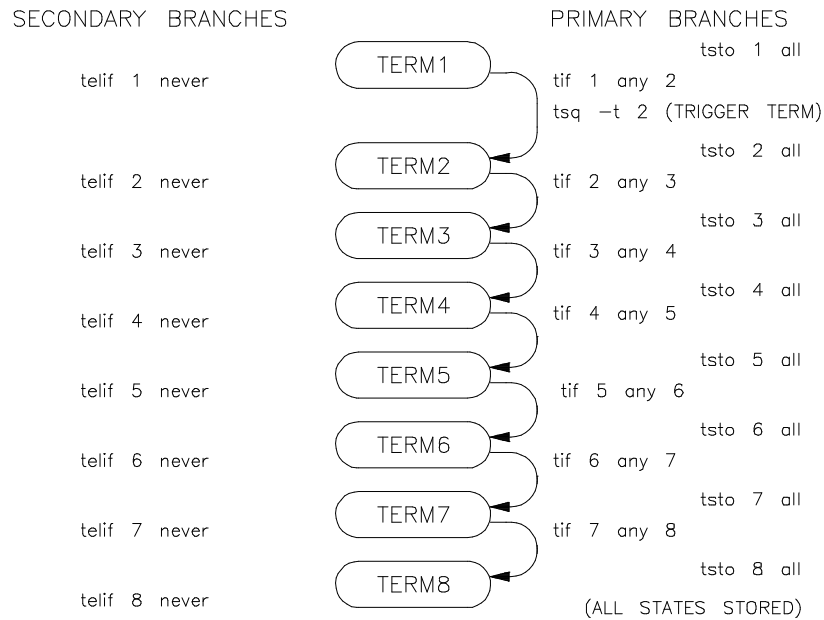
If the **tsq** information scrolls off your screen, you may wish to display the sequencer specifications with a combination of other display commands; for example, you could enter the **tif**, **telif**, **tsto**, and **tsq -t** commands to display the same information.

To specify a simple trigger condition

- Use the **tg** command.

Using the **tg** (simple trigger) command in the "complex" configuration will cause the first two sequence terms to be modified. The pattern specified in the **tg** command becomes the primary branch expression of the first sequence term. The primary and secondary branch expressions of the second sequence term are set to **never**, and this term is specified as the trigger term. The secondary branch expression of the first sequencer term is also set to **never**.

The result of the **tg** command in the "complex" configuration is the same as in the "easy" configuration, and equivalent **tg** commands (where the pattern is the same as the "easy" configuration expression, and the storage qualifiers are the same) will yield identical traces in each of the trace configurations.

As in the "easy" configuration, the **tg** command with no options will display the primary branch expression of the first sequence term. This will only be the trigger condition when the second sequence term is the trigger term.

Examples

To set up a simple trigger on the branch to the first instruction in the demo program's "for" loop (0A7AH):

```
U>sym for_loop=0a7a
U>tpat p1 addr=for_loop
U>tg p1
```

```
U>tsq
  tif 1 p1 2
  tif 2 never
  tif 3 any 4
  tif 4 any 5
  tif 5 any 6
  tif 6 any 7
  tif 7 any 8
  tif 8 never
  tsq -t 2
  tsto 1 all
  tsto 2 all
  tsto 3 all
  tsto 4 all
  tsto 5 all
  tsto 6 all
  tsto 7 all
  tsto 8 all
  telif 1 never
  telif 2 never
  telif 3 never
  telif 4 never
  telif 5 never
  telif 6 never
  telif 7 never
  telif 8 never
```

A diagram of this sequencer specification is shown in the figure below.
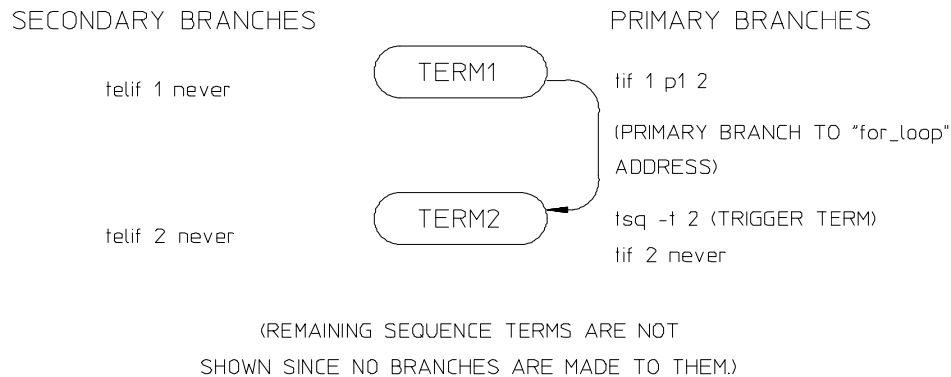
To specify primary and secondary branch
===
To specify primary and secondary branch expressions

- Use the **tif** and **telif** commands.

In the "easy" configuration, primary branches are always to the next sequence term. In the "complex" configuration, primary branches may be to any sequence term. Therefore, the number of the destination term must be specified before the occurrence count.

In the "easy" configuration, the secondary branch expression is a "global restart". It applies to all sequence terms and causes branches back to the first sequence term. In the "complex" configuration, you can specify secondary branch expressions for each sequence term and the branch may be to any sequence term. Therefore, the number of the destination term must be specified.

Examples   To specify a primary branch from sequence term 2 to sequence term 5 when the pattern p2 is found:

```
U>tif 2 p2 5
```

To specify a secondary branch from sequence term 2 to sequence term 3 when the pattern p3 is found:

```
U>telif 2 p3 3
```

To specify that the sequencer never branch out of term 5:

```
U>tif 5 never
U>telif 5 never
```

To specify the trigger term

- Use the **tsq -t** command.

In the "easy" configuration, the branch out of the last sequence term constitutes the trigger. In the "complex" configuration there are always eight terms in the sequencer, and any of the sequence terms except the first may be specified as the trigger term. Entry into the trigger term constitutes the trigger. The trigger term is specified with the **tsq -t** command.

Examples   To specify that entry into the fifth term constitutes the trigger:

```
U>tsq -t 5
```

To specify storage qualifiers

- Use the **tsto** command.

In the "easy" configuration, the trace storage qualifier is global, that is, it applies to all sequence terms. In the "complex" configuration, storage qualifiers are associated with each sequence term (though you can specify that one storage qualifier applies to all terms).

Prestore qualifiers still apply to all normal storage states; however, in the "complex" configuration, you specify pattern or range resources with the **tpq** command.

Examples

To store states matching pattern p4 while searching for the branch expressions of sequence term 7:

```
U>tsto 7 p4
```

To store states matching the range resource while searching for the branch expressions of sequence term 5:

```
U>tsto 5 r
```

To store all states when searching for branch expressions, except when searching for the branch expressions of sequence term 1:

```
U>tsto all
U>tsto 1 none
```

To trace windows of activity

1 Set up one sequence term as the window enable term.

2 Set up one sequence term as the window disable term.

3 Set up a trigger term.

4 Do not store states while searching for the window enable condition.

5 Store all states while searching for the window disable condition.

One common use for the "complex" configuration sequencer is to trace "windows" of execution or, perhaps, to eliminate "windows" of execution from traces.

For example, suppose you wish to trace only the execution within a certain range of addresses. These addresses could be a subroutine or perhaps they are just the addresses of instructions in which you are interested.

A simple windowing sequencer specification would consist of a window enable term, a window disable term, and perhaps a trigger term (if you wish to trigger on a condition other than the enable or disable terms). Only the states which occur between the window enable condition and the window disable condition are stored.

Examples
To trace only the execution of the "rand" library routine, you would set up the sequencer specification so that the call to the "rand" subroutine is the window enable term and the return at the subroutine's "ret" instruction is the window disable term.

To display the "rand" subroutine in memory, enter the following command.

```
U>m -dm 1048..1077
  000001048  rand:_srand     MOVE.L   ($0004,A7),data_gen:__rand_seed
  000001050  -               RTS
  000001052  rand:_rand      MOVE.L   data_gen:__rand_seed,D0
  000001058  -               MULS.L   #$41C64E6D,D0
  000001060  -               ADDI.L   #$00003039,D0
  000001066  -               MOVE.L   D0,data_gen:__rand_seed
  00000106c  -               CLR.W    D0
  00000106e  -               SWAP     D0
  000001070  -               ANDI.L   #$00007FFF,D0
  000001076  -               RTS
```

Suppose that you wish to trigger on the instruction at 1066H. The diagram of the sequencer to do this is shown in the figure below.
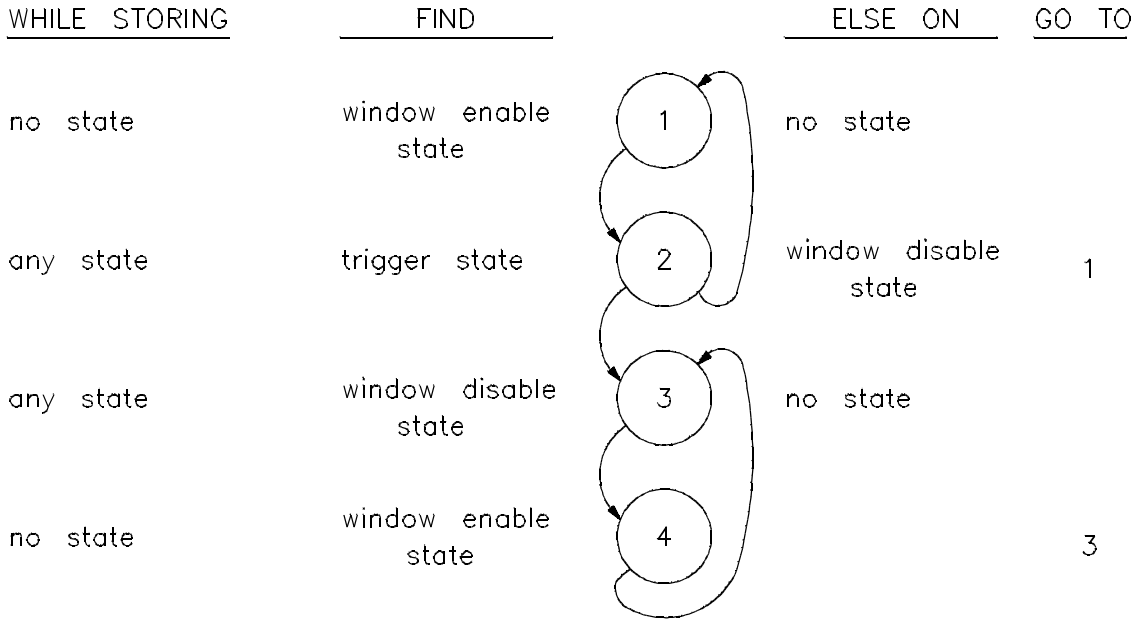
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To define symbols for the enable, disable, and trigger states:

```
U>sym enable=1052
U>sym disable=1076
U>sym trigger=1066
```

To reset the sequencer:

```
U>tsq -r
```

To specify trace patterns:

```
U>tpat p1 addr=enable
U>tpat p2 addr=disable
U>tpat p3 addr=trigger
```

To specify the primary and secondary branch expressions:

```
U>tif 1 p1 2
U>tif 2 p3 3
U>telif 2 p2 1
U>tif 3 p2 4
U>tif 4 p1 3
```

To specify the trigger term:

```
U>tsq -t 3
```

To specify the storage qualifiers so that states are stored only while searching for the window disable condition (the first command below specifies all storage qualifiers to be **none**, and the second command specifies that all states be stored while searching for the window disable condition):

```
U>tsto none
U>tsto 2 all
U>tsto 3 all
```

To place the trigger position at the center of the trace:
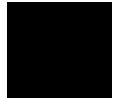
```
U>tp c
```

To display the sequencer specification.

```
U>tsq
  tif 1 p1 2
  tif 2 p3 3
  tif 3 p2 4
  tif 4 p1 3
  tif 5 any 6
  tif 6 any 7
  tif 7 any 8
  tif 8 never
  tsq -t 3
  tsto 1 none
  tsto 2 all
  tsto 3 all
  tsto 4 none
  tsto 5 none
  tsto 6 none
  tsto 7 none
  tsto 8 none
  telif 1 never
  telif 2 p2 1
  telif 3 never
  telif 4 never
  telif 5 never
  telif 6 never
  telif 7 never
  telif 8 never
```

Starting the trace, waiting for the measurement to complete, and displaying the trace will result in the following information.

```
U>t
  Emulation trace started
U>ts
  --- Emulation Trace Status ---
  NEW User trace complete
  Arm ignored
  Trigger in memory
  Arm to trigger ?
  States 268 (268) -12..255
  Sequence term 4
  Occurrence left 1
U>tl -de -t 30
```

```
Line    addr,H    68340 Mnemonic                                   count,R  seq
-----   --------  ---------------------------------------------    ---------  ---
 -12    enable    MOVE.L    data_gen:__rand_seed,D0                     ---    +
 -11    00001054  $0006           supr prgm word rd (ds16)         0.720 uS   .
 -10    00001056  $04DA           supr prgm word rd (ds16)         0.680 uS   .
  -9    00001058  MULS.L    #$41C64E6D,D0                          0.720 uS   .
  -8    and_seed  $3304           supr data long rd (ds16)         0.720 uS   .
  -7    000604dc  $31B3           supr data word rd (ds16)         0.720 uS   .
  -6    0000105a  $0800           supr prgm word rd (ds16)         0.720 uS   .
  -5    0000105c  $41C6           supr prgm word rd (ds16)         0.720 uS   .
  -4    0000105e  $4E6D           supr prgm word rd (ds16)         0.720 uS   .
  -3    00001060  ADDI.L    #$00003039,D0                         0.720 uS   .
  -2    00001062  $0000           supr prgm word rd (ds16)         0.720 uS   .
  -1    00001064  $3039           supr prgm word rd (ds16)         5.240 uS   .
   0    trigger   MOVE.L    D0,data_gen:__rand_seed               0.720 uS   +
   1    00001068  $0006           supr prgm word rd (ds16)         0.680 uS   .
   2    0000106a  $04DA           supr prgm word rd (ds16)         0.720 uS   .
   3    0000106c  CLR.W     D0                                    0.720 uS   .
   4    0000106e  SWAP      D0                                    0.720 uS   .
   5    and_seed  $E35F           supr data long wr (ds16)         0.720 uS   .
   6    000604dc  $E370           supr data word wr (ds16)         0.720 uS   .
   7    00001070  ANDI.L    #$00007FFF,D0                         0.720 uS   .
   8    00001072  $0000           supr prgm word rd (ds16)         0.720 uS   .
   9    00001074  $7FFF           supr prgm word rd (ds16)         0.680 uS   .
  10    disable   RTS                                             0.720 uS   +
  11    enable    MOVE.L    data_gen:__rand_seed,D0               89.76 uS   +
  12    00001054  $0006           supr prgm word rd (ds16)         0.680 uS   .
  13    00001056  $04DA           supr prgm word rd (ds16)         0.720 uS   .
  14    00001058  MULS.L    #$41C64E6D,D0                         0.720 uS   .
  15    and_seed  $E35F           supr data long rd (ds16)         0.720 uS   .
  16    000604dc  $E370           supr data word rd (ds16)         0.720 uS   .
  17    0000105a  $0800           supr prgm word rd (ds16)         0.720 uS   .
```

7
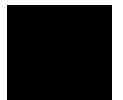
Making Coordinated Measurements

Making Coordinated Measurements

When HP 64700 Card Cages are connected together via the Coordinated Measurement Bus (CMB), you can start and stop up to 32 emulators at the same time.

You can use the analyzer in one HP 64700 to arm (that is, activate) the analyzers in other HP 64700 Card Cages or to cause emulator execution in other HP 64700 Card Cages to break into the monitor.

You can use the HP 64700's BNC connector (labeled TRIGGER IN/OUT on the lower left corner of the HP 64700 rear panel) to trigger an external instrument (for example, a logic analyzer or oscilloscope) when the analyzer finds its trigger condition. Also, you can allow an external instrument to arm the analyzer or break emulator execution into the monitor.

The coordinated measurement tasks you can perform are grouped into the following sections:

- Setting up for coordinated measurements.

- Starting and stopping multiple emulators.

- Using external trigger signals.

The location of the CMB and BNC connectors on the HP 64700 rear panel is shown in the following figure.

CMB Connector
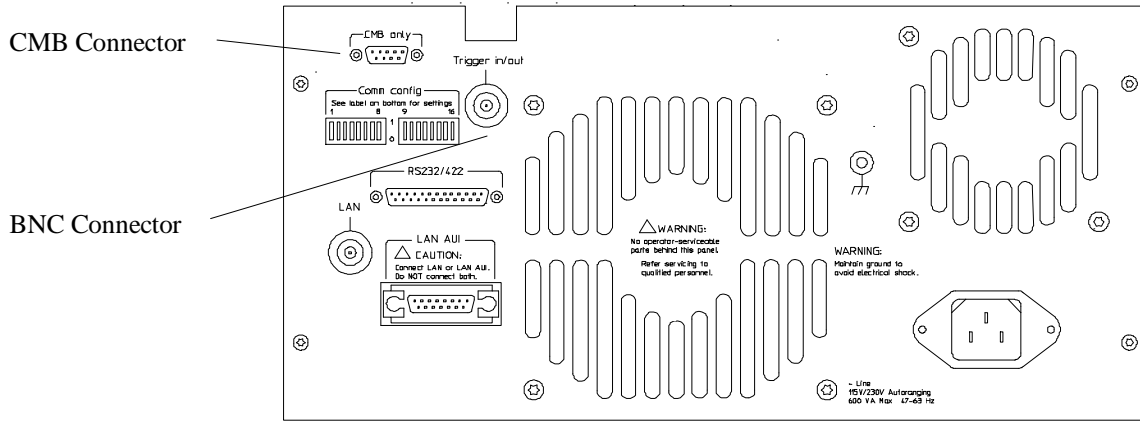
BNC Connector

Signal Lines on the CMB

There are three bi-directional signal lines on the CMB connector on the rear panel of the emulator. These CMB signals are:

TRIGGER   The CMB TRIGGER line is low true. This signal can be driven or received by any HP 64700 connected to the CMB. This signal can be used to trigger an analyzer. It can be used as a break source for the emulator.

READY   The CMB READY line is high true. It is an open collector and performs an ANDing of the ready state of enabled emulators on the CMB. Each emulator on the CMB releases this line when it is ready to run. This line goes true when all enabled emulators are ready to run, providing for a synchronized start.

When CMB is enabled, each emulator is required to break to background when CMB READY goes false, and will wait for CMB READY to go true before returning to the run state. When an enabled emulator breaks, it will drive the CMB READY false and will hold it false until it is ready to resume running. When an emulator is reset, it also drives CMB READY false.

EXECUTE The CMB EXECUTE line is low true. Any HP 64700 on the CMB can drive this line. It serves as a global interrupt and is processed by both the emulator and the analyzer. This signal causes an emulator to run from a specified address when CMB READY returns true.

BNC Trigger Signal

The BNC trigger signal is a positive rising edge TTL level signal. The BNC trigger line can be used to either drive or receive an analyzer trigger, or receive a break request for the emulator.

Comparison Between CMB and BNC Triggers The CMB trigger and BNC trigger lines have the same logical purpose: to provide a means for connecting the internal trigger signals (trig1 and trig2) to external instruments. The CMB and BNC trigger lines are bi-directional. Either signal may be used directly as a break condition.

The CMB trigger is level-sensitive, while the BNC trigger is edge-sensitive. The CMB trigger line puts out a true pulse following receipt of EXECUTE, despite the commands used to configure it. This pulse is internally ignored.

Note that if you use the EXECUTE function, the CMB TRIGGER should not be used to trigger external instruments, because a false trigger will be generated when EXECUTE is activated.

Setting Up for Coordinated Measurements

This section describes how to:

- Connect the Coordinated Measurement Bus.

- Connect the rear panel BNC.

To connect the Coordinated Measurement Bus (CMB)

CAUTION   Be careful not to confuse the 9-pin connector used for CMB with those used by some computer systems for RS-232C communications. Applying RS-232C signals to the CMB connector is likely to result in damage to the HP 64700 Card Cage.

To use the CMB, you will need one CMB cable for the first two emulators and one additional cable for every emulator after the first two. The CMB cable is orderable from HP under product number HP 64023A. The cable is four meters long.

You can build your own compatible CMB cables using standard 9-pin D type subminiature connectors and 26 AWG wire.

Note that Hewlett-Packard does not ensure proper CMB operation if you are using a self-built cable!

---

1 Connect the cables to the HP 64700 CMB ports.
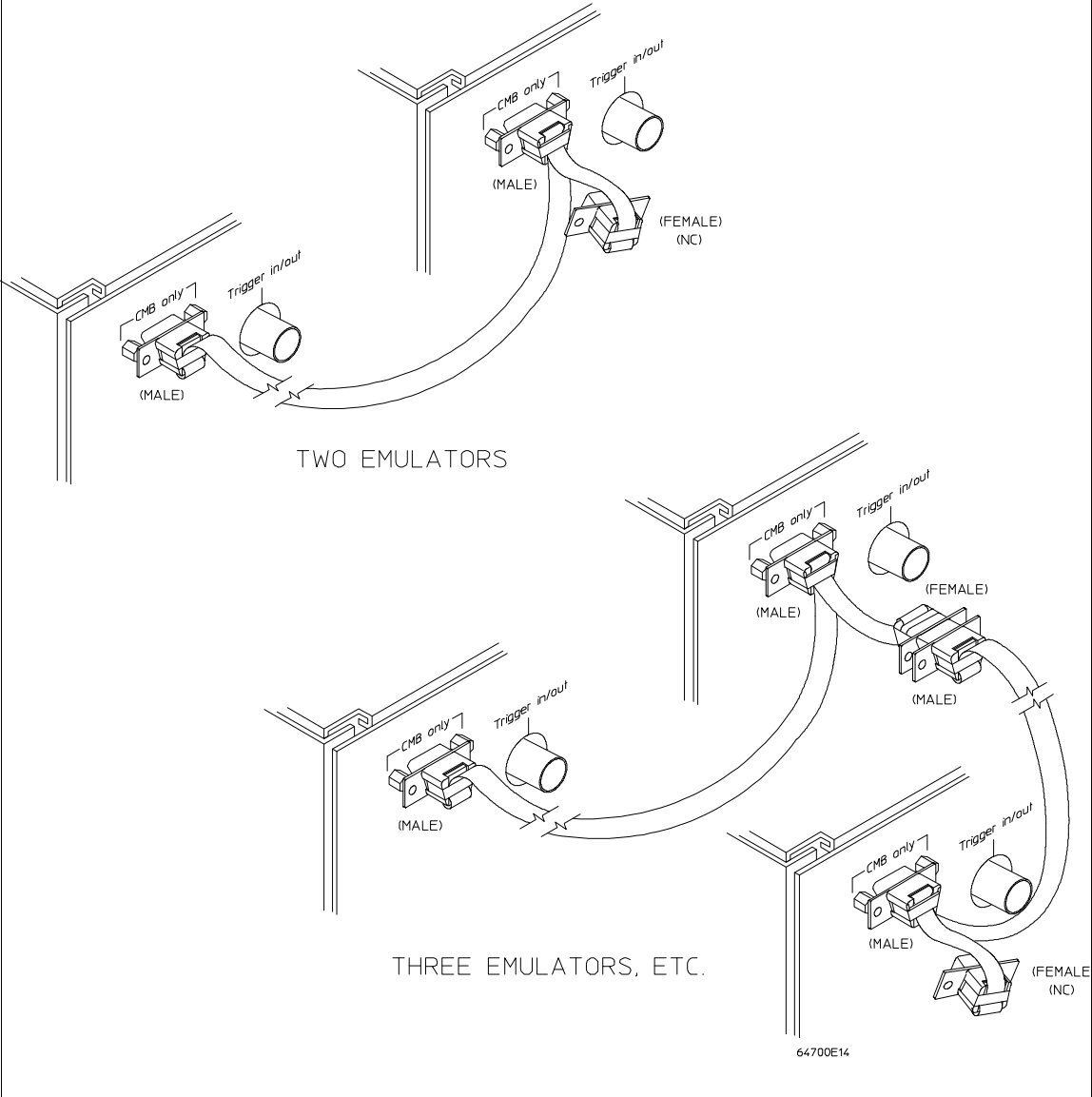
64700E14

Number of HP 64700 Series Emulators	Maximum Total Length of Cable	Restrictions on the CMB Connection
2 to 8	100 meters	None.
9 to 16	50 meters	None.
9 to 16	100 meters	Only 8 emulators may have rear panel pullups connected. *
17 to 32	50 meters	Only 16 emulators may have rear panel pullups connected. *

* A modification must be performed by your HP Customer Engineer.

Emulators using the CMB must use background emulation monitors.

At least 3/4 of the HP 64700-Series emulators connected to the CMB must be powered up before proper operation of the entire CMB configuration can be assured.
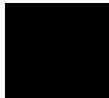
To connect to the rear panel BNC

CAUTION   The BNC line on the HP 64700 accepts input and output of TTL levels only. (TTL levels should not be less than 0 volts or greater than 5 volts.) Failure to observe these specifications may result in damage to the HP 64700 Card Cage.

1 Connect one end of a 50 ohm coaxial cable with male BNC connectors to the HP 64700 BNC receptacle and the other end to the appropriate BNC receptacle on the other measuring instrument.

Trigger In/Out

ALIGN SLOTS ON
SIDES OF PLUG
WITH TABS ON
SIDES OF JACK

Trigger In/Out

PUSH TOGETHER
AND TURN UNTIL
CONNECTORS LOCK

64700E15
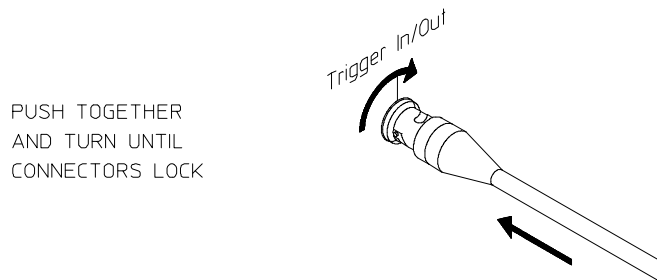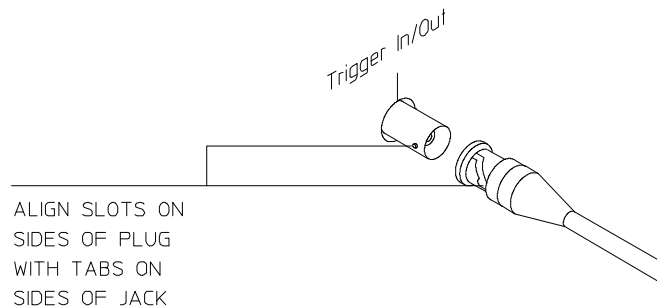
The BNC connector is capable of driving TTL level signals into a 50 ohm load. (A positive rising edge is the trigger signal.) It requires a driver that can supply at least 4 mA at 2 volts when used as a receiver. The BNC connector is configured as an open-emitter structure which allows for multiple drivers to be connected. It can be used for cross-triggering between multiple HP 64700Bs when no other cross-measurements are needed. The output of the BNC connector is short-circuit protected and is protected from TTL level signals when the emulator is powered down.

Starting/Stopping Multiple Emulators

When HP 64700 Card Cages are connected together via the Coordinated Measurement Bus (CMB), you can start and stop up to 32 emulators at the same time. These are called synchronous measurements. This section describes how to:

- Enable synchronous measurements.

- Start synchronous measurements.

- Disable synchronous measurements.

To enable synchronous measurements

- Enter the **cmb -e** command.

  You can enable the emulator's interaction with the CMB by using the **cmb -e** command. When the EXECUTE signal is received, the emulator will run at the address specified by the **rx** command. (Specifying an address with the **rx** command will automatically enable interaction with the CMB.)

  The **tx -e** command enables the analyzer to start a measurement when the EXECUTE signal is received. If trace at execute is disabled (**tx -d**), the analyzer ignores the CMB EXECUTE signal.

  Note that the **cmb** command does not affect the operation of analyzer cross-triggering.

Examples   To enable synchronous measurements with the **cmb -e** command:

U>**cmb -e**

To enable synchronous measurements with the **rx <address>** command:

U>**rx 920**

To start synchronous measurements

- Enter the **x** command.

The **x** command causes the EXECUTE line to be pulsed, thereby initiating a synchronous measurement. CMB interaction does not have to be enabled (**cmb -e**) in order to use the **x** command. (The **cmb -e** command only specifies how the emulator will react to the CMB EXECUTE signal.)

All emulators whose CMB interaction is enabled will break into the monitor when any one of those emulators breaks into its monitor.

Note that when the CMB is being actively controlled by another emulator, the step command (**s**) does not work correctly. The emulator may end up running in user code (NOT stepping). Disable CMB interaction (**cmb -d**) while stepping the processor.

`U>`**x**

To disable synchronous measurements

- Enter the **cmb -d** command.

You can disable the emulator's interaction with the CMB by using the **cmb -d** command. When interaction is disabled, the emulator ignores the CMB EXECUTE and READY lines.

Using External Trigger Signals

External trigger signals come from the CMB and BNC connectors. A diagram of
the internal signals and the commands which may be used to drive them or to arm
an analyzer with them are shown in the figure below. This diagram is only
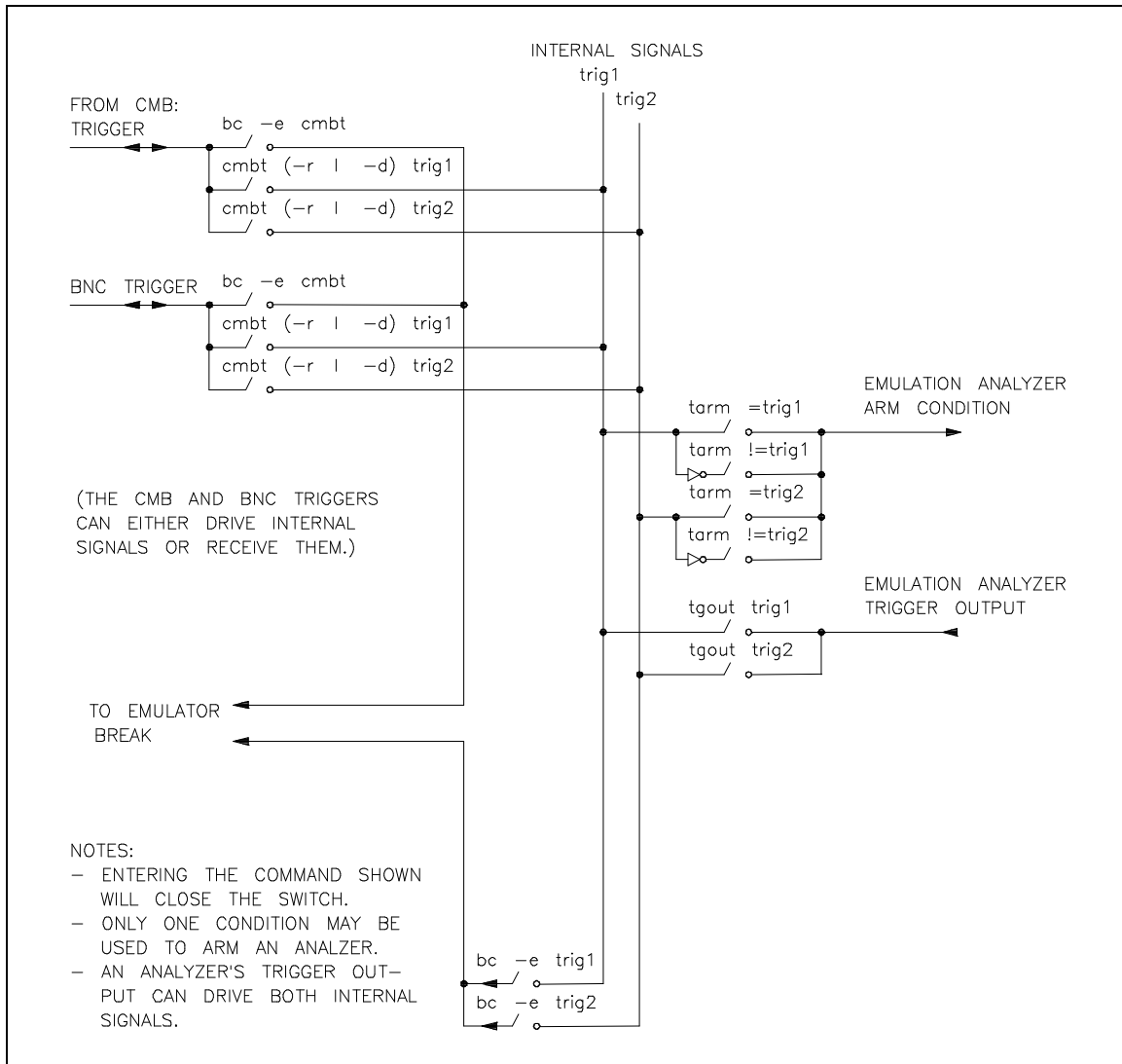
intended to show logical connections, and does not represent actual circuitry inside the emulator.

This section describes how to:

- Arm analyzers with external trigger signals.

- Break emulator execution with external trigger signals.

- Send analyzers' trigger output signals to external lines.

To arm analyzers with external trigger signals

1 Use the **cmbt -d** or **bnct -d** commands to have the rear panel drive an internal trigger signal.

2 Use the **tarm** command to arm the analyzer on the internal signal.

By default, the analyzers are **always** armed. This means that the analyzers arm conditions are always true.

The **tarm** (trace arm condition) command is used to specify or display the emulation analyzer arm condition.

There are two internal signals, **trig1** and **trig2**, which may be specified as the arm condition. You can specify that the arm condition be true when one of these two signals is true (=**trig1** or =**trig2**).

By using **!=trig1** or **!=trig2**, you can specify that the analyzer be armed or never armed, depending on the state of the internal signal when the trace is started. .

The keyword **arm** may be used to specify primary and secondary branch qualifiers, as well as storage or prestore qualifiers.

It is often important to start the analyzer which receives a signal before the analyzer which drives the signal. For example, if you start the analyzer which drives a signal first, the signal may already be driven before you start the analyzer which receives the signal. The receiving analyzer will most likely capture states which execute long after the condition which caused the signal to be driven.

Examples   To arm the emulation analyzer when the external CMB trigger signal is true:

```
M>cmbt -d trig1
M>tarm =trig1
```

If you enter the following commands:

```
M>bnct -d trig2
M>tarm !=trig2
```

If the **trig2** signal is asserted when the analyzer is started, the analyzer can never be armed. If the **trig2** signal is not asserted when the analyzer is started, the analyzer is armed immediately.

To break emulator execution with external trigger signals

- Use the **bc -e cmbt** or **bc -e bnct** commands.

You can use the **bc -e cmbt** or **bc -e bnct** commands to enable emulator execution to break into the monitor when a trigger signal is received.

Examples   To enable breaks on the CMB TRIGGER signal:

```
R>bc -e cmbt
```

To enable breaks on the BNC TRIGGER signal:

```
R>bc -e bnct
```

To send analyzer trigger output signals to external lines

1 Use the **cmbt -r** or **bnct -r** commands to have the rear panel receive an internal trigger signal.

2 Use the **tgout** commands to drive the trigger output to the internal signal.

The default condition of the analyzer specifies that the emulation analyzer does not drive the internal **trig1** or **trig2** signals when the trigger is found.

The **tgout** command is used to specify that one of the internal signals be driven when the emulation analyzer trigger is found. The **tgout** command with no options will display the signal which is currently being driven when the trigger is found (or **none** if no signal is driven when the trigger is found).

The signals which may be driven when the trigger is found are the internal signals **trig1** and **trig2**. The trig1 and trig2 signals may drive the CMB or BNC TRIGGER lines or the emulator break.

Note that you should not set up an analyzer to both drive and receive the same trigger signal. For example, if you issue the commands **tg arm; tarm =trig1; tgout trig1; bnct -d trig1 -r trig1**, the analyzer trig1 signal will become latched in a feedback loop and will remain latched until the loop is broken. To break the loop, you must first disable the signal's source, then momentarily disable either the drive or receive function. In this case, the commands **tgout none** and **bnct -d none** will break the loop.

Examples

To send the emulation analyzer trigger output to the CMB trigger line over the internal trig1 signal:

```
M>cmbt -r trig1
M>tgout trig1
```

To send the emulation analyzer trigger output to the BNC trigger line over the internal trig2 signal:

```
M>bnct -r trig2
M>tgout trig2
```

Part 3

Reference

Part 3
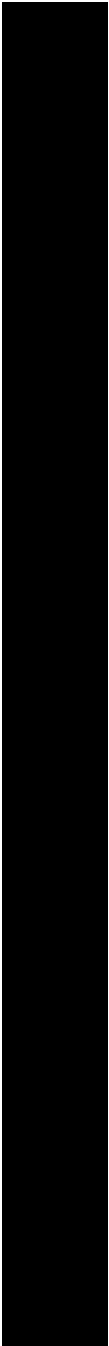
8

Commands

Commands

This chapter describes:

- The Terminal Interface commands.

- Analyzer state qualifier expressions.

- Values that that can be specified in commands.

<addr> - address specification in the 68340 emulator

```
XXXXXXXX                    - 32 bit address
XXXXXXXX@<fc>               - 32 bit address with function code specifier
XXXXXXXX..XXXXXXXX          - address range, 32 bit address through
                              32 bit address
XXXXXXXX..XXXXXXX@<fc>      - address range with function code specifier
XXXXXXXX..                  - 128 byte address range
XXXXXXXX@<fc>..             - 128 byte address range with function code
                              specifier
```

The 68340 emulator allows you to specify function code information in addition to the numerical address. This allows you to map separate regions of memory for user and supervisor program and data space.

The parameters are as follows:

<fc>   The function code may be any one of the following:

> u — User
> s — Supervisor
> d — Data
> p — Program
> ud — User Data
> up — User Program
> sd — Supervisor Data
> sp — Supervisor Program
> cpu — CPU space
> x — don't care

Examples   To map address ranges:

```
R>map 0..0fff erom
R>map 10000..1ffff@sp erom
R>map 10000..1ffff@up erom
R>map 20000..2ffff@d eram
R>map
  # remaining number of terms   : 3
  # remaining emulation memory  : 10000h bytes
  map  000000000..000000fff   erom              # term 1
  map  000010000..00001ffff@sp  erom            # term 2
  map  000010000..00001ffff@up  erom            # term 3
  map  000020000..00002ffff@d   eram            # term 4
  map  other tram
```

Notice that you can map the same address range to different blocks of memory by using function code specifiers.

To display the contents of memory locations in these ranges:

```
R>m -db 10000..1000f@sp
  000010000@sp  00 00 57 00 ff ff ff ff ff ff ff ff ff ff ff ff
M>m -db 10000..1000f@up
  000010000@up  ff ff ff ff ff ff ff ff ff ff ff ff ef ff ff
M>m -db 20000..2000f@d
  000020000@d   00 08 00 09 00 01 09 ff ff ff ff 63 45 ff 00 ff
M>m -db 20000..2000f@ud
  000020000@ud  00 08 00 09 00 01 09 ff ff ff ff 63 45 ff 00 ff
M>m -db 20000..2000f@sd
  000020000@sd  00 08 00 09 00 01 09 ff ff ff ff 63 45 ff 00 ff
M>m -db 20000..2000f
!ERROR  312! Ambiguous address: 000020000
M>m -db 10000..1000f@p
!ERROR  312! Ambiguous address: 000010000@p
```

The "Ambiguous address" error message occurs because the address range exists in different blocks of memory (mapped with different function codes). If you don't use a function code specifier with the address range, the emulator doesn't know which block of memory you're referring to.

See Also   **m** (allows you to display or modify memory locations or ranges)

map (used to define the type and location of memory used by the emulator)

b - break emulation processor to monitor

```
b
```

The **b** command issues a break to the emulator, causing it to stop executing the user program and enter the monitor state. If the emulator is in the reset state when a break occurs, it will be released from reset into the monitor state.

See Also   **r** (runs the user program from the current pc or a specified address)

s (steps the user program a number of instructions from the current pc or a specified address)

bc - set or display break conditions

```
bc                              - display current setting for all break conditions
bc -e <condition>                    - enable specified break condition(s)
bc -d <condition>                    - disable specified break condition(s)
bc -d <condition> <condition>   - multiple <condition>s allowed
```

The **bc** command allows you to set break conditions for the emulation system. This allows you to have the emulator break to the monitor upon error conditions (such as write to ROM), emulation processor trace events, or break to the monitor when a trigger signal is received.

The parameters are as follows:

-e   Enables the indicated break conditions (which must be specified immediately following the **-e** on the command line).

-d   Disables the indicated break conditions (which must be specified immediately following the **-d** on the command line).

<condition>   You can enable or disable the following break conditions:

bp   Software breakpoints and breakpoint registers. Software breakpoints and the processor breakpoint registers can not be configured independently. The "bp" condition enables or disables them both.

rom   Writes to ROM memory locations, as characterized when mapping memory.

bnct   Assertion of the rear panel BNC TRIGGER signal. Note that this signal may also drive either of the internal **trig1** or **trig2** signals or both.

cmbt   Assertion of the CMB (Coordinated Measurement Bus) TRIGGER signal. Note that the CMB trigger signal may also drive either of the internal **trig1** or **trig2** signals or both.

trig1   Assertion of the internal **trig1** signal. Refer to the **tgout**, **bnct**, and **cmbt** commands for information on specifying drivers and receivers of the **trig1** signal.

trig2   Assertion of the internal **trig2** signal. Refer to the **tgout**, **bnct**, and **cmbt** commands for information on specifying drivers and receivers of the **trig2** signal.

When you use the **bc** command, the emulator may break into the monitor while each enable/disable is being executed. If the emulator was executing your program when the **bc** command was received, it will return to your program when finished executing the command. If you request only a display of the current break conditions, the emulator does not break to the monitor.

When a hardware reset occurs during processing of the **bc** command, the result may be that a particular break condition is left in an unknown state. If this occurs, a display of the break conditions will show a question mark "?" instead of **-e** or **-d** next to the break condition.

See Also   **bnct** (specify drivers and receivers of the rear panel BNC signal)

cmbt (specify drivers and receivers of the CMB trigger signal)

bp (set/delete software breakpoints)

map (specify whether memory locations are mapped as RAM or ROM)

tgout (specify whether the **trig1** and/or **trig2** signals are to be driven when the analyzer finds the trigger condition)
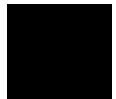
bnct - specify control of rear panel BNC signal

```
bnct              - display current bnct set up
bnct -d <dtype>   - rear panel BNC drives trig(1,2) signal(s)
bnct -r <rtype>   - rear panel BNC receives trig(1,2) signal(s)

--- NOTES ---
All option combinations are accepted:
'bnct -d trig1,trig2 -r trig1,trig2'   is a valid command
```

The **bnct** command allows you to specify which of the internal **trig1** or **trig2** trigger signals will drive and/or receive the rear panel BNC trigger. You can specify the signals individually, as an ORed condition for drive, or as an ANDed condition for receive; or, you can specify that the signals are not to be driven or received.

Upon powerup, **bnct** is set to **bnct -d none -r none**.

The parameters are as follows:

-d   Specifies that the rear panel BNC port drives the internal trigger signals, trig1 and trig2.

-r   Specifies that the rear panel BNC port receive the internal trigger signals, trig1 or trig2, and send them out the BNC port.

<dtype>   The valid drive options are:

        trig1   When the BNC signal is received, drive trig1 signal.

        trig2   When the BNC signal is received, drive trig2 signal.

        none   When the BNC signal is received, drive neither signal.

<rtype>   The valid receive options are:

        trig1   When trig1 signal goes true, send out the BNC signal.

        trig2   When trig2 signal goes true, send out the BNC signal.

        none   Neither trig1 or trig2 will send the BNC signal out.

Normally, you would use this command to cross-trigger instruments. For example, you may wish to trigger a digitizing oscilloscope hooked to various timing signals

when the emulation analyzer finds a certain state, or, you may wish to do the converse and trigger the HP 64700's analyzer when an oscilloscope finds its trigger.

See Also   **bc** (break conditions; can be used to specify that the emulator will break into the emulation monitor upon receipt of one of the **trig1**/**trig2** signals)

cmbt (coordinated measurement bus trigger; used to specify which internal signals will be driven or received by the HP 64700 coordinated measurement bus)

tarm (analyzer trace arm; used to specify arming (begin to search for trigger) conditions for the analyzer -- **trig1/trig2** can be used to arm the analyzer)

tgout (specifies which of the **trig1/trig2** signals are to be driven when the analyzer trigger is found)

bp - set, enable, disable, remove or display software breakpoints

```
bp                    - display current breakpoints
bp <addr>             - set breakpoint at <addr>
bp -e *               - enable all breakpoints
bp -e <addr>          - enable breakpoint at <addr>
bp -d *               - disable all breakpoints
bp -d <addr>          - disable breakpoint at <addr>
bp -r *               - remove all breakpoints
bp -r <addr>          - remove breakpoint at <addr>
bp <addr> <addr>  - more than one <addr> may be given
```

Upon powerup or **init** initialization, the breakpoint table is cleared and the breakpoint feature is disabled.

The parameters are as follows:

<addr>   Specifies the address location where the software breakpoint is to be inserted. If you specify options **-e**, **-d**, or **-r**, the address specifies the location of the software breakpoint to be enabled, disabled, or removed.

-e   Enables (activates) the breakpoint(s) at the address(es) specified. This installs the necessary breakpoint instruction in memory. If the breakpoint is already enabled, no action is taken.

-d   Disables (deactivates) the software breakpoint(s) at the address(es) specified. When the software breakpoint is disabled, the original memory contents are restored if the breakpoint was enabled. The software breakpoint address(es) remain in the breakpoint definition table and can be reset by using the **bp -e <ADDRESS>** command.

-r   Removes the software breakpoint(s) at the addresses specified. When the software breakpoint is removed, the original memory contents are restored if the breakpoint was enabled; then, the address is removed from the breakpoint table.

Note that when the breakpoint table is displayed with the **bp** command, the enable/disable status of each breakpoint is tested by reading the memory locations in question. If a software break instruction is found, the breakpoint is displayed as "enabled"; if not, the breakpoint is displayed as "disabled". If the software breakpoint is in target RAM and emulator is running under the real-time restriction, the breakpoint is displayed as "status unknown".

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If the emulator executes a BGND instruction that was placed by you (either through your compiler or via memory modification) and not by the **bp** command, an "undefined breakpoint" error message is generated.

If the emulator is executing in the user program when you define or modify breakpoints, it will break into the monitor for each breakpoint that is defined or modified. The emulator will return to user program execution after breakpoint definition or modification.

Remember that any operation which modifies memory or the memory map will alter the existing breakpoints. For example, if you load a new program in the same address range where breakpoints reside, the breakpoints will be destroyed. Changing the memory map will prevent the emulator from placing new breakpoints or enabling existing breakpoints.

If you disable the breakpoints break condition with the **bc -d bp** command, the software breakpoints currently defined will remain in the breakpoint table, but will be disabled and will remain in that state until the breakpoint feature is reenabled and the specified breakpoints are reenabled (**bc -e bp** and **bp -e <addr>**).

See Also   **bc** (enable/disable breakpoint conditions (including **bp**))

mo (defines memory access and display modes; the **bp** command uses the currently defined modes when writing software breakpoints into memory)
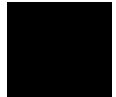
cf - display or set emulation configuration

```
cf                 - display current settings for all config items
cf <item>          - display current setting for specified <item>
cf <item>=<value>  - set new <value> for specified <item>
cf <item> <item>=<value> <item> - set and display can be combined
```

The parameters are as follows:

<item>   Configuration item. The valid HP 64751 emulator configuration items are:

clk   Select internal or external emulation clock.

If **cf clk=int**, the emulator will use the internal 32.768 KHz crystal. The target system MUST drive MODCLK high (or allow a pullup resistor in the emulator to pull it high) during reset to enable the 68340 VCO.

If **cf clk=ext**, the emulator will use the crystal or TTL oscillator in the target system. MODCLK should be driven appropriately.

rrt   Enable or disable restriction to real-time runs.

When **cf rrt=en** and while the emulator is running the user program, any command that requires a break to the monitor will be rejected except **rst**, **b**, **r**, or **s**.

When **cf rrt=dis**, commands that require a break to the monitor will always be accepted.

rv   Select SSP and PC when monitor is entered from emulation reset.

The **cf rv=<SSP_value>,<PC_value>** command defines initial values for the supervisor stack pointer and program counter when the monitor is entered from either emulation or target system reset. This is true for both background and foreground monitors. The SSP and PC must be set to an even address.

If a run from reset command is given, this configuration item has no affect and the initial supervisor stack pointer and

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program counter will be retrieved from reset vector in the user's
vector table.

lfc   Select 68340 function codes for file loading.

The **cf lfc=<function_code>** command specifies the function
code range that the **load** command uses to load files. This
configuration item must be used if 68340 function codes are
part of the memory map. The function codes can be:

  x function codes unmapped
  s load file in supervisor space
  u load file in user space
  p load file in program space
  d load file in data space
  sp load file in supervisor program space
  sd load file in supervisor data space
  up load file in user program space
  ud load file in user data space

mon   Select foreground or background monitor.

When a background monitor is selected (**cf mon=bg**), the
Background Debug Mode (BDM) of the 68340 processor is
used. The BKPT line is asserted to enter the monitor.

During background monitor operation, there will be no bus
cycle activity except for memory reads and writes that result
from memory display or modify commands. The 68340
processor will not respond to interrupts.

If a target system reset occurs, the 68340 will be reset and the
background monitor will be re-entered when reset is released.
The reset values of SSP and PC will be loaded from the **rv**
configuration item. The values in the **cf_sim** register set will
also be loaded.

When a foreground monitor is selected (**cf mon=fg**), the default
foreground monitor or downloaded custom monitor is loaded
into dual-ported emulation memory. Unlike the background
monitor, the foreground monitor runs within the same address

space as the target program consuming a 4 Kbyte block of the 68340's address range. The foreground monitor can run with target interrupts enabled (see the **monintr** configuration item).

Modifying this configuration item deletes the current memory map and adds a map term if a foreground monitor is selected. The starting address of the foreground monitor block is set with the **monaddr** configuration item and the **mondsi** configuration item determines whether the **dsi** (/DSACK interlock) memory attribute is added.

A custom monitor is downloaded using the **load -f** command and must be assembled and linked starting at the 4K byte boundary specified by the **monaddr** configuration item. Refer to the foreground monitor source provided with the emulator for more information.

Except for single stepping, the foreground monitor uses BDM as the method of breaking to the monitor.

In order for single stepping to operate with the foreground monitor, the trace vector in the target system's exception table must point to the TRACE_ENTRY address in the monitor. This address is equal to the value of **monaddr** plus 800H in the default foreground monitor. An exception stack frame of 7 to 13 words will be temporarily pushed onto the user's stack during monitor entry.

See related configuration items **monaddr**, **mondsi**, and **monintr**.

monaddr   Select the base address of the monitor.

When a background monitor is selected, this configuration item has no meaning.

When a foreground monitor is selected, the **cf monaddr=<address>** command defines the starting address of the 4 Kbyte block of dual-ported emulation memory. The address must reside on a 4 Kbyte boundary (an address ending in 000H) and must be specified in hexadecimal. The current

memory map will be deleted and a new map term added for the monitor.

monintr   Select interrupt priority level for foreground monitor.

When a background monitor is selected, this configuration item has no meaning. During background monitor operation, all target system interrupts, including level 7 non-maskable interrupts, are blocked.

The **cf monintr=<level>** command configures the default foreground monitor to run at a lowered interrupt priority level to allow critical target system interrupts to be processed during monitor execution. At the point it is safe to lower the interrupt priority level, the foreground monitor will set the interrupt priority mask to the value of **monintr** or the interrupt level that was in effect before monitor entry, whichever is greater.

mondsi   Enable or disable foreground monitor /DSACK interlocking.

When interlocking is enabled (**cf mondsi=en**), cycle termination of accesses to foreground monitor memory will not occur until the target system provides a /DSACK. If the monitor is placed in an address range for which the target system does not generate a /DSACK, the emulator will be unable to break into the monitor and a "CPU in wait state" status will result.

When interlocking is disabled (**cf mondsi=dis**), accesses to foreground monitor memory will be terminated by a /DSACK signal generated by the emulator. Any cycle termination signals generated by the target system during monitor memory accesses, including /BERR, will be ignored.

Modifying this configuration item will reset the processor and controls whether the **dsi** (/DSACK Interlock) memory attribute is used in the foreground monitor memory map term.

regfmt   Specifies, when displaying single registers, whether expanded information about the fields within the register are displayed.

The **cf regfmt=exp** command causes the expanded information to be displayed. The fields are decoded, and the contents of the bits or fields within the register are described.

The **cf regfmt=norm** command returns to the default register displays which show only the hexadecimal contents of the register.

Refer to the 68340 microprocessor users manual for complete information about fields within individual registers and their meanings.

See Also   **help** (you can get an on line display of the configuration items for a particular emulator by typing **help cf**. To obtain more information regarding a particular configuration item, type **help cf <config_item>**).

cl - set or display command line editing mode

```
cl                - display command line edit mode
cl -e             - enable command line editing
cl -d             - disable command line editing
cl -l <columns> - number of columns for command line
```

The **cl** command allows you to enable or disable command line editing. Command line editing has two typing modes. The normal command entry is input mode. The input mode functions like normal (canonical) command entry. The control mode allows command modification.

The parameters are as follows:

-e   Enables command line editing.

-d   Disables command line editing.

-l <columns>   This option allows you to set the column length for the command line. The <columns> value can be from 40 to 132 columns.

cl - set or display command line editing mode

The editing mode commands are as follows.

Command	Description
<ESC>	enter command editing mode
i	insert before current character
a	insert after current character
x	delete current character
r	replace current character
dd	delete command line
D	delete to end of line
A	append to end of line
$	move cursor to end of line
0	move cursor to start of line
^	move cursor to start of line
h	move left one character
l	move right one character
k	fetch previous command
j	fetch next command
/<string>	find previous command in history matching <string>
n	fetch previous command matching <string>
N	fetch next command matching <string>

cmb - enable/disable Coordinated Measurement Bus run/break

```
cmb          - display current setting
cmb -e       - enable CMB run/break interaction
cmb -d       - disable CMB run/break interaction
```

The **cmb** command allows you to enable or disable interaction on the CMB (Coordinated Measurement Bus). The CMB allows you to make measurements involving cross-triggering of multiple HP 64700 analyzers, and to synchronously run and break multiple emulators.

The **cmb** command only affects the ability for multiple emulators to run or break in a synchronized fashion. The analyzer trigger capability is unaffected by the **cmb** command.

If no options are supplied, the current state of CMB enable/disable is displayed.

The parameters are as follows:

-e   Enables interaction between the emulator and the Coordinated Measurement Bus.

-d   Disables interaction between the emulator and the Coordinated Measurement Bus.

When interaction is enabled via the **cmb -e** command, the emulator will run code beginning at the address specified via the **rx** command when the CMB /EXECUTE (/ means active low) pulse is received.

The CMB READY line is driven false while the emulator is running in the monitor. The line goes to the true state whenever execution switches to the user program.

Notice that if the **rx** command is given, CMB interaction is enabled just as if a **cmb -e** command was issued. Refer to the syntax pages for the **rx** command for further information.

When interaction is disabled via the **cmb -d** command, the emulator ignores the actions of the /EXECUTE and READY lines. In addition, the emulator does not drive the READY line.

See Also   **rx** (allows you to specify the starting address for user program execution when the CMB /EXECUTE line is asserted)

tx (controls whether or not the emulation analyzer is started when the /EXECUTE line is asserted)

x (pulses the /EXECUTE line, initiating a synchronous execution among emulators connected to the CMB and enabled)

Also, refer to the "Making Coordinated Measurements" for further information on CMB operation.

cmbt - specify control of the rear panel CMB trigger signal

```
cmbt              - display current cmbt set up
cmbt -d <dtype>   - rear panel CMB drives trig(1,2) signal(s)
cmbt -r <rtype>   - rear panel CMB receives trig(1,2) signal(s)

--- NOTES ---
All option combinations are accepted:
'cmbt -d trig1,trig2 -r trig1,trig2'   is a valid command
```

The **cmbt** command allows you to specify which of the internal **trig1/trig2** trigger signals will drive and/or receive the rear panel CMB (Coordinated Measurement Bus) trigger. You can specify the signals individually, as an ORed condition for drive, or as an ANDed condition for receive; or, you can specify that the signals are not to be driven and/or received.

If no options are specified, the current setting of **cmbt** is displayed. Upon powerup, **cmbt** is set to **cmbt -d none -r none**.

The parameters are as follows:

-d   Specifies that the rear panel CMB TRIGGER line drives the internal trigger signals, trig1 and trig2.

-r   Specifies that the rear panel CMB receive the internal trigger signals, trig1 or trig2, and send them out on the CMB TRIGGER line.

<dtype>   The valid drive options are:

    trig1   When the CMB TRIGGER signal is received, drive trig1 signal.

    trig2   When the CMB TRIGGER signal is received, drive trig2 signal.

    none   When the CMB TRIGGER signal is received, drive neither signal.

<rtype>   The valid receive options are:

    trig1   When trig1 signal goes true, send out the CMB TRIGGER signal.

trig2   When trig2 signal goes true, send out the CMB TRIGGER signal.

none   Neither trig1 or trig2 will send the CMB TRIGGER signal out.

You use this command to trigger other HP 64700 analyzers. For example, you may wish to start a trace on another HP 64700 analyzer when the analyzer in this emulator finds its trigger; or, you may wish to do the opposite and trigger the analyzer in this emulator when another emulation analyzer finds its trigger.

See Also   **bc** (break conditions; can be used to specify that the emulator will break into the emulation monitor upon receipt of one of the **trig1**/**trig2** signals)

bnct (BNC trigger; used to specify which internal signals will be driven or received by the rear panel BNC connector)

cmb (Used to enable or disable interaction on the CMB. This does not affect whether measurement instruments can exchange triggers over the CMB; it only controls run/break interaction between multiple emulators)

tarm (analyzer trace arm; used to specify arming (begin to search for trigger) conditions for the analyzer -- **trig1/trig2** can be used to arm the analyzer)

tgout (specifies which of the **trig1/trig2** signals are to be driven when the analyzer trigger is found)

cp - copy memory block from source to destination

```
cp <dest_addr>=<addr>..<addr>  - copy range to destination address
```

The **cp** command allows you to copy a block of data from one region of memory to another.

When **cp** is executed, the data from the specified range is copied to the destination address, with the lower boundary data going to the destination address, lower boundary + 1 to destination + 1, and so on until the upper boundary of the source range is copied.

The parameters are as follows:

<dest_addr>   Specifies the lower boundary of the destination range.

<addr>   Specifies the lower, and possibly upper, memory address boundaries of the source range to be copied. The default is a hexadecimal number; other bases may be specified. You can use "<addr>.." to specify a range from the address through the next 127 bytes.

If the source or destination addresses reside within the target system or single-port emulation memory, the emulator will break to the monitor and will return to the user program after the copy is completed.

If memory mapped as guarded is encountered in the source or destination range during the copy, the command is aborted; however, all locations modified prior to accessing guarded memory are left in the modified state.

See Also   **m** (allows you to display or modify memory locations or ranges)

map (used to define the type and location of memory used by the emulator)

ser (used to search memory ranges for a specific set of data values)

demo - demo program

```
demo - load demo program with symbols
```

This command loads the quick start demo program and its symbols for use with the tutorial presented in the "Quick Start" chapter.

The **demo** command resets the processor, initializes all configuration items, and defines a new memory map.
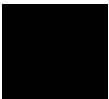
dt - display or set current date and/or time

```
dt                       - display current date and time
dt <yymmdd>              - set current date
dt <hh:mm:ss>            - set current time
dt <yymmdd> <hh:mm:ss>  - set current date and time
```

The **dt** command allows you to set or display the current date and time stored by the HP 64700 series emulators.

Note that the emulator system date & time clock is reset when power is cycled.

If no parameters are specified, the current date and time settings are displayed.

The parameters are as follows:

<yymmdd>   Current date in year, month, day format.

<hh:mm:ss>   Current time in hour:minute:second format.

Examples   To display the current date and time settings at emulator powerup:

```
M>dt
  January 01, 1988  0:00:21
```

To set the date to August 18, 1987:

```
M>dt 870818
```

To set the date to August 18, 1987 and the time to 11:05:00 (the order of the two arguments is not significant):

```
M>dt 870818 11:05:00
```

Note that if **yy** is greater than 50, the year is assumed to be in the 20th century (in other words, **19yy**). If **yy** is less than 50, the year is assumed to be in the 21st century (in other words, **20yy**).

dump - upload processor memory in absolute file format
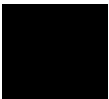
```
dump -i <addr>..<addr> - upload intel hex format
dump -m <addr>..<addr> - upload motorola S-record format
dump -t <addr>..<addr> - upload extended tek hex format
dump -h <addr>..<addr> - upload hp format (requires transfer protocol)
dump -b <addr>..<addr> - send data in binary (valid with -h option)
dump -x <addr>..<addr> - send data in hex ascii (valid with -h option)
dump -c <hex char> <addr>..<addr> - after uploading a hex ascii
                                     format file send this character
                                     to close the file
```

The **dump** command allows a host interface program to dump the contents of emulation and/or target system memory to a host file. The contents can be dumped in HP, Tektronix hex, Intel hex, and Motorola S-record formats by specifying various options on the command line.

When uploading the file in HP file format using the HP 64000 **transfer** software, record checking is performed automatically by the **transfer** protocol.

The parameters are as follows:

-i   Specifies in Intel hex record format. Note that the various options for HP file format transfer (such as **-x**, **-b**, and **-e**) are invalid with this format.

-m   Specifies the Motorola S-record format.

-t   Specifies the Tektronix extended hexadecimal format.

-h   Indicates that the memory contents will be dumped in HP absolute file format.

-b   Indicates that the records will be sent in binary; this is only valid with **-h** (HP file format).

-x   The records will be sent in hexadecimal; this is only valid with the **-h** option (HP file format).

-c <hex char>   Indicates that the ASCII hexadecimal character specified should be sent to the host at the end of the file upload.

<addr>   Specifies the lower, then upper, address boundaries of the memory range to be dumped. The default is a hexadecimal number; other bases may be supplied.

Note that the HP 64000 format ".X" file created with a "dump -hx" command has records that contain 136 fewer bytes of data than the file format standard allows. Because of this, HP 64000 format ".X" files which are created with the **dump** command may take longer to be processed by consumers of the ".X" file (depending on how the consumer processes sequential records).

See Also   **load** (used to load emulation memory from a host computer file)

echo - evaluate arguments and display results

```
echo "string"          - echo string to output
echo `string`          - echo string to output
echo expression        - evaluate expression and display results in
                         hex
echo \<value>          - echo character equal to value
echo expression \<value> - multiple arguments may be evaluated
```

The **echo** command allows you to display ASCII strings or the results of evaluated expressions on the standard output device. You must enclose strings in single open quote marks (') (ASCII 60 hex) or double quotation marks (") (ASCII 22 hex). A string not enclosed in delimiters will be evaluated as an expression and the result will be echoed. In addition, you may supply a backslash with a two digit hex constant; the corresponding ASCII character(s) will be echoed.

Echoing strings or ASCII characters is particularly useful within macros, command files, and repeats where you wish to prompt the user to perform some action during a "wait for any keystroke" command (see description for **w**). The expression capability is useful as a quick calculator.

Note that all options may combined within the same echo command as long as they are separated by spaces.

The parameters are as follows:

string
Any set of ASCII characters enclosed between single open quote marks ('), or double quotes ("). Since the command buffer is limited to 256 characters, the maximum number of characters in a string is 248.

Note that many keyboards (and printers) represent the single open quote mark as an accent grave mark. In any case, the correct character is ASCII 60 hexadecimal. The correct double quote character is ASCII 22 hexadecimal.

Note that a character which is used as a delimiter cannot be used within the string. For example, the string **"Type "C""** is incorrect and will return an error. The string **`Type "C"`** is correct.

expression
A valid expression. The expression will be evaluated and the result will be echoed.

<value>
Is the hex code for any valid ASCII character. More than one character can be echoed with a single command; each "nn" must be preceded by a backslash. A total of 62 ASCII characters can be represented within a single **echo** command.

This capability is particularly useful for sending non-displaying control characters to a terminal; refer to the examples below.

Examples

To echo the string "Set S1 to OFF" to the standard output, type the following:

```
M>echo "Set S1 to OFF"
Set S1 to OFF
```

A useful application of the backslash option is to send a terminal control characters:

```
M>echo \1b "H" \1b "J" \1b "&dBSet S1 to OFF"
```

The above command sends "<ESC>H<ESC>J<ESC>&dB Set S1 to OFF" to the terminal. On an HP 2392A terminal this homes the cursor, clears the screen, sets the video mode to inverse video, and writes the message "Set S1 to OFF". Therefore, the user would see the message "Set S1 to OFF" in inverse video at the upper left hand corner of an otherwise blank screen.

You might combine this with a macro command as part of a procedure. For example, type:

```
M>mac PROMPT={echo "Set S1 to OFF";w}
M>PROMPT
```

You will see:

```
Set S1 to OFF
Waiting for any keystroke...
```
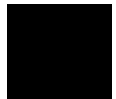
To calculate the value of the expression (1f + 1e), type:

```
M>echo 1f+1e
03dh
```

See Also

mac (grouping a set of commands under a label for later execution)

rep (grouping a set of commands for immediate repetition)

w (wait command, allows user specified delays)

equ - define, display or delete equates

```
equ name=<value>          - equate name to number or pattern
equ name                  - display named equate
equ -d name               - delete named equate
equ -d *                  - delete all equates
equ *                     - list all equates
equ                       - list all equates
equ name1=<value> name2   - multiple operands allowed
```

The **equ** command allows you to equate arithmetic values with names that you can easily remember; these names can then be used in other commands to reference the value.

A number of equates have been predefined for common analyzer status values. The equates are present after the emulator is powered up or initialized.

The parameters are as follows:

name   A character string that names the equate to be displayed, deleted, or assigned a value. The name must be an alphanumeric designator no greater than 31 characters in length, beginning with an alpha character or underscore and including only alphanumeric characters or underscores thereafter.

<value>   An arithmetic expression to be assigned to the equate name.

-d   Deletes the named.

Note that each equate is translated to its actual value at the time of command entry. For example, if you specify an equate **count=21h**; and an expression **start=2000h**, then the command **tg addr=start count** will be entered into the system as **tg addr=start 33**. At this point, redefining the value of **addr** or **count** would not change the address expression or the occurrence counter for the trigger.

Note that the combination of a single **equ** command with all names and expressions cannot exceed 255 characters. The number of equates and symbols that may be defined is limited only by available system memory; thus, it is dependent on the number of equates, symbols, macros, etc. defined.

See Also   **tg, tpat, tif, telif,** and others. (**equ** provides an easy way to name expressions to use in setting up trigger or branch conditions)

r, m, bp (equates may be used to specify run addresses, memory addresses, or breakpoint addresses)

es - display current emulation system status

```
es
```

The **es** command displays the current status of emulation activity. The following types of information may be displayed:

- R - emulator in reset state
- U - running user program
- M - running monitor program
- W - waiting for CMB to become ready
- w - CPU in wait state
- ? - No monitor communication
- c - no target system clock
- r - target system reset active
- h - processor halted
- b - bus idle
- g - bus granted
- p - no target power

The emulator will not break to the monitor to obtain information. Therefore, any information that can only be obtained while in the monitor will not be displayed if the emulator is not in the monitor.

See Also   **ta** (allows you to display activity on emulation analyzer lines)

ts (allows you to display the current status of the emulation analyzer)

<expr> - analyzer state qualifier expressions

In the easy configuration:

```
any/all                                    - always true set
none/never                                 - always false set
arm                                        - external qualifier
<label>=<value>                            - define state qualifier
<label>!=<value>                           - define state qualifier
<label>=<value> and <label>=<value> ...    - state and state
<label>!=<value> or <label>!=<value> ...   - state or state
<label>=<value>..<value>                   - define state range
<label>!=<value>..<value>                  - define notstate range
```

In the complex configuration:

```
any/all                                    - always true set
none/never                                 - always false set
<set1>                                      - single set
<set2>                                      - single set
<set1> and <set2>                           - set global and set
<set1> or <set2>                            - set global or set
```

Analyzer state qualifier expressions are used in specifying triggers, time qualifiers, primary and secondary branch conditions, prestore qualifiers, and other analyzer setup items.

There are two types of analyzer expressions, simple and complex.

The parameters are as follows:

<label>   A trace label that is currently defined with the **tlb** command.

<value>   Values are numeric constants, equates, or symbols. Also, values can be the result of constants, equates, and symbols combined with operators. Refer to the <value> description.

<set1>   Consists of: p1, p2, p3, p4, r, !r. The pattern resources are assigned values with the **tpat** command and the range resource is assigned a value with the **trng** command.

<set2>   Consists of: p5, p6, p7, p8, arm. The pattern resources are assigned values with the **tpat** command. The "arm" keyword specifies the arm condition as specified in the **tarm** command.

Resources within a set can be combined with intraset operators. Resources between the two sets can be combined with the interset operators.

Intraset Operators

You use intraset operators to form relational expressions between members of the same set. The operators are:

~ (intraset logical NOR)

| (intraset logical OR)

The operators must remain the same throughout a given intraset expression.

Interset Operators

You use interset operators to form relational expressions between members of set 1 and set 2. The operators are:

and (interset logical AND)

or (interset logical OR)

You can then form the following types of expressions:

(set 1 expression) and (set 2 expression)

(set 1 expression) or (set 2 expression)

The order of sets does not matter:

(set 2 expression) and (set 1 expression)

Combining Intraset and Interset Operators

You can use both the intraset and interset operators to form very powerful expressions. For example:

```
p1~p2 and p5|arm
p3 or p6~p7~p8
```

However, you cannot repeat different sets to extend the expression. The following is invalid:

```
p1~p2 and p5 and p3 and p7
```

DeMorgan's Theorem and Complex Expressions

At first glance, it seems that you only have a few operators to form logical expressions. However, using the combination of the simple and complex expression operators, along with a knowledge of DeMorgan's Theorem, you can

form virtually any expression you might need in setting up an analyzer specification.

DeMorgan's theorem in brief says that

> **A NOR B = (NOT A) AND (NOT B)**

and

> **A NAND B = (NOT A) OR (NOT B)**

The NOR function is provided as an intraset operator. However, the NAND function is not provided directly. Suppose you wanted to set up an analyzer trace of the condition

> **(addr=2000) NAND (data=23)**

This can be done easily using the simple and complex expression capabilities. First, you would define the simple expressions as the inverse of the values you wanted to NAND:

```
tpat p1 addr!=2000
tpat p2 data!=23
```

Then you would OR these together using the intraset operators:

```
p1|p2
```

This is effectively the same as:

> **(NOT addr=2000) OR (NOT data=23) = (addr=2000) NAND (data=23)**

If you need an intraset AND operator, you can use the same theory. Suppose you actually wanted:

> **(addr=2000) AND (data=23)**

First, define the simple expressions as the inverse values:

```
tpat p1 addr!=2000
tpat p2 data!=23
```

Then you would NOR these together using the intraset operators:

```
p1~p2
```

This is effectively the same as:

> **(NOT addr=2000) NOR (NOT data=23) = (addr=2000) AND (data=23)**

Examples   **Some easy configuration examples include:**

```
tg addr=2000
```

```
tif 1 data=20..30
telif addr!=3000 or data!=5
```

Some complex configuration examples include:

First, to assign values to pattern names:

```
tpat p1 addr=2000
tpat p2 addr!=3000
tpat p5 data!=5
trng data=20..30
```

Next, to create complex expressions within the analyzer commands:

```
tg p1
tif 1 r
telif 1 p2 or p5 3
```

To use intraset operators:

To store pattern 1 NOR pattern 2 NOR range:

```
tsto p1~p2~r
```

To trigger on pattern 2 OR (NOT range):

```
tg p2 | !r
```

help, ? - display help information

```
help <group>         - print help for desired group
help -s <group>      - print short help for desired group
help <command>       - print help for desired command
help                 - print this help screen
```

The **help (?)** command lets you display syntax, description and examples for any HP 64700 emulator Terminal Interface command. You may display a brief description for anything from a single command to command groups or the entire command set. Detailed information is available for single commands.

You may enter a question mark **?** instead of typing help; it performs the same function.

The parameters are as follows:

<group>   The valid group names are:

> gram   System grammar.
>
> proc   Processor specific grammar.
>
> sys   System commands.
>
> emul   Emulation commands.
>
> trc   Analyzer trace commands.
>
> *   All command groups.

-s   Switches to the abbreviated help mode; only the expanded name of each command is displayed next to the command.

<command>   Detailed help information is displayed for the named command.

> Note that if you specify "*" for <command> or <group>, information for all commands will be displayed.

init - reinitialize system

```
init       - limited initialization; resets emulation and analysis
             products
             but not environment (macros, equates, date & time, etc..)
init -c    - complete initialization; does not run system memory
             integrity tests
init -p    - powerup initialization; run from reset with complete
             system verification tests
init -r    - powerup initialization; run from reset with complete
             system verification tests
             ignore all optional products
             do not use flash ROM
```

The **init** command allows you to re-initialize the emulator. Powerup, complete, and limited initializations are available through various options. In most cases you should only use this command if the emulator is not responsive to other commands.

If no options are specified, a limited initialization sequence is performed. The operating system and data communications are not affected but all of the emulation and analysis boards are reset. For example, a limited initialization would not change macro definitions, system date and time, or the data communications parameters, but the emulation memory map and breakpoint list would be reset to their default states.

The parameters are as follows:

-p   Specifies a powerup initialization sequence. This initializes the operating system, data communications, emulation and analyzer boards, and runs extensive performance verification.

-c   Specifies a complete initialization sequence. Everything is initialized as defined by the powerup sequence with the exception of the performance verification.

-r   Specifies a complete initialization with system verification tests (as with **-p**), but optional products and the flash ROM are ignored.

Note that the **init -c**, **init -p**, or **init -r** commands cause a loss of system memory. If these commands are used in macros, commands that follow them will not be executed.

See Also   **cf** (change emulation configuration)

dt (set system date and time)

map (define the emulation memory map)

stty (set data communications parameters)

tinit (reset the analyzer to powerup defaults)

lan - set configuration parameters

```
lan                  - display the current lan configuration
lan -l               - startup lan if not already started
lan -b               - enable BNC
lan -a               - enable AUI
lan -i <ip_addr>   - set Internet Protocol address
lan -g <ip_addr>   - set Internet Protocol Gateway address
lan -p <port>        - set TCP service port number
```

The parameters are as follows:

-l   Selects the LAN interface without having to change the HP 64700 configuration switch settings. Note that the serial interface is always active.

-b   Selects the LAN interface's BNC connector without having to change the HP 64700 configuration switch settings.

-a   Selects the LAN interface's AUI connector without having to change the HP 64700 configuration switch settings.

-i <ip_addr>   Internet Address in dot notation (for example, 192.6.94.2).

-g <ip_addr>   Gateway Address in dot notation (for example, 192.6.94.2).

-p <port>   Any number that is likely to be unused (for example, 6470).

lanpv - performance verification on LAN interface

```
lanpv -b   - testing performed through BNC connector
lanpv -a   - testing performed through AUI connector
lanpv -v   - print the error code value
```

To run performance verification, the connector under test must be removed from the network and capped with a terminator.

The parameters are as follows:

-b   Tests the LAN interface through its BNC connector.

-a   Tests the LAN interface through its 15-pin AUI connector.

-v   Prints the error code value. The error codes and their meanings are:

load - download absolute file into processor memory space

```
load -i          - download intel hex format
load -m          - download motorola S-record format
load -t          - download extended tek hex format
load -S          - download symbol file
load -h          - download hp format (requires transfer protocol)
load -a          - reserved for internal hp use
load -e          - write only to emulation memory
load -u          - write only to target memory
load -f          - download foreground monitor code
load -b          - data sent in binary (valid with -h option)
load -x          - data sent in hex ascii (valid with -h option)
load -q          - quiet mode
load -p          - record ACK/NAK protocol (valid with -imt options)
```

The **load** command lets you load program code into emulation or target memory. Various file formats are supported via options to the load command. The destination of the program code is determined by the information contained in the program file. Additional options allow you to load only target memory or emulation memory as desired.

If a load error occurs, the current load procedure is aborted. However, records which were successfully loaded will remain in memory.

Note that at least one dash (-) must be included before any parameters are specified. It is optional to include or omit dashes for succeeding parameters. At least one file format option must be specified.

The parameters are as follows:

-i   Specifies that the program code will be in Intel hex file format.

-m   Specifies that the program code will be in Motorola S-record file format.

-t   Specifies that the program code will be in extended Tektronix hexadecimal file format.

-h   Specifies that the program code will be in HP file format. In this case, the file is expected to be transferred using the HP 64000 Hosted Development System **transfer** protocol.

-e   Load only those portions of program code which would reside in memory mapped to emulation memory space. (Refer to the **map** command.)

-u   Load only those portions of program code which would reside in memory mapped
            to target memory space. (Refer to the **map** command.)

-f   Download customized foreground monitor code into reserved block of memory.
            (Refer to the **cf mon** command.)

-q   The program code will be transferred in quiet mode. If **-q** is not specified, the
            emulator controller will write a "#" to **stdout** for each record successfully received
            and processed.

S   This allows you to download a symbol file from the host computer into the
            emulator.

-b   When using the HP file format, the program is expected to be in binary.

-x   When using the HP file format, the program is expected to be in hex.

-p   When using Intel, Motorola or Tektronix file formats, this option sets up a protocol
            checking scheme using ASCII **ACK**/**NAK** characters. If using this option, the host
            should send one record at a time and wait for the emulator to return an ASCII **ACK**
            character between records. If the emulator returns an ASCII **NAK** instead, there
            has been an error in data transmission. When the emulator receives the EOF
            character, it will return only the normal emulator prompt since data transmission is
            complete.

            If, during the transfer, the host receives a **NAK** for a record, it should retransmit the
            record until an **ACK** is received or until a timeout value is reached, whichever
            occurs first.

            Note that when you load an absolute file, the incoming data is examined for valid
            records (in the specified format). If the data being sent does not contain any valid
            records, the emulator will wait forever looking for valid records. The process must
            be terminated be entering a <CTRL>c.

See Also   **dump** (allows you to transfer emulation memory contents to a host)

m - display or modify processor memory space

```
m <addr>                 - display memory at address
m -d<dtype> <addr>       - display memory at address with display option
m <addr>..<addr>         - display memory in specified address range
m -dm <addr>..<addr>     - display memory mnemonics in specified range
m <addr>..               - display 128 byte block starting at address A
m <addr>=<value>         - modify memory at address to <value>
m -d<dtype> <addr>=<value>      - modify memory with display option
m <addr>=<value>,<value>        - modify memory to data sequence
m <addr>..<addr>=<value>,<value> - fill range with repeating sequence
```

The **m** command allows you to display and modify emulation and target system memory. Options allow you to specify the display mode, specific address or addresses for display or modification, and the data values to be inserted.

At least one address must be specified. If no display mode is specified the display mode set by the **mo** command is used. Data items specified in memory modification are repeated as a group to fill the address range specified. The memory display defaults to the last value specified, or the default format for the emulator in use upon powerup initialization (varies dependent on the microprocessor being emulated).

If the selected address range for display or modification includes memory within the user's target system, emulator execution must break to the monitor in order to perform the access. After the command is complete, the processor will be returned to foreground execution if no errors occurred.

The parameters are as follows:

-d<dtype>   The **-d** option allows you to set the display mode for memory accesses. The valid display modes are:

b   display size is 1 byte(s)

s   display size is 2 byte(s)

w   display size is 4 byte(s)

m   display processor mnemonics

<addr>   Specifies the address to be displayed or modified. As noted in the syntax, an address followed by two periods and another address specifies a range of addresses to display or modify. The address default representation is a hexadecimal number.

\<value\>	Data value to which a particular location is to be modified. If a range of locations is to be modified to a sequence of data values, the values must be separated by commas. Note that data may be specified in decimal, octal, or binary in addition to the hexadecimal default.

Note that the way the data item is handled depends on the display mode in effect. For example, if the display mode is byte, and the value entered is 1a3f66, the location specified will be modified to 66 hex. If the display mode is short, the location will be modified to 3f66 hex. And if the display mode is word, the location will be modified to 1a3f66.

Conversely, if you specify the value 33 hex for modification in byte mode, the value 33 is entered; in word mode, the value 0033 is entered; in long word mode, the value 000033 is entered. In other words, if the value supplied is shorter than the mode in effect, it is padded with leading zeros.

See Also   **map** (specify mapping of memory to emulation or user memory and to RAM or ROM)

mo (specify global access and display modes)

mac - display, define, or delete current macros

```
mac                        - display currently defined macros
mac <name>                 - display macro <name>
mac <name>={<cmd_list>}    - define macro <name> as list of commands
mac -d <name>              - delete macro <name>
mac -d *                   - delete all macros
mac -q                     - set expansion echo to quiet mode
mac -v                     - set expansion echo to verbose mode
```

The **mac** command allows you to save a group of commands under a name of your choice. This allows you to instantly recall that command group by typing in the assigned name. The emulator will then preprocess the macro to expand the commands stored in it to a normal command line. Then, the command line is then executed.

The parameters are as follows:

-d   The **-d** parameter, in conjunction with the macro <NAME>, deletes the macro defined by <NAME>. If <NAME> is given as the character "*" then all macros are deleted.

<name>   This represents the name you assign to the macro definition. Names can be any combination of alphanumeric characters; however, you cannot define a macro that has a name identical to that of another HP 64700 Terminal Interface command.

            If you specify a name which is the same as a currently defined macro, that macro will be overwritten by the new macro you define.

<cmd_list> This represents one or more emulator commands, including names which are used to define other macros. Commands in <cmd_list> must be separated from other commands by a semicolon (;).

            When using command substitution, you can include pseudo-parameters in the form of "&token&" in the macro definition. Do not include any white space between the two "&" symbols. When you execute the macro, include the string to be substituted for &token& as a parameter on the command line. The macro will execute using the command expanded with the string you substituted.

-q   Sets the macro expansion echo to quiet mode. In this mode, any macro that you run will be executed without displaying the expanded command string.

-v   Sets the macro expansion echo to verbose mode. In this mode, any macro that you run will first display the expanded command string as a comment, and then will execute the macro.

Nested macro calls are permitted and limited only by constraints of system memory.

The commands within the macro definition are not checked for correct syntax until the macro is executed; therefore, it is advisable to test the command string before defining the macro.

The number of macros that can be created is limited to 100, but may be less depending on the complexity of the macros defined.

The length of the macro name combined with the macro definition is limited only by the maximum HP 64700 command length of 255 characters; thus, the macro name and definition can be a maximum of 251 characters.

A command within a macro definition cannot contain the pound sign character (#) unless the command is enclosed in a quoted string. (Otherwise, text following the # is interpreted as a comment.) This means there can be no matching brace at the end of the command. Use the **echo** command to place comments in a macro definition.

Command line substitution is possible when invoking a macro. During the macro definition, you may include pseudo-parameters which allow you to substitute parameters, such as file names, when invoking the macro.

See Also   **rep** (repeat; allows you to repeat any command, including macros)

map - display or modify the processor memory map

```
map                                  - display current map structure
map <addr>..<addr> <type> <attrib> - map address range as memory type
map other <type>                     - map other range as memory type
map -d <term #>                      - delete specified map term
map -d *                             - delete all map terms
```

Because the emulator can use target system memory or emulation memory (or both), it is necessary to map ranges of memory so that the emulator knows where to direct its accesses.

Up to 16 ranges of memory can be mapped, and the resolution of mapped ranges is 256 bytes (that is, the memory ranges must begin on 256 byte boundaries and must be at least 256 bytes in length).

The parameters are as follows:

<addr>   Specifies the address range to be mapped.

other   Specifies unmapped address ranges. Only the **trom**, **tram**, or **grd** types can be specified for unmapped memory. The "other" range is unaffected when all mapper terms are deleted with the **map -d *** command.

<type>   The valid types are:

eram   Indicates that the given address range is to reside in emulation address space and act as RAM (read/write).

erom   Indicates that the given address range resides in emulation address space; it is to act as ROM (read only).

tram   Indicates that the given address range lies within target system RAM space. When the emulation processor accesses an address within this range, the target system data buffers will be enabled by a mapper signal to complete the transaction.

trom   Indicates that the given address range lies within target system ROM space.

grd   The **grd** parameter indicates the given address range is to be
                "guarded". An emulation system break will be generated upon
                accesses to guarded memory.

<attrib>   The valid attributes are:

dp   Dual-port emulation memory.

                One emulation memory range, up to 4 Kbytes in length, can be
                given the **dp** attribute. The **dp** attribute specifies that the range
                be mapped to the 4 Kbyte block of dual-port emulation
                memory. If a foreground monitor program is selected, the **dp**
                attribute is automatically assigned to the memory range
                reserved for the monitor program.

dsi   Interlock emulation memory and target system /DSACK.

                The **dsi** attribute specifies that accesses in that range of
                emulation memory be synchronized with the target system.
                This means the termination of accesses in the range will not
                occur until the target system provides a /DSACK. If the target
                system does not generate a /DSACK, the emulator will be
                unable to break into the monitor and a "CPU in wait state"
                status will result.

                When interlocking is disabled, accesses to emulation memory
                will be terminated by a /DSACK signal generated by the
                emulator. Any cycle termination signals generated by the target
                system during emulation memory accesses, including /BERR,
                will be ignored.

cs0   Use 68340 chip select 0.

                The **cs0** attribute allows you to emulate the 68340's global chip
                select operation. One memory range, either target or emulation,
                can be given this attribute. Refer to the "To emulate global chip
                select operation" task description in the "Using the Emulator"
                chapter.
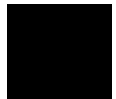
-d <term #>   Delete the mapped address range. The emulation system assigns a term number to each mapped address range. Term numbers are assigned in ascending order of address range.

When any map term is added or deleted the emulation processor will be reset and held in the reset state until a break or run command is issued. The processor remains reset in recognition of the fact that returning to execution directly after mapper modification is most likely invalid.

Be sure to disable all software breakpoints (**bc -d bp**) before changing the map. Software breakpoints are not cleared when the memory map is changed. After the new map and the program are set up, you can re-enable the breakpoints break condition (**bc -e bp**) and enter the **bp -e *** command to reenable the defined software breakpoints.

Note that the memory mapper re-assigns blocks of emulation memory after the insertion or deletion of mapper terms.

Note that if you map the same address range to different blocks of memory by using function code specifiers, all further references to addresses in that range must be fully specified with a function code. Otherwise, the emulator will return an "Ambiguous address" error message.

See Also   **bc** (break conditions; determines whether emulator breaks to monitor upon write to space mapped as ROM)

m (memory display/modify)

bp (set/delete software breakpoints)

mo - set or display current default mode settings

```
mo                 - display current mode settings
mo -d<dtype>       - set display mode to specified type
mo -a<atype>       - set access mode to specified type
```

The **mo** command allows you to modify the global access and display modes. Access mode is defined as the type of processor data cycles used by the emulation monitor to access a portion of user memory. Display mode is defined as the method used to display or modify data resident in memory.

The parameters are as follows:

-a<atype>   The **-a** option allows you to set the access mode. The valid access modes are:

d   the same as the display mode

b   byte, display size is 1 byte(s)

w   word, display size is 2 byte(s)

-d<dtype>   The **-d** option allows you to set the display mode. The valid display modes are:

b   byte, display size is 1 byte(s)

w   word, display size is 2 byte(s)

l   long, display size is 4 byte(s)

m   display processor mnemonics

At powerup or after **init**, the default access mode is set to **b** (byte), and the default display mode is set to **w** word.

See Also   **m** (memory display/modify)

po - set or display prompt

```
po              - display the current port settings
po -p "string" - change the prompt string
```

The **po** command allows you to change the system prompt characters.

The parameters are as follows:

-p   Allows you to change the emulator's command prompt to one specified by **<STRING>**.

string   Any group of ASCII characters enclosed by single open quotes (') or double (") quote marks.

pv - execute the system performance verification diagnostics

```
pv                - display pv warning message
pv <repeat_count> - execute diagnostics <repeat_count> number of times
```

CAUTION   The **pv** command performs a system powerup initialization after all pv execution is completed. Therefore, all equates, macros, memory map, configuration settings, system clock, software breakpoints, trace specifications, and other configuration items you have altered will be cleared.

The **pv** command runs performance verification on the emulator and analyzer. The performance verification exercises all the emulator hardware and software to high confidence level.

You should only run performance verification when the emulation probe is plugged into the demo target system.

The parameters are as follows:

<repeat_count>   Specifies the number of times to repeat the performance verification.

If **pv** reports failures, first check your hardware installation as described in the "Installation" chapter. If the failures persist, call your local HP Sales and Service office for assistance. A list of offices is provided in the *Support Services* guide.

Note that providing multiple commands such as **pv 1;r** is invalid; the second command will not execute due to the system reset.

Typing in <CTRL>c to abort the **pv** command may result in incorrect failure messages.

See Also   **init** (reinitializes the emulator)

r - run user code

```
r            - run from current Program Counter
r $          - run from current Program Counter
r <addr>     - run from address <addr>
r rst        - run from processor reset
```

The **r** command starts an emulation run. Execution begins at the address specified by the <addr> parameter; if no address is specified, execution begins at the address currently present in the program counter.

The parameters are as follows:

<addr>   Specifies the address where execution is to begin. If you specify **$**, the processor runs from the current program counter value.

rst   Specifies that the emulation processor runs from reset.

See Also   **s** (step; allows controlled stepping through program instructions)

rx (run only when CMB (Coordinated Measurement Bus) execute pulse is received)

x (pulse the CMB execute line if resident on the CMB)

reg - display and set registers

```
reg                             - display all basic register contents
reg *                           - display all basic register contents
reg <reg>                       - display contents of the named reg
reg <regclass>                  - display contents of the named reg class
reg <reg>=<value>               - modify contents of the named reg
reg <reg> <reg>=<value> <regclass>  - display and set may be combined
```

The **reg** command allows you to display and modify emulation processor register contents. Individual registers may be displayed or modified; related groups of registers may be displayed; combinations of display and modify are permitted on the same command line.

The parameters are as follows:

<reg>

<regclass>   Refer to the following table.

<value>   A numeric value.

Register Class	Register	Description
* (General Registers)	pc st usp ssp d0 - d7 a0 - a7 vbr sfc, dfc	Program Counter Status Register User Stack Pointer Supervisor Stack Pointer Data Registers 0 through 7 Address Registers 0 through 7 Vector Base Register Alternate Function Code Registers

Register Class	Register	Description
sim (System Integration Module)	mbar sim_mcr syncr avr rsr porta ddra ppara1 ppara2 portb portb1 ddrb pparb swiv sypcr picr pitr swsr cs0mask cs0addr cs1mask cs1addr cs2mask cs2addr cs3mask cs3addr	Module Base Address Register Module Configuration Register Clock Synthesizer Control Register Autovector Register Reset Status Register Port A Data Port A Data Direction Port A Pin Assignment 1 Port A Pin Assignment 2 Port B Data Port B Data Port B Data Direction Port B Pin Assignment Software Interrupt Vector System Protection Control Periodic Interrupt Control Register Periodic Interrupt Timing Register Software Service Address Mask CS0 Base Address CS0 Address Mask CS1 Base Address CS1 Address Mask CS2 Base Address CS2 Address Mask CS3 Base Address CS3
dma1/2 (DMA Controller Module s1 and 2)	dma_mcr1/2 intr1/2 ccr1/2 csr1/2 fcr1/2 sar1/2 dar1/2 btc1/2	Module Configuration Register Interrupt Register Channel Control Register Channel Status Register Function Code Register Source Address Register Destination Address Register Byte Transfer Counter

Register Class	Register	Description
serial (Serial Module)	serial_mcr ilr ivr mr1a sra csra cra rba tba ipcr acr isr ier mr1b src csrb crb rbb tbb ip opcr op_set op_rst mr2a mr2b	Module Configuration Register Interrupt Level Interrupt Vector Mode Register 1A Status Register A Clock-Select Register A Command Register A Receiver Buffer A Transmitter Buffer A Input Port Change Register Auxiliary Control Register Interrupt Status Register Interrupt Enable Register Mode Register 1B Status Register B Clock-Select Register B Command Register B Receiver Buffer B Transmitter Buffer B Input Port Register Output Port Control Register Output Port Bit Set Output Port Bit Reset Mode Register 2A Mode Register 2B
timer1/2 (Timer Modules 1 and 2)	timer_mcr1/2 ir1/2 cr1/2 sr1/2 cntr1/2 prel11/2 prel21/2 com1/2	Module Configuration Register Interrupt Register Control Register Status/Prescaler Register Counter Register Preload 1 Register Preload 2 Register Compare Register

Register Class	Register	Description
cf_sim	cf_mbar	Module Base Address Register
	cf_sim_mcr	Module Configuration Register
(Emulator	cf_ppara1	Port A Pin Assignment 1
Configuration	cf_ppara2	Port A Pin Assignment 2
Registers)	cf_cs0mask	Address Mask CS0
	cf_cs0addr	Base Address CS0
	cf_cs1mask	Address Mask CS1
	cf_cs1addr	Base Address CS1
	cf_cs2mask	Address Mask CS2
	cf_cs2addr	Base Address CS2
	cf_cs3mask	Address Mask CS3
	cf_cs3addr	Base Address CS3

See Also   **s** (step; allows you to step through program execution — combination with the **reg** command is useful in debugging)

rep - repeat execution of the command list multiple times

```
rep <value> {<cmd_list>}  - execute the command list <value> number
                            of times
rep 0 {<cmd_list>}        - execute the command list forever

<cmd_list> - list of valid commands separated by semicolons
```

The **rep** command allows you to repeat a group of commands and macros a specified number of times.

No other command input will be accepted until the command group has executed the indicated number of repetitions.

The parameters are as follows:

<value>   An integer value specifying how many times the command list should be executed. A count of zero is a special case, meaning "repeat forever" (the repetition can be terminated by entering <CTRL>c, which issues a break signal to the emulator).

<cmd_list>   Any valid HP 64700 command, including previously defined macros, may be specified with the options appropriate to the command. The list of commands must be preceded by an opening brace and followed by a closing brace. Also, the commands must be separated by semicolons. The commands will be executed in the same order as they are specified on the command line.

See Also   **mac** (allows assignment of a name to a command group for easy recall of a specified command sequence)

rst - reset emulation processor

```
rst          - reset and stay in reset state
rst -m       - reset, then enter monitor
```

The **rst** command resets the emulation microprocessor. An option allows you to specify that the emulator should enter the monitor immediately after the reset. If **-m** is not specified, the emulation processor remains in the reset state. Note that any commands which require the monitor for command processing will not execute while the processor is in the reset state; these include commands such as **reg**.

Commands or hardware signals which will take the emulator out of a reset state include **b**, **r**, **s**, and the CMB /EXECUTE pulse.

The parameters are as follows:

-m   Causes the emulator to enter the monitor immediately after the reset.

rx - run at CMB-execute

```
rx          - display run-at-CMB-execute address
rx $        - when CMB-execute occurs, use the PC value at that time
rx <addr>   - set run-at-CMB-execute address
```

The **rx** command allows you to set the starting address for synchronous CMB (Coordinated Measurement Bus) execution.

The parameters are as follows:

<addr>   Specifies where to start program execution when the CMB EXECUTE pulse is detected. If $ is specified for address, the current program counter value is used (default).

If the HP 64700 emulator is connected to the CMB, and the CMB-EXECUTE pulse is detected, followed by the CMB-READY line in the true state, the emulator will begin execution at the address specified by the **rx** command. If no **rx** command has been issued, execution begins at the current program counter value (same as **rx $**).

Execution will begin at the address specified by **rx** every time the conditions listed above are met. For example, if you type the command **rx 100**, the emulator will start executing at address 100 hex every time the CMB-EXECUTE line is pulsed.

The **rx** command automatically turns on CMB interaction by effectively performing the equivalent of a **cmb -e** command whether or not you have done so.

See Also   **cmb** (enables or disables CMB interaction)

x (initiates a synchronous CMB interaction by pulsing the CMB-EXECUTE line)

s - step emulation processor

```
s                       - step one from current PC
s <count>               - step <count> from current PC
s <count> $             - step <count> from current PC
s <count> <addr>        - step <count> from <addr>
s -q <count> <addr>     - step <count> from <addr>, quiet mode
s -w <count> <addr>     - step <count> from <addr>, whisper mode
```

The **s** command allows you to single-step the emulation processor through a program. You can specify the number of steps to execute at a single time; or, you can direct the emulator to step continuously. In addition, you may specify the starting address for stepping.

The parameters are as follows:

<count>   Specifies the number of steps to execute in sequence before returning command control.

The default base for <decimal> is decimal; however, other number bases may be specified.

If you do not specify a value for <count>, then a value of one (1) is assumed. If you specify a step count of zero (0), the emulator interprets this as "step continuously". Continuous stepping can be aborted with the <CTRL>c command; or, it will be terminated upon receipt of an emulation break condition such as a write-to ROM.

<addr>   Specifies the starting address for stepping. If you substitute **$** for the <addr> parameter, the current program counter value will be used as the <addr> value. The same will occur if no address parameter is specified.

Note that if you specify a value for <addr>, then you must specify a value for <count>. Otherwise, the address value will be interpreted as a step count; the emulator will step the number of locations specified.

-q   Stepping will occur in quiet mode; that is, the instructions and program counter are not displayed upon execution of each step.

-w   Stepping will be done in whisper mode; only the final program counter value is displayed after the step is executed.

If the emulator was in the run state (U> prompt) executing a user program when you request the step, it will break to the monitor before executing the step.

Note that when the Coordinated Measurement Bus (CMB) is being actively controlled by another emulator, the step command (**s**) does not work correctly. The emulator may end up running in user code (NOT stepping). Disable CMB interaction (**cmb -d**) while stepping the processor.

See Also   **r** (run emulation processor from a specified address)

reg (view or modify processor register contents)
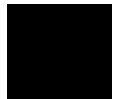
ser - search through processor memory for specified data

```
ser <addr>..<addr>=<value>            - search for data value in range
ser -d<dtype> <addr>..<addr>=<value> - search with display option
ser <addr>..<addr>=<value>,<value>   - search for data sequence in
                                        range
ser <addr>..<addr>="CDE"             - search for string "CDE" in
                                        range
```

The **ser** command allows you to search memory for a data value, a character string, or a combination of both. For every pattern match, the starting address of the match is displayed.

Using the **-d** (display mode) option, the method of interpreting the pattern supplied by the user can be altered. If no option is given, the display mode used is taken from global default set by the **mo** command.

The parameters are as follows:

<addr>   Specifies first the lower, and possibly the upper, address boundaries of the memory range to search for the given data pattern. You can use "<addr>.." to specify the range from the address through the next 127 bytes.

<value>   Either a numeric expression or a string to be used as a reference pattern in the search.

Strings must be bounded by single open quote marks (') or double quotes (").

Note that many keyboards (and printers) represent the single open quote mark as an accent grave mark. In any case, the correct character is ASCII 60 hexadecimal. The correct double quote character is ASCII 22 hexadecimal.

Note that if the character string you are searching for contains double quotes, you must delimit the string with single open quotes and vice versa. For example, the string **"Type "C""** will return an error; the string **'Type "C"'** is correct.

-d<dtype>   Allows you to specify the display mode used for the search. The valid display modes are:

b   display size is 1 byte(s)

s   display size is 2 byte(s)

w   display size is 4 byte(s)

If addresses specified in the search reside in target system memory, the emulator is broken to the monitor and returned to the user program when the command is completed.

Note that you can concatenate various combinations of values to form more complex search patterns by separating the parameters with commas (**,**).

See Also   **cp** (used to copy the contents of one memory range to another)

m (used to display/modify memory locations)
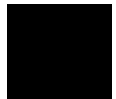
stty - set or display current communications settings

```
stty <port> <options>
```

Parameter	<options>
Parity	noparity, evenp, onep, zerop
Character Size	cs7, cs8
Baud	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800
Protocol	rs232, rs422
Stop Bits	1stopb, 2stopb
Request/Clear to Send	crts, -crts
Data Set/Terminal Rdy	cdsr, -cdsr
Start/Stop	xon, -xon
Line Terminator	onlcr, ocrnl, ocr, onl
Echo	echo, -echo
Data Term/Comm Equip	dte, dce

The **stty** command allows you to modify the parameters of the serial data communications port without changing the configuration switch settings.

The serial port, port A, may be modified by **stty**.

The powerup default configuration for the serial port are determined by the rear panel configuration switches; refer to the "Installation" chapter for more information.

The parameters are as follows:

rs232 rs422	RS-422 utilizes balanced transmission lines and therefore can achieve much higher data rates with reliability over long distances than RS-232. Otherwise, the interfaces are similar.
dte dce	The serial port may be set to operate either as Data Communications Equipment (DCE) or as Data Terminal Equipment (DTE). This configures the handshake lines and transmit/receive lines for the proper signal to pin relationships on the interface.
onlcr	Generate new-line and carriage-return on output.
ocrnl	Generate carriage-return and new-line on output.
ocr	Generate carriage-return on output.
onl	Generate new-line on output.
crts -crts	The option **crts** enables the Request To Send/Clear To Send handshake. Specifying **-crts** disables this handshake.
cdsr -cdsr	The option **cdsr** enables exchange and recognition of the Data Set Ready/Data Terminal Ready status lines. Specifying **-cdsr** disables the exchange.
xon -xon	If you specify **xon**, the system generates XON/XOFF (DC1/DC3 characters) software handshaking to control the amount of data received at a given time. Specifying **-xon** disables this handshake sequence. (When the emulator's receive buffer is full, it will send a DC3 (XOFF) character to the host to stop transmission; when it is ready for more data, it will send a DC1 (XON) character to restart transmission.) Note that if you toggle the **xon** parameter when running at 1200 baud and below, the **stty** command will return invalid characters. The PC Interface attempts to do this when starting up and fails with a datacomm error. To get around this problem, set switch 13 on the emulator's back panel (enable xon) to allow the PC Interface to start up successfully. In the Terminal Interface, just enter another carriage return to regain proper communications.
echo -echo	If you specify **echo**, all characters received by the emulator datacomm are echoed back to the sending system. Specifying **-echo** means the system will not echo back characters received. You will normally use this in conjunction with the echo settings required by your host computer and your terminal. Most Hewlett-Packard systems will require that you enable the echo feature, as HP host computers automatically echo characters back to data terminal devices.

For further information on the meanings of various data communications parameters, you may refer to the book entitled *Touring Datacomm: A Data Communications Primer.* This book is orderable from HP's Direct Marketing Division under the part number 5957-4622. Another book which may be helpful is *The RS-232 Solution*, orderable from HP under the product number 92234X. You also may need to refer to the hardware and software reference manuals that are supplied with your terminal and/or host computer for further information on required data communications parameters for links to those devices.

Examples

To display the current data communications settings:

```
M>stty
```

```
stty A 9600 cs8 1stopb noparity dce rs232 -crts cdsr -xon onlcr echo
```

To set the baud rate to 1200 baud:

```
M>stty 1200
M>stty
```

```
stty A 1200 cs8 1stopb noparity dce rs232 -crts cdsr -xon onlcr echo
```

sym - define, display or delete symbols

```
sym <name>        - display all or named symbols
sym -g <name>     - display all or named global symbol
sym -u <name>     - display all or named user symbol
sym -l            - display all local modules
sym -l <name>     - display symbols in local module
sym <name>=<addr> - define user symbol
sym -d            - delete all symbols
sym -du           - delete all user symbols
sym -du <name>    - delete named user symbol
sym -dg           - delete all global symbols
sym -dl           - delete all local symbols in all modules
sym -dl <name>    - delete all local symbols in module
```

The **sym** command defines, displays, or deletes symbols in the emulator. The **sym** command without any parameters displays all of the symbols currently defined.

Three types of symbols are supported: global, local, and user. Global symbols reference addresses anywhere in memory using an absolute reference. Local symbols also use absolute addressing but are grouped within a "module." User symbols are defined at the command line. Global and local symbols cannot be defined at the command line.

The definition of a module for grouping local symbols depends on the environment being used. For local symbols created by a high-level language, a module might be a function, a procedure, or a separately compilable source file. When you define local symbols through the use of a symbol file, a module, in effect, becomes a technique to manage the symbols. It can be a mnemonic device to refer to modules, or it can be a simple way to group local symbols into a set for display and deletion purposes since the **sym** command facilitates manipulation of local symbols by their module name.

Symbols are used like equated variables. When using symbols in expressions, only the + and **-** operators can be used immediately before and after the symbol name. The expression can contain literals and equated (**equ**) labels, but not other symbols.

When using symbols, if a symbol and an equated value have the same name, the equated value will be used.

The symbol table can be updated in three ways:

- You can enter user symbols at the command line.

- You can update it from an external "symbol file" using the **load -So** command.

- You can load an absolute file (such as an IEEE-695 file) which can contain symbols as well as program code.

A "symbol file" is a text file containing user-specified symbols.

The parameters are as follows:

<name>   This represents the symbol label to be defined or referenced. The format of the symbol name reference is determined by the type of symbol, where:

name	Is a user symbol or module name.
:name	Is a global symbol name.
name:	Is a local module name.
module:name	Is a symbol name in a local module.

In addition, symbols can be referenced using a "wild card" expression when displaying and deleting names. Only one wildcard character can appear in a symbol name. An asterisk ("*") character is used to represent zero or more characters at the end of a symbol name. A wildcard can be used in any of the following symbol types:

name*	Represents a user symbol name followed by zero or more of any character or characters.
:name*	Represents a global symbol name followed by zero or more of any character or characters.
module:name*	Represents a local module:symbol followed by zero or more of any character or characters.

<addr>   Specifies the value to assign to a user symbol.

-d   Deletes all symbols.

-du   Deletes user symbols. If a <name> parameter is not included, all user symbols are deleted. If a <name> parameter is included, only user symbols matching the entered name are deleted.

-dg   Deletes all global symbols. No option exists to delete one global symbol.

-dl   Deletes local symbols in a module. If a <name> parameter is not included, all local
                       symbols are deleted for all modules. If a <name> parameter is included to specify a
                       module name, only local symbols in the module matching the entered name are
                       deleted.

-g   Specifies the display of global symbols. If a <name> parameter is not included, all
                       global symbols are displayed. If a <name> parameter is included, only global
                       symbols matching the entered name are displayed.

-l   This option allows you to display local modules and symbols. If a <name>
                       parameter is not included, all local modules are displayed. If a <name> parameter is
                       included, only local symbols matching the symbol name or module are displayed.

-u   This option allows you to display user symbols. If a <name> parameter is not
                       included, all user symbols are displayed. If a <name> parameter is included, only
                       user symbols matching the entered name are displayed.

See Also   **equ** (used to equate names to expressions)

                       load (used to load a program file with symbols, or a symbol text file)

sync - synchronize emulator

```
sync sim   - sync cf_sim registers to M68340 sim registers
sync cf    - sync M68340 sim registers to cf_sim registers
sync diff  - show differences for M68340 and cf_sim registers
```

The **sync** command synchronizes the 68340's system integration module (SIM) registers to the emulator's **cf_sim** registers.

The parameters are as follows:

sim   Copies the 68340 SIM registers into the emulator's **cf_sim** registers.

cf   Copies the emulator's **cf_sim** registers into the 68340 SIM registers.

diff   Displays the differences between the 68340 SIM registers and the emulator's **cf_sim** registers.

See Also   **reg** (view or modify processor register contents)

t - start a trace

```
t - start an emulation trace
```

The **t** command starts an emulation traces. This command (or **tx** if making a synchronous CMB execution) must be entered to actually begin a measurement; most other trace commands are used only for specification of triggering, sequencer, and storage parameters; or to display trace results or status.

See Also   **r** (starts a user program run; normally will be specified after entering the **t** command)

th (halts a trace in process)

ts (allows you to determine the current status of the emulation analyzer)

tx (specifies whether a trace is to begin upon start of CMB execution)

x (begins synchronous CMB execution)
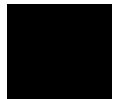
ta - current status of analyzer signals is displayed

```
ta
```

The **ta** command allows you to display the activity on each of the analyzer input lines. Each signal may be low (0), high (1), or moving (?).

Each pod (group of 16 lines) is displayed on a single line with bit 0 (LSB) at the far right and bit 15 (MSB) on the far left.
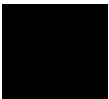
tarm - specify the arm condition

```
tarm  <signal>    - arm the emulation analyzer
```

The **tarm** command allows you to specify an arming condition for the emulation analyzer. You can specify the arm condition as the assertion of the trig1 or trig2 signals or as **tarm always**.

The trig1 or trig2 signals can be asserted from many sources including the analyzer itself or the rear panel BNC connector or the CMB. See **bnct**, **cmbt**, and **tgout** for examples.

The arm condition may be used in specifying the analyzer trigger or in specifying branch conditions for the sequencer, as well as count or prestore qualifiers.

If no parameters are supplied, the current **tarm** condition is displayed. The default setting after powerup or **tinit** is **tarm always**.

The parameters are as follows:

=trig1	The assertion of the trig1 signal will arm the analyzer.
=trig2	The assertion of the trig2 signal will arm the analyzer.
!=trig1	If the trig1 signal is asserted when the analyzer is started, the analyzer can never be armed.
	If the trig1 signal is not asserted when the analyzer is started, the analyzer is armed immediately.
!=trig2	If the trig2 signal is asserted when the analyzer is started, the analyzer can never be armed.
	If the trig2 signal is not asserted when the analyzer is started, the analyzer is armed immediately.
always	The analyzer is always armed.

See Also   **bc** (can be used to cause the emulator to break to the monitor upon receipt of the trig1 and/or trig2 signals)

bnct (used to define connections between the internal trig1 and trig2 signals and the rear panel BNC connector)

cmbt (used to define connections between the internal trig1 and trig2 signals and the CMB trigger signal)

tgout (defines whether or not the trig1 or trig2 signals are driven when the analyzer finds the trigger state)

tcf - set or display trace configuration

```
tcf                - display trace configuration
tcf -c             - set complex trace configuration
tcf -e             - set easy trace configuration
```

The **tcf** command is used to set the configuration for the emulation analyzer. There are two possible configurations for the analyzer, an easy configuration (**tcf -e**) and a complex configuration (**tcf -c**).

The easy configuration hides some of the complexity of the analyzer sequencer and makes it easy to use. The complex configuration gives you greater capability when using the sequencer and gives you greater flexibility when using expressions to qualify states.

In the easy configuration, you can insert up to five sequence terms in the sequencer. The branch out of the last sequence term constitutes the trigger.

In the complex configuration, there are always eight terms in the sequencer. Any of the sequence terms except the first may be specified as the *trigger term*. Entry into the trigger term constitutes the trigger.

In the complex configuration, up to eight pattern resources and one range resource may be used in trace commands wherever state qualifier expressions are used in the easy configuration. These patterns are grouped in to sets and may be combined with set operators to specify more complex qualifiers.

If no parameters are supplied, the current analyzer configuration is displayed. After powerup or **tinit**, the default analyzer configuration is **tcf -e**.

The parameters are as follows:

-e   Sets the analyzer to the easy configuration.

-c   Sets the analyzer to the complex configuration.

See Also   **tarm** (used to set the analyzer arm specification; this specification can only be used in analyzer expressions in complex configuration)

telif (sets the global restart in easy configuration, secondary branch condition in complex configuration)

tg (used to set a trigger expression in either analyzer configuration)

tif (sets primary branch specification in either analyzer configuration)

tpat (used to label complex analyzer expressions with a pattern name; the pattern name is then used by the analyzer setup commands. Only valid in complex configuration)

tpq (specifies trace prestore qualifier in either analyzer configuration)

trng (defines a range of values to be used in complex analyzer expressions)

tsto (specifies a qualifier to be used when storing analyzer states)

tsq (used to modify the trace sequencer's number of terms and trigger term)

tck - set or display clock specification for the analyzer

```
tck -r <clock>     - clock analyzer on rising edge of clock
tck -f <clock>     - clock analyzer on falling edge of clock
tck -x <clock>     - clock analyzer on either edge of clock
tck -l <clock>     - qualify on low level of clock
tck -h <clock>     - qualify on high level of clock
tck -b             - qualify when emulation in background
tck -u             - qualify when emulation in user
tck -s <speed>     - define the clock speed
```

The **tck** command allows specification of clock qualifiers and master edges of the master clocks used for the emulation analyzer.

The **tck** command is included with the system for the purpose of internal system initialization and system control through high-level software interfaces.

You should ONLY use the **tck** command when you wish to trace background execution. In other words, **do not change the the "tck -r L" setting**.

The parameters are as follows:

<clock>   Three clock signals are defined: L, M, and N.

               The L, M, and N clocks are generated by the emulator. The L clock is the emulation clock derived by the emulator, the N clock is used as a qualifier to provide the user/background tracing options (**-u** and **-b**) to **tck**, and the M clock is not used.

r   The analyzer is clocked on the rising edge of the indicated clock signal.

f   The analyzer is clocked on the falling edge of the indicated clock signal.

x   The analyzer is clocked on both the rising and falling edges of the indicated clock signal.

l   Qualifies the analyzer clock so that the analyzer is only clocked when this clock signal is low (less positive/more negative voltage).

h   Qualifies the analyzer clock so that the analyzer is only clocked when this clock signal is high (more positive/less negative voltage).

-b   The analyzer is only clocked when the emulator is executing in background (in other words, the background monitor).

-u   The analyzer is only clocked when the emulator is executing in foreground (in other
                            words, the user program or foreground monitor). This is the default.

-s <speed>   Specifies the maximum qualified clock speed. The <speed> parameter can be:

                            S   SLOW, less than or equal to 16 MHz.

                            F   FAST, between 16 MHz and 20 MHz.

                            VF   VERY FAST, between 20 MHz and 25 MHz.

                            Changing the clock speed affects the **tcq** command parameters. When speed is set
                            to **S** (slow), the **tcq** command may either count states or time. When speed is set to
                            F (fast), the **tcq** command may be used to count states but not time. If clock speed
                            is set to **VF** (very fast), **tcq** cannot count either state or time and should be set to
                            tcq none.

                            If no parameters are specified, the current clock definitions are displayed. After
                            powerup or **tinit**, the **-u** option is always set.

                            When several clock edges are specified with the **-r**, **-f**, or **-x** options, any one of the
                            edges clocks the given trace. If several qualifiers are specified with the **-l** or **-h**
                            options, they are ORed so that the trace is clocked when any of the qualifiers are
                            met.

                            Note that the **-u** and **-b** qualifiers are ORed with all of the other qualifiers specified.

See Also   **tcq** (specifies the trace count qualifier as states, time, or none. The maximum
                            qualified clock speed set by **tck -s** affect which **tcq** parameters are valid.)

                            tsck (used to define slave clock signals used by the analyzer; **tck** defines the master
                            clock signals. Default mode for **tsck** is off on all pods.)

tcq - set or display the count qualifier specification

```
tcq           - display count qualifier specification
tcq time      - define count on time
tcq <expr>    - define count on state
```

The **tcq** command allows you to specify a qualifier for the emulation trace tag counter.

When the tag counter is active, the analyzer counts occurrences of the expression you specify (which may include simple or complex expressions (depending on analyzer configuration), **time**, or **none**). Each time a trace state is stored, the value of the counter is also stored and the counter is reset. The tag counter shares trace memory with stored states, so only half as many states can be captured by the analyzer when the tag counter is active. (The analyzer can store 1024 states with **tcq none**, 512 states otherwise.)

If no parameters are given, the current count qualifier is displayed. Upon powerup or after **tinit** initialization, the clock qualifier defaults to the state **tcq time**.

The parameters are as follows:

time
: If you specify **time** rather than an analyzer expression, the trace tag counter measures the amount of time between stored states.

Note that the **tcq time** qualifier is only available when the analyzer clock speed is set to the slow (**S**) speed setting (default). If the clock speed is set to very fast (**VF**), then trace tag counting must be turned off by specifying **tcq none**. Refer to the **tck** command (analyzer clock specification) for further information.

<expr>
: State qualifier expression. Refer to the <expr> description in this chapter.

Note that the count qualifier **tcq arm** is not permitted in any configuration.

See Also
: **tck** (used to specify the clock source and clock parameters for the analyzer)

tp (specifies position of the trigger within the trace; note that **tcq** affects the number of states the analyzer can store and therefore may affect trigger positioning)

tpat (assigns analyzer expressions to pattern names in complex configuration; the pattern names are then used to specify qualifiers in other analyzer commands such as **tcq**)

trng (specifies a range of values to be used as a complex mode qualifier; this range definition can be used as a count qualifier by **tcq**)

tsq (used to manipulate the trace sequencer)

telif - set or display secondary branch specification

In the easy configuration:

```
telif              - display global restart specification
telif <expr>       - define global restart specification
```

In the complex configuration:

```
telif              - display all secondary branch specifications
telif X            - display secondary branch specification X
telif X <expr>     - define secondary branch specification X
telif X <expr> Y   - secondary branch X will jump to Y (default next
                     term)
```

The **telif** command allows you to set the global restart qualifier (in easy configuration) for the emulation analyzer sequencer. In complex configuration, **telif** lets you set the secondary branch qualifier for each term of the emulation analyzer sequencer.

Note that the **telif** command is used as a global restart qualifier in easy configuration and a secondary branch qualifier in complex configuration. The hierarchy of the **tif** and **telif** commands is such that either branch will be taken if found before the other; however, if both branches are found simultaneously, the **tif** branch is always taken over the **telif** branch.

When in easy configuration, the sequencer will restart by jumping to sequencer term number one (1) when the expression specified by **telif** occurs.

When in complex configuration, the sequencer will branch to the sequencer level specified by the Y parameter when the expression specified is found. There are always eight sequencer terms available. Position of the trigger term is defined with the **tsq** command. If both the **tif** and **telif** expressions are satisfied simultaneously, the **tif** branch is taken; otherwise, branching occurs according to which expression is first satisfied.

The parameters are as follows:

<expr>   State qualifier expression. Refer to the <expr> description in this chapter.

X   Specifies a sequence term number to associate with the given <expr>. When you associate a term number with a complex expression, that expression is only used as a secondary branch qualifier at the sequencer level specified by the term number. If

you specify X without an expression, the secondary branch qualifier currently associated with that term number is displayed.

Y   Specifies the branch destination when <expr> is found. For example, if you wish to have the sequencer branch from term 1 to term 3 after the expression is found you would be specified as **telif 1 <expr> 3**. If you do not specify a term number, the default is to increment the sequencer level (**telif X <expr> (X+1)**).

If **telif** is entered with no parameters, the global restart qualifier or secondary branch qualifiers (depending on analyzer configuration) for all sequencer levels are displayed. If **telif** is entered with only an X parameter in complex configuration, the secondary branch qualifier for only that term number is displayed.

Upon initialization via a powerup sequence or the **tinit** command, the secondary branch specifiers are set to **telif never**.

Note that the default branch to condition for sequence term 8 is 8; that is, branch to the same term.

Note that if the **tif** expression for the given sequence term X has a <count> parameter other than one (1), the counter is reset to zero (0) if the **telif** branch is taken before the occurrence counter parameter is satisfied. For example, if the **tif** counter parameter is 7, and the **tif** expression has been found 5 times, then the **telif** expression is satisfied, the **telif** branch will be taken and the **tif** counter will be reset from 5 to 0. This might cause you difficulty if you happen to have **telif** branching back to the same term; your occurrence condition may or may not be satisfied.

See Also   **tarm** (allows you to specify that the **trig1** or **trig2** signal will arm the analyzer. This arm condition can then be used as part of the secondary branch qualifier)

tcf (used to select whether the analyzer is operated in easy configuration or complex configuration)

tif (used to specify a primary branch specification for the analyzer)

tg (used to set up a simple trigger qualifier in either analyzer configuration. Specifying the **tg** command overrides the current sequencer specification and will modify the existing **telif** qualifier stored in sequence term number 1)

tpat (used to assign pattern names to simple expressions for use in specifying complex expressions. These complex expressions are used to specify **telif** qualifiers in analyzer complex configuration)

trng (used to set up an expression which assigns a range of values to a range variable. This range information may be used in specifying complex **telif** qualifiers)

tsto (specifies a global trace storage qualifier in both easy & complex configurations; also specifies a trace storage qualifier for each sequencer term in complex configuration. Used to control the types of information stored by the analyzer)

tsq (used to manipulate the trace sequencer)

tf - specify trace display format

```
tf                        - display current format
tf <label>,<base>         - display the label in the specified base
tf mne                    - disassembled mnemonic
tf count                  - count, absolute (relative to trigger)
tf count,a                - count, absolute (relative to trigger)
tf count,r                - count, relative to preceding state
tf seq                    - sequencer state change
tf mne <label>,<base> count count,r seq
                          - multiple fields may be specified
tf addr,H mne count,r seq - default format
tf addr,<base>,<width>    - column width (addr column only)
```

The **tf** command allows you to specify which pieces of information from the
emulation analyzer trace will be displayed by **tl** (trace list) commands. Each label
represents a column in the trace list display.

The parameters are as follows:

<label>   A label defined with the **tlb** command. The analyzer bits associated with that label
                 will be displayed in a column of the trace listing.

<base>   Specifies the numeric base in which <label> is to be displayed. The choices are **Y**
                 (binary), **Q** or **O** (octal), **T** (decimal), **H** (hexadecimal), or **A** (ASCII). The
                 specifiers are not case sensitive. In ASCII mode, non printing characters are
                 displayed as periods (.). If <base> is not specified, the default base is hexadecimal.

mne   Displays mnemonic information about a state. Depending on the trace list
                 disassembler options (see **tl -o**), disassembled instructions may be displayed in this
                 column. To ensure correct operation of **mne**, the predefined labels **addr**, **data**, and
                 stat must not be redefined.

count   Absolute time counts are displayed. That is, the the time shown for each state is
count,a   relative to the trigger state.

count,r   Relative time counts are displayed. That is, the time count shown for each state is
                 relative to the previous state.

seq   If you specify **seq**, a "+" is displayed in the seq column for each state that causes
                 the sequencer to branch from one term to another.

<width>   This option allows you to set the width of the column for the "addr" predefined
                 trace label to values from 4 to 50. A wider address field is useful when displaying
                 symbols in the trace list.

The minimum width is really defined by the base of the "addr" column. For example, if the 32-bit address is displayed in binary, the minimum width is 32.

Note that changing the trace format DOES NOT change the type of information captured by the analyzer; it only specifies how the captured data should be displayed.

See Also   **tl** (displays the current data in emulation trace memory according to the specifications set up by **tf**)

tlb (define labels which represent groups of emulation analyzer input lines; these labels may be used to create special trace list displays by including the labels in the **tf** definition)

tg - set and display trigger condition

```
tg                  - display sequence term 1 primary branch
tg <expr>           - define trigger
tg <expr> <count>   - define trigger and occurrence count
```

The **tg** command sets a trigger condition for the emulation analyzer. When the expression specified occurs the number of times specified, the analyzer triggers.

The parameters are as follows:

<expr>   State qualifier expression. Refer to the <expr> description in this chapter.

<count>   Specifies the number of times the expression must occur before the trigger condition is satisfied. The <count> value specified must be from 1 to 65535. The default number base for <count> is decimal. If <count> is not specified, the occurrence count is 1.

If no parameters are specified, the current primary branch condition for sequencer term 1 is displayed. Note that this is not necessarily the trigger condition if other sequence terms are used. After powerup or **tinit** initialization, **tg** is set to **tg any**.

The **tg** command modifies the current analyzer sequence specification. The manner in which the sequencer is modified is dependent upon the analyzer configuration.

If the analyzer is in easy configuration (**tcf -e**), the sequencer is reduced to a one term sequence triggering upon exit from term 1. The global restart qualifier is set to never (**telif never**); the primary branch condition is set to the specified trigger expression (**tif 1 <expr> <count>**).

If the analyzer is in complex configuration (**tcf -c**), the sequencer is modified to trigger upon entrance to the second sequence term (**tsq -t 2**), the secondary branch qualifier is set to never (**telif 2 never**), and the primary branch qualifier for term number 1 is set to the specified expression (**tif 1 <expr> 2 <count>**).

The analyzer storage qualifier (**tsto**) is not affected in either configuration; therefore, the analyzer uses the storage qualifier from the most recent **tsto** command.

See Also   **bc** (allows you to break the emulator to the monitor when various conditions occur; you can have the emulator break upon analyzer trigger by specifying **tgout trig1** and **bc -e trig1** (or you could use the trig2 signal to perform the same function))

t (starts an emulation trace)

tarm (used to specify an analyzer arm condition; the analyzer will not trigger until the arm condition is received if you specify **tg arm**)

tcf (used to specify whether the analyzer is operated in easy or complex configuration)

tpat (used to assign pattern names to simple analyzer expressions; the pattern names are then used in creating complex analyzer expressions which could be used with the **tg** command to trigger the analyzer)

trng (used to specify a range of values for a particular group of analyzer lines; this range may be used in specifying complex analyzer expressions for triggering the analyzer)

tsto (specifies which states encountered by the analyzer should be stored in trace memory)

tsq (used to manipulate the trace sequencer. Note that the sequencer's current status is affected by the **tg** command.)

tgout - specify signals to be driven by the analyzer

```
tgout  <signal>    - find trigger then drive signal
```

The **tgout** command allows you to specify which of the internal trig1 and/or trig2 signals will be driven when the emulation analyzer finds its trigger condition.

The parameters are as follows:

<signal>   Specifies the internal signal to drive when the trigger is found. This signal can be:

      trig1   The trig1 signal is driven by the analyzer when the trigger state is found.

      trig2   The trig2 signal is driven by the analyzer when the trigger state is found.

      trig1,trig2   Both trig1 and trig2 should are driven when the analyzer trigger is found.

      none   Neither the trig1 nor trig2 signals are driven when the analyzer finds its trigger state.

If no parameters are specified, the current state of **tgout** is displayed. Upon powerup or **tinit**, the default state is **tgout none**.

Note that if the analyzer is receiving trig1 or trig 2 via the **tarm** command, then that signal cannot be driven, although no error message will be issued to that effect.

See Also   **bc** (allows you to specify a break to emulation monitor when the tgout condition is satisfied)

bnct (specifies whether or not trig1 and trig2 are used to drive and/or receive the rear panel BNC connector signal line)

cmbt (specifies whether or not trig1 and trig2 are used to drive and/or receive the CMB trigger signal)

tarm (used to specify that the analyzer will be armed upon assertion or negation of trig1 or trig2)

th - halt the trace

```
th          - halt the emulation trace
th -w       - suppress output and errors
```

The **th** command stops an emulation trace.

The parameters are as follows:

-w   Suppresses the output and errors. In other words, "Emulation trace halted" is not
shown.

The analyzer will stop driving the **trig1** and **trig2** signals when the trace is halted.
This may cause you difficulty in making measurements with instruments connected
to the BNC. For example, if you set the analyzer to drive **trig1** (**tgout trig1**) when
the trigger condition is found, then drive this to the BNC connector with **bnct -d
trig1**, the BNC signal will be driven high when the analyzer finds its trigger while a
trace is in progress; it will fall low when the trace finishes.

You should start the trace after you have begun the external instrument's
measurement. Otherwise, the following measurement errors may occur, depending
on the type of external instrument you are using:

• With an edge sensitive instrument, starting the instrument after the analyzer
trigger is found will mean that the instrument never sees the transition of the
trig1 line and therefore never triggers.

• With a level sensitive instrument, starting the instrument after the analyzer
trigger is found will mean that the instrument triggers immediately; although
many states of interest have probably already passed.

Note that if the analyzer trigger specification has not been found, you will need to
use the **th** command to halt the analyzer before you can display the trace list.

See Also   **t** (used to start an analyzer trace)

ts (allows you to determine the current status of the emulation analyzer)

tx (starts an analyzer trace upon receipt of the CMB execute signal)

x (starts a synchronous CMB execution)

tif - set or display primary sequence branch specifications

In the easy configuration:

```
tif                      - display all primary branch specifications
tif X                    - display primary branch X specification
tif X <expr>             - define primary sequence branch X
tif X <expr> <count>     - branch X jump to next term after count times
```

In the complex configuration:

```
tif                      - display all primary branch specifications
tif X                    - display primary branch X specification
tif X <expr>             - define primary sequence branch X
tif X <expr> Y           - define primary sequence branch X jump to Y
tif X <expr> Y <count>   - define branch X jump to Y after count times
```

The **tif** command allows you to set the primary branch qualifier for each term of the emulation analyzer sequencer.

The parameters are as follows:

X
Specifies the sequence term whose primary branch qualifier is to be modified with the <expr> state qualifier. If you specify X without an expression, the **tif** qualifier for that term number is displayed.

<expr>
State qualifier expression. Refer to the <expr> description in this chapter.

<count>
Specifies the number of times the expression must occur before the trigger condition is satisfied. The <count> value specified must be from 1 to 65535. The default number base for <count> is decimal. If <count> is not specified, the occurrence count is 1.

Note that, in the complex configuration, if you specify the <count> parameter, you must also specify a Y parameter. If you omit the Y parameter when specifying <count>, the system will interpret the count as "branch to term" information; if greater than eight (8), an error will be returned; otherwise, you will have just specified an incorrect branch.

Y
Specifies the branch destination when the state qualifier is found. For example, if you wish to have the sequencer branch from term 1 to term 3 after the expression is found, this would be specified as **tif 1 <expr> 3**. If you do not specify a term number, the default is to increment the sequencer level (**tif X <expr> (X+1)**).

If **tif** is entered with no parameters, the primary branch qualifiers for all sequencer levels are displayed. If **tif** is entered with only an X parameter, the primary branch qualifier for only that term number is displayed.

Upon initialization via a powerup sequence or the **tinit** command, the primary branch specifiers are set to **tif X any (X+1)**.

Note that the **telif** command is used as a global restart qualifier in easy configuration and a secondary branch qualifier in complex configuration. The hierarchy of the **tif** and **telif** commands is such that either branch will be taken if found before the other; however, if both branches are found simultaneously, the **tif** branch is always taken over the **telif** branch.

When in easy configuration, the sequencer will increment to the next sequencer level when the expression specified by **tif** occurs the number of times specified by the <count> parameter. There is a maximum of five sequence levels; only one is available at initialization. If you require more sequencer levels, you must insert them with the **tsq** command. (The term you are specifying a primary branch for with the **tif** command must be present in the sequence.) The branch out of the last sequencer term constitutes the trigger.

When in complex configuration, the sequencer will branch to the sequencer level specified by the Y parameter when the expression specified occurs the number of times indicated in the <count> parameter. There are always eight sequencer terms available. Position of the trigger term is defined with the **tsq** command.

Note that, in the complex configuration, at sequencer term number 8, the default branch to condition is also term 8; that is, branch to the same term.

See Also   **tarm** (allows you to specify that the **trig1** or **trig2** signal will arm the analyzer. This arm condition can then be used as part of the primary branch qualifier)

tcf (used to select whether the analyzer is operated in easy configuration or complex configuration)

telif (used to specify a secondary branch specification for the analyzer)

tg (used to set up a simple trigger qualifier in either analyzer mode. Specifying the **tg** command overrides the current sequencer specification and will modify the existing **tif** qualifier stored in sequence term number 1)

tpat (used to assign pattern names to simple expressions for use in specifying complex expressions. These complex expressions are used to specify **tif** qualifiers in analyzer complex configuration)

trng (used to set up an expression which assigns a range of values to a range variable. This range information may be used in specifying complex **tif** qualifiers)

tsto (specifies a global trace storage qualifier in both easy and complex configurations; also specifies a trace storage qualifier for each sequencer term in complex configuration. Used to control the types of information stored by the analyzer)

tsq (used to manipulate the trace sequencer)

tinit - initialize emulation analyzer to powerup defaults

```
tinit
```

The **tinit** command restores all trace specification items to their powerup default values which are as follows:

Trace Specification	Default Value
Analyzer arm	tarm always
Trace Configuration	tcf -e
Analyzer master clocks	tck -r L -u -s VF
Trace format	tf addr mne count,r
Trace trigger	tg any tgout none
Analyzer signal line labels	#### Emulation trace labels tlb addr 0..31 tlb data 32..47 tlb stat 64..79
Trigger Position	tp s
Trace Prestore Qualifier	tpq none
Trace sequencer (includes branch and store conditions)	tif 1 any tsto all telif never
Trace slave clocks	tsck -o 1 tsck -o 2 tsck -o 3 tsck -o 4 tsck -o 5
Trace Upon Execute?	tx -d # ignore the execute signal

See Also   **init** (used to initialize selected portions of the emulator or the entire emulator, dependent on the options given)

tl - display trace list

```
tl                - display next states
tl *              - display all states
tl 10..20         - display states 10 through 20
tl -d -15..3      - display states -15 through 3, disassembled
tl -d -ol -8      - disassemble starting from low-order word of
                    state -8
tl -d -od 5..25   - display states 5 through 25, disassembled
                    and dequeued
tl -d -od 50 62   - display dequeued disassembly, disassembling opcodes
                    from state 50 and aligning operands from state 62
tl -on            - display non-dequeued disassembly (turn off
                    option -od)
tl -oi -10..10    - display instructions only (no operand cycles shown)
tl -oa -10..10    - display instructions and operands (turn off
                    option -oi)
tl -e             - display states with symbols and addresses
tl -s 10..30      - display states with symbols only (no addresses
                     shown)
tl -a             - display states with addresses only (no symbols
                    shown)
tl -n 3           - display next 3 states
tl -t 123         - display top 123 states
tl -h             - display next states, no header
tl -b             - upload binary trace list
```

The **tl** command allows you to display the current emulation analyzer trace list information.

If the trigger specification has not yet been satisfied, the trace list cannot be displayed until the trace in progress is halted with the **th** command. Entering the **tl** command before the trace is halted results in the message "**** Trigger not in memory ****."

If the analyzer was halted before any states were captured, the message "**** No trace data ****" is displayed upon entry of the **tl** command.

The parameters are as follows:

-d   Disassemble instructions in the trace.

-s   Display symbols in the address column.

-a   Display absolute addresses in the address column. This is the default.

-e   Display symbols and absolute addresses in the address column.

-h   Suppresses the display of column headers.

-n	Display the next number of states of the trace. If you do not specify a number, the same number of states will be displayed as the last time you used **tl** to display part (but not all) of the trace.
-o \<opts\>	Specify disassembler options for the inverse assembly of information in the mne column. The valid disassembler options are:

l	Disassemble starting from the low order word.
d	Disassemble and dequeue the trace.
n	Display non-dequeued disassembly (turn OFF **-od**).
i	Display instruction cycles only (no operand cycles are shown).
a	Display instruction and operand cycles (turn OFF **-oi**).

-t	Displays the top number of states of the trace. If you do not specify a number, the number of states displayed is the same number as the last time **tl** was invoked to display part (but not all) of the trace.
-b	Dumps the trace list in binary format using the HP 64000 **transfer** protocol.
	Note that the **-h** and **-d** options cannot be used with the **-b** option.
\<align_operand _state\>	The first state or state range specifies the trace states that should be displayed. The second state specifies the state from which the operands should be aligned.
	If no parameters are given, the trace list is displayed starting with the first state that has not yet been displayed. The number of states displayed is identical to the number of states displayed by the last **tl** command. For example, if the last trace list display was **tl -t 5**, then the next **tl** command will start the display at state 6 and display a total of five states.
	Note that the HP 64700 remembers the last option specified for the address field (**-s**, **-a**, or **-e**), and uses it for the next **tl** command if no other option is specified.

See Also	**t** (starts an analyzer trace)
	tf (specifies the display format for the trace)
	th (halts a trace in process)

tlb (defines analyzer signal line labels; these may be used by **tf** in specifying the trace list display format)

ts (allows you to determine the current status of the emulation analyzer)

tlb - define and display trace labels

```
tlb addr 0..15          - define addr, positive polarity, bits
                          0 through 15
tlb data 16..23         - define data, positive polarity, bits
                          16 through 23
tlb stat 24..31         - define stat, bits 24 through 31
tlb stat 31..24         - define stat, bits 24 through 31;
                          31..24 is the same bit range as 24..31
tlb -n LRESET 25        - define LRESET, negative polarity, bit 25
tlb -d LRESET           - delete named label
tlb -d *                - delete all labels
tlb addr                - display named label
tlb                     - display all labels
```

The **tlb** command allows you to define new labels for emulation analyzer lines, as well as display or delete previously defined analyzer labels.

The parameters are as follows:

-d   Delete the named label. If the label is currently used in a trace specification or in the trace display format (tf command), it will not be deleted until removed from all of the specifications. If * is used, all labels are deleted.

-n   Defines the named label with negative polarity. That is, after label definition, bits that are a one (1) refer to a signal lower than the threshold voltage and bits that are a zero (0) refer to a signal higher than the threshold voltage. If **-n** is not specified, the named label defaults to positive polarity.

If no parameters are specified, the current label definitions are displayed. Upon emulator powerup, or after a **tinit** command, the following labels are defined:

```
M>tlb
  #### Emulation trace labels
  tlb addr 0..31
  tlb data 32..47
  tlb stat 64..79
```

Note that the predefined emulation trace labels are special labels, used for trace list disassembly. They should not be changed or deleted.

In emulation analyzer labels, no more than 32 signal lines may be assigned to a given label. Also, an emulation analyzer label may not cross more than a multiple of 16 boundary. For example, a label cannot be defined for emulation analyzer lines 15..32 since one multiple of 16 boundary is crossed from 15 to 16 and another boundary is crossed from 31 to 32.

Labels are made up of alphanumeric characters; upper and lower case are distinguished. Labels can be up to 31 characters in length.

Labels can be made to overlap; for example, you may wish to define a label for a particular status line or data bit so that you can easily track its state in the trace list.

The number of labels that can be defined is limited only by system memory.

See Also   **tf** (used to specify the trace list format; **tlb** <LABEL> definitions can be specified as output columns in the trace listing through the **tf** command)

tpat (trace pattern definition; labels defined in **tlb** can be used in pattern definitions)

trng (trace range, used to specify a range of valid values to be used in a trace specification; labels defined by **tlb** may be used in defining the trace range)

tp - set and display trigger position within the trace

```
tp                 - display trigger position
tp s               - trigger position start of the trace
tp c               - trigger position center of the trace
tp e               - trigger position end of the trace
tp -b <offset>     - trigger is offset states from beginning of trace
tp -a <offset>     - trigger has offset states after the trigger
```

The **tp** command allows you to specify where the trigger state will be positioned within the emulation trace list.

The position number specified has an accuracy of +/- 1 state when counting states or time; when counts are turned off, the accuracy is +/- 3 states.

The parameters are as follows:

s   The trigger is positioned at the start of the trace list.

c   The trigger is positioned at the center of the trace list.

e   The trigger is positioned at the end of the trace list.

-b   Indicates that the trigger is to be placed in the trace list with <offset> number of states before the trigger position to the beginning of the trace.

-a   Indicates that the trigger is to be placed in the trace list with <offset> number of states after the trigger position to the end of the trace.

<offset>   A decimal value from 0 to 1023.

If no parameters are supplied, the current trigger position setting is displayed. Upon powerup or after **tinit**, the trigger position is **tp s**.

See Also   **tg** (defines the trigger expression)

tl (used to display the trace list)

tsq (used to specify the trigger position within the trace sequencer; reference the sequencer operation when deciding where to position the trigger in the trace list, if you want to capture all of the sequence conditions)

tpat - set and display pattern resources

```
tpat                                - display all patterns
tpat <pattern>                      - display named patterns
tpat <pattern> <label>=<value>      - equals pattern
tpat <pattern> <label>!=<value>     - not equals pattern
tpat <pattern> <label>=<value> and <label>=<value>
tpat <pattern> <label>!=<value> or <label>!=<value>
```

The **tpat** command allows you to assign pattern names to simple emulation analyzer expressions. These pattern names are then used in building complex expressions for other analyzer commands.

The **tpat** command is only valid in the complex analyzer configuration (**tcf -c**).

The parameters are as follows:

<pattern>   One of the pattern names **p1** through **p8**.

<label>   A trace label that is currently defined with the **tlb** command.

<value>   Values are numeric constants, equates, or symbols. Also, values can be the result of constants, equates, and symbols combined with operators. Refer to the <value> description.

If no parameters are given, or if the pattern name is given as *****, all eight of the current pattern assignments are displayed. If one of the pattern names is given, the expression assigned to that pattern is displayed.

Upon entering complex configuration after powerup or a **tinit** initialization, all eight patterns are defined as **tpat <pattern> any**.

See Also   **tcf** (defines whether the analyzer is in easy configuration or complex configuration; the **tpat** command is only valid in complex configuration)

telif (specifies a secondary branch qualifier in analyzer complex configuration; **tpat** patterns may be used in qualifier specification)

tg (used to specify a simple trigger in either easy configuration or complex configuration; **tpat** patterns may be used in complex configuration trigger specification)

tif (used to specify a primary branch qualifier in either analyzer configuration; **tpat** patterns may be used in complex configuration branch specifications)

tpq (specifies a trace prestore qualifier; **tpat** patterns may be used in qualifier specification)

trng (defines a range of values on a set of analyzer input lines; this range may be used in conjunction with the patterns defined by **tpat** in setting up complex analysis qualifiers)

tsq (used to manipulate the trace sequencer)

tsto (used to define global storage qualifiers in both analyzer configurations; may also be used to define storage qualifiers for each sequencer level in complex configuration. The patterns defined by **tpat** may be used in complex configuration storage qualifier definition.)

tpq - set or display prestore specification

```
tpq               - display prestore specification
tpq <expr>        - set prestore specification
```

The **tpq** command allows you to specify a prestore qualifier for the emulation trace.

During the trace, the analyzer fills a two stage pipe with states that satisfy the prestore qualifier. Each time a trace state is stored into the trace buffer, the prestore qualifier is also stored and then cleared. Therefore, up to two prestore events may be stored for each normal store event; the prestore events in the trace buffer will correspond to the most recent states that satisfied the prestore qualifier immediately prior to a store event but following the previous store event.

The parameters are as follows:

<expr>   State qualifier expression. Refer to the <expr> description in this chapter.

If no parameters are given, the current prestore qualifier setting is displayed. Upon powerup or after **tinit** initialization, the prestore qualifier defaults to **tpq none**.

See Also   **tcf** (specifies whether the analyzer is to operate in easy configuration or complex configuration)

tsq (used to manipulate the trace sequencer)

tsto (used to specify a global storage qualifier for both easy configuration and complex configuration; also used to specify individual sequence term storage qualifiers in complex configuration)

trng - set or display range pattern

```
trng                          - display range
trng <label>=<value>..<value> - define range
```

The **trng** command lets you specify a range of acceptable values for an emulation trace label. This range may then be used in complex qualifiers for the trace specification. The **trng** command is only available in the analyzer's complex configuration (see **tcf** syntax pages).

There is no need for a not equals operator in specifying ranges, as the trace specification commands which allow "range" as a parameter also accept "not range" in the form **!r**.

The parameters are as follows:

<label>   A trace label that is currently defined with the **tlb** command.

<value>   Values are numeric constants, equates, or symbols. Also, values can be the result of constants, equates, and symbols combined with operators. Refer to the <value> description.

If no parameters are supplied, the current range definition is displayed. After powerup or **tinit** initialization, the **trng** command is set to **trng any**. (Note that **trng** is not directly available after analyzer initialization; the analyzer is set to easy configuration when initialized. You must then switch to complex configuration to access **trng**.)

Ranges can be specified that encompass more bits than the number of bits defined for the specified label.

Note that the **tcf -e** (set trace configuration to easy) command also will reset **trng**. In other words, any **trng** defined when the analyzer was in complex configuration is destroyed when the analyzer is set to easy configuration; you cannot return to complex configuration and use the old **trng**.

See Also   **tcf** (sets analyzer to complex or easy configuration; analyzer must be in complex configuration to utilize the **trng** command)

telif (specifies the sequencer secondary branch expression; in complex configuration, this expression can include references to the range)

tg (specifies analyzer trigger; may trigger on references to range)

tif (specifies the sequencer primary branch expression; in complex configuration, branch expression may include range qualifier)

tpat (trace pattern definition; assigns pattern names to simple expressions for later use in analyzer specifications. **tpat** essentially commits only one pattern to a label; whereas **trng** allows a range of values to be assigned to the range pattern)

tpq (defines trace prestore qualifier; the range specification may be used in complex configuration prestore qualifier expressions)

tsq (trace sequencer definition)

tsto (defines trace storage qualifier; that is, specifies exactly what states are actually to be stored by the analyzer. In complex configuration, this can include states that fall within the specification defined by **trng**)

ts - display status of emulation trace

```
ts          - display complete emulation trace status
ts -w       - display short status
```

The **ts** command allows you to determine the current status of the emulation analyzer.

The parameters are as follows:

-w   The **-w** option indicates that the trace status should be printed in whisper mode; this gives an abbreviated version of the status. See "Whisper Mode Trace Display" below for interpretation of the whisper status information.

Trace Status Display

The emulation trace status is displayed in the following form:

```
---Emulation Trace Status---
(NEW) [User | CMB ] trace [complete | halted | running ]
Arm [ ignored | (not) received ]
Trigger (not) found
Arm to trigger armcount
States visible (history) first..last
Sequence term term
Count remaining count
```

trace

The first line of the trace status indicates the initiator of the trace, whether the trace is completed, running, or halted, and whether or not this trace has been displayed.

NEW   This trace has not been displayed. The **tl** command will clear this flag until the next trace is started. Halting a trace that is running (as opposed to complete), marks the trace as being NEW even though the trace may have been displayed while running. The next **tl** command with no options will list the trace from the top.

User   The operator initiated this trace with the **t** command.

CMB   This trace was initiated by a /EXECUTE pulse on the CMB after a **tx** command was entered.

complete   The trace has found its trigger and completed.

halted   The trace was halted in response to a **th** command.

running   The trace is still running; either the complete sequencer specifications have not yet been satisfied; or not enough qualified store states have been found to fill trace memory.

Arm

The second line of the trace display indicates the analyzer arm status.

ignored   The arm condition specified for this trace was **tarm always**.

received   The arm condition has been satisfied.

not received   The arm condition was not satisfied. (If you specified an arm condition but didn't use it in trigger qualification, this will be displayed if the arm condition is not satisfied. However, the analyzer may still find the correct trigger and complete the trace.)

trigger

The third line of the state trace display indicates the trigger status. Because of the pipelined analyzer architecture, it is possible that the trace status may display "not found" when in fact the trigger has been found. This will occur when not enough states satisfying the storage specification are found to push the trigger out of the pipeline and into trace memory. In any case, the trace will not be displayable until the trigger is in trace memory (unless you halt the analyzer).

found   The trigger condition has been found.

not found   The trigger condition has not yet been satisfied.

Arm to trigger

The fourth line of the trace display indicates the amount of time that passed between the arm signal and the trigger condition.

armcount   This will be from -0.04 microseconds to 41.943 milliseconds. The arm to trigger counter may underflow or overflow, in which case "<-0.04 microseconds" or ">41.943 milliseconds" are reported, respectively. If the arm signal was ignored or if the trigger was not found, the character "?" (unknown) is displayed.
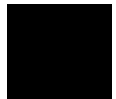
States

The fifth line of the trace display indicates the number of states displayable by **tl**.

visible Number of states which can be displayed by **tl**; this will be a number from 0 to 1024 (or 0 to 512 if **tcq** is active).

history Number of states which can be displayed if the current trace is halted; this may include history states which may be overwritten and thus unavailable if the current trace runs to completion.

first Number of the first state stored in trace memory, relative to the trigger state. This will be a number from -1024 to 0. The character "?" is displayed if the trigger state is not yet in memory.

last Number of the last state stored in trace memory, relative to the trigger state. This will be a number from -1 to 1023. The character "?" is displayed if the trigger state is not yet in memory.

Sequence term

The sixth line of the trace display indicates the current sequencer term position.

term Current sequence term position (1 through 5 in easy configuration; 1 through 8 in complex configuration). If the trace is completed or halted, the last sequence term number is displayed. A "?" is displayed if the trace is running and the sequencer is running too quickly for the current term number to be read.

Count remaining

The seventh line of the trace display indicates the count qualifier status for the primary branch condition of the current sequence term, see **tif** for further details.

count Remaining number of occurrences of the primary branch qualifier needed to satisfy the qualifier so that the primary branch will be taken. A "?" is displayed if the trace is running and the counter is updating too quickly to be read.

Whisper Mode Trace Display

If the **-w** option is given, an abbreviated version of the trace status is given as
follows:

Trace run status:

R - trace running

C - trace completed

H - trace halted

Trace arm status:

A - Arm has been received

a - arm has not yet been received

x - arm signal is being ignored

Trace trigger status:

T - trace trigger has been found

t - trace trigger has not yet been found

Trace list status:

* - indicates that this trace has not been displayed

See Also   **es** (allows you to determine general emulator status)

t (starts an emulation trace)

tarm (arm the analyzer based on state of the trig1 and trig2 signals)

tg (specify the analyzer trigger state)

th (halt the current trace in process)

tif (specify sequencer primary branch condition and number of occurrences)

tx (specify that trace is to begin upon receiving the CMB /EXECUTE pulse)

x (begin a synchronous CMB execution)

tsck - set or display slave clock specification for the analyzer

```
tsck -o <pod number>             - turn slave clock off in pod
tsck -d <pod number> -r <clock> - demux pod, rising edge of clock(s)
tsck -d <pod number> -f <clock> - demux pod, falling edge of clock(s)
tsck -d <pod number> -x <clock> - demux pod, both edges of clock(s)
tsck -m <pod number> -r <clock> - mix pod clocks, rising edge of
                                   clock(s)
tsck -m <pod number> -f <clock> - mix pod clocks, falling edge of
                                   clock(s)
tsck -m <pod number> -x <clock> - mix pod clocks, both edges of
                                   clock(s)
```

The **tsck** command allows you to specify the slave clock edges used for the emulation analyzer trace.

Each analyzer pod has the capability of latching certain signals with a slave clock instead of the master clock. (You set up the master clock with the **tck** command.)

The parameters are as follows:

<pod number>   Specifies one of 5 groups of analyzer input lines. These are as follows:

Pod #	Bits
1	0-15
2	16-31
3	32-47
4	48-63
5	64-79

-d   Specifies that the slave clock operates in demultiplexed mode. In this mode, the lower 8 channels of the analyzer pod (bits 0-7) are latched with the slave clock and the upper 8 channels (bits 8 through 15) are replaced with the lower 8 channels. In other words, the upper 8 bits are identical to the lower 8 at the pod.

However, the data is not clocked into the analyzer itself until the next master clock occurs. Therefore, if no slave clocks have occurred since the last master clock, the data on the lower 8 analyzer lines is identical to the upper 8. If one or more slave clocks have occurred since the last master clock, the data on the lower 8 bits is the only data available to the analyzer.

When using the **-d** option, you must specify one of the **-r**, **-f**, or **-x** options to indicate the active edge(s) of the slave clock.

-m   Specifies that the slave clock operates in mixed mode. In the mixed mode, the
                          lower 8 channels of the analyzer pod (bits 0-7) are latched with the slave clock, and
                          the master clock latches in the entire pod. Therefore, if no slave clock has occurred
                          since the last master clock, the data on the lower 8 bits of the pod will be clocked
                          into the analyzer at the same time as the upper 8 bits. If more than one slave clocks
                          has occurred since the last master clock, only the first slave clock data will be
                          available to the analyzer.

                          When using the **-m** option, you must specify one of the **-r**, **-f**, or **-x** options to
                          indicate the active edge(s) of the slave clock.

-r   Indicates that the pod should latch data on the **rising** edge of the slave clock.

-f   Indicates that the pod should latch data on the **falling** edge of the slave clock.

-x   Indicates that the pod should latch data on **both** edges of the slave clock.

<clock>   Three clock signals are defined: L, M, and N.

                          The L, M, and N clocks are generated by the emulator. The L clock is the
                          emulation clock derived by the emulator, the N clock is used as a qualifier to
                          provide the user/background tracing options (**-u** and **-b**) to **tck**, and the M clock is
                          not used.

-o   If you specify **-o** with a <pod number>, the slave clock is ignored on that pod.

                          If no parameters are specified, the current slave clock definitions are displayed.
                          The default for all slave clocks is **off** after powerup or **tinit** initialization.

See Also   **ta** (allows you to display active signals on the analyzer input lines; useful in
                          verifying that you have selected the correct clock conditions)

                          tck (used to define master clock signals used by the analyzer; **tsck** defines the slave
                          clock signals. Default mode for **tsck** is off on all pods.)

tsq - modify or display sequence specification

In the easy configuration:

```
tsq                 - display entire sequence specification
tsq -r              - reset the sequence specification
tsq -i X            - insert sequence term X into sequence
tsq -d X            - delete sequence term X from sequence
```

In the complex configuration:

```
tsq                 - display entire sequence specification
tsq -t              - display sequence trigger specification
tsq -t X            - set the sequence to trigger on entrance to term X
tsq -r              - reset the sequence specification
```

The **tsq** command allows you to manipulate or display the emulation trace sequencer.

When the analyzer is in easy configuration (**tcf -e**), the sequencer has a maximum of four sequence terms with a minimum of one term.

If the analyzer is in complex configuration (**tcf -c**), the sequencer always has eight terms (although the particular sequencer setup may mean that only two are ever accessed).

The parameters are as follows:

-r   Resets the sequencer.

In the easy configuration, the result is a simple one term sequence which stores all states and triggers on the first occurrence of any state. This is equivalent to issuing the commands:

In the complex configuration, the result is an eight term sequence with the trigger term at term number 2. The sequencer will be set to **tsto any** (store any state). All secondary branch qualifiers are turned off (**telif X never**), and all primary branch qualifiers will jump to the next higher numbered term on any state (**tif X any (X+1)**).

-i   Inserts a new sequence term at X. The new sequence term will use the default storage qualifier (which can be modified with the **tsto** command). It will also use the secondary branch qualifier (global restart in easy configuration) specified by the **telif** command.

If there is already a sequence term with number X, terms with number X and above will be renumbered (X becomes X+1) to make room for the new term.

You must insert terms in a contiguous manner; for example, you cannot insert a term number 4 if the sequencer only has two terms defined. Instead, you must next insert a term numbered 1, 2 or 3.

The primary branch qualifier for the new term will be defined as **tif X any** unless it is the last term in the sequence (by definition, the trigger term), in which case the primary branch qualifier is set to **tif X never**.

-d   Deletes the term specified and renumbers higher numbered terms downward to fill the gap.

X   Specifies a sequence term number.

In the easy configuration, X is in the range from 1 through 4 when inserting or deleting terms.

In the complex configuration, X is in the range 2 through 8 to use as the trigger term.

-t   Specifies the trigger term when a sequence term number is included. When no sequence term number is included, the trigger term is displayed. The analyzer triggers on a sequencer branch to the trigger term.

If no options are given, all of the sequencer storage and branch qualifiers are displayed along with the trigger term position. Upon powerup or after **tinit** initialization, the sequencer defaults to the following state:

```
tif 1 any
tsto all
telif never
```

In other words, the sequencer powers up with two sequence terms; the second sequence term is the trigger term. Any state will cause a branch from the first term to the second term; global restart is set to never and all states are stored by the analyzer.

Switching analyzer configurations from easy to complex or vice versa also resets the sequencer (that is, **tcf -c** or **tcf -e**).

See Also   **tcf** (defines whether analyzer is operated in complex configuration or easy configuration)

telif (sets global restart qualifier in easy configuration; secondary branch qualifier in complex configuration)

tg (defines the trigger qualifier)

tif (sets the primary branch qualifier in both easy and complex configuration)

tsto (defines the analyzer global storage qualifier)
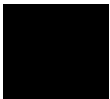
tsto - set or display trace storage specification

In the easy configuration:

```
tsto              - display storage specification
tsto <expr>       - define storage specification
```

In the complex configuration:

```
tsto              - display all storage specifications
tsto X            - display storage qualifier X specification
tsto <expr>       - define global storage specification
tsto X <expr>     - define storage qualifier X specification
```

The **tsto** command allows you to specify a trace storage qualifier for the emulation analyzer. The expression parameter qualifies the states to be stored by the analyzer.

The parameters are as follows:

<expr>   State qualifier expression. Refer to the <expr> description in this chapter.

X   Specifies the sequence term number whose storage qualifier is either displayed or assigned as <expr>.

If no parameters are given, the current trace storage qualifier settings are displayed. Upon powerup or after **tinit** initialization, the trace storage qualifier defaults to **tsto all**. Using the **tcf** command to switch from complex configuration to easy configuration or vice versa will also reset the storage qualifier to **tsto all**.

If the analyzer is in easy configuration (**tcf -e**), the expression is specified by <expr> and this serves as a global storage qualifier. In other words, the same expression is used as a storage qualifier regardless of the current sequencer state.

If the analyzer is in complex configuration (**tcf -c**), the expression is specified by <expr> and may be assigned to a sequencer state with the X parameter. When an expression is assigned to a specific term number, the analyzer will only store states corresponding to the given expression when at the given sequencer level. If no sequence term number is used, the associated expression is defined as global; the analyzer stores states satisfying the expression regardless of the sequencer level.

See Also   **tcf** (used to specify whether the analyzer is in easy configuration or complex configuration)

telif (used to specify a global restart qualifier in easy configuration; specifies a secondary branch qualifier for each sequencer level in complex configuration)

tg (used to specify a trigger condition in either easy configuration or complex configuration; overrides the current sequencer specification. Note that **tg** does not affect **tsto**; therefore, the current **tsto** specifications remain in effect whenever a **tg** command is entered)

tif (used to specify a primary branch qualifier in either analyzer configuration)

tpat (used to assign pattern names to simple analyzer expressions for use in constructing complex analyzer expressions; these expressions can be used in specifying storage qualifiers for the **tsto** command)

trng (used to specify a range of values of a set of analyzer inputs; this range information can be used in constructing complex configuration qualifiers for the **tsto** command)

tsq (used to manipulate the trace sequencer)

tx - enable/disable execute condition

```
tx -e    - start a measurement when the execute signal is received
tx -d    - ignore the execute signal
```

The **tx** command allows you to specify that the analyzer will begin a measurement when the CMB /EXECUTE line is asserted.

The parameters are as follows:

-e   Specifies that the analyzer will start a measurement upon receiving the CMB /EXECUTE signal.

-d   The analyzer will NOT start a measurement upon receiving the CMB /EXECUTE signal.

If no options are specified, the current state of **tx** enable/disable is displayed. Upon powerup or after a **tinit**, the system defaults to **tx -d**.

If **tx -e** is given, enabling measurement on execute, the CMB trigger is immediately driven true upon receiving the /EXECUTE signal. If the analyzer is not driving either trig1 or trig2, it is then started. The CMB trigger is then disabled and the HP 64700 waits for all other participants in the measurement to release the CMB trigger. When the last instrument releases the CMB trigger, the trigger will go false; at this point any analyzers driving trig1 or trig2 will be started.

See Also   **cmbt** (specifies whether the CMB trigger signal is driven or received by the internal trig1 and trig2 signals)

tarm (specifies the arm condition for the analyzer)

tg (specifies a trigger condition for the analyzer)

<value> - values in Terminal Interface commands

Values are numeric constants, equates, or symbols. Also, values can be the result of constants, equates, and symbols combined with operators. Equates are defined with the **equ** command. Symbols can be loaded with the **load** command or defined with the **sym** command.

Constants

A value may be specified as a constant in any of the following number bases. (Constants with no base specified are assumed to be hexadecimal numbers.)

- Hexadecimal (base **H** or **h**). For example: 6eh, 9xH, 0f3, or 0cfh. (The leading digit of a hexadecimal constant must be 0-9.)

- Decimal (base **T** or **t**, for base "ten"). For example: 27t or 99T. (Don't cares are not allowed in decimal numbers.)

- Binary (base **Y** or **y**). For example: 1101y, 01011Y, or 0xx10xx11y. (The leading digit of a binary constant must be 0 or 1. Do not use the characters "B" or "b" to specify the base of binary numbers because they will be interpreted as hexadecimal numbers; for example, 1B equals 27 decimal.)

- Octal (base **Q**, **q**, **O**, or **o**). For example: 777o, 6432q, or 7xx3Q. (The leading digit of an octal constant must be 0-7.)

Don't cares are not allowed in ranges or decimal numbers. A value of all don't cares may be represented by a question mark (**?**).

Operators. When specifying values, constants can be combined with the following operators (in descending order of precedence):

-, ~	Unary two's complement, unary one's complement. The unary two's complement operator is not allowed on constants containing don't care bits.
*, /, %	Integer multiply, divide, and modulo. These operators are not allowed on constants containing don't care bits.
+, -	Addition, subtraction. These are not allowed on constants containing don't care bits.

<<, <<<, >>, >>>	Shift left, rotate left, shift right, rotate right.
&	Bitwise AND.
^	Bitwise exclusive or, XOR.
|	Bitwise inclusive OR.
&&	Logical AND/bit-wise merge. When bits are different, the first value overrides the second; e.g., 10xxy && 11x1y == 10x1y.
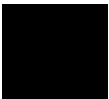
Note that all operations are carried out on 32-bit numbers.

ver - display system software and hardware version numbers

```
ver
```

The **ver** command instructs the emulator to return the current emulator Terminal Interface software version numbers.

w - wait for specified condition before continuing

```
w            - wait for any keystroke
w <value>  - wait for <value> number of seconds or any keystroke
w -m         - wait for measurement complete or any keystroke
```

The **w** command is used to program automatic waits into macros, repeats, and command files. Normal operation is to wait for any keystroke before executing the next operation; optionally, the wait can be programmed for a specific time period or for completion of a measurement in process (such as a trace).

The parameters are as follows:

<value>   The number of seconds before proceeding.

-m   Wait for completion of the current measurement before proceeding.

Examples   To cause the emulator to wait for any keystroke before proceeding to the next command, type:

U>**w**

You might use this in a situation where you wish the operator to make a judgment regarding some other condition before proceeding with the next measurement.

To cause the emulator to wait for 32 seconds or for any keystroke, type:

U> **w 32**

This might be used where you know the desired system state will be reached in a definite amount of time (or should be reached within that time).

To have the emulator wait until another measurement is completed or for any keystroke entry, type:

U> **w -m**

Note that the above examples, taken exactly as shown, don't provide you with a useful function -- they are provided only to show correct examples of command line syntax. To use the wait command effectively, it should be applied within macros, repeat commands, or command files. Refer to the **rep** and **mac** commands for further examples.

x - emit a Coordinated Measurement Bus execute signal

x

The **x** command allows you to initiate a synchronous CMB (Coordinated Measurement Bus) measurement execution.

When **x** is performed, the CMB /EXECUTE line is pulsed. If **tx** (trace at execute) is enabled, an analyzer measurement will begin. If the CMB is enabled via the **cmb -e** command, a break will occur, followed by a run at execute as specified by the **rx** command.

The **x** command is available whether CMB and trace at execute are enabled or not. Specifically, the **cmb** and **tx** commands control how this HP 64700 emulator will respond when an /EXECUTE or READY is detected. The **x** command only controls when this emulator will issue an /EXECUTE signal.

See Also   **cmb** (used to enable or disable interaction with the CMB)

rx (used to specify an address to start a program run when the /EXECUTE pulse is received from the CMB)

tx (used to specify that an analyzer measurement should begin when the /EXECUTE pulse is received from the CMB)

9

Error Messages

Emulator Error Messages

This chapter contains descriptions of error messages that can occur while using the Terminal Interface. The error messages are listed in numerical order, and each description includes the cause of the error and the action you should take to remedy the situation.

The emulator can return messages to the display only when it is prompted to do so. Situations may occur where an error is generated as the result of some command, but the error message is not displayed until the next command (or a carriage return) is entered.

A maximum number of 8 error messages can be displayed at one time. If more than 8 errors are generated, only the last 8 are displayed.

1   **I/O port access not supported**

Cause: You attempted to use the **io** command for an emulator whose processor does not support separate I/O (such as the 68340).

Action: Use the **m** command to modify I/O ports on these emulators.

20   **Attempt to change foreground monitor map term**

Cause: The **cf mon=fg** command that sets up use of a foreground monitor also maps a memory range for the monitor's use. You attempted to alter that term using the **map** command.

Action: Try using another memory range for the new map term. If you need to have the range used by the foreground monitor, then switch to a background monitor, delete the old foreground monitor map term, and add the new term. Now you can return to using a foreground monitor; remember you will need to reload the monitor code.

21   **Insufficient emulation memory**

Cause: You have attempted to map more emulation memory than is available.

Action: Reduce the amount of emulation memory that you are trying to map.

40   **Restricted to real time runs**

Cause: While the emulator is restricted to real-time execution, you have attempted to use a command that requires a temporary break in execution to the monitor. The emulator does not permit the command and issues this error message.

Action: You must break the emulator's execution into the monitor before you can enter the command.

61   **Emulator is in the reset state**

Cause: You have entered a command that requires the emulator to be running in the monitor (for example, displaying registers).

Action: Enter the **b** (break) command to cause the emulator to run in the monitor, and enter the command that caused the error again.

80   **Stack pointer is odd**

Cause: You have attempted to modify the stack pointer to an odd value for a processor that expects the stack to be aligned on a word boundary (such as the 68340).

Action: Modify the stack pointer to an even value.

81   **Stack is in guarded memory**

Cause: Your stack pointer pointed to a location in memory mapped as guarded; you then attempted to run or step the emulation processor. The emulator was unable to access the stack to complete the transition from the monitor to the user program or vice versa.

Action: Either remap memory so the stack pointer points to a location in RAM, or change the stack pointer value (either with your program or with the **cf** command options, if available) to point to a location in RAM.

82   **Stack is in target ROM**

Cause: Your stack pointer pointed to a location in memory mapped as target ROM; you then attempted to run or step the emulation processor. The emulator was unable to access the stack to complete the transition from the monitor to the user program or vice versa.
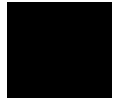
Action: Either remap memory so the stack pointer points to a location in RAM, or change the stack pointer value (either with your program or with the **cf** command options, if available) to point to a location in RAM.

83   **Stack is in emulation ROM**

Cause: Your stack pointer pointed to a location in memory mapped as emulation ROM; you then attempted to run or step the emulation processor. The emulator was unable to access the stack to complete the transition from the monitor to the user program or vice versa.

Action: Either remap memory so the stack pointer points to a location in RAM, or change the stack pointer value (either with your program or with the **cf** command options, if available) to point to a location in RAM.

84   **Program counter is odd**

Cause: You attempted to modify the program counter to an odd value using the **reg** command on a processor which expects even alignment of opcodes.

Action: Modify the program counter only to even numbered values.

102   **Monitor failure; no clock input**

Cause: The monitor is unable to run because no emulation processor clock is available.

Action: If running out of circuit, choose configuration option **cf clk=int**; if running in-circuit, choose configuration option **cf clk=ext** and make sure a clock meeting the microprocessor's specifications is input to the clock pin of the target system probe.

103   **Monitor failure; no processor cycles**

Cause: The monitor is unable to run since the processor is not running. The monitor is unable to determine the cause of the failure.

Action: If running in-circuit, troubleshoot the target system. If running out of circuit, reinitialize the emulator and try the procedure again.

104   **Monitor failure; bus grant**

Cause: The monitor is unable to run. The emulation processor is not running because it has granted the bus to another device.

Action: Wait until the processor has regained bus control, then retry the operation.

105   **Monitor failure; halted**

Cause: The monitor is unable to run because the processor is halted (due to an external halt line or a halt instruction).

Action: Release the external halt and retry the operation. If the processor halted due to a halt instruction, try the **rst** command, then retry the operation.

106   **Monitor failure; wait state**

Cause: The monitor is unable to run because the processor is in a continuous wait state.

Action: A continuous wait state may indicate target system problems. Troubleshoot the wait line. If you were running out of circuit, try initializing the emulator with **init**, then retry the procedure.

107   **Monitor failure; bus error**

Cause: The monitor is unable to run because the processor has encountered a bus fault (such as the 68340 /BERR line).

Action: Release the /BERR line and determine why it was activated.
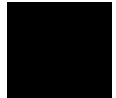
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The following error messages are unique to the 68340 emulator.

141   **Dual ported memory limited to 4K bytes**

Cause: You attempted to map an address range larger than 4 Kbytes to dual-port emulation memory. Only 4 Kbytes of dual-port emulation memory is available.

Action: Split the address range into one 4 Kbyte range that will be mapped to dual-port emulation memory and another range that will be mapped to single-port emulation memory.

142   **Dual ported memory already in use**

Cause: You attempted to map a second address range to dual-port emulation memory. Only one address range can be mapped to dual-port emulation memory.

Action: If both ranges can fit into one 4 Kbyte range, delete the term currently mapped to dual-port emulation memory, and map the larger range. If both ranges cannot fit into one 4 Kbyte range, you must map one of the ranges to single-port emulation memory.

143   **Dual ported memory in use by foreground monitor**

Cause: You attempted to map an address range to the 4 Kbyte block of dual-port emulation memory when it has already been allocated to the foreground monitor.

Action: When using a foreground monitor, only single-port emulation memory is available when mapping memory.

144   **Dual ported memory not mapped to <abs_file_address_range> for downloaded monitor**

Continuing with default foreground monitor

Cause: You attempted to load, with the **load -f** command, a foreground monitor absolute file whose address range does not agree with the range defined by the **cf monaddr** configuration item. The second message tells you the default foreground monitor, resident in the emulator firmware, continues to be used.

Action: Either assemble and link your foreground monitor at the address specified by the **cf monaddr** configuration item or change the **cf monaddr** configuration item so that it agrees with the monitor program absolute file.

145   **Downloaded monitor spans multiple 4K byte block boundaries**

Cause: You attempted to load, with the **load -f** command, a foreground monitor absolute file that does not fit into one 4 Kbyte address range.

Action: Edit your foreground monitor program source file so that it fits into one 4 Kbyte address range.

146   **Monitor must be mapped on a 4K byte boundary**

Cause: You attempted to define a foreground monitor base address (using the **cf monaddr** configuration item) that is not on a 4 Kbyte boundary.

Action: Re-enter the **cf monaddr=<address>** command, specifying an address that is on a 4 Kbyte boundary (in other words, ending in 000H).

147   **cs0 can be used on one term only**

Cause: You attempted to map a second address range for global chip select operation. Only one address range can be mapped for this purpose.

Action: You must remove the current mapper term that is assigned the **cs0** attribute before you can map a different range for global chip select operation.

148   **Bus activity required to access dual ported memory**

Cause: In order for the system controller to be able to access dual-port emulation memory, the 68340 emulation processor's /AS signal must not remain active for too long a time (more than 100 microseconds, approximately). Typically, this situation occurs when the 68340 emulation processor attempts to access memory that is not present.

Action: Investigate the cause of the /AS signal being active too long.

149   **Register mbar valid bit not set**

Register cf_mbar valid bit not set

Cause: The contents of the mbar or cf_mbar register must be valid (that is, bit 0 of the register must be set to 1) before you can display of modify of the SIM or SIM configuration registers.

Action: Make sure the contents of the mbar or cf_mbar register are valid.

150   **Program counter is odd or uninitialized**

Program counter is located in guarded memory

Cause: You attempted to run or step from the current program counter when it contains an odd value or an address that is mapped as guarded memory.

Action: When running from the current program counter, make sure it contains an even address that is not in guarded memory.

151   **Supervisor stack pointer is odd or uninitialized**

Supervisor stack is located in emulation ROM

Supervisor stack is located in guarded memory

Cause: You are using a foreground monitor, and you have attempted to run or step when the stack pointer contains an odd value or when the stack pointer contains an address that is mapped as emulation ROM or guarded memory.

Action: Make sure the stack pointer contains an even address value that is not mapped as emulation ROM or guarded memory.

152   **Foreground monitor had unexpected exception %d**

Cause: The decimal number value of the vector offset (included with the message) tells you what type of exception caused the message. For example, if a priviledged opcode is attempted to be executed at the user access level, the decimal value 32 is shown with this error message.

Action: Determine the cause of the exception.

155   **Unable to verify trace vector; vector table in guarded memory**

Cause: In order to step when using a foreground monitor, the trace vector must contain the address of the monitor program's TRACE_ENTRY label (which equals the monitor base address plus 800H). The step command reads the trace vector on each step to make sure it contains the correct address value. This error occurs when the vector table is in guarded memory.

Action: Make sure the vector table is not in an address range mapped as guarded memory.

156   **Unable to verify trace vector; vector table read failed**

Cause: In order to step when using a foreground monitor, the trace vector must contain the address of the monitor program's TRACE_ENTRY label (which equals the monitor base address plus 800H). The step command reads the trace vector on each step to make sure it contains the correct address value. This error occurs when the vector table is in target memory and the read fails.

Action: Make sure the vector base register points to the correct location in target memory and that the memory system is operating correctly.

157   **Unable to set trace vector to <TRACE_ENTRY_address>; vector table write failed**

Cause: In order to step when using a foreground monitor, the trace vector must contain the address of the monitor program's TRACE_ENTRY label (which equals the monitor base address plus 800H). The step command reads the trace vector on each step to make sure it contains the correct address value. If the trace vector does not contain the correct value, the emulator attempts to write the correct value. This error occurs when the vector table is in target memory and the write fails.

Action: Make sure the vector base register points to the correct location in target memory and that the memory system is writeable and is operating correctly.

158   **Trace vector modified to <TRACE_ENTRY_address> for single stepping**

Cause: In order to step when using a foreground monitor, the trace vector must contain the address of the monitor program's TRACE_ENTRY label (which equals the monitor base address plus 800H). The step command reads the trace vector on each step to make sure it contains the correct address value. If the trace vector does not contain the correct value, the emulator attempts to write the correct value. This
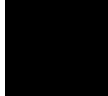
message informs you the emulator was successful in writing the correct value to the trace vector.

159   **Unable to set trace vector to <TRACE_ENTRY_address>; vector table in TROM**

Cause: In order to step when using a foreground monitor, the trace vector must contain the address of the monitor program's TRACE_ENTRY label (which equals the monitor base address plus 800H). The step command reads the trace vector on each step to make sure it contains the correct address value. If the trace vector does not contain the correct value, the emulator attempts to write the correct value. This error occurs when the vector table is in memory mapped as target ROM.

Action: If the vector table is really in target ROM memory, its trace vector must already contain the correct address value.

160   **Coverage not supported**

Cause: You attempted to use the **cov** command for an emulator that does not provide coverage memory.

161   **Copy target image not supported**

Cause: You attempted to use the **cim** command for an emulator that does not support the command.

162   **Double bus fault occurred**

Cause: This message informs you of a double bus fault in the emulation microprocessor. The most common cause of this error message is running or stepping from target memory locations that do not exist.

163   **Update HP64740 firmware to version A.02.02 or newer**

Cause: The HP 64751 emulator requires version A.02.02 or newer of the analyzer firmware.

Action: Refer to the "Updating Emulator/Analyzer Firmware" section in the "Installation" chapter.

168   **Can't access module regs, addr space mask (@sd bit 6) is set**

Cause: You have attempted to modify the **mbar** or **cf_mbar** register with a value that masks supervisor data space by setting bit 6 (for example, **reg mbar=4041**). The HP 64751 emulator requires an address space to access 68340 SIM registers and, therefore, doesn't let you set bit 6 in the **mbar** or **cf_mbar** register.

Action: Modify the **mbar** or **cf_mbar** registers with values that do not set bit 6.

168   **Can't access module regs, mbar (@sd bit 6) is set**

Can't access module regs, cf_mbar (@sd bit 6) is set

Cause: These errors occur if the user program sets bit 6 of the **mbar** register (whose contents can be copied into the **cf_mbar** register with the **sync sim** command) and the emulator needs to access other SIM or emulator configuration registers.

Action: Modify the **mbar** or **cf_mbar** registers with values that do not set bit 6.

177   **BDM communication failed**

Cause: There was some problem with the serial communication interface with the emulation processor's Background Debug Mode (BDM).

Action: Initialize the emulator or cycle power. Then reenter the command. If the same failure occurs, call your HP sales and service office.

178   **Unable to run performance verification tests**

Cause: The emulator was unable to run the performance verification tests.

Action: Make sure the emulator probe is connected correctly and that all cables are secured. Make sure that the emulator probe is plugged into the demo target system and that the demo target system power cable is connected to the HP 64700.

179   **M68340 probe not connected or configured incorrectly**

Cause: The emulator is reading an invalid identifier for the emulation probe.

Action: Make sure that the emulator probe cables are connected correctly. Also, make sure that the probe is the 68340 probe.

179 **Fuse F1 blown on HP64748C ABG Control Board**

Cause: The emulator detects a blown fuse on the HP 64748C Emulation Control Board.

Action: Contact your Hewlett-Packard Representative.

General Emulator and System Messages

201   **Out of system memory**

Cause: Macros and equates that you have defined have used all of the available system memory.

Action: Delete some of the existing macros (**mac -d \<NAME\>**) and equates (**equ -d \<NAME\>**), which will free additional memory.

204   **FATAL SYSTEM SOFTWARE ERROR**

205   **FATAL SYSTEM SOFTWARE ERROR**

208   **FATAL SYSTEM SOFTWARE ERROR**

Cause: The system has encountered an error from which it cannot recover.

Action: Write down the sequence of commands which caused the error. Cycle power on the emulator and reenter the commands. If the error repeats, call your local HP Sales and Service office for assistance.

206   **Incompatible compatibility table entry**

Cause: The emulation firmware (ROM) is not compatible with the analysis or system firmware in your HP 64700 system.

Action: The ROMs in your emulator must be compatible with each other for your emulation system to work correctly. Contact your Hewlett-Packard Representative.

300   **Invalid option or operand**

305   **Invalid option or operand: %s**

Cause: You have specified incorrect option(s) to a command. %s, if printed, indicates the incorrect option(s).

Action: Reenter the command with the correct syntax. Refer to the on-line help information.

307   **Invalid expression: %s**

Cause: You have entered an expression with incorrect syntax; therefore, it cannot be evaluated. %s is the bad expression.

Action: Reenter the expression, following the syntax rules for that type of expression. Refer to the command description to determine the expression type; then refer to the expression syntax pages to determine the correct syntax for that type.

308   **Invalid number of arguments**

Cause: You have either entered too many options to a command or an insufficient number of options.

Action: Re-enter the command with correct syntax. Refer to the command syntax pages in this manual for information.

310   **Invalid address: %s**

Cause: You specified an invalid address value as an argument to a command (other than an analyzer command). For example, you may have specified digits that don't correspond to the base specified, or you forgot to precede a hexadecimal letter digit with a number (even zero (0)).

Action: Re-enter the command and the address specification. See the <ADDRESS> and <EXPRESSION> syntax pages in the "Commands" chapter for information on address specifications.

311   **Invalid address range: %s**

Cause: You specified an invalid address range as an argument to a command (other than an analyzer command). For example, you may have specified digits that don't correspond to the base specified, or you forgot to precede a hexadecimal letter digit with a number, or the upper boundary of the range you specified is less than the lower boundary.

Action: Re-enter the command and the address specification. See the <ADDRESS> and <EXPRESSION> syntax pages in the "Commands" chapter for information on address specifications. Also, make sure that the upper boundary specification is greater than the lower boundary specification (the lower boundary must always precede the upper boundary on the command line).

312   **Ambiguous address: %s**

Cause: Certain emulators support segmentation or function code information in addressing. The emulator is unable to determine which of two or more address ranges you are referring to, based upon the information you entered.

Action: Re-enter the command and fully specify the address, including segmentation or function code information.

313   **Missing option or operand**

Cause: You have omitted a required option to the command.

Action: Re-enter the command with the correct syntax. Refer to the "Commands" chapter for further information on required syntax.

314   **Option conflict: %s**

Cause: You have entered a command with two options which cannot be used together. For example, you might have entered **tl -bx**; you cannot ask for both a binary and hexadecimal trace list dump.

Action: Reenter the command, specifying only non-conflicting options. Refer to the command description to determine which options may be used together.

315   **Invalid count: %s**

Cause: This error occurs when the emulation system expects a certain number (of arguments, for example), but you specify a different number.

Action: Enter the number the system expects to receive.

316   **Invalid range expression: %s**

Cause: In the **tl** command, you specified an illegal range. For example, you might have specified **tl -10..a**.

Action: Use only legitimate range numbers in the **tl** command (-1024..1023); the second range value must be greater than the first.
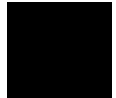
317   **Range out of bounds: %s**

Cause: In the **tl** command, you specified a range number which was greater than the number of states available in the analyzer. For example, you might have specified **tl -2048..2048**; the analyzer only has 1024 states.

Action: Specify range numbers between -1024 and 1023.

318   **Count out of bounds: %s**

Cause: You specified an occurrence count less than 1 or greater than 65535 for **tg** or **tif**. For example, you might have entered **tif 1 any 2 69234**.

Action: Re-enter the command, specifying a count value from 1 to 65535. For example: **tif 1 any 2 65535**.

319   **Invalid base: %s**

Cause: This error occurs if you have specified an invalid base in the **tf** command.

Action: Enter the **help tf** command to view the valid base options.

320   **Invalid label: %s**

Cause: You tried to define a label with characters other than letters, digits, or underscores.

Action: Re-enter the **tlb** command with a label consisting only of letters, digits, or underscores.

321   **Label not defined: %s**

Cause: You entered an analyzer expression in which the label was not present in the analyzer label list. For example, if the label list includes **addr**, **data**, and **stat**, you might have entered something such as **tg lowerdata=24t**. This error also occurs if you try to delete a label that does not exist.

Action: You can re-enter the command, using one of the previously defined labels and adjust the expression as necessary to accommodate the fit of that label to the analyzer input lines. Or, you can define a new label using the **tlb** command, then re-enter the analyzer command using the newly defined label.

400   **Record checksum failure**

Cause: During a **transfer** operation, the checksum specified in a file did not agree with that calculated by the HP 64700.

Action: Retry the **transfer** operation. If the failure is repeated, make sure that both your host and the HP 64700 data communications parameters are configured correctly.

401   **Records expected: %s; records received: %s**

Cause: The HP 64700 received a different number of records than it expected to receive during a **transfer** operation.

Action: Retry the **transfer**. If the failure is repeated, make sure that the data communications parameters are set correctly on the host and on the HP 64700. Refer to the "Installation" chapter for details.

410   **File transfer aborted**

Cause: A **transfer** operation was aborted due to a break received, most likely a <CTRL>c from the keyboard.

Action: If you typed <CTRL>c, you probably did so because you thought the transfer was about to fail. Retry the transfer, making sure to use the correct command options. If you are unsuccessful, make sure that the data communications parameters are set correctly on the host and on the HP 64700, then retry the operation.

411   **Severe error detected, file transfer failed**

Cause: An unrecoverable error occurred during a **transfer** operation.

Action: Retry the transfer. If it fails again, make sure that the data communications parameters are set correctly on the host and on the HP 64700. Also make sure that you are using the correct command options, both on the HP 64700 and on the host.

412   **Retry limit exceeded, transfer failed**

Cause: The limit for repeated attempts to send a record during a **transfer** operation was exceeded, therefore the transfer was aborted.

Action: Retry the transfer. Make sure you are using the correct command options for both the host and the HP 64700. The data communications parameters need to be set correctly for both devices. Also, if you are in a remote location from the host, it is possible that line noise may cause the failure.

413   **Transfer failed to start**

Cause: Communication link or transfer protocol incorrect.

Action: Check link and transfer options.

415   **Timeout, receiver failed to respond**

Cause: Communication link or transfer protocol incorrect.

Action: Check link and transfer options.

420   **Unknown mode: %s**

Cause: This error occurs when you have specified an unknown option in the **stty** command.

Action: Enter the **help stty** command to view the valid options.

425   **Load option conflict: %s and option: %s**

Cause: Two or more options in the load command cannot be used together.

Action: Enter the **help load** command to view the options that cannot be used together.

520   **Equate not defined: %s**

Cause: You tried to delete an equate that did not exist in the equate table. For example suppose the equates **a=1** and **b=2** were in the equate table. If you typed **equ -d c**, you would receive the above error message.

Action: Use **equ** to display the list of named equates before deleting equates.

600   **Adjust PC failed during break**

Cause: System failure or target condition.

Action: Run performance verification (**pv** command), and check target system.

602   **Break failed**

Cause: The **b** command was unable to break the emulator to the monitor.

Action: Determine why the break failed, then correct the condition and retry the command. See message 608.

603   **Read PC failed during break**

Cause: System failure or target condition.

Action: Try again.

604   **Disable breakpoint failed: %s**

Cause: System failure or target condition.

Action: Run performance verification (**pv** command), and check target system.

605   **Undefined software breakpoint: %s**

Cause: The emulator has encountered a software breakpoint in your program that was not inserted with the **bp** command.

Action: If your processor allows different software breakpoint instructions, either modify the ones you inserted in your code, or modify the ones inserted by **bp** using your emulator's configuration options (**cf** command). If only one instruction is available, remove those inserted in your code before assembly and link, then reinsert them using the **bp** command.

606   **Unable to run after CMB break**

Cause: System failure or target condition.

Action: Run performance verification (**pv** command), and check target system.

608   **Unable to break**

Cause: This message is displayed if the emulator is unable to break to the monitor because the emulation processor is reset, halted, or is otherwise disabled.

Action: First, look at the emulation prompt and other status messages displayed to determine why the processor is stopped. If reset by the emulation controller, use the **b** command to break to the monitor. If reset by the emulation system, release

that reset. If halted, try **rst -m** to get to the monitor. If there is a bus grant, wait for the requesting device to release the bus before retrying the command. If there is no clock input, perhaps your target system is faulty or you have configured the clock wrong with **cf clk**. It's also possible that you have configured the emulator to restrict to real time runs, which will prohibit temporary breaks to the monitor.

610   **Unable to run**

Cause: System failure or target condition.

Action: Run performance verification (**pv** command), and check target system.

611   **Break caused by CMB not ready**

Cause: This status message is printed during coordinated measurements if the CMB READY line goes false. The emulator breaks to the monitor. When CMB READY is false, it indicates that one or more of the instruments participating in the measurement is running in the monitor.

Action: None, information only.

612   **Write to ROM break**

Cause: This status message will be printed if you have set **bc -e rom** and the emulation processor attempted a write to a memory location mapped as ROM.

Action: None (except troubleshooting your program).

613   **Analyzer Break**

Cause: Status message.

Action: None.

614   **Guarded memory access break**

Cause: This message is displayed if the emulation processor attempts to read or write memory mapped as guarded.

Action: Troubleshoot your program; or, you may have mapped memory incorrectly.

615   **Software breakpoint: %s**

Cause: This status message will be displayed if a software breakpoint entered with **bp** and enabled with **bc -e bp** is encountered during a program run. The emulator is broken to the monitor. The string %s indicates the address where the breakpoint was encountered.

Action: None.

616   **BNC trigger break**

Cause: This status message will be displayed if you have set **bc -e bnct** and the BNC trigger line is activated during a program run. The emulator is broken to the monitor.

Action: None.

617   **CMB trigger break**

Cause: This status message will be displayed if you have set **bc -e cmbt** and the CMB trigger line is activated during a program run. The emulator is broken to the monitor.

Action: None.

618   **trig1 break**

Cause: This status message will be displayed if you have set the analyzer to drive **trig1** upon finding the trigger, **bc -e trig1** is set, and the analyzer has found the trigger condition while tracing a program run. The emulator is broken to the monitor.

Action: None.

619   **trig2 break**

Cause: This status message will be displayed if you have set the analyzer to drive **trig2** upon finding the trigger, **bc -e trig2** is set, and the analyzer has found the trigger condition while tracing a program run. The emulator is broken to the monitor.

Action: None.
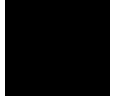
620   **Unexpected software breakpoint**

Cause: If you have enabled software breakpoints with **bc -e bp**, this message is displayed if a software breakpoint instruction is encountered in your program that was not inserted by **bp** and is therefore not in the breakpoint table.

Action: If your processor allows different software breakpoint instructions, either modify the ones you inserted in your code, or modify the ones inserted by **bp** using your emulator's configuration options (**cf** command). If only one instruction is available, remove those inserted in your code before assembly and link, then reinsert them using the **bp** command.

621   **Unexpected step break**

Cause: System failure.

Action: Run performance verification (**pv** command).

622   **%s**

Cause: Monitor specific message.

Action: None.

623   **CMB execute break**

Cause: This message occurs when coordinated measurements are enabled and an EXECUTE pulse causes the emulator to run; the emulator must break before running.

Action: This is a status message; no action is required.

624   **Configuration aborted**

Cause: Occurs when a <CTRL>c is entered during **cf** display command.

Action: None.

625   **Invalid configuration value: %s**

Cause: You have entered a configuration option incorrectly, such as typing **cf rrt=enn** instead of **cf rrt=en**.

Action: Re-enter the configuration command, specifying only the correct options. Enter the **help cf** command for a description of the configuration options for your emulator.

626   **Configuration failed; setting unknown: %s=%s**

Cause: Target condition or system failure.

Action: Check target system, and run performance verification (**pv** command).

627   **Invalid configuration item: %s**

Cause: You specified a non-existent configuration item in the **cf** command. For example, you would see this message if you tried to enter **cf bob** since there is no **bob** configuration item for the emulator.

Action: Re-enter the command, specifying only configuration items that are supported by your emulator. Enter the **help cf** command for a description of the configuration options for your emulator.

628   **Guarded memory break: <address>**

Cause: A memory access to a location mapped as guarded memory has occurred during execution of the user program.

Action: Investigate the cause of the guarded memory access by the user program.

628   **Write to ROM break: <address>**

Cause: When the **rom** break condition is enabled, a memory write access to a location mapped as ROM has occurred during execution of the user program.

Action: Investigate the cause of the write to ROM by the user program. You can disable the break condition with the **bc -d rom** command.

630   **Register access aborted**

Cause: Occurs when a <CTRL>c is entered during register display.

Action: None.

631   **Unable to read registers in class: %s**

Cause: The emulator was unable to read the registers you requested.

Action: To resolve this, you must look at the other status messages displayed. Most likely, the emulator was unable to break to the monitor to perform the register read. See message 608.

632   **Unable to modify register: %s=%s**

Cause: The emulator was unable to modify the register you requested.

Action: To resolve this, you must look at the other status messages displayed. It's likely that emulator was unable to break to the monitor to perform the register modification. See message 608.

634   **Display register failed: %s**

Cause: The emulator was unable to display the register you requested.

Action: To resolve this, you must look at the other status messages displayed. It's likely that emulator was unable to break to the monitor to perform the register display. See message 608.

636   **Register not writable: %s**

Cause: This error occurs when you attempt to modify a read only register.

Action: If this error occurs, you cannot modify the contents of the register with the **reg** command.

637   **Register class cannot be modified: %s**

Cause: You tried to modify a register class instead of an individual register.

Action: You can only modify individual registers. Refer to the **reg** command description for a list of register names.

640   **Unable to reset**

Cause: Target condition or system failure.

Action: Check target system, and run performance verification (**pv** command).

641   **Unable to reset into monitor**

Cause: You have entered a **rst -m** command and the emulator is unable to break into the monitor.

Action: Reload monitor (**rst** for background).

650   **Unable to configure break on write to ROM**

Cause: The emulator controller is unable to execute the **bc -e rom** command correctly, possibly because the emulator was left in an unknown state or because of a hardware failure.

Action: Initialize the emulator or cycle power. Then reenter the command. If the same failure occurs, call your HP sales and service office.

651   **Unable to configure break on software breakpoints**

Cause: The emulator controller is unable to execute the **bc -e bp** command, possibly because the emulator is in an unknown state or because of a hardware failure.

Action: Initialize the emulator or cycle power, then re-enter the command. If the same failure occurs, call your HP sales and service office.

652   **Break condition must be specified**

Cause: You entered **bc -e** or **bc -d** without specifying a break condition to enable or disable.

Action: Re-enter the **bc** command along with the enable/disable flag and the break condition you wish to modify.

653   **Break condition configuration aborted**

Cause: Occurs when <CTRL>c is entered during **bc** display.

Action: None.

661   **Software breakpoint break condition is disabled**

Cause: You entered the **bp** command and options; however, the software breakpoint break condition is disabled.

Action: Enable the software breakpoint feature with **bc -e bp**, then enter the desired breakpoints with **bp**.

663   **Specified breakpoint not in list: %s**

Cause: You tried to enable a software breakpoint (**bp -e <ADDRESS>**) that was not previously defined. The string %s prints the address of the breakpoint you attempted to enable.

Action: Insert the breakpoint into the table and memory by typing **bp <ADDRESS>**.

664   **Breakpoint list full; not added: %s**

Cause: The software breakpoint table is full. The breakpoint you just requested, with address %s, was not inserted.

Action: Remove breakpoints that are no longer in use with **bp -r <ADDRESS>**. Then insert the new breakpoint.

665   **Enable breakpoint failed: %s**

Cause: System failure or target condition.

Action: Check memory mapping and configuration questions.

666   **Disable breakpoint failed: %s**

Cause: System failure or target condition.

Action: Check memory mapping and configuration questions.

667   **Breakpoint code already exists: %s**

Cause: You attempted to insert a breakpoint with **bp <ADDRESS>**; however, there was already a software breakpoint instruction at that location which was not already in the breakpoint table.

Action: Your program code is apparently using the same breakpoint instruction as **bp**. If multiple breakpoint instructions are available on your processor, either change those in your program code or modify the one **bp** uses with your emulator's configuration options (**cf** command). If only one instruction is available, remove the breakpoints from your program code and use **bp** to insert breakpoints.

668   **Breakpoint not added: %s**

Cause: You tried to insert a breakpoint in a memory location which was not mapped or was mapped as guarded memory.

Action: Insert breakpoints only within memory ranges mapped to emulation or target RAM or ROM.

669   **Breakpoint remove aborted**

Cause: Occurs when <CTRL>c is entered during a **bp -r** command.

Action: None.

670   **Breakpoint enable aborted**

Cause: Occurs when <CTRL>c is entered during a **bp -e** command.

Action: None.

671   **Breakpoint disable aborted**

Cause: Occurs when <CTRL>c is entered during a **bp -d** command.

Action: None.

680   **Stepping failed**

Cause: Stepping has failed for some reason.

Action: Usually, this error message will occur with other error messages. Refer to the descriptions of the accompanying error messages to find out more about why stepping failed.

682   **Invalid step count: %s**

Cause: You specified an non-cardinal value for a step count in the **s** command (such as entering **s 22.1**).

Action: Reenter the step command, using only cardinal values (positive integers) for the step count.

684   **Failed to disable step mode**

Cause: System failure.
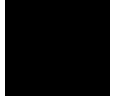
Action: Run performance verification (**pv** command).

685   **Stepping aborted**

Cause: This message is displayed if a break was received during a **s** (step) command with a step count of zero (0). The break could have been due to any of the break conditions in **bc** or a <CTRL>c break.

Action: None.

686   **Stepping aborted; number steps completed: %d**

Cause: This message is displayed if a break was received during a **s** (step) command with a step count greater than zero. The break could have been due to any of the break conditions in **bc** or a <CTRL>c break. The number of steps completed is displayed.

Action: None.

688   **Step display failed**

Cause: System failure or target condition.

Action: Check memory mapping and configuration questions.

689   **Break due to cause other than step**

Cause: An activity other than a **step** command caused the emulator to break. This could include any of the break conditions in a **bc** command or a <CTRL>c break.

Action: None.

692   **Trace error during CMB execute**

Cause: System failure.

Action: Run performance verification (**pv** command).

693   **CMB execute; run started**

Cause: This status message is displayed when you are making coordinated measurements. The CMB /EXECUTE pulse has been received; the emulation processor started running at the address specified by the **rx** command.

Action: None; information only.

694   **Run failed during CMB execute**

Cause: System failure or target condition.

Action: Run performance verification (**pv** command), and check target system.

700   **Target memory access failed**

Cause: This message is displayed if the emulator was unable to perform the requested operation on memory mapped to the target system.

Action: In most cases, the problem results from the emulator's inability to break to the monitor to perform the operation. See message 608.

702   **Emulation memory access failed**

Cause: System failure.

Action: Run performance verification (**pv** command).

707   **Request access to guarded memory: %s**

Cause: The address or address range specified in the command included addresses within a range mapped as guarded memory. When the emulator attempts to access these during command processing, the above message is printed, along with the specific address or addresses accessed.

Action: Re-enter the command and specify only addresses or address ranges within emulation or target RAM or ROM. Or, you can remap memory so that the desired addresses are no longer mapped as guarded.

710   **Memory range overflow**

Cause: Accessing a word or short word, for example "**m -dw 0ffffffff**" will cause a rounding error that overflows physical memory.

Action: Reduce memory display request.
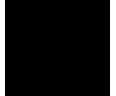
720   **Invalid map term number: %s**

Cause: You attempted to delete a mapper term that does not exist. For example, you may have tried **map -d 17** (there are a maximum of 8 mapper terms). Or you may have tried **map -d 2**, when only one mapper term has been defined.

Action: Use the **map** command to determine the numbers of the terms currently mapped. Then delete the appropriate mapper term.

721   **No map terms available; maximum number already defined**

Cause: You tried to add more than 8 mapper terms.

Action: Either combine map ranges to conserve on the number of terms or delete mapper terms that aren't needed to free another mapper term.

723   **Invalid map address range: %s**

Cause: You specified an invalid address range as an argument to the **map** command. For example, you may have specified digits that don't correspond to the base specified, or you forgot to precede a hexadecimal letter digit with a number, or the upper boundary of the range you specified is less than the lower boundary.

Action: Re-enter the **map** command and the address specification. See the <ADDRESS> and <EXPRESSION> syntax pages in the "Commands" chapter for information on address specifications. Also, make sure that the upper boundary specification is greater than the lower boundary specification (the lower boundary must always precede the upper boundary on the command line).

725   **Unable to load new memory map; old map reloaded**

Cause: There is not enough emulation memory left for this request.

Action: Reduce the amount of emulation memory requested.

726   **Unable to reload old memory map; hardware state unknown**

Cause: System failure.

Action: Run performance verification (**pv** command).

730   **Invalid memory map type: %s**

Cause: You specified a memory type while mapping that is not one of the supported types: **eram**, **erom**, **tram**, **trom**, or **grd**.

Action: Re-enter the **map** command, specifying only one of the five types listed above.

731   **Invalid memory map attribute: <attribute>**

Cause: You have entered an unknown attribute when mapping a range of memory.

Action: Only the **dp**, **dsi**, and **cs0** attributes are available; the **dp** and **dsi** attributes are only valid for emulation memory ranges.

732   **Invalid memory type for 'other' range: %s**

Cause: The unmapped memory type must be **tram**, **trom**, or **grd**. If you see the above message, you have tried to map the "other" range to **eram** or **erom**.

Action: Map the "other" range to **tram**, **trom**, or **grd**.

734   **Map range overlaps with term: %d**

Cause: You entered a map term whose address range overlaps with one already mapped. For example, you may have entered a term **map 1000..2fff eram**, then tried to enter a term **map 2000..3fff erom**.

Action: Re-enter the map term so that ranges do not overlap, or combine terms and change the memory type.

736   **Memory not mapped as emulation: %s**

Cause: This error occurs when a feature available only for emulation memory is attempted with target memory.

Action: You must remap the address range as emulation memory.

740   **I/O port access failed**

Cause: The emulator was unable to read or write the port specified in the **io** command. This message is also printed if your processor does not support separate I/O.

Action: If your processor does not support separate I/O, use the **m** command to modify I/O ports. Otherwise, retry the operation, and make sure that you are specifying a valid I/O address.

752   **Copy memory aborted; next destination: %s**

754   **Memory modify aborted; next address: %s**

756   **Memory search aborted; next address: %s**

Cause: One of these message is displayed if a break occurs during processing of the **cp**, **m**, or **ser** commands, respectively. The break could result from any of the break conditions (except **bp**) or could have resulted from a <CTRL>c break.

Action: Retry the operation. If breaks are occurring continuously, you may wish to disable some of the break conditions with the **bc** command.

800   **Invalid command: %s**

Cause: You have entered a command which is not part of the standard Terminal Interface command set (documented in this manual) and was not found in the currently defined macros.

Action: Enter only commands defined in this manual or in the macro set. You can display the macro set using **mac**. You can rename commands or name command groups using the **mac** command.

801   **Invalid command group: %s**

Cause: This error occurs when you specify an invalid group name in the **help -s <group>** command.

Action: Enter the **help** command with no options for a listing of the valid group names.

802   **Invalid command format**

Cause: This error occurs when an invalid macro is entered, for example, **mac {help;{}**.

Action: Refer to the **mac** command description.

807   **Macro list full; macro not added**

                Cause: The maximum number of macros have been defined.

                Action: You must delete macros before adding any new macros.

809   **Macro buffer full; macro not added**

                Cause: This error occurs when the memory reserved for macros is all used up.

                Action: You must delete macros to reclaim memory in the macro buffer.

812   **Invalid macro name: %s**

                Cause: You tried to delete a macro that did not exist; or you tried to define a new macro with a name containing characters other than letters, digits, or underscores.

                Action: Use the **mac** command to display the names of macros in the macro table before deleting them with **mac -d <NAME>**. Define new macro names using only letters, digits, and underscore characters.

813   **Command line too long; maximum line length: %d**

                Cause: This error occurs when the command line exceeds the maximum number of characters.

                Action: Split the command line into two command lines.

814   **Command line too complex**

                Cause: There was not enough memory for the expressions in the command line.

                Action: Split up the command line, or use fewer expressions.

815   **Missing macro parameter: %s**

                Cause: This error occurred because you did not include a parameter with the specified **mac** command for macro expansion.

                Action: Enter the command again, and include the appropriate parameter for the macro expansion.

816   **Command line too complex**

                Cause: Too many expression operators are used.

Action: Split up the command line, or use fewer expressions.

818 **Command line too complex**

Cause: A maximum nesting level has been exceeded for nested command execution.

Action: Reduce the number of nesting levels.

820 **Unmatched quote encountered**

Cause: In entering a string, such as with the **echo** command, you didn't properly match the string delimiters (either **''** or **""**). For example, you might have entered

echo "set S1 to off

Action: Re-enter the command and string, making sure to properly match opening and closing delimiters. Note that both delimiters must be the same character. For example: **echo "set S1 to off"**.

822 **Unmatched command group encountered**

Cause: You entered the **mac** or **rep** command group without matching braces **{}**. For example: **mac test={rst -m;cf** or **rep 2 {rst -m;map**.

Action: Re-enter the command, making sure to match braces around commands you want grouped into the macro or repeat. For example: **mac test={rst -m;cf}**.

824 **Maximum number of arguments exceeded**

Cause: Exceeding the limit of 100 arguments per command.

Action: Reduce the number of arguments in the command.

826 **Maximum argument buffer space exceeded**

Cause: Exceeding space limits for argument lists.

Action: Reduce request.

840 **Invalid date: %s**

Cause: You have specified the date format incorrectly in the **dt** command.

Action: Re-enter the command with the correct date format. Refer to the **dt** command description for the correct format.

842   **Invalid time: %s**

Cause: You have incorrectly specified the time format in the **dt** command.

Action: Re-enter the command with the correct time format. Refer to the **dt** command description for the correct format.

844   **Invalid repeat count: %s**

Cause: You entered a non cardinal value for the repeat count in the **rep** command, such as **rep 22.1 <command_group>**.

Action: Re-enter the **rep** command, specifying only a cardinal number (positive integer) for the repeat count.

850   **Attempt to load code outside of allocated bounds**

Cause: This error occurs when the **lcd** command attempts to load an absolute file that contains code or data outside the range allocated for system code.

Action: Generally, you will not use the **lcd** command. The **lcd** command is intended to be used by high-level interfaces to the HP 64700.

875   **Invalid syntax for global or user symbol name: %s**

Cause: This error occurs when you enter a global or user symbol name with incorrect syntax.

Action: Make sure that you enter the global or user symbol name using the correct syntax. When specifying a global symbol, make sure that you precede the global symbol with a colon (for example, :glb_sym). When specifying a user symbol (created with the **sym** command), make sure that you enter the name correctly without a colon.

876   **Invalid syntax for local symbol or module: %s**

Cause: This error occurs when you enter a local symbol or module name with incorrect syntax.

Action: When entering a local symbol name using the **sym** command, make sure that you specify the module name, followed by a colon, then the symbol name (for example module:loc_sym). Make sure that you specify the module name correctly.

877 **Symbol not found: %s**

Cause: This occurs when you try to enter a symbol name that doesn't exist.

Action: Enter a valid symbol name.

878 **Symbol cannot contain wildcard in this context**

Cause: You tried to enter a global, local, or user symbol name using the wildcard (*) incorrectly.

Action: When you enter the symbol name again, include the wildcard (*) at the end of the symbol.

879 **Symbol cannot contain text after the wildcard**

Cause: You tried to include text after the wildcard specified in the symbol name (for example, sym*text).

Action: Enter the symbol again, but don't include text after the wildcard (*).

880 **Conflict between expected and received symbol information**

Cause: The information you supplied in a symbol definition is not what the HP 64700 expected to receive.

Action: Make sure that all symbols in the symbol file are defined correctly. Verify that there are no spaces in the address definitions for the symbols in the symbol file being downloaded.

881 **Ascii symbol download failed**

Cause: This error occurs because the system is out of memory.

Action: You must either reduce the number of symbols to be loaded, or free up additional system space and try the download again.

882   **No module specified for local symbol**

Cause: This error occurs because you tried to specify a local symbol name without specifying the module name where the symbol is located.

Action: Enter the module name where the local symbol is located, followed by a colon, then the local symbol name.

901   **Invalid firmware for emulation subsystem**

Cause: This error occurs when the HP 64700 system controller determines that the emulation firmware (ROM) is invalid.

Action: This message is not likely to occur unless you have upgraded the ROMs in your emulator. Be sure that the correct ROM is installed in the emulation controller.

902   **Invalid analysis subsystem; product address: %s**

Cause: This error occurs when the HP 64700 system controller determines that the analysis firmware (ROM) is invalid.

Action: This message is not likely to occur unless you have upgraded the ROMs in your emulator. Be sure that the correct ROMs are installed in the analyzer board.

903   **Invalid ET subsystem; product address: %s**

Cause: Detects an invalid ET. Used only internally.

Action: None.

904   **Invalid auxiliary subsystem; product address: %s**

Cause: For future products.

Action: None.

911   **Lab firmware for emulation subsystem**

Cause: This message should never occur. It shows that you have an unreleased version of emulation firmware.

Action: None.
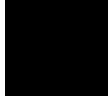
912   **Lab firmware analysis subsystem; product address: %s**

Cause: This message should never occur. It shows that you have an unreleased version of analysis firmware.

Action: None.

913   **Lab firmware subsystem; product address: %s**

Cause: This message should never occur. It shows that you have an unreleased version of system controller firmware.

Action: None.

914   **Lab firmware auxiliary subsystem; product address: %s**

Cause: This message should never occur. It shows that you have an unreleased firmware version of the auxiliary subsystem.

Action: None.
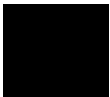
Analyzer Messages

1000   **Conflicting disassembler option: <option>**

Cause: This error occurs when you attempt to specify inverse assembly options (tl -o<ialopts>) which are not allowed with each other.

Action: You must not use conflicting inverse assembly options in the same trace list command.

1001   **Invalid disassembler option: <option>**

Cause: The <ialopts> option specified with the **tl -o** command is not valid.

Action: Refer to the **tl** command description for a list of the valid options.

1102   **Invalid bit range; crosses two multiples of 16: <sig#>..<sig#>**

Cause: This error occurs when defining trace labels. A trace label may not contain trace signals crossing two 16-bit boundaries. For example, the command "**tlb name 1..32**" will cause this error because "name" contains signals which cross the 15-16 and 31-32 16-bit boundaries.

Action: Redefine your trace label so that no more than one 16-bit boundary is crossed.

1103   **Invalid bit range; out of bounds: <sig#>..<sig#>**

Cause: This error occurs when defining trace labels, and you have attempted to assign non-existent trace signals to a label.

Action: Enter the trace activity command to view the trace signals present, and use only these signals when defining trace labels.

1104   **Invalid bit range; too wide: <sig#>..<sig#>**

Cause: This error occurs when defining trace labels, and you have attempted to assign more than 32 trace signals to a label.

Action: Use more than one trace label to define over 32 trace signals.

1105   **Unable to delete label; used by emulation analyzer: <label>**

Cause: This error occurs when you attempt to delete an emulation trace label which is currently being used as a qualifier in the emulation trace specification or is currently specified in the emulation trace format.

Action: Display the emulation trace sequencer specification in the easy configuration, display the emulation trace patterns in the complex configuration, or display the trace format to see where the label is used. Also, you should check **tpq** for uses of that label. You must change the pattern or format specification to remove the label before you can delete it.

1108   **Unable to redefine label; used by emulation analyzer: <label>**

Cause: This error occurs when you attempt to redefine an emulation trace label which is currently used as a qualifier in the emulation trace specification.

Action: Display the emulation trace sequencer specification in the easy configuration, display the emulation trace patterns in the complex configuration, or display the emulation trace format to see where the label is used. You must change the pattern or format specification to remove the label before you can redefine it.

1130   **Illegal base for count display**

Cause: When specifying the trace format, counts may only be displayed relative or absolute. When counting states, the count is always displayed as a decimal number.

Action: Respecify the trace format without using a base for the count column. Also, you can use "**,A**" to specify that counts be displayed absolute, or you can use "**,R**" to specify that counts be displayed relative.

1131   **Illegal base for mnemonic disassembly display**

Cause: When specifying the trace format, you cannot specify a number base for the column containing mnemonic information.

Action: Respecify the trace format without using a base for the mnemonic column.

1132   **Illegal base for sequencer display**

Cause: When specifying the trace format, you cannot specify a number base for the column containing sequencer information.

Action: Respecify the trace format without using a base for the sequencer column.

1133   **Trace format command failed; using old format**

Cause: This error occurs when the trace format command fails for some reason. This error message always occurs with another error message.

Action: Refer to the "Action" description for the other error message displayed.

1138   **Illegal width for symbol display: %s**

Cause: This error occurs when the value specified for the trace format address field width is not valid.

Action: Enter the **tf** command again, and specify the width of the address field for symbol display within the range of 4 to 55.

1139   **Illegal width for addr display, mne not specified**

Cause: This error occurs when you specify a width for the address field in the **tf** command, but do not include the **mne** option.

Action: Enter the command again, and include the **mne** option.

1140   **Symbol display unsupported**

Cause: This error occurs when you try to display symbols in the trace list, but the emulator you are using doesn't support symbols.

Action: Enter the **tl** command again, but don't try to display symbols.

1141   **Symbol display unavailable without mne field**

Cause: This error occurs when you try to display symbols, but have not included the **mne** option to the **tf** command.

Action: Don't try to display symbols unless the **mne** field has already been specified.

1202   **Trigger position out of bounds: <bounds>**

Cause: This error occurs when you attempt to specify a number of lines to appear either before or after the trigger which is greater than the number of lines allowed. The <bounds> string indicates the incorrect range that you typed (not the correct limits on the range).

Action: Be sure that the trigger position specified is within the range -1024 to 1023.

1207   **Invalid clock channel: <name>**

Cause: Valid clock channels are L, M, and N.

Action: Respecify the command using valid clock channels.

1209   **Operator must be "and" or "or": <expression>**

Cause: When combining trace labels to specify trace patterns (in simple expressions or with the **tpat** command), an operator of either "and" or "or" must appear between the label qualifiers.

Action: Refer to the "Qualifying Trigger and Store Conditions" section of the "Using the Emulation Analyzer - Easy Configuration" chapter.

1210   **Illegal mix of = and !=**

Cause: When combining trace labels to specify patterns (in simple expressions or with the tpat command), all labels must either be equal to values or not equal to values.

Action: Refer to the "Qualifying Trigger and Store Conditions" section of the "Using the Emulation Analyzer - Easy Configuration" chapter.

1211   **Illegal mix of and/or**

Cause: When combining trace labels to specify patterns (in simple expressions or with the tpat command), all label qualifiers must either be ANDed together or ORed together. You cannot mix these operators.

Action: Refer to the "Qualifying Trigger and Store Conditions" section of the "Using the Emulation Analyzer - Easy Configuration" chapter.

1212   **Conflict with overlapping label: <label>**

Cause: When combining trace labels to specify patterns (in simple expressions or with the tpat command), you cannot combine labels which are defined for common trace signals. For example, the following easy configuration commands will result in this error: tlb low8 0..7; tlb low16 0..15; tg low8=0 and low16=1.

Action: Either omit one of the overlapping labels, or redefine your labels so that they do not contain common trace signals. You could also circumvent this error by

using don't cares in the appropriate places; for the example shown in cause, you could specify patterns **tg low8=0xx0xY and low16=1**.

1213   **Illegal mix of !=/and**

Cause: When combining trace labels to specify patterns (in simple expressions or with the tpat command), labels which are not equal to values must be ORed together so that the entire pattern specifies a "not equals" condition.

Action: Refer to the "Qualifying Trigger and Store Conditions" section of the "Using the Emulation Analyzer - Easy Configuration" chapter.

1214   **Illegal mix of =/or**

Cause: When combining trace labels to specify patterns (in simple expressions or with the tpat command), labels which are equal to values must be ANDed together so that the entire pattern specifies an "equals" condition.

Action: Refer to the "Qualifying Trigger and Store Conditions" section of the "Using the Emulation Analyzer - Easy Configuration" chapter.

1215   **Comparator must be = or !=: <label>**

Cause: When combining trace labels to specify patterns (in simple expressions or with the tpat command), the value of the label can only be specified with the "=" or "!=" operators.

Action: Refer to the "Qualifying Trigger and Store Conditions" section of the "Using the Emulation Analyzer - Easy Configuration" chapter.

1217   **Illegal pattern name: <name>**

Cause: Valid pattern names are p1 through p8.

Action: Use only valid pattern names.

1218   **Illegal comparator for range qualifier: !=**

Cause: When specifying a range with the trng command, you cannot use the"!=" operator.

Action: Use the "!r" range name.

1219   **Range cannot be combined with any other qualifier**

Cause: For example, the following easy configuration command will result in this error: tsto addr=400..4ff and data=40.

Action: Do not attempt to combine labels when using range qualifiers.

1221   **Range resource in use**

Cause: This error occurs when you attempt to use two different range expressions in the "easy" configuration trace specification or when you attempt to redefine the "complex" configuration range resource while it is currently being used as a qualifier in the trace specification.

Action: Only one range expression may be used in the "easy" configuration trace specification. In the "complex" configuration, display the sequencer specification to see where the range resource is being used and remove it; then, you can redefine the range resource.

1224   **Sequence term number out of range: <term>**

Cause: This error occurs when a sequencer qualification command (**tif**, **telif**, **tsq**, or **tsto**) specifies a non-existent sequence term. The easy configuration sequencer may have a maximum of 4 sequence terms. Eight sequence terms exist in the complex configuration sequencer.

Action: Re-enter the command using an existing sequence term.

1225   **Sequence term not contiguous: <term>**

Cause: This error occurs when you attempt to insert a sequence term which is not between existing terms or after the last term. For example, the following easy configuration commands will result in this error: tg any; tsq -i 4.

Action: Be sure that the sequence term you enter is either between existing sequence terms or after the last sequence term.

1226   **Too many sequence terms**

Cause: This error occurs when you attempt to insert more than 4 sequence terms.

Action: Do not attempt to insert more than 4 sequence terms.

1227   **Sequence term not defined: \<term\>**

Cause: This error occurs when you attempt to delete, or specify a primary branch
expression for, a sequence term number which is possible, but which is not
currently defined.

Action: Insert the sequence term, and respecify the primary branch expression for
that term.

1228   **One sequence term required**

Cause: This error occurs when you attempt to delete terms from the sequencer
when only one term exists.

Action: At least one term must exist in the sequencer. Do not attempt to delete
sequence terms when only one exists.

1234   **Invalid occurrence count: \<number\>**

Cause: Occurrence counts may be from 1 to 65535.

Action: Re-enter the command with a valid occurrence count.

1235   **Illegal threshold value: \<value\>**

Cause: Threshold voltage specifications may be from -6.4 V to +6.35 V in
increments of 0.05 V.

Action: Re-enter the command with a valid threshold voltage.

1239   **Clock speed not available with current count qualifier.**

Cause: This error occurs when you attempt to specify a fast (F) or very fast (VF)
maximum qualified clock speed when counting time (tcq time). This error also
occurs when you attempt to specify a very fast (VF) maximum qualified clock
speed when counting states (for example, tcq addr=400).

Action: Change the count qualifier; then, re-enter the command.

1240   **Count qualifier not available with current clock speed.**

Cause: This error occurs when you attempt to specify the "time" count qualifier
when the current maximum qualified clock speed is fast (F) or very fast (VF). This

error also occurs when you attempt to specify a "state" count qualifier when the maximum qualified clock speed is fast (F).

Action: Change the clock speed; then, change the count qualifier.

1241   **Invalid qualifier resource or operator: <expression>**

Cause: When specifying complex expressions, you have either specified an illegal pattern or used an illegal operator.

Action: Refer to the "Using Complex Expressions" section of the "Using the Emulation Analyzer - Complex Configuration" chapter for information on valid patterns and operators.

1245   **Range qualifier not accessible in easy configuration**

Cause: This error occurs when you attempt to use the **trng** command in the easy configuration.

Action: Changing into the complex configuration will allow you to use the **trng** command; otherwise, specify the range in easy configuration command expressions.

1246   **Pattern qualifiers not accessible in easy configuration**

Cause: This error occurs when you attempt to use the **tpat** command in the easy configuration.

Action: Changing into the complex configuration will allow you to use the **tpat** command; otherwise, specify the patterns in easy configuration command expressions.

1248   **Range term used more than once**

Cause: This error occurs when you attempt to use the range resource more than once in a sequencer branch expression.

Action: You cannot use the range resource more than once in a sequencer branch expression.

1249   **Invalid qualifier expression: <expression>**

Cause: This error message is shown with the errors that occur when patterns, the range, or the arm condition is used more than once within a set. This error message

also occurs when intraset operators are not the same. For example, the following complex expression will result in this error: p1 ~ p2 | p3.

Action: Refer to the "Using Complex Expressions" section of the "Using the Emulation Analyzer - Complex Configuration" chapter for information on valid patterns and operators.

1250   **Arm term used more than once**

Cause: This error occurs when you attempt to use the "arm" qualifier more than once in a sequencer branch expression.

Action: You cannot use the "arm" qualifier more than once in a sequencer branch expression.

1251   **Trigger term cannot be term 1**

Cause: This error occurs when to attempt to specify the first sequence term as the trigger term. The trigger term may be any term but the first.

Action: Respecify the trigger term as any other sequence term.

1253   **Invalid pod number: <pod#>**

Cause: This error message occurs when you attempt to specify a slave clock for a non-existent analyzer pod.

Action: Use the trace activity command to display the valid pod numbers, and use only these numbers when entering commands.

1302   **Trig1 signal cannot be driven and received**

Cause: This error occurs when you attempt to specify the internal trig1 signal as the trace arm condition while the same analyzer's trigger output is currently driving the trig1 signal. This error also occurs if you attempt to specify that the trigger output drive the internal trig1 signal while that signal is currently specified as the arm condition for the same analyzer.

Action: You can either change the arm or the trigger output specification; in either case, make sure that they do not use the same internal signal.

1303   **Trig2 signal cannot be driven and received**

Cause: This error occurs when you attempt to specify the internal trig2 signal as the trace arm condition while the same analyzer's trigger output is currently driving the trig2 signal. This error also occurs if you attempt to specify that the trigger output drive the internal trig2 signal while that signal is currently specified as the arm condition for the same analyzer.

Action: You can either change the arm or the trigger output specification; in either case, make sure that they do not use the same internal signal.

1305   **CMB execute; emulation trace started**

Cause: This status message informs you that an emulation trace measurement has started as a result of a CMB execute signal (as specified by the "**tx -e**" command).

10
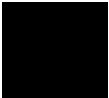
Specifications and Characteristics

Emulator Specifications and Characteristics

This section contains the following types of emulator specifications and characteristics:

- Electrical characteristics (including emulator timing).

- Physical characteristics.

- Environmental characteristics.

Electrical

This section describes the electrical characteristics of the HP 64751 68340 Emulator and the HP 64700 Card Cage.

Electrical Characteristics of the HP 64751 Emulator

The emulator requires some control signals and power supply in order to run. Therefore, a target system is required in order to use the emulator. The demo board that is included with the emulator is one such minimum target system.

DC Characteristics. The DC characteristics of the HP 64751 emulator's active probe are listed in the following table.

DC Electrical Specifications				
Characteristic	**Symbol**	**Min**	**Max**	**Unit**
Input High Voltage (except clock)	V_{IH}	2.0	V_{CC}	V
Input Low Voltage	V_{IL}	GND	0.8	V
Input Leakage Current, $GND \leq V_{in} \leq V_{CC}$ $\overline{BR}$, $\overline{BGACK}$, $\overline{IRQx}$	I_{in}	-2.5	2.5	µA
Input High Current $\overline{BERR}$, $\overline{DSACKx}$ $\overline{RESET}$, $\overline{HALT}$	I_{IH}	— —	25 50	µA
Input Low Current $\overline{BERR}$, $\overline{DSACKx}$ $\overline{RESET}$, $\overline{HALT}$	I_{IL}	— —	-0.25 -1.0	mA
Output High Voltage, $I_{OH} = -0.8$ mA A0-A23, $\overline{AS}$, $\overline{BG}$, D0-D15, $\overline{DS}$, R/$\overline{W}$, $\overline{RMC}$, SIZ0-SIZ1, FC0-FC3	V_{OH}	2.4 2.4	— —	V
Output Low Voltage $I_{OL} = 2.0$ mA A0-A23, SIZ0-SIZ1, FC0-FC3 $I_{OL} = 4.5$ mA R/$\overline{W}$, $\overline{RMC}$ $I_{OL} = 20$ mA $\overline{AS}$, D0-D15, $\overline{DS}$ $I_{OL} = 14$ mA $\overline{RESET}$, $\overline{HALT}$	V_{OL}	— — — —	0.5 0.5 0.5 0.5	V
Power Dissipation $T_A = 0°C$ $T_A = 70°C$	P_D	— —	2.2 2.2	W
Capacitance, $V_{in} = 0$ V, $T_A = 25°C$, f = 1 MHz	C_{in}	—	20	pF
Load Capacitance A0-A31, R/$\overline{W}$, SIZ0-SIZ1, FC0-FC3 All Other	C_L	— —	100 50	pF

AC Characteristics. The AC characteristics of the HP 64751 emulator's active probe are listed in the following tables.

AC Electrical Specifications (64751-66508 and higher active probe board numbers) — Clock Timing

Num.	Characteristic	Symbol	MC68340 25.16 MHz Min	Max	HP 64751 Min	Max	Unit
	System Frequency (See Note)	f_{sys}	dc	25.16	dc	25.16	MHz
	Crystal Frequency	f_{XTAL}	25	50	25	50	kHz
	On-Chip VCO System Frequency	f_{sys}	0.13	25.16	0.13	25.16	MHz
	On-Chip VCO Frequency Range	f_{VCO}	0.1	50.3	0.1	50.3	MHz
	Crystal Oscillator Startup Time	t_{rc}	—	20	—	20	ms
1	CLKOUT Period	t_{cyc}	40	—	40	—	ns
2,3	CLKOUT Pulse Width	t_{CW}	19	—	19	—	ns
4,5	CLKOUT Rise and Fall Times	t_{Crf}	—	4	—	4	ns
	NOTE: All internal registers retain data at 0 Hz.						

AC Electrical Specifications (64751-66508 and higher active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 25.16 MHz		HP 64751		Unit
			Min	Max	Min	Max	
6	CLKOUT High to Address, FC, SIZE, $\overline{RMC}$ Valid	t_{CHAV}	0	20	0	20	ns
7	CLKOUT High to Address, Data, FC, SIZE, RMC High Impedance	t_{CHAZx}	0	40	0	40	ns
8	CLKOUT High to Address, FC, SIZE, $\overline{RMC}$ Invalid	t_{CHAZn}	0	—	0	—	ns
9	CLKOUT Low to $\overline{AS}$, $\overline{DS}$, $\overline{CS}$, $\overline{IACK}$, IFETCH[A], IPIPE[A] Asserted	t_{CLSA}	3 3 3	20 20 20	0 3 —	23 20 —	ns ns ns
9A[2]	$\overline{AS}$ to $\overline{DS}$ or $\overline{CS}$ Asserted (Read)	t_{STSA}	-6	6	-8	8	ns
11	Address, FC, SIZE, $\overline{RMC}$ Valid to $\overline{AS}$, $\overline{CS}$ (and DS Read) Asserted	t_{AVSA}	10	—	10	—	ns
12	CLKOUT Low to $\overline{AS}$, $\overline{DS}$, $\overline{CS}$, $\overline{IACK}$, IFETCH[A], IPIPE[A] Negated	t_{CLSN}	3 3 3	20 20 20	0 3 —	23 20 —	ns ns ns
13	$\overline{AS}$, $\overline{DS}$, $\overline{CS}$, $\overline{IACK}$ Negated to Address, FC, SIZE Invalid (Address Hold)	t_{SNAI}	10	—	10	—	ns
14	$\overline{AS}$, $\overline{CS}$ (and $\overline{DS}$ Read) Width Asserted	t_{SWA}	70	—	70	—	ns
14A	$\overline{DS}$ Width Asserted Write	t_{SWAW}	30	—	30	—	ns
14B	$\overline{AS}$, $\overline{CS}$, $\overline{IACK}$, (and $\overline{DS}$ READ) Width Asserted (Sync Cycle)	t_{SWDW}	30	—	30	—	ns
15[3]	$\overline{AS}$, $\overline{DS}$, $\overline{CS}$ Width Negated	t_{SN}	30	—	30	—	ns

AC Electrical Specifications (64751-66508 and higher active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 25.16 MHz Min	Max	HP 64751 Min	Max	Unit
16	CLKOUT High to $\overline{AS}$, $\overline{DS}$, R/$\overline{W}$ High Impedance	t_{CHSZ}	— —	60 60	— —	$0.5t_{cyc}+30$ 40	ns ns
17	$\overline{AS}$, $\overline{DS}$, $\overline{CS}$ Negated to R/$\overline{W}$ High	t_{SNRN}	10	—	10	—	ns
18	CLKOUT High to R/$\overline{W}$ High	t_{CHRH}	0	20	0	20	ns
20	CLKOUT High to R/$\overline{W}$ Low	t_{CHRL}	0	20	0	20	ns
21	R/$\overline{W}$ High to $\overline{AS}$, $\overline{CS}$ Asserted	t_{RAAA}	10	—	10	—	ns
22	R/$\overline{W}$ Low to $\overline{DS}$ Asserted (Write)	t_{RASA}	47	—	47	—	ns
23	CLKOUT High to Data-Out Valid	t_{CHDO}	—	20	—	23	ns
24	Data-Out Valid to Negating Edge of $\overline{AS}$, $\overline{CS}$ (Synchronous Write)	t_{DVASN}	10	—	10		ns
25	$\overline{DS}$, $\overline{CS}$ Negated to Data-Out Invalid (Data-Out Hold)	t_{SNDOI}	10	—	10	—	ns
26	Data-Out Valid to $\overline{DS}$ Asserted (Write)	t_{DVSA}	10	—	9	—	ns
27	Data-In Valid to CLKOUT Low (Data Setup)	t_{DICL}	5	—	8	—	ns
27A	Late $\overline{BERR}$, $\overline{HALT}$, $\overline{BKPT}$[B] Asserted to CLKOUT Low (Setup Time)	t_{BELCL}	10 10	— —	10 —	— —	ns ns
28	$\overline{AS}$, $\overline{DS}$ Negated to $\overline{DSACKx}$, $\overline{BERR}$, $\overline{HALT}$	t_{SNDN}	0	50	0	50	ns
29[4]	$\overline{DS}$ Negated to Data-In Invalid (Data-In Hold)	t_{SNDI}	0	—	0	—	ns
29A[4]	$\overline{DS}$ Negated to Data-In High Impedance	t_{SHDI}	—	40	—	40	ns

AC Electrical Specifications (64751-66508 and higher active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 25.16 MHz		HP 64751		Unit
			Min	Max	Min	Max	
30[4]	CLKOUT Low to Data-In Invalid (Synchronous Hold)	t_{CLDI}	10	—	10	—	ns
30A[4]	CLKOUT Low to Data-In High Impedance	t_{CLDH}	—	60	—	60	ns
31[5]	$\overline{DSACKx}$ Asserted to Data-In Valid	t_{DADI}	—	32	—	32	ns
32	$\overline{HALT}$ and $\overline{RESET}$ Input Transition Time	t_{RHrf}	0	140	0	140	ns
33	CLKOUT Low to $\overline{BG}$ Asserted	t_{CLBA}	—	20	—	20	ns
34	CLKOUT Low to $\overline{BG}$ Negated	t_{CLBN}	—	20	—	20	ns
35[7]	$\overline{BR}$ Asserted to $\overline{BG}$ Asserted ($\overline{RMC}$ Not Asserted)	t_{BRAGA}	1	—	1	—	clks
37	$\overline{BGACK}$ Asserted to $\overline{BG}$ Negated	t_{GAGN}	1	2.5	1	2.5	clks
39	$\overline{BG}$ Width Negated	t_{GH}	2	—	2	—	clks
39A	$\overline{BG}$ Width Asserted	t_{GA}	1	—	1	—	clks
46	R/$\overline{W}$ Width Asserted (Write or Read)	t_{RWA}	100	—	100	—	ns
46A	R/$\overline{W}$ Width Asserted (Sync. Write or Read)	t_{RWAS}	60	—	60	—	ns
47A	Asynchronous Input Setup Time	t_{AIST}	5	—	5	—	ns
47B	Asynchronous Input Hold Time	t_{AIHT}	10	—	10	—	ns
48[8]	$\overline{DSACKx}$ Asserted to $\overline{BERR}$, $\overline{HALT}$ Asserted	t_{DABA}	—	20	—	20	ns
53	Data-Out Hold from CLKOUT High	t_{DOCH}	0	—	0	—	ns
54	CLKOUT High to Data-Out High Impedance	t_{CHDH}	—	20	—	20	ns
55	R/$\overline{W}$ Asserted to Data Bus Impedance Change	t_{RADC}	25	—	25	—	ns

AC Electrical Specifications (64751-66508 and higher active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 25.16 MHz		HP 64751		Unit
			Min	Max	Min	Max	
56	RESET Pulse Width (Reset Instruction)	t_{HRPW}	512	—	512	—	clks
57	BERR Negated to HALT Negated (Rerun)	t_{BNHN}	0	—	0	—	ns
70	CLKOUT Low to Data Bus Driven (Show Cycle)	t_{SCLDD}	0	30	—C	—C	ns
71	Data Setup Time to CLKOUT Low (Show Cycle)	t_{SCLDS}	10	—	—C	—	ns
72	Data Hold from CLKOUT Low (Show Cycle)	t_{SCLDH}	6	—	—C	—	ns

MC68340 NOTES:
1. All AC timing is shown with respect to 0.8-V and 2.0-V levels unless otherwise noted.
2. This number can be reduced to 5 ns if strobes have equal loads.
3. If multiple chip selects are used, the CS width negated (#15) applies to the time from the negation of a heavily loaded chip select to the assertion of a lightly loaded chip select.
4. These hold times are specified with respect to DS on asychronous reads and with respect to CLKOUT on synchronous reads. The user is free to use either hold time.
5. If the asychronous setup time (#47) requirements are satisfied, the DSACKx low to data setup time (#31) and DSACKx low to BERR low setup time (#48) can be ignored. The data must only satisfy the data-in to CLKOUT low setup time (#27) for the following clock cycle, BERR must only satisfy the late BERR low to CLKOUT low setup time (#27A) for the following clock cycle.
6. To ensure coherency during every operand transfer, BG will not be asserted in response to BR until after cycles of the current operand transfer are complete and RMC is negated.
7. In the absence of DSACKx, BERR is an asychronous input using the asychronous setup time (#47).
8. Address Access Time = $2t_{cyc} + t_{CW} - t_{CHAV} - t_{DICL} = 74$ ns (@ 25.16-MHz clock). Chip Select Access Time = $2t_{cyc} - t_{CLSA} - t_{DICL} = 55$ ns (@ 25.16-MHz clock).

HP 64751 NOTES:
A. IFETCH and IPIPE are not driven to the target system.
B. The emulator does not respond to BKPT from the target system.
C. The emulator does not drive data to the target system during show cycles.

AC Electrical Specifications (64751-66506 and lower active probe board numbers) — Clock Timing							
			MC68340 16.78 MHz		HP 64751		
Num.	Characteristic	Symbol	Min	Max	Min	Max	Unit
	System Frequency (See Note)	f_{sys}	dc	16.78	dc	16.78	MHz
	Crystal Frequency	f_{XTAL}	25	50	25	50	kHz
	On-Chip VCO System Frequency	f_{sys}	0.13	16.78	0.13	16.78	MHz
	On-Chip VCO Frequency Range	f_{VCO}	0.1	35	0.1	35	MHz
	Crystal Oscillator Startup Time	t_{rc}	—	100	—	100	ms
1	CLKOUT Period	t_{cyc}	59.6	—	59.6	—	ns
2,3	CLKOUT Pulse Width	t_{CW}	28	—	28	—	ns
4,5	CLKOUT Rise and Fall Times	t_{Crf}	—	5	—	5	ns
NOTE: All internal registers retain data at 0 Hz.							

AC Electrical Specifications (64751-66506 and lower active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 16.78 MHz		HP 64751		Unit
			Min	Max	Min	Max	
6	CLKOUT High to Address, FC, SIZE, $\overline{RMC}$ Valid	t_{CHAV}	0	30	0	30	ns
7	CLKOUT High to Address, Data, FC, SIZE, RMC High Impedance	t_{CHAZx}	0	60	0	60	ns
8	CLKOUT High to Address, FC, SIZE, $\overline{RMC}$ Invalid	t_{CHAZn}	0	—	0	—	ns
9	CLKOUT Low to $\overline{AS}$, $\overline{DS}$, $\overline{CS}$, $\overline{IACK}$, $\overline{IFETCH}^A$, $\overline{IPIPE}^A$ Asserted	t_{CLSA}	3 3 3	30 30 30	0 3 —	33 30 —	ns ns ns
9A[2]	$\overline{AS}$ to $\overline{DS}$ or $\overline{CS}$ Asserted (Read)	t_{STSA}	-15	15	-15	15	ns
11	Address, FC, SIZE, $\overline{RMC}$ Valid to $\overline{AS}$, $\overline{CS}$ (and DS Read) Asserted	t_{AVSA}	15	—	15	—	ns
12	CLKOUT Low to $\overline{AS}$, $\overline{DS}$, $\overline{CS}$, $\overline{IACK}$, $\overline{IFETCH}^A$, $\overline{IPIPE}^A$ Negated	t_{CLSN}	3 3 3	30 30 30	0 3 —	33 30 —	ns ns ns
13	$\overline{AS}$, $\overline{DS}$, $\overline{CS}$, $\overline{IACK}$ Negated to Address, FC, SIZE Invalid (Address Hold)	t_{SNAI}	15	—	15	—	ns
14	$\overline{AS}$, $\overline{CS}$ (and $\overline{DS}$ Read) Width Asserted	t_{SWA}	100	—	100	—	ns
14A	$\overline{DS}$ Width Asserted Write	t_{SWAW}	45	—	45	—	ns
14B	$\overline{AS}$, $\overline{CS}$, $\overline{IACK}$, (and $\overline{DS}$ READ) Width Asserted (Sync Cycle)	t_{SWDW}	40	—	40	—	ns
15[3]	$\overline{AS}$, $\overline{DS}$, $\overline{CS}$ Width Negated	t_{SN}	40	—	40	—	ns

AC Electrical Specifications (64751-66506 and lower active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 16.78 MHz		HP 64751		Unit
			Min	Max	Min	Max	
16	CLKOUT High to $\overline{AS}$, $\overline{DS}$, R/$\overline{W}$ High Impedance	t_{CHSZ}	— —	60 60	— —	$0.5t_{cyc}+40$ 60	ns ns
17	$\overline{AS}$, $\overline{DS}$, $\overline{CS}$ Negated to R/$\overline{W}$ High	t_{SNRN}	15	—	15	—	ns
18	CLKOUT High to R/$\overline{W}$ High	t_{CHRH}	0	30	0	30	ns
20	CLKOUT High to R/$\overline{W}$ Low	t_{CHRL}	0	30	0	30	ns
21	R/$\overline{W}$ High to $\overline{AS}$, $\overline{CS}$ Asserted	t_{RAAA}	15	—	15	—	ns
22	R/$\overline{W}$ Low to $\overline{DS}$ Asserted (Write)	t_{RASA}	70	—	70	—	ns
23	CLKOUT High to Data-Out Valid	t_{CHDO}	—	30	—	33	ns
24	Data-Out Valid to Negating Edge of $\overline{AS}$, $\overline{CS}$ (Synchronous Write)	t_{DVASN}	15	—	15	—	ns
25	$\overline{DS}$, $\overline{CS}$ Negated to Data-Out Invalid (Data-Out Hold)	t_{SNDOI}	15	—	15	—	ns
26	Data-Out Valid to $\overline{DS}$ Asserted (Write)	t_{DVSA}	15	—	12	—	ns
27	Data-In Valid to CLKOUT Low (Data Setup)	t_{DICL}	5	—	8	—	ns
27A	Late $\overline{BERR}$, $\overline{HALT}$, $\overline{BKPT}$[B] Asserted to CLKOUT Low (Setup Time)	t_{BELCL}	20 20	— —	20 —	— —	ns ns
28	$\overline{AS}$, $\overline{DS}$ Negated to DSACKx, $\overline{BERR}$, $\overline{HALT}$	t_{SNDN}	0	80	0	80	ns
29[4]	$\overline{DS}$ Negated to Data-In Invalid (Data-In Hold)	t_{SNDI}	0	—	0	—	ns
29A[4]	$\overline{DS}$ Negated to Data-In High Impedance	t_{SHDI}	—	60	—	60	ns

AC Electrical Specifications (64751-66506 and lower active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 16.78 MHz		HP 64751		Unit
			Min	Max	Min	Max	
30[4]	CLKOUT Low to Data-In Invalid (Synchronous Hold)	t_{CLDI}	15	—	15	—	ns
30A[4]	CLKOUT Low to Data-In High Impedance	t_{CLDH}	—	90	—	90	ns
31[5]	DSACKx Asserted to Data-In Valid	t_{DADI}	—	50	—	50	ns
32	HALT and RESET Input Transition Time	t_{RHrf}	0	200	0	200	ns
33	CLKOUT Low to BG Asserted	t_{CLBA}	—	30	—	30	ns
34	CLKOUT Low to BG Negated	t_{CLBN}	—	30	—	30	ns
35[7]	BR Asserted to BG Asserted (RMC Not Asserted)	t_{BRAGA}	1	—	1	—	clks
37	BGACK Asserted to BG Negated	t_{GAGN}	1	2.5	1	2	clks
39	BG Width Negated	t_{GH}	2	—	2	—	clks
39A	BG Width Asserted	t_{GA}	1	—	1	—	clks
46	R/W Width Asserted (Write or Read)	t_{RWA}	150	—	150	—	ns
46A	R/W Width Asserted (Sync.Write or Read)	t_{RWAS}	90	—	90	—	ns
47A	Asynchronous Input Setup Time	t_{AIST}	5	—	5	—	ns
47B	Asynchronous Input Hold Time	t_{AIHT}	15	—	15	—	ns
48[8]	DSACKx Asserted to BERR, HALT Asserted	t_{DABA}	—	30	—	30	ns
53	Data-Out Hold from CLKOUT High	t_{DOCH}	0	—	0	—	ns
54	CLKOUT High to Data-Out High Impedance	t_{CHDH}	—	30	—	30	ns
55	R/W Asserted to Data Bus Impedance Change	t_{RADC}	40	—	40	—	ns

AC Electrical Specifications (64751-66506 and lower active probe board numbers) — Read and Write Cycles
(Vcc = 5.0 Vdc +/-5%; GND = 0 Vdc; $T_A = T_L$ to T_H)

Num.	Characteristic	Symbol	MC68340 16.78 MHz Min	Max	HP 64751 Min	Max	Unit
56	RESET Pulse Width (Reset Instruction)	t_{HRPW}	512	—	512	—	clks
57	BERR Negated to HALT Negated (Rerun)	t_{BNHN}	0	—	0	—	ns
70	CLKOUT Low to Data Bus Driven (Show Cycle)	t_{SCLDD}	0	30	—[C]	—[C]	ns
71	Data Setup Time to CLKOUT Low (Show Cycle)	t_{SCLDS}	15	—	—[C]	—	ns
72	Data Hold from CLKOUT Low (Show Cycle)	t_{SCLDH}	10	—	—[C]	—	ns

MC68340 NOTES:
1. All AC timing is shown with respect to 0.8-V and 2.0-V levels unless otherwise noted.
2. This number can be reduced to 5 ns if strobes have equal loads.
3. If multiple chip selects are used, the CS width negated (#15) applies to the time from the negation of a heavily loaded chip select to the assertion of a lightly loaded chip select.
4. These hold times are specified with respect to DS on asychronous reads and with respect to CLKOUT on synchronous reads. The user is free to use either hold time.
5. If the asychronous setup time (#47) requirements are satisfied, the DSACKx low to data setup time (#31) and DSACKx low to BERR low setup time (#48) can be ignored. The data must only satisfy the data-in to CLKOUT low setup time (#27) for the following clock cycle, BERR must only satisfy the late BERR low to CLKOUT low setup time (#27A) for the following clock cycle.
6. To ensure coherency during every operand transfer, BG will not be asserted in response to BR until after cycles of the current operand transfer are complete and RMC is negated.
7. In the absence of DSACKx, BERR is an asychronous input using the asychronous setup time (#47).
8. Address Access Time = $2t_{cyc} + t_{CW} - t_{CHAV} - t_{DICL} = 112.2$ ns (@ 16.78-MHz clock). Chip Select Access Time = $2t_{cyc} - t_{CLSA} - t_{DICL} = 84.2$ ns (@ 16.78-MHz clock).

HP 64751 NOTES:
A. IFETCH and IPIPE are not driven to the target system.
B. The emulator does not respond to BKPT from the target system.
C. The emulator does not drive data to the target system during show cycles.

Electrical Characteristics of the HP 64700

The electrical characteristics of the HP 64700 communication ports are as follows.

Communications

Serial Port	RS-232-C DCE or DTE to 38.4 Kbaud. RS-422 DCE to 460.8 Kbaud.
BNC (labeled TRIGGER IN/OUT)	Input. The signal must drive approximately 4 mA at 2 V. Edge Sensitive. Minimum pulse width is approximately 25 ns.
	Output. Driven active high only; equals +2.4V into a 50 ohm load.

Physical

Dimensions of Emulator Probe

There must be enough clearance in the target system to allow the emulation probe to be plugged in and the cable routed from the target system to the emulator control card in the HP 64700. The following figure shows probe dimensions.
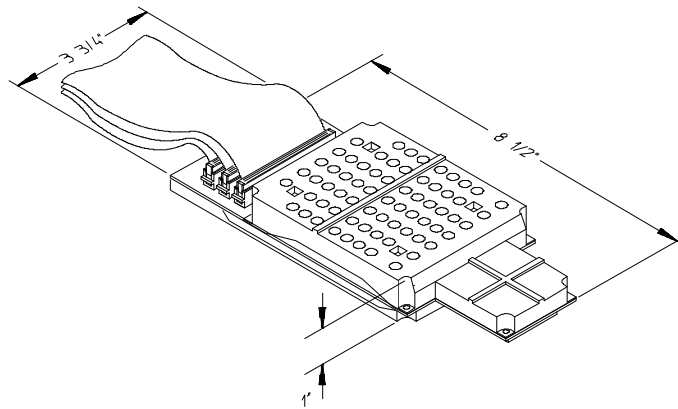
Emulator Dimensions

Width	325 mm (12.8 in.)
Height	173 mm (6.8 in.)
Length	389 mm (15.3 in.)

Emulator Weight

HP 64751	8.2 kg (18 lb)

Cable Length

Emulator to   approximately 914 mm (3 ft).
  target system

Probe Dimensions

92 mm (3.625 in.) width x 16 mm (0.626 in.) height x 159 mm (6.25 in.) length

Communications

Serial Port   25-pin female type "D" subminiature connector.

CMB Port   9-pin female type "D" subminiature connector.

CAUTION   **Possible damage to emulator**. Any component used in suspending the emulator **must** be rated for 30 kg (65 lb) capacity.

Environmental

Temperature

Operating   0°C to +55°C
                 (+32°F to 131°F)

Non-operating   -40°C to +70°C
                 (-40°F to 158°F)

Altitude

Operating   4 600m
                 (15 000 ft)

Non-operating   15 300m
                 (50 000 ft).

Relative Humidity

15% to 95%.

Part 4

Concept Guide

Part 4

11

Concepts
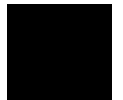
Concepts

This chapter provides conceptual information on the following topics:

- Demo program descriptions.
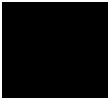
Demo Program Descriptions

Three demo programs have been used to generate examples throughout this manual. The quick start demo program is used in the "Quick Start" chapter's tutorial. The emulator demo program is used to generate examples in the "Using the Emulator" chapter. The analyzer demo program is used to generate examples in the "Using the Analyzer" chapters. The quick start demo is an assembly language program and the emulator and analyzer demo programs are simple C language programs.

Quick Start Demo Program

The HP 64751 emulator contains a simple demo program that allows you to learn about the emulator and Terminal Interface without having to write and load a program.

The **demo** command resets the processor, initializes all configuration items, defines a new memory map, and loads the quick start demo program and its symbols.

The quick start demo program was written in 68000 assembly language. The program is a simple command interpreter. It has a one-byte input buffer for commands, and recognizes the ASCII characters "A" and "B." All other values are considered invalid.

When you input a command to the buffer, the program calls a subroutine that interprets the command and writes a corresponding message to an output buffer.

There are two modules in the program. One is the main module, called demo. The second module, which has the subroutines for printing the messages, is called handle_msg.

The "demo.s" source file is shown below.

```
*
* This program is a simple 68000 assembler program that can be used
* to demonstrate run and trace features for the HP 64751 emulator.
* It emulates a simple command interpreter.
*
* The program scans the location Cmd_Input looking for a non-null
* value. When it finds one, it calls a routine to determine whether
* the command is "A," "B," or an invalid command. This routine sets
* up certain parms for the output message handler, then calls the
* message handler to write a message based on the command input.
*
* Module name: demo.s
*
```
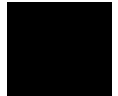
```
* Define the chip. Call it 68000 here since we don't use any 68340-specific
* features.

        chip 68000

* Int_Cmd is in the module handle_msg.

        xref    Int_Cmd

* Set up the stack pointer and initial program counter for run-from-reset.

        sect    Table,,r
        org $0

        dc.l    Top_of_Stack
        dc.l    Main

* Set up the trace vector
* so single-stepping works
        org $24
        dc.l 0

* The stack is declared as 16 long words, which should be more than
* sufficient since there shouldn't be more than 3 PC's on the stack (plus
* whatever the emulation monitor pushes).

        sect    Stack,,d
Stack   ds.l    16
Top_of_Stack

* The only data local to this module is the command input buffer, which
* is a single byte.

        sect    Data,,d

Cmd_Input   ds.b    1

* Main program starts here.

        sect    Prog,,c

* Load the user stack pointer, then clear the command input byte.

Main    move.l  #Top_of_Stack,a7
        move.b  #0,Cmd_Input

* Now loop, looking for a nonzero value. If found, call the message interpreter.

Loop    move.b  Cmd_Input,d0
        bne     Call_Int
        bra     EndLoop

* Call to the message interpreter is a simple subroutine branch. The parameter
* is passed in d0 (the command we read). When finished, clear the command
* input buffer.

Call_Int bsr    Int_Cmd
        move.b  #0,Cmd_Input

* Branch forever.

EndLoop    bra    Loop
```

```
          end     Main
```

```
* End of demo.s
```

The "handle.s" source file is shown below.

```
* This module contains the message intepreter and message printing routines
* for the quick start demo program. The main program module is demo.s.
*
* Module: handle_msg.s


* Int_Cmd must be made global so demo.s can see it.

          xdef    Int_Cmd

* Data local to this module are the message definitions and the message
* output buffer.

          sect    Data,,d

* Define the messages printed for commands A, B and invalid respectively.

Msg_A           dc.b     'Command A entered'
Msg_B           dc.b     'Entered B command'
Msg_I           dc.b     'Invalid command'
End_Msgs

* Message output buffer.

Msg_Dest       ds.b     32

* Start program code for this module.

          sect     Prog,,c

* Int_Cmd is the command interpreter routine. It is called by the main
* program loop in demo.s whenever a command is found.

Int_Cmd   cmp.b    #'A',d0
          beq      Cmd_A
          cmp.b    #'B',d0
          beq      Cmd_B
          bra      Cmd_I

* If "A", then load a pointer to the beginning of the "A" message into a0,
* and load the message's length into d1. Then call the routine to print
* the message. When done, return to the caller (the main program loop in
* demo.s).

Cmd_A     lea      Msg_A,a0
          move.l   #Msg_B-Msg_A-1,d1
          bsr      Print_Msg
          rts

* If "B", then load a pointer to the beginning of the "B" message into a0,
* and load the message's length into d1. Then call the routine to print
* the message. When done, return to the caller (the main program loop in
* demo.s).

Cmd_B     lea      Msg_B,a0
          move.l   #Msg_I-Msg_B-1,d1
```

```
        bsr     Print_Msg
        rts
```

```
* The command isn't recognized, so load a pointer to the beginning of the
* invalid message into a0,
* and load the message's length into d1. Then call the routine to print
* the message. When done, return to the caller (the main program loop in
* demo.s).
```

```
Cmd_I    lea     Msg_I,a0
         move.l  #End_Msgs-Msg_I-1,d1
         bsr     Print_Msg
         rts
```

```
* End of Int_Cmd
```

```
* Print_Msg handles the writing of the appropriate message to the Msg_Dest
* buffer. After the message is written, it writes nulls to the remaining
* locations to clear them from previous commands.
```

```
* To print the message, we load a pointer to the output buffer into
* a1, then do a block xfer with autoincrement addressing. When the number
* of characters specified in d1 has been moved, fall out of the Again loop.
```

```
Print_Msg       lea     Msg_Dest,a1
Again           move.b  (a0)+,(a1)+
                dbeq    d1,Again
```

```
* Now move a null to the next location pointed to by a1 (which is now after
* the last character of the message. Compare the address in a1 to the end
* address of the message buffer, and keep repeating until all remaining
* destination buffer locations are zeroed. Then return to the caller
* (Int_Cmd in this case).
```

```
Fill_Dest       move.b  #0,(a1)+
                cmpa    #Msg_Dest+32,a1
                bne     Fill_Dest
                rts
```

```
* End of Print_Msg
```

```
* End of handle_msg.s
```

How the Quick Start Demo Program was Built

The quick start demo program was built using the Hewlett-Packard 68000/10/20 Assmbler/Linker/Librarian software development tools on the HP 9000 Series 300 host computer with the following commands:

```
$ as68k -h demo.s
$ as68k -h handle_msg.s
$ ld68k -h -c demo.k -o demo.x
```

Where the "demo.k" linker command file contains:

```
CHIP 68000
LIST c,d,p,s,t,x
SECT Prog=$400
SECT Data=$500
SECT Stack=$f00

LOAD demo
LOAD handle_msg
```

Emulator Demo Program

The emulator demo program used in this chapter is a simple command interpreter. The "cmd_rdr.c" source file is shown below.

```
volatile char Cmd_Input;
char Msg_Dest[0x20];

void Write_Msg (char *s)
{
   char *Dest_Ptr;

   Dest_Ptr = Msg_Dest;
   while (*s != '\0')
   {
      *Dest_Ptr = *s;
      Dest_Ptr++;
      s++;
   }
}

main ()
{
   static char Msg_A[] = "Command A Entered                 ";
   static char Msg_B[] = "Entered B Command                 ";
   static char Msg_I[] = "Invalid Command          ";
   char c;

   for (;;)
   {
      Cmd_Input = '\0';
      while ((c = Cmd_Input) == '\0');
      switch (c) {
         case 'A' :
            Write_Msg (Msg_A);
            break;
         case 'B' :
            Write_Msg (Msg_B);
            break;
         default :
            Write_Msg (Msg_I);
            break;
      }
   }
}
```
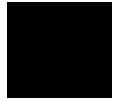
The "cmd_rdr" program continuously reads values from **Cmd_Input**; when a value other than NULL is found, the program calls the **Write_Msg** function to copy a string to the **Msg_Dest** array.

Building the Emulator Demo Program

The emulator demo program was built using the Hewlett-Packard 68332 Advanced C Cross Compiler and the 68000/10/20 Assmbler/Linker/Librarian software development tools on the HP 9000 Series 300 host computer with the following command:

```
$ cc68332 -hOGNr hp64751 -Wl,-Lfx -o cmd_rdr cmd_rdr.c > cmd_rdr.map
```

Analyzer Demo Program

The "anly.c" source file is shown below.

```c
#include <stdlib.h>

int Results[0x100];

void Write_Num (int Number, int Offset)
{
   Offset = Offset % 256;
   Results[Offset] = Number;
}

void Caller_0 (int Num, int Ofs)
{
   Write_Num (Num, Ofs);
}

void Caller_1 (int Num, int Ofs)
{
   Write_Num (Num, Ofs);
}

void Caller_2 (int Num, int Ofs)
{
   Write_Num (Num, Ofs);
}

void Caller_3 (int Num, int Ofs)
{
   Write_Num (Num, Ofs);
}

static int cmp_function (const int *item1, const int *item2)
{
   if (*item1 < *item2)
   {
      return (-1);
   }
   else if (*item1 > *item2)
   {
      return (1);
```

```
    }
    else
    {
        return (0);
    }
}

void main ()
{
    int Rand_Num=0, Rand_Num_Old=0, Rand_Num_Older, Counter;

    Counter = 4096;
    for (;;)
    {
        Rand_Num_Older = Rand_Num_Old;
        Rand_Num_Old = Rand_Num;
        Rand_Num = rand();

        switch (Rand_Num_Old % 4) {
            case 0 :
                Caller_0 (Rand_Num, Rand_Num_Older);
                break;
            case 1 :
                Caller_1 (Rand_Num, Rand_Num_Older);
                break;
            case 2 :
                Caller_2 (Rand_Num, Rand_Num_Older);
                break;
            case 3 :
                Caller_3 (Rand_Num, Rand_Num_Older);
                break;
            default :
                break;
        }
        Counter--;
        if (Counter == 0)
        {
            qsort (Results, 0x100, sizeof(*Results),
                (int (*)(const void *, const void *))cmp_function);
            Counter = 4096;
        }
    }
}
```

The "anly" program uses four different functions to call the Write_Num function to simulate situations in real programs where routines are called from many different places.
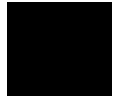
Building the Analyzer Demo Program

The analyzer demo program was built using the Hewlett-Packard 68332 Advanced
C Cross Compiler and the 68000/10/20 Assmbler/Linker/Librarian software
development tools on the HP 9000 Series 300 host computer with the following
command:
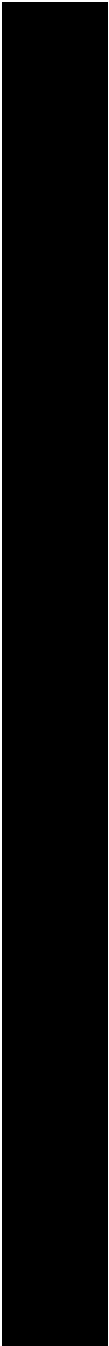
```
$ cc68332 -hOGNr hp64751 -Wl,-Lfx -o anly anly.c > anly.map
```
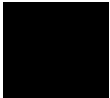
Part 5

Installation Guide

Part 5

12

Installation

Installation at a Glance

HP 64700
CARD CAGE

HP 64704A
ANALYZER CARD

POWER CABLE

HP 64748C
EMULATION
CONTROL CARD

HP 64751A
PROBE

DEMO TARGET
SYSTEM

MEMORY
MODULES

RS-232 OR
LAN CABLE

POWER CORD

HOST COMPUTER
OR TERMINAL

FLATBLADE
SCREWDRIVER

64751E02

Equipment supplied

The minimum system contains:

- HP 64751A 68340 PGA Emulator Probe (which includes the demo target system).
- HP 64748C Emulation Control card.
- HP 64704A 80-Channel Emulation Bus Analyzer card.
- HP 64700 Card Cage.

Optional parts are:

- HP 64171A 256 Kbyte Memory Modules or HP 64171B 1 Mbyte Memory Modules (0 wait state emulation memory through 16.7 MHz, 1 wait state above 16.7 MHz).
- HP 64172A 256 Kbyte Memory Modules or HP 64172B 1 Mbyte Memory Modules (0 wait state emulation memory through 25 MHz).
- HP 64173A 4 Mbyte Memory Modules (0 wait state emulation memory through 22 MHz, 1 wait state above 22 MHz).

Equipment and tools needed

In order to install and use the 68340 emulation system, you need:

- Host computer or terminal with RS-232/RS-422 port.
- RS-232/RS-422 cable.
- Flat-blade screwdriver.

Installation overview

The steps in the installation process are:

1   Connect the emulator probe cables.
2   Install emulation control and analyzer boards into the HP 64700 Card Cage.
3   Connect the HP 64700 Card Cage to a host computer or terminal.
4   Install memory modules on emulator probe.
5   Connect the emulator probe to the demo target system.
6   Apply power to the HP 64700.
7   Verify emulator and analyzer performance.

Your emulation and analysis system may already be assembled (depending on how parts of the system were ordered), and you may only need to connect the HP 64700 to a host computer or terminal and the target microprocessor system.

Antistatic precautions

Integrated-circuit boards contain electrical components that are easily damaged by
small amounts of static electricity. To avoid damage to the emulator cards, follow
these guidelines:

- If possible, work at a static-free workstation.
- Handle the boards only by the edges; do not touch components or traces.
- Use a grounding wrist strap that is connected to the HP 64700's chassis.
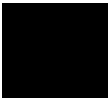
Step 1. Connect the Emulator Probe Cables

Three ribbon cables connect the HP 64748C emulation control card to the HP 64751 68340 emulator probe.

The shortest cable connects from J1 of the emulation control card to J3 of the emulator probe. The medium length cable connects from J2 of the emulation control card to J2 of the emulator probe. The longest cable connects from J3 of the emulation control card to J1 of the emulator probe.

1 Connect the emulator probe cables to the emulation control card.
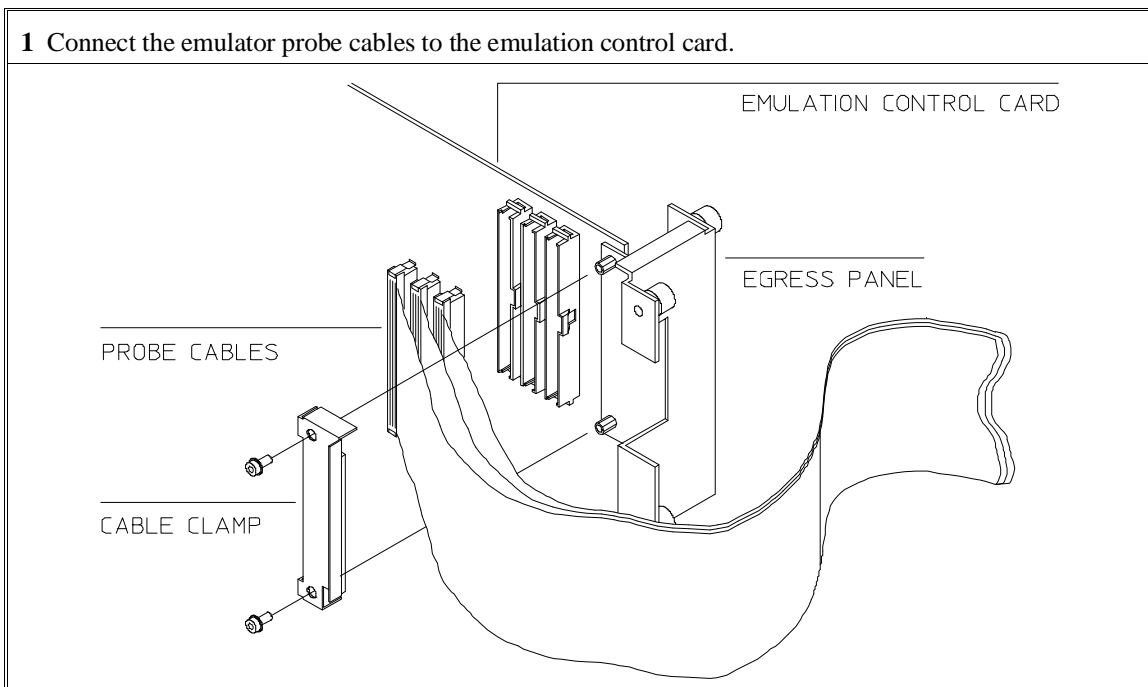
2 When inserting cable connectors into the sockets, press inward on the connector clips so that they hook into the sockets as shown.

PUSH IN ON CLIPS
SO THEY HOOK
INTO SOCKET
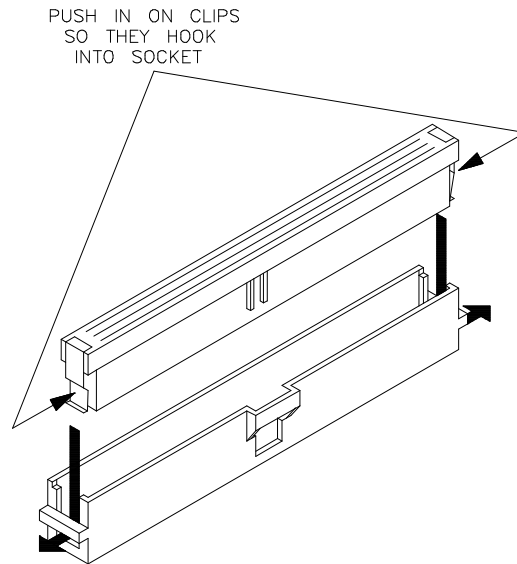
3 Connect the other ends of the cables to the emulator probe.

PROBE CABLES

TOP PLASTIC COVER

ACTIVE PROBE

BOTTOM PLASTIC COVER

DEMO BOARD
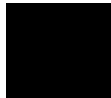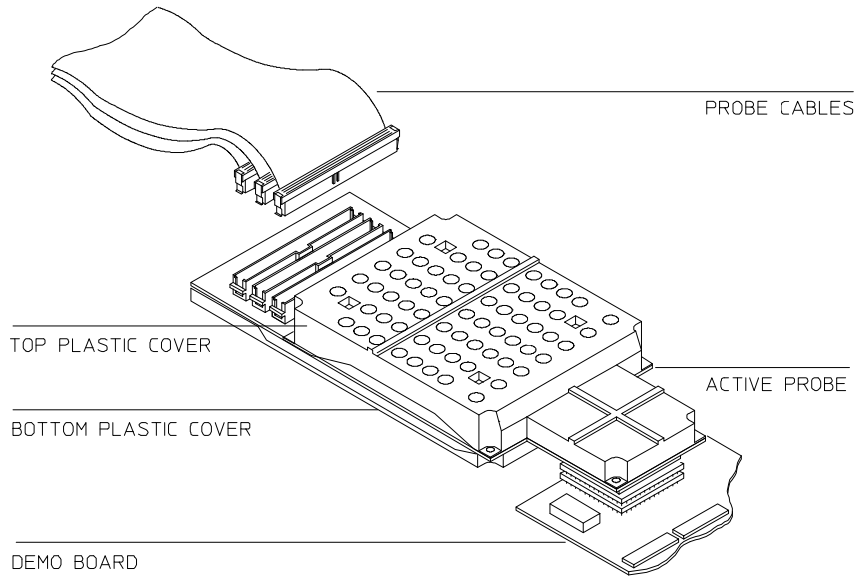
Step 2. Install Boards into the HP 64700 Card Cage

WARNING **Before removing or installing parts in the HP 64700 Card Cage, make sure that the card cage power is off and that the power cord is disconnected.**

CAUTION Do NOT stand the HP 64700 on the rear panel. You could damage the rear panel ports and connectors.

If your emulator and analyzer boards are already installed in the HP 64700 Card Cage, go to "Step 3a. Connect the HP 64700 via RS-232/RS-422" or "Step 3b. Connect the HP 64700 via LAN".

1 Use a ground strap when removing or installing boards into the HP 64700 Card Cage to reduce the chances of damage to the circuit cards from static discharge. A jack on the rear panel of the HP 64700 Card Cage is provided for this purpose.

GROUND STRAP
PLUG

64700E07

2 Turn the thumb screw and remove the top cover by sliding the cover toward the rear and up.

LOOSEN THUMB SCREW
AND SLIDE COVER
TO REMOVE.

64700E08

3 Remove the side cover by unsnapping the two latches and lifting off.

EMULATOR SIDE COVER

LATCHES
(ON BOTTOM PANEL)

TAB SLOTS

4 Remove the card supports.

NUMBER HERE
INDICATES SLOT !

CARD SUPPORTS

64700E01

421

5 First, completely loosen the four egress thumb screws.

To remove emulator cards, insert a flat blade screwdriver in the access hole and eject the emulator cards by rotating the screwdriver.

EMULATOR CARD

FOUR EGRESS
THUMB SCREWS

PROBE CABLES

64700E02

WITH FLAT BLADE SCREWDRIVER
EJECT EMULATOR CARD, EGRESS
AND PROBE CABLE AS AN ASSEMBLY

6 Insert a screw driver into the third slot of the right side of the front bezel, push to release catch, and pull the right side of the bezel about one half inch away from the front of the HP 64700. Then, do the same thing on the left side of the bezel. When both sides are released, pull the bezel toward you approximately 2 inches.

INSERT SCREW DRIVER INTO THIRD
SLOT OF FRONT BEZEL, PUSH
TO RELEASE CATCH AND
PULL BEZEL TOWARD YOU.
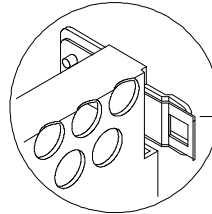
FRONT PANEL
WITHOUT BEZEL
SHOWING CATCH
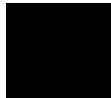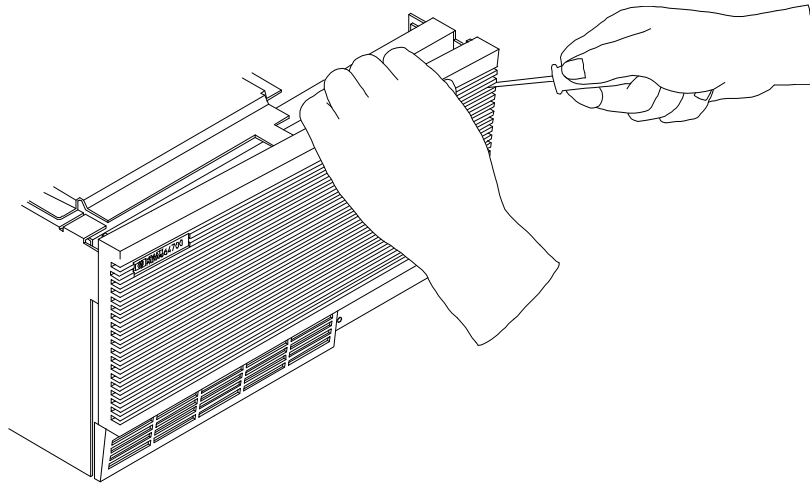
7 Lift the bezel panel to remove. Be careful not to put stress on the power switch extender.

LIFT BEZEL PANEL AND
TIP TOWARD YOU TO
REMOVE.

BE CAREFUL NOT TO
PUT STRESS ON POWER
SWITCH EXTENDER.
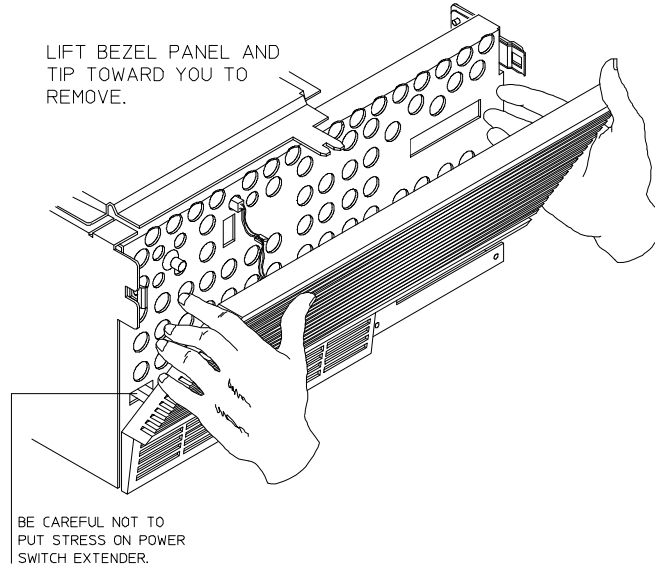
8 If you're removing an existing analyzer card that provides external analysis, remove the right angle adapter board by turning the thumb screws counter-clockwise.
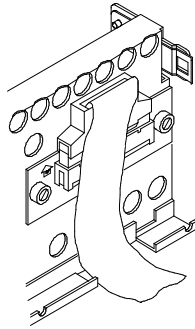
9 To remove the analyzer card, insert a flat blade screwdriver in the access hole and eject the analyzer card by rotating the screwdriver.

EJECT ANALYZER CARD
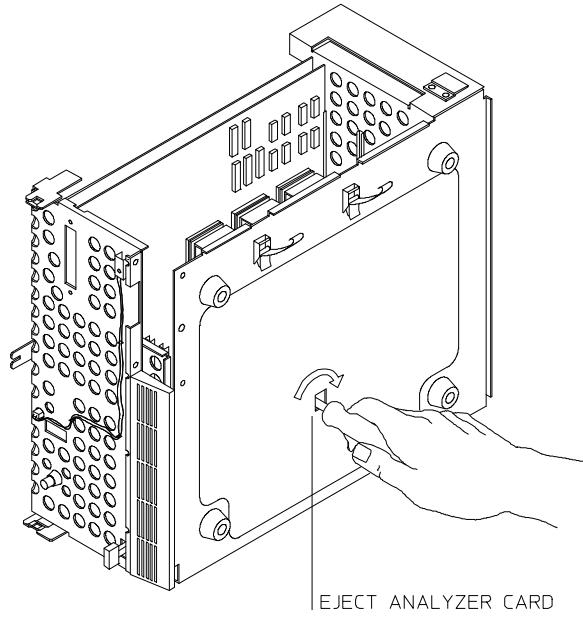
Do not remove the system control board. This board is used in all HP 64700 emulation and analysis systems.
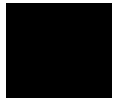
10 Install HP 64704A and HP 64748C boards. The HP 64704A is installed in the slot next to the system controller board. The HP 64748C is installed in the second slot from the bottom of the HP 64700. These boards are identified with labels that show the model number and the serial number.

To install a card, insert it into the plastic guides. Make sure the connectors are properly aligned; then, press the card into mother board sockets. Check to ensure that the cards are seated all the way into the sockets. If the cards can be removed with your fingers, the cards are NOT seated all the way into the mother board socket.

80 CHANNEL
ANALYZER CARD

64748C
EMULATION
CONTROL

CONTROL
CARD

CARDCAGE

64751E03
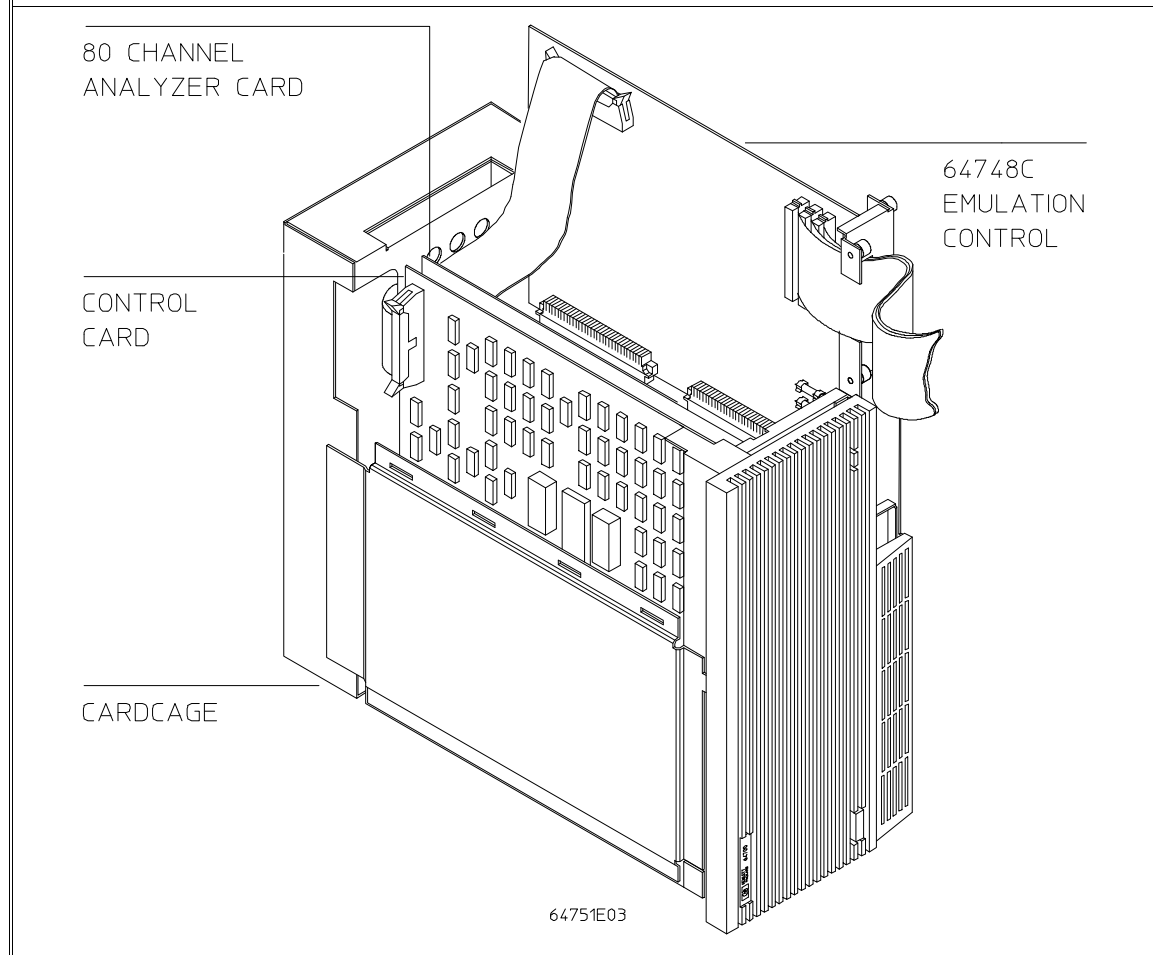
11 Connect the +5 V power cable to the connector in the HP 64700 front panel.

POWER CONNECTION
FOR DEMO BOARD
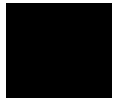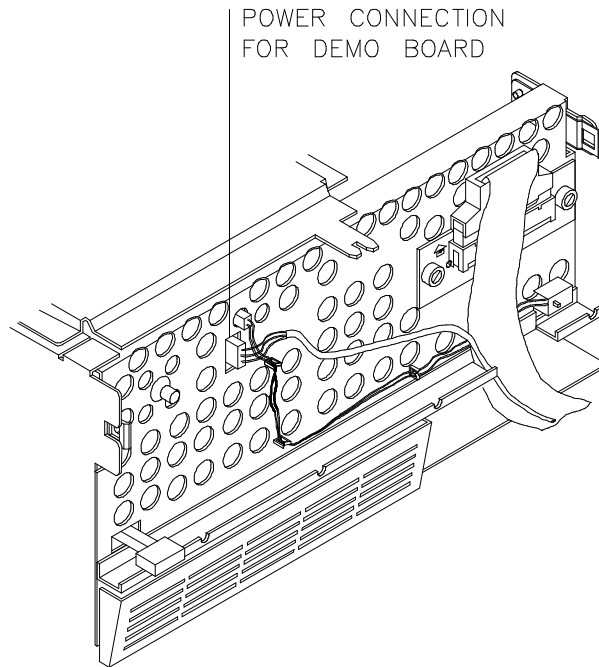
12 To reinstall the front bezel, be sure that the bottom rear groove of the front bezel is aligned with the lip as shown below.

BE SURE BACK GROOVE
OF BEZEL IS ALIGNED
WITH LIP
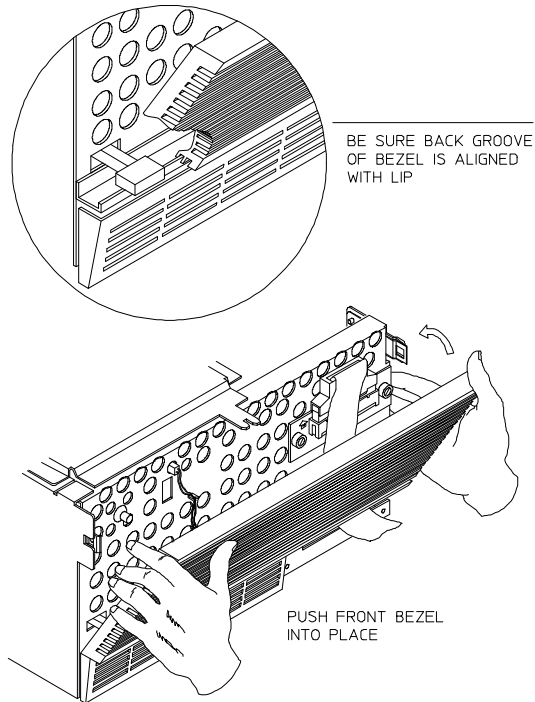
PUSH FRONT BEZEL
INTO PLACE

13 Install the card supports.

NUMBER HERE
INDICATES SLOT I

CARD SUPPORTS

64700E01
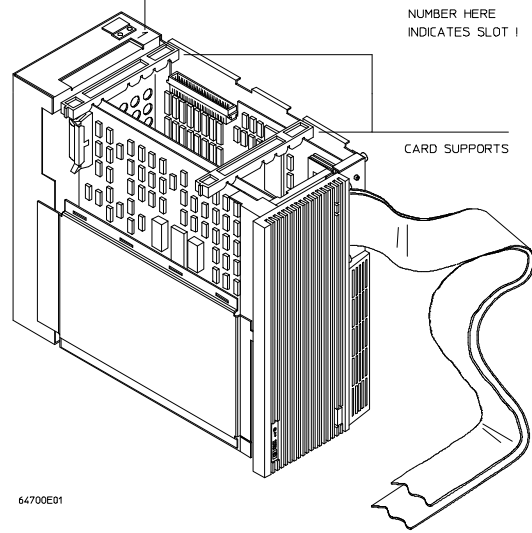
14 To install the side cover, insert the side cover into the tab slots and fasten the two latches.

EMULATOR SIDE COVER

LATCHES
(ON BOTTOM PANEL)

TAB SLOTS
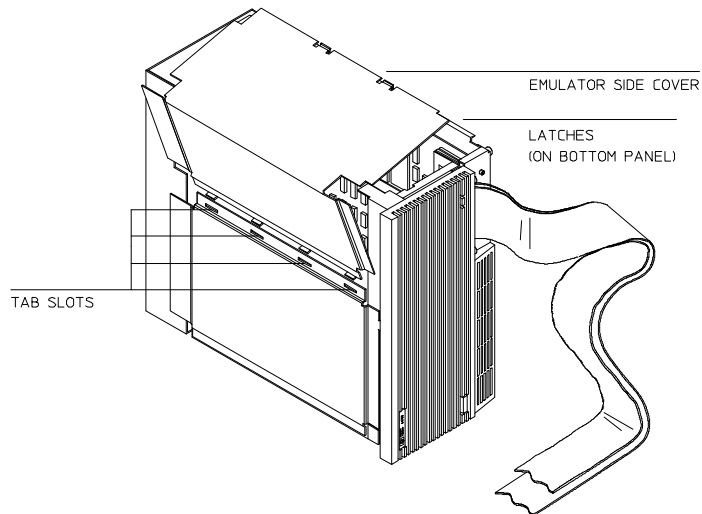
15 Install the top cover in reverse order of its removal, but make sure that the side panels of the top cover are attached to the side clips on the frame.

SIDE CLIP

64700E09
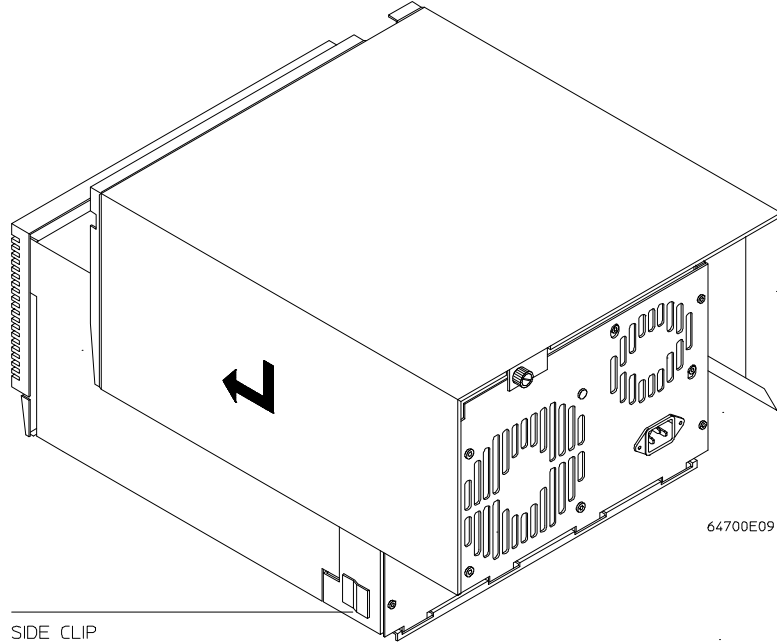
Step 3a. Connect the HP 64700 via RS-232/RS-422

If you wish to connect the HP 64700 to a host computer via the LAN interface, go to "Step 3b. Connect the HP 64700 via LAN".

1 Set the data communications configuration switches so that the HP 64700 port will have characteristics compatible with the terminal or host computer interface to which it will be connected (see the following switch summary tables). Note that the configuration switch settings are only read when the HP 64700 is powered ON or when the **init -p** command is entered.

The locations of the data communications ports and configuration switches are shown below.

TRIGGER IN/OUT

CMB ONLY

CONFIGURATION
SWITCHES

RS232/422

LAN

LAN AUI

64700E10

POWER CONTROL MODULE
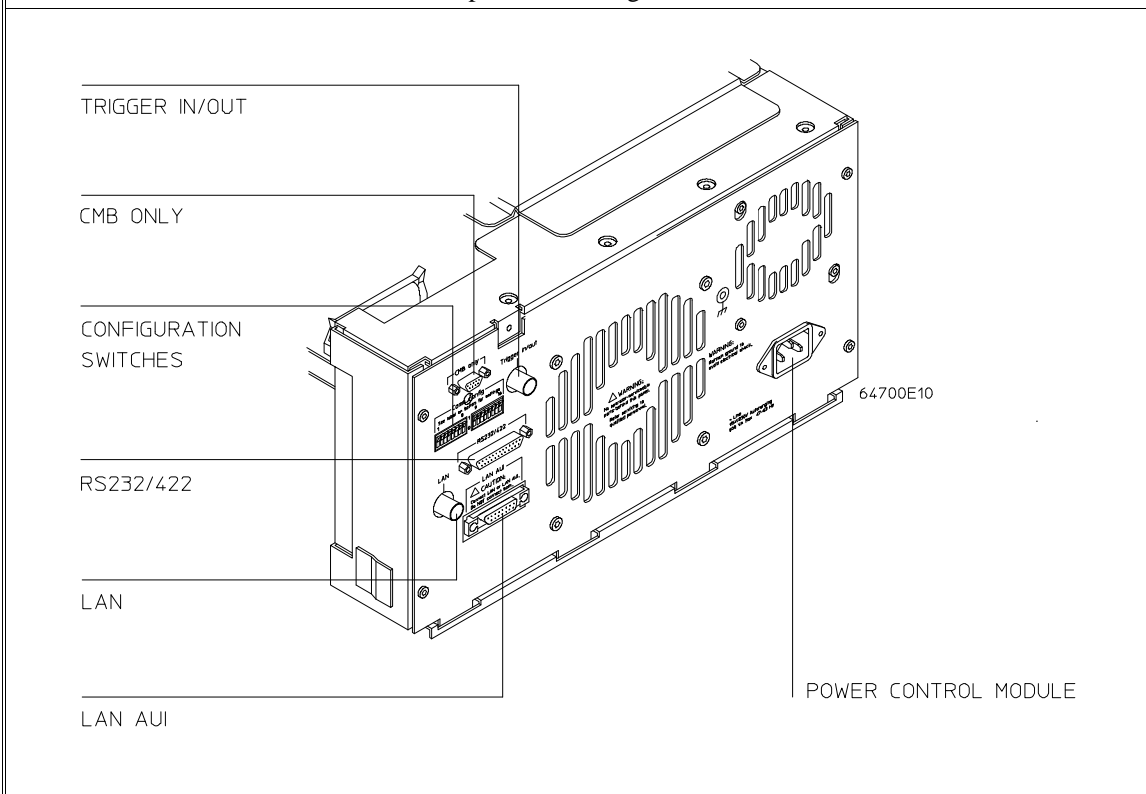
HP 64700B Configuration Switch Summary

The information in the following table is also on an adhesive label attached to each HP 64700B.

Configuration Switches S1-S8							
S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**
RS-232/RS-422 Baud Rate 1 1 1 = 230400 1 1 0 = 115200 1 0 1 = 38400 1 0 0 = 57600 0 1 1 = 1200 0 1 0 = 2400 0 0 1 = 19200 0 0 0 = 9600			1 = DTE	1 = RS-422	1 = Service	1 = Service	1 = Reserved for future use
			0 = DCE	0 = RS-232	0 = Normal	0 = Normal	0 = Normal

NOTES:

S1 - S3: Asynchronous baud rates include 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The rear panel switches can be used to initialize at 1200, 2400, 9600, 19200, 38400, or 115200 baud. Rates of 300 baud and 4800 baud are only selectable through the Terminal Interface **stty** command. This entire range of rates are supported at RS-422 signal levels. The EIA-RS232-D standard only covers data rates up to 20,000 bits per second (actual 19200). Asynchronous connections using RS-232 signal levels above this rate can be used but cannot be guaranteed.

Isosynchronous rates of 230400 baud and 460800 baud are supported at RS-422 signal levels using a 1X clock. The rate of 230400 can be selected through the rear panel switches but 460800 is only selectable through the **stty** command.

S4: DCE = Data Communications Equipment, DTE = Data Terminal Equipment. This switch is ignored if S5 sets the serial port to be an RS-422 device (which is always DCE).

S6: When this switch is set to "1", self diagnostic information is displayed by a flashing LED on the control board during the powerup cycle. This information is intended to be used by a qualified service technician only.

S7: When this switch is set to "1", the HP 64700B firmware is forced to execute from ROM instead of Flash EPROM. This mode is intended to be used by a qualified service technician only.

Configuration Switches S9-S16							
S9	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**	**S16**
1 = 7 Bit character size	1 = Parity enabled	1 = Parity even	1 = RTS/CTS DSR/DTR	1 = XON/ XOFF	1 = LAN BOOTP enabled	1 = 15 pin AUI	1 = LAN
0 = 8 Bit character size	0 = Parity disabled	0 = Parity odd	0 = No HW handshake	0 = No SW handshake	0 = LAN BOOTP disabled	0 = BNC ThinLAN	0 = Serial

NOTES:

S12: Hardware pacing uses a modified handshake. When hardware handshake is enabled, the DTE uses Clear to Send (CTS) to control its output. When CTS is true, data may be output, when CTS is false, data output will stop at the end of the current character. The DCE is expected to negate CTS during receipt of a character if the internal hardware buffer is full. Once a position is available in the internal hardware buffer, CTS is to be set true.

A modification is made in the use of Request to Send (RTS) as a reverse channel Clear to Send to control the output of the DCE. The DTE sets RTS false during the receipt of a character if there is no room in its hardware buffer. The DCE must stop transmission of data at the conclusion of the current character and wait until the DTE sets RTS true before resuming transmission.

This modified RTS/CTS handshake protocol provides full bi-directional hardware handshaking of the data streams. The HP 64700B can support baud rates up to 460800 using this protocol.

S13: Software pacing uses XON/XOFF protocols (DC1/DC3). Upon receipt of an XOFF, the HP 64700B can continue to transmit up to 3 additional characters. The HP 64700B sends an XOFF when its internal buffer can accept only 64 additional bytes before overflow. Software pacing is only valid on the transmission of ASCII data streams. It is not supported for binary transfers. It will support a maximum baud rate of 57600. Above this rate hardware handshaking must be used to prevent data loss.

2 Select and connect the RS-232/RS-422 cable.

To connect cables to the HP 64700, simply align the cable with the serial port and insert the 25-pin male connector of the cable until it is firmly seated. You should then tighten the holding screws on each side of the cable with a small flat blade screwdriver. This will ensure that the cable pins and shield hood make good contact with the HP 64700 connector and will also guard against accidental disconnection of the cable.
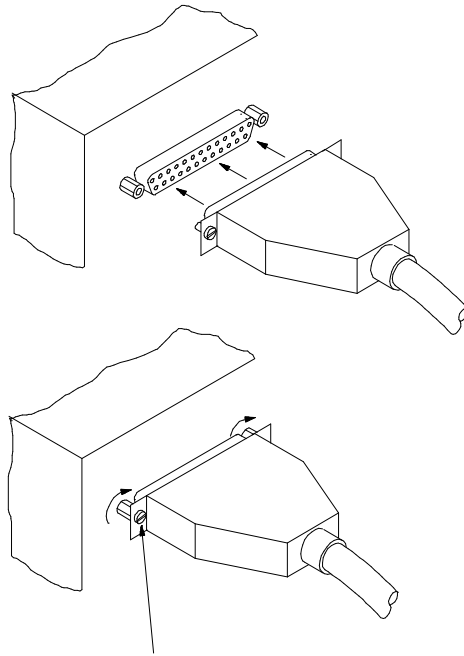
TIGHTEN W/
SMALL FLAT BLADE SCREWDRIVER

Step 3b. Connect the HP 64700 via LAN

1 Enable the LAN interface. If you are using the HP 64700's LAN interface, you must enable it by setting switch S16 is set to one (1). Set all other switches (S1 through S13) to zero.
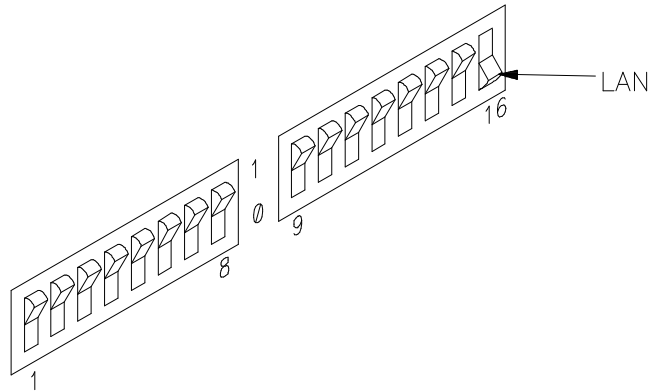
2 Select the BNC or 15-pin AUI port. S15 is used to select which of the HP 64700's LAN connectors will be used: either the BNC connector (S15 = 0) or the 15-pin AUI connector (S15 = 1).
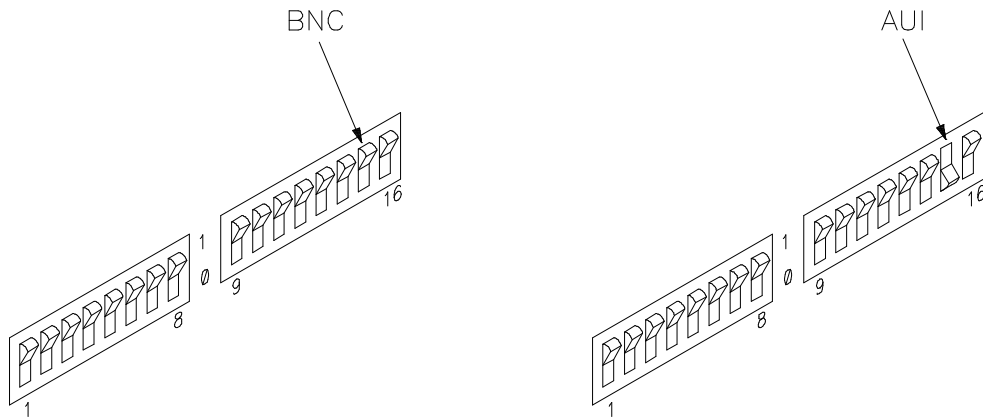
3 Enable or disable BOOTP.

BOOTP is a network service running on a host computer that allows the HP 64700's LAN parameters to be set automatically when the emulator is powered up.

When S14 is set to (1) and the host computer's "bootptab" table file has been modified to include information for the HP 64700, BOOTP will be used to set the HP 64700's LAN parameters when the emulator is powered up.

When S14 is set to zero (0), BOOTP is disabled and LAN parameters must be set by connecting the HP 64700 to a terminal or host computer via the serial port (as described in the previous Step 3a) and use the Terminal Interface **lan** command to set the HP 64700's LAN parameters. Once the LAN parameters are set (they are saved in EEPROM), you can change the configuration switch settings and connect the HP 64700 to the LAN.
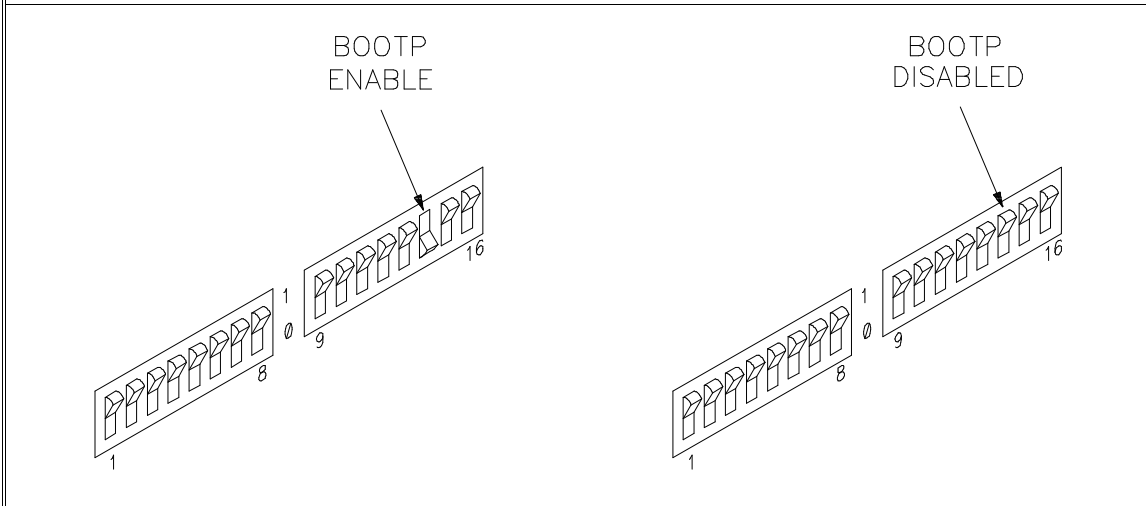
Step 4. Install emulation memory modules on emulator probe

1 Remove plastic rivets that secure the plastic cover on the top of the emulator probe, and remove the cover.

TO INSTALL RIVET:
PUSH DOWN ON
RIVET HEAD

TO REMOVE RIVET:
PUSH UP ON
CENTER SHAFT

ADD PLASTIC
WASHERS TO
THESE TWO
POSITIONS ONLY
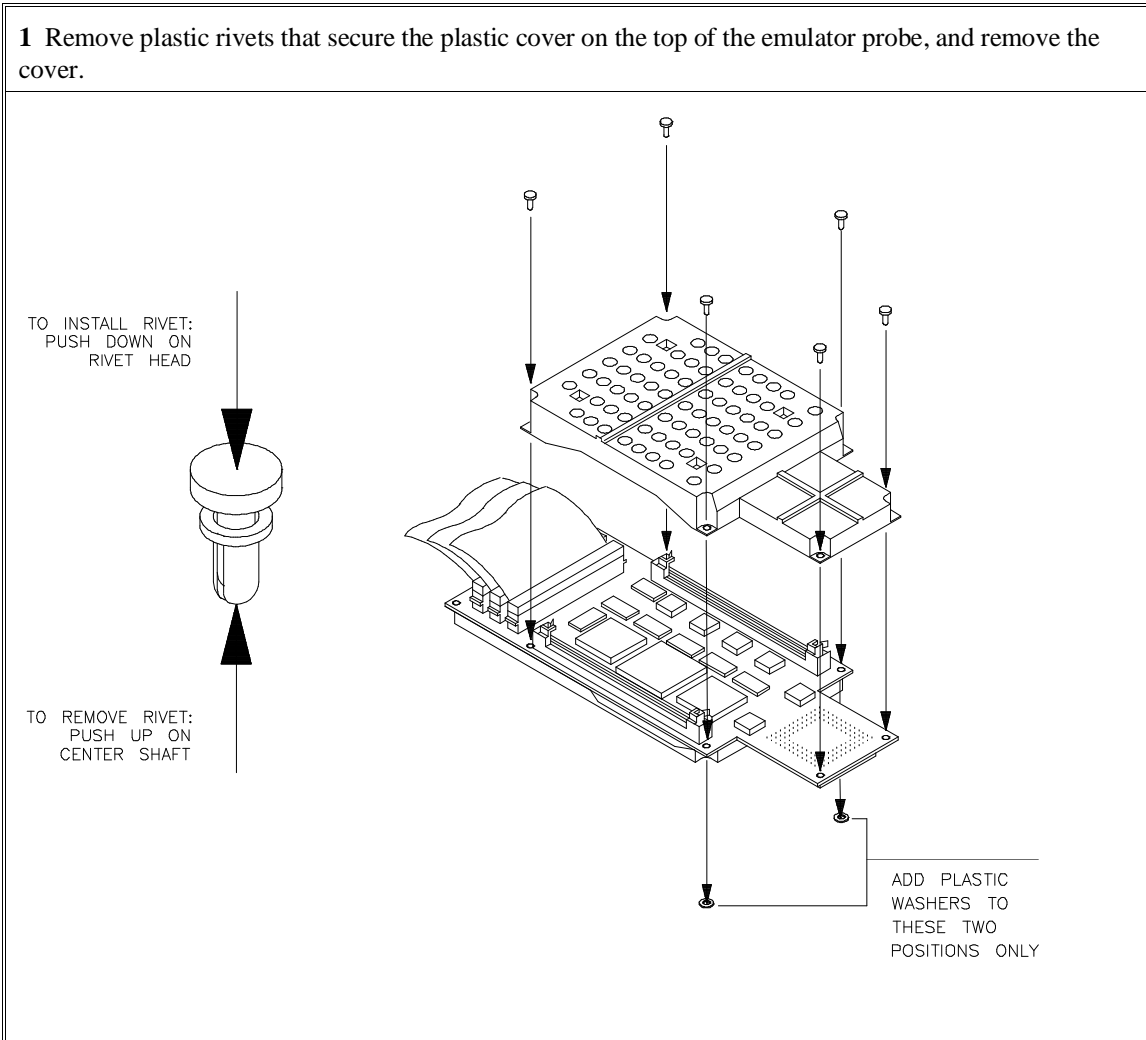
2 Determine the placement of the emulation memory modules. Three types of modules may be installed: 256 Kbyte (HP 64171A or HP 64172A), 1 Mbyte (HP 64171B or HP 64172B), and 4 Mbyte (HP 64173A). Any type of module may be installed in either bank.

Memory in bank 0 is divided into 4 equal blocks that can be allocated by the memory mapper. Memory in bank 1 is divided into 2 equal blocks.

If you have only one emulation memory module, place it in bank 0 to give yourself greater flexibility when mapping address ranges to emulation memory. If you have two memory modules and one is larger than the other, place the larger module in bank 0 to give yourself more evenly proportioned blocks.

The HP 64171A/B memory modules provide 0 wait state emulation memory through 16.7 MHz and 1 wait state above 16.7 MHz. The HP 64172A/B memory modules provide 0 wait state emulation memory through 25 MHz. The HP 64173A memory modules provide 0 wait state emulation memory through 22 MHz and 1 wait state above 22 MHz. (The 68340 processor is programmed for the correct number of wait states by user code.) If memory modules are mixed, the performance characteristics of the slower module should be used.

3 Install emulation memory modules on emulator probe. There is a cutout on one side of the memory modules so that they can only be installed one way.

To install memory modules, place the memory module into the socket groove at an angle. Firmly press the memory module into the socket to make sure that it is completely seated. Once the memory module is seated in the connector groove, pull the memory module forward so that the notches on the socket fit into the holes on the memory module. There are two latches on the sides of the socket that hold the memory module in place.
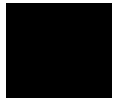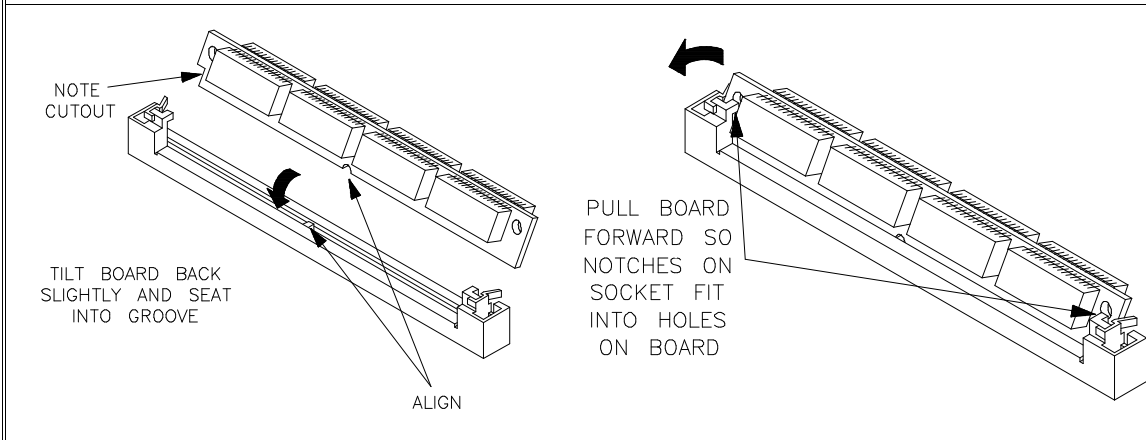
NOTE
CUTOUT

TILT BOARD BACK
SLIGHTLY AND SEAT
INTO GROOVE

ALIGN

PULL BOARD
FORWARD SO
NOTCHES ON
SOCKET FIT
INTO HOLES
ON BOARD

4 Replace the plastic cover, and insert new plastic rivets (supplied with the emulator) to secure the cover.

TO INSTALL RIVET:
PUSH DOWN ON
RIVET HEAD

TO REMOVE RIVET:
PUSH UP ON
CENTER SHAFT

ADD PLASTIC
WASHERS TO
THESE TWO
POSITIONS ONLY
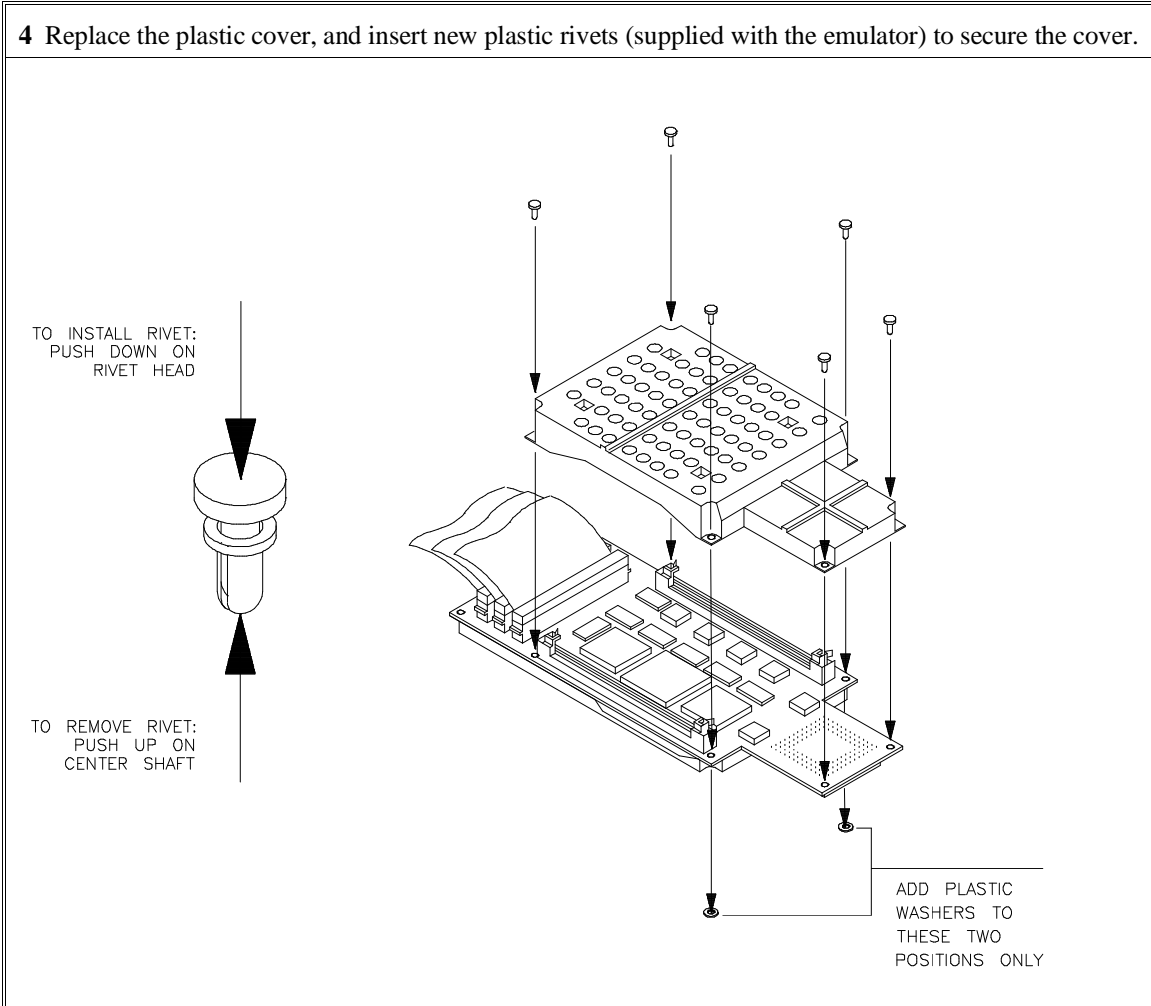
Step 5. Plug the emulator probe into the demo target system

1 With HP 64700 power OFF, connect the emulator probe cables to the demo target system.

68340
EMULATOR
PROBE

PGA SOCKET

PIN A1

DEMO BOARD
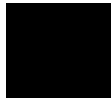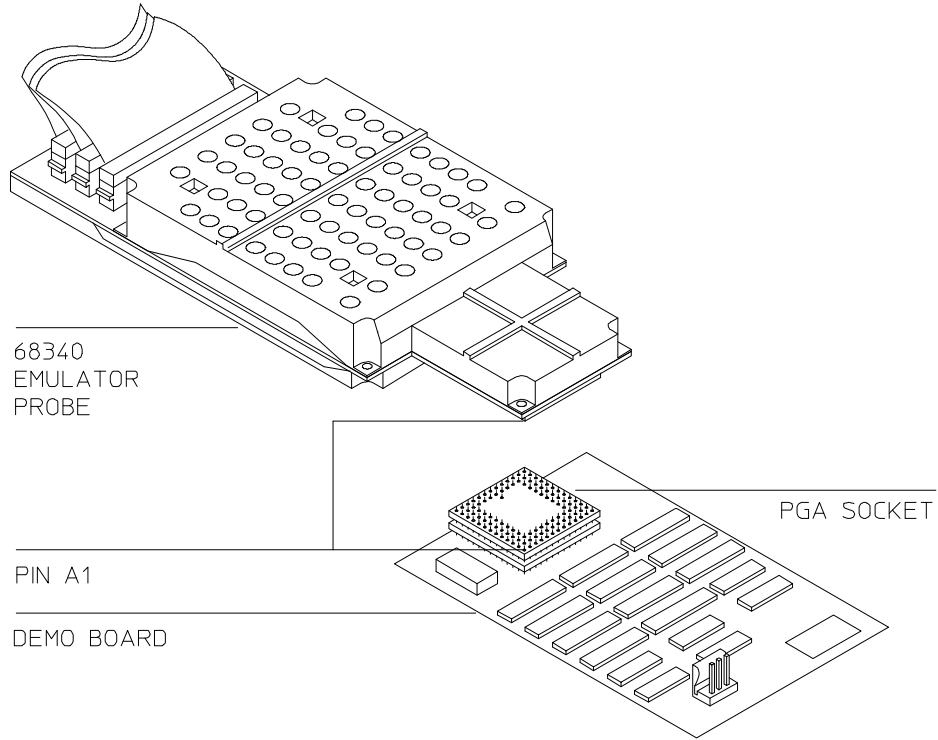
2 Connect the power supply wires from the emulator to the demo target system. The 3-wire cable has 1 power wire and 2 ground wires. **When attaching the 3-wire cable to the demo target system, make sure the connector is aligned properly so that all three pins are connected**.

POWER CONNECTION
FOR DEMO BOARD
FROM HP 64700

ALIGN AND
CONNECT

64751E05
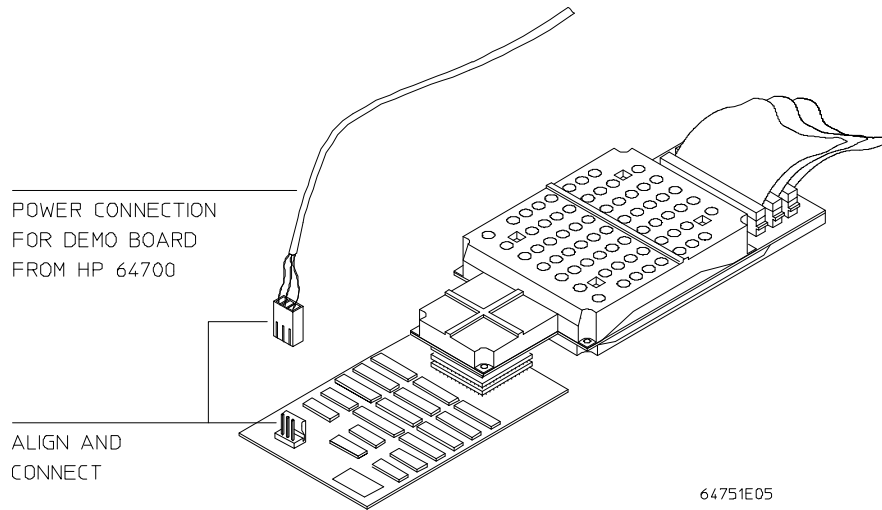
Step 6. Apply power to the HP 64700

The HP 64700B automatically selects the 115 Vac or 220 Vac range. In the 115 Vac range, the HP 64700B will draw a maximum of 345 W and 520 VA. In the 220 Vac range, the HP 64700B will draw a maximum of 335 W and 600 VA.
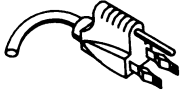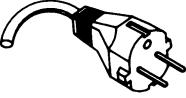
The HP 64700 is shipped from the factory with a power cord appropriate for your country. You should verify that you have the correct power cable for installation by comparing the power cord you received with the HP 64700 with the drawings under the "Plug Type" column of the following table.

If the cable you received is not appropriate for your electrical power outlet type, contact your Hewlett-Packard sales and service office.
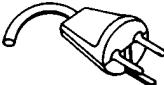
Power Cord Configurations

Plug Type	Cable Part No.	Plug Description	Length in/cm	Color
Opt 903 124V **	8120-1378	Straight * NEMA5-15P	90/228	Jade Gray
	8120-1521	90°	90/228	Jade Gray
Opt 900 250V	8120-1351	Straight * BS136A	90/228	Gray
	8120-1703	90°	90/228	Mint Gray
Opt 901 250V	8120-1369	Straight * NZSS198/ASC	79/200	Gray
	8120-0696	90°	87/221	Mint Gray
Opt 902 250V	812001689	Straight * CEE7-Y11	79/200	Mint Gray
	8120-1692	90° Straight	79/200	Mint Gray
	8120-2857	(Shielded)	79/200	Coco Brown

* Part number shown for plug is industry identifier for plug only.
Number shown for cable is HP part number for complete cable including plug.
** These cords are included in the CSA certification approval for the equipment.

Power Cord Configurations (Cont'd)

Plug Type	Cable Part No.	Plug Description	Length in/cm	Color
Opt 906 250V	8120-2104	Straight * SEV1011	79/20	Mint Gray
	8120-2296	1959-24507 Type 12 90°	79/200	Mint Gray
Opt 912 220V		Straight *DHCK107	79/200	Mint Gray
	8120-2957	90°	79/200	Mint Gray
Opt 917 250V	8120-4600	Straight SABS164	79/200	Jade Gray
	8120-4211	90°	79/200	
Opt 918 100V	8120-4753	Straight Miti	90/230	Dark Gray
	8120-4754	90°	90/230	
* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP part number for complete cable including plug. ** These cords are included in the CSA certification approval for the equipment.				

1 Connect the power cord and turn on the HP 64700.

The line switch is a push button located at the lower left hand corner of the front panel. To turn ON power to the HP 64700, push the line switch button in to the ON (1) position. The power light at the lower right hand corner of the front panel will be illuminated.

WARNING:
Maintain ground to
avoid electrical shock.

~ Line
115V/230V Autoranging
600 VA Max   47–63 Hz

64700E03
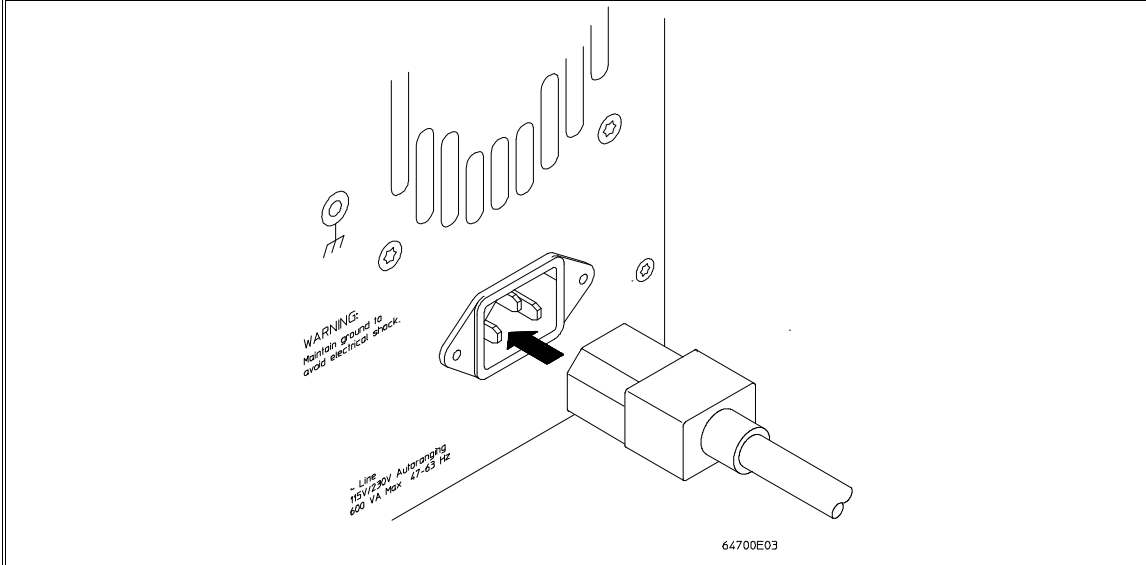
When the emulator powers up, it sends a message (similar to the one that follows) to the selected command port and then displays the Terminal Interface prompt. You can verify that your data communications configuration is at least partially functional by looking for the message and prompt on the controlling device (terminal or terminal emulation program running on a host computer).

```
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written permission is prohibited, except as allowed under copyright laws.

 HP64700B Series Emulation System
   Version:  B.01.00 20Dec93
   Location:  Flash
   System RAM:1 Mbyte

 HP64751A Motorola 68340 Emulator
 HP64740 Emulation Analyzer
R>
```

If the HP 64700 does not provide the Terminal Interface prompt

When using the RS-232/RS-422 interface:

If the HP 64700 does not provide the Terminal Interface prompt to the controlling device when power is applied:

☐ Make sure that you have connected the emulator to the proper power source and that the power light is lit.

☐ Make sure that you have properly configured the data communications switches on the emulator and the data communications parameters on your controlling device. You should also verify that you are using the correct cable.

The most common type of data communications configuration problem involves the configuration of the HP 64700 as a DCE or DTE device and the selection of the RS-232 cable. If you are using the wrong type of cable for the device selected, no prompt will be displayed.

When the serial port is configured as a DCE device, a modem cable should be used to connect the HP 64700 to the host computer of terminal. Pins 2 and 3 at one end of a modem cable are tied to pins 2 and 3 at the other end of the cable.

When the serial port is configured as a DTE device, a printer cable should be used to connect the HP 64700 to the host computer of terminal. Pins 2 and 3 at one end of a printer cable are swapped and tied to pins 3 and 2, respectively, at the other end of the cable.

If you suspect that you may have the wrong type of cable, try changing the S4 setting and cycling power.

When using the LAN interface:

You must use the **telnet** command on the host computer to access the HP 64700. After powering up the HP 64700, it takes a minute before the HP 64700 can be recognized on the network. After a minute, try the **telnet <internet address>** command.

If **telnet** does not make the connection:

☐ Make sure that you have connected the emulator to the proper power source and that the power light is lit.

☐ Make sure that the LAN cable is connected. Refer to your LAN documentation for testing connectivity.

☐ Make sure that the HP 64700's Internet Address is set up correctly. You must use the RS-232/RS-422 port to verify this that the Internet Address is set up correctly. While you accessing the emulator via the RS-232/RS-422 port, run performance verification on the LAN interface with the **lanpv** command. See "To run PV on the LAN interface".

If **telnet** makes the connection, but no Terminal Interface prompt is supplied:

☐ It's possible that the HP 64000 software is in the process of running a command (for example, if a repetitive command was initiated from telnet in another window). You can use <CTRL>c to interrupt the repetitive command and get the Terminal Interface prompt.

☐ It's also possible for there to be a problem with the HP 64700 firmware while the LAN interface is still up and running. In this case, you must cycle power on the HP 64700.
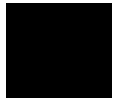
To run PV on the LAN interface

1 Connect a host computer or terminal to the HP 64700 using the RS-232 interface.

The HP 64700 LAN interface can be tested through a Terminal Interface command called **lanpv**. You can only use this command when communicating with the HP 64700 over an RS-232 connection. Do not use this command when communicating with the HP 64700 over the LAN.

2 Disconnect the HP 64700 from the LAN and terminate the HP 64700's LAN port you want to test.

Before you run the test, the HP 64700 must be disconnected from the network.

The connector you wish to test must be completely terminated, and the other connector must not be terminated. Only one connector can be tested at a time.

To properly terminate the BNC port, place a BNC "T" connector on the port and place 50 ohm terminators on each end of the T-connector.

To properly terminate the 15-pin AUI port, leave the MAU attached to the port and, using the appropriate loopback hood or loopback connector, terminate the end of the MAU that is normally connected to the LAN.

3 Access the Terminal Interface and enter the **lan -va** command to test the 15-pin AUI connector or the **lan -vb** command to test the BNC connector.

This command will return "PASSED" or "FAILED" before issuing a prompt. For example, to test the BNC connector:

```
R>lanpv -vb
  Testing: HP 64700B LAN interface (BNC connector)
      PASSED
```

Step 7. Verify emulator and analyzer performance

The emulator probe must be plugged into to the demo target system when you run the performance verification tests.

After the emulator probe is plugged into the demo target system (make sure the power lines from the emulator are connected to the demo target system), power has been applied to the HP 64700, and the HP 64700 has supplied the Terminal Interface prompt to the controlling device, you can run performance verification tests on the emulator and analyzer.

1 Type the "pv" command, along with the number of times you want to execute the command.

For example:

```
R>pv 1
```

```
  Testing: HP64751A Motorola 68340 Emulator
    PASSED
    Number of tests: 1          Number of failures: 0
  Testing: HP64740 Emulation Analyzer
    PASSED
    Number of tests: 1          Number of failures: 0

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  HP64700B Series Emulation System
    Version:   B.01.00 20Dec93
    Location:  Flash
    System RAM:1 Mbyte

  HP64751A Motorola 68340 Emulator
  HP64740 Emulation Analyzer
R>
```
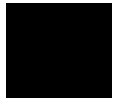
If performance verification fails

☐ Make sure the emulator probe cables are connected to the demo target system correctly (see Step 5) and that the power lines from the emulator are connected to the demo target system.

☐ Make sure the emulator and analyzer boards have been installed into the HP 64700 Card Cage correctly (see Step 2) and that there are no bent or broken pins on any of the connectors.

If this does not seem to solve the problem, call the nearest Hewlett-Packard Sales and Service office listed in the *Support Services* manual.

13

Installing/Updating Emulator Firmware
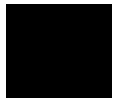
Installing/Updating Emulator Firmware

If you ordered the HP 64751A 68340 emulator probe and the HP 64748C emulation control card together, the control card contains the correct firmware for the HP 64751A.

However, if you ordered the HP 64751A and the HP 64748C separately, or if you are using a HP 64748C that has been previously used with a different emulator probe, you must download the firmware for the HP 64751A into the emulation control card.

The firmware, and the program that downloads it into the control card, are included with the 68340 emulator probe on the following MS-DOS format floppy disks:

- 68340 EMULATION FIRMWARE 64751

- 64700 SW UTIL

The steps to install or update the emulator firmware are:

1   Connect the HP 64700 card cage to an IBM PC AT compatible computer's RS-232 serial port.

2   Install the firmware update utility and the 64751 emulator firmware.

3   Run "progflash" to update emulator firmware.

Step 1. Connect the HP 64700 to a PC host computer

1 Set the HP 64700 data communications configuration switches.

Set all "COMM CONFIG" (communications configuration) switches on the rear panel of the HP 64700 to the zero or open position.
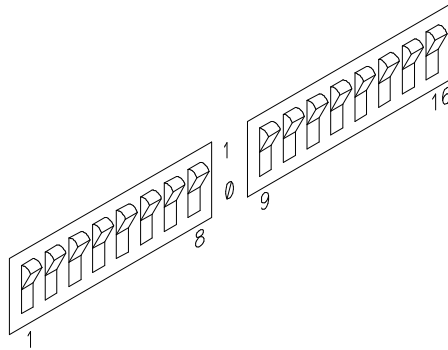
Note that switch settings are read ONLY after the HP 64700 is powered up. Any changes made to the switches after power-up will not be read until you turn the HP 64700 off and back on again.

2 Connect the RS-232 cable.

Recommended cables are HP 13242N (25-pin male to 25-pin male) or HP 24542M (9-pin female to 25-pin male) which are equivalent to a MODEM cable.

To connect cables to the HP 64700, simply align the cable with the serial port and insert the 25-pin male connector of the cable until it is firmly seated. You should then tighten the holding screws on each side of the cable with a small flat blade screwdriver. This will ensure that the cable pins and shield hood make good contact with the HP 64700 connector and will also guard against accidental disconnection of the cable.

TIGHTEN W/
SMALL FLAT BLADE SCREWDRIVER
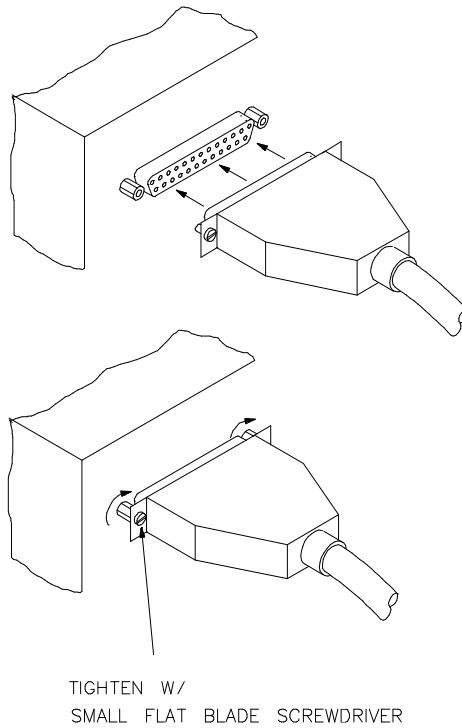
Step 2: Install the firmware update utility

Your HP Vectra PC or IBM PC AT compatible computer must have MS-DOS 3.1 or greater and a fixed disk drive. The firmware update utility and the 64751 firmware require about 300 Kbytes of disk space.

1 Insert the 64700 SW UTIL disk into drive A.

2 Change MS-DOS prompt to drive A: by typing "A:" at the MS-DOS prompt.

For example:

```
C> A: <RETURN>
A>
```

3 Type "INSTALL" at the MS-DOS prompt.

For example:

```
A> INSTALL <RETURN>
```

After confirming that you want to continue with the installation, the install program will give you the option of changing the default drive and/or subdirectory where the software will reside. The defaults are:

```
Drive = C:
Directory Path = C:\HP64700
```

Follow the remaining instructions to install the firmware update utility and the 64751 firmware. These instructions include editing your CONFIG.SYS and AUTOEXEC.BAT files. Details follow in the next steps.

4 After completing the install program, use the PC editor of your choice and edit the \CONFIG.SYS file to include these lines:

```
BREAK=ON
FILES=20
```
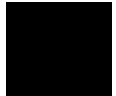
BREAK=ON allows the system to check for two break conditions:
<CTRL><Break>, and <CTRL>c.

FILES=20 allows 20 files to be accessed concurrently. This number must be at
LEAST 20 to allow the firmware update utility to operate properly.

5 Edit the AUTOEXEC.BAT file to add:

```
C:\HP64700\BIN (to the end of the PATH variable)
SET HPTABLES=C:\HP64700\TABLES (as a new line)
SET HPBIN=C:\HP64700\BIN (as a new line)
```

Part of an example AUTOEXEC.BAT file resembles:

```
ECHO OFF
SET HPTABLES=C:\HP64700\TABLES
PATH=C:\DOS;C:\HP64700\BIN
```

6 If you are using the COM3 or COM4 ports, you will need to edit the
\HP64700\TABLES\64700TAB file. The default file contains entries to establish
the communications connection for COM1 and COM2. The content of this file is:

```
EMUL_COM1 unknown COM1 OFF 9600 NONE ON 1 8
EMUL_COM2 unknown COM2 OFF 9600 NONE ON 1 8
```

Either add another line or modify one of the existing lines. For example:

```
EMUL_COM3 unknown COM3 OFF 9600 NONE ON 1 8
EMUL_COM4 unknown COM4 OFF 9600 NONE ON 1 8
```

The "unknown" field usually specifies the processor type (which is "m68340" for
the HP 64751 emulator), but you don't need to change this field in order to update
the emulator firmware.

Software installation is now complete. The PC will need to be rebooted to enable
the changes made to the CONFIG.SYS and AUTOEXEC.BAT files. To reboot,
press the <CTRL><ALT><DEL> keys simultaneously.

Step 3: Run "progflash" to update emulator firmware

- Enter the PROGFLAS [-V] [EMUL_NAME] [PRODUCTS ...] command.

The PROGFLAS command downloads code from files on the host computer into Flash EPROM memory in the HP 64700.

The -V option means "verbose". It causes progress status messages to be displayed during operation.

The EMUL_NAME option is the logical emulator name as specified in the \HP64700\TABLES\64700TAB file.

The PRODUCTS option names the products whose firmware is to be updated.

If you enter the PROGFLAS command without options, it becomes interactive. If you don't include the EMUL_NAME option, PROGFLAS displays the logical names in the \HP64700\TABLES\64700TAB file and asks you to choose one. If you don't include the PRODUCTS option, PROGFLAS displays the products which have firmware update files on the system and asks you to choose one. (In the interactive mode, only one product at a time can be updated.) You can abort the interactive PROGFLAS command by pressing <CTRL>c.

PROGFLAS will print "Flash programming SUCCEEDED" and return 0 if it is successful; otherwise, it will print "Flash programming FAILED" and return a nonzero (error).

You can verify the update by displaying the firmware version information.
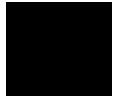
Examples   To install or update the HP 64751 emulator firmware in the HP 64700 that is connected to the COM1 port:

```
C> PROGFLAS <RETURN>



            HP64700S006 A.00.04 24Feb92
                 64700 SW UTIL

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    restrictions as set forth in subparagraph (c) (1) (II) of the Rights
    in Technical Data and Computer Software clause at  DFARS 52.227-7013.
    HEWLETT-PACKARD Company , 3000 Hanover St. , Palo Alto, CA 94304-1181

            Logical Name       Processor
          1 EMUL_COM1           unknown
          2 EMUL_COM2           unknown

Number of Emulator to Update? (intr (usually cntl C or DEL) to abort)
```

To update firmware in the HP 64700 that is connected to the COM1 port, enter "1".

```
          Product
        1 64751

Number of Product to Update? (intr (usually cntl C or DEL) to abort)
```

To update the HP 64751A 68340 emulator firmware, enter "1".

```
Enable progress messages? [y/n] (y)
```

To enable status messages, enter "y".

```
Checking System firmware revision...
Mainframe is a 64700B

Reading configuration from '/hp64700/update/64751.cfg'
ROM identifier address = 2FFFF0H
Required hardware identifier = 1FFFH,1FF4H
Control ROM start address = 280000H
Control ROM size = 40000H
Control ROM width = 16
Programming voltage control address = 2FFFFEH
Programming voltage control value = FFFFH
Programming voltage control mask = 0H

Rebooting HP64700...
Checking Hardware id code...
Erasing Flash ROM
Downloading ROM code: /hp64700/update/64751.X
    Code start 280000H (should equal control ROM start)
    Code size 27BF4H (must be less than control ROM size)
Finishing up...

Rebooting HP64700...
Flash programming SUCCEEDED
C>
```

You could perform the same update as in the previous example with the following command:

```
C> PROGFLAS -V EMUL_COM1 64751 <RETURN>
```
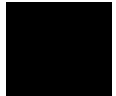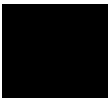
Glossary

access mode Specifies the types of cycles used to access target system memory locations. For example a "byte" access mode tells the monitor program to use load/store byte instructions to access target memory.

active emulator probe An emulator probe that contains circuitry that allows the emulator to more closely imitate the electrical characteristics of the microprocessor thereby avoiding the timing problems that can occur with passive probes.

analyzer An instrument that captures data on signals of interest at discreet periods.

background The emulator mode in which foreground operation is suspended so the emulation processor can be used for communication with the emulation controller. The background monitor does not occupy any processor address space.

background emulation monitor An emulation monitor that does not execute as part of the user program, and therefore, operates in the emulator's background mode.

display mode When displaying memory, this mode tells the emulator the size of the memory locations to display. When modifying memory, the display mode tells the emulator the size of the values to be written to memory.

embedded microprocessor system The microprocessor system which the emulator plugs into.

emulation bus analyzer The internal analyzer that captures emulator bus cycle information synchronously with the processor's clock signal.

emulation monitor program A program that is executed by the emulation processor which allows the emulation controller to access target system resources. For example, when you display target system memory locations, the monitor program executes microprocessor instructions that read the target memory locations and send their contents to the emulation controller.
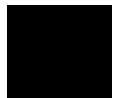
emulator An instrument that performs just like the microprocessor it replaces, but at the same time, it gives you information about the operation of the processor. An emulator gives you control over target system execution and allows you to view or modify the contents of processor registers, target system memory, and I/O resources.

foreground The mode in which the emulator is executing the user program. In other words, the mode in which the emulator operates as the target microprocessor would.

global restart When the same secondary branch condition is used for all terms in the analyzer's sequencer, and secondary branches are always back to the first term.

prestore The analyzer feature that allows up to two states to be stored before normally stored states. This feature is useful when you want to find the cause of a particular state. For example, if a variable is accessed from many different places in the program, you can qualify the trace so that only accesses of that variable are stored and turn on prestore to find out where accesses of that variable originate from.

primary sequencer branch Occurs when the analyzer finds the primary branch state specified at a certain level and begins searching for the states specified at the primary branch's destination level.

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

secondary sequencer branch Occurs when the analyzer finds the secondary branch state specified at a certain level before it found the primary branch state and begins searching for the states specified at the secondary branch's destination level.

sequence terms Individual levels of the sequencer. The analyzer provides 8 sequence terms.

sequencer The part of the analyzer that allows it to search for a certain sequence of states before triggering.

sequencer branch Occurs when the analyzer finds the primary or secondary branch state specified at a certain level and begins searching for the states specified at another level.

target system The microprocessor system which the emulator plugs into.

trace A collection of states captured on the emulation bus (in terms of the emulation bus analyzer) or on the analyzer trace signals (in terms of the external analyzer) and stored in trace memory.

trigger The captured analyzer state about which other captured states are stored. The trigger state specifies when the trace measurement is taken.
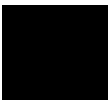
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DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Company

Manufacturer's Address: Colorado Springs Division
1900 Garden of the Gods Road
Colorado Springs, CO 80907 USA

declares, that the product

Product Name: Microprocessor Emulator (HP 64700 Series)

Model Number(s):   HP 64751A/B

Product Option(s): All

conforms to the following Product Specifications:

Safety: IEC 348:1978 / HD 401 S1:1981
UL 1244
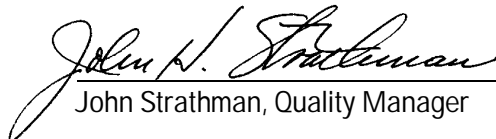CSA-C22.2 No. 231 (Series M-89)

EMC: CISPR 11:1990 / EN 55011:1991   Group 1 Class A
IEC 801-2:1991 / EN 50082-1:1992   4 kV CD, 8 kV AD
IEC 801-3:1984 / EN 50082-1:1992   3 V/m, {1kHz 80% AM, 27-1000 MHz}
IEC 801-4:1988 / EN 50082-1:1992   0.5 kV Sig. Lines, 1 kV Power Lines

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

This product was tested in a typical configuration with Hewlett-Packard test systems.

Colorado Springs, 9/30/96

John Strathman, Quality Manager

Product Regulations

Safety IEC 348 / HD 401
UL 1244
CSA-C22.2 No.231 (Series M-89)

EMC This Product meets the requirement of the European Communities (EC)
EMC Directive 89/336/EEC.

Emissions	EN55011/CISPR 11 (ISM, Group 1, Class A equipment)		
Immunity	EN50082-1	Code[1]	Notes[2]
	IEC 801-2 (ESD) 4 kV CD, 8 kV AD	3	A, B, C
	IEC 801-3 (Rad.) 3 V/m	1	A
	IEC 801-4 (EFT) 0.5 kV, 1 kV	1	B

[1] Performance Codes:
  1 PASS - Normal operation, no effect.
  2 PASS - Temporary degradation, self recoverable.
  3 PASS - Temporary degradation, operator intervention required.
  4 FAIL - Not recoverable, component damage.

[2] Notes:
  A Electrostatic discharge (ESD) to the 64700B mainframe may cause
     degradation in performance requiring operator intervention.
  B The active probe assembly is sensitive to ESD events. Use standard
     ESD preventative practices to avoid component damage.
  C The CMB and active probe power connectors were not subjected to
     immunity testing.

Sound Pressure Less than 60 dBA
Level

Certification and Warranty

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard system product is warranted against defects in materials and workmanship for a period of 90 days from date of installation. During the warranty period, HP will, at its option, either repair or replace products which prove to be defective.

Warranty service of this product will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other cases, products must be returned to a service facility designated by HP.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country. HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environment specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. HP specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. HP shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety

Summary of Safe Procedures

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

Ground The Instrument

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

Do Not Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Do Not Service Or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do Not Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification of the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING   Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

Safety Symbols Used In Manuals

The following is a list of general definitions of safety symbols used on equipment or in manuals:

Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be marked with this symbol).

Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating the equipment.

Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual before operating the equipment.

Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

Alternating current (power line).

Direct current (power line).

Alternating or direct current (power line).

| **Caution** | The Caution sign denotes a hazard. It calls your attention to an operating procedure, practice, condition, or similar situation, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. |

| **Warning** | The Warning sign denotes a hazard. It calls your attention to a procedure, practice, condition or the like, which, if not correctly performed, could result in injury or death to personnel. |