
Help Volume

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Emulation: Hitachi SH7709A/29

Using the SH7709A/29 Emulation Control Interface



The SH7709A/29 Emulation Control Interface works with an emulation module or emulation probe to give you an emulation interface for Hitachi SH7709A/29 based target systems. Also, with an analysis probe and a logic analyzer, you can make coordinated trace measurements.

Before you begin using the Emulation Control Interface, make sure you have set all of the necessary configuration options (see page 13).

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Analysis System help volume)

Glossary of Terms (see page 85)

Related Help

Setting Up and Starting the Emulation Control Interface (see the *Emulation: Setting Up* help volume)

Using the SH7709A/29 Emulation Control Interface

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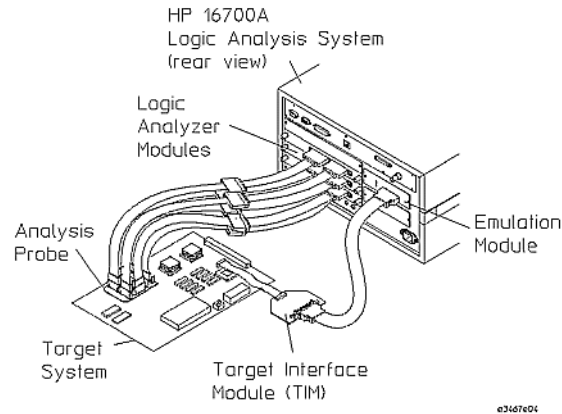
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Glossary

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Control Interface

At a Glance



- Logic analysis system Contains measurement modules such as the 16550A State/Timing Logic Analyzer Module. Contains the Emulation Control Interface that controls the emulation module or emulation probe.
- Analysis probe The E8022A analysis probe provides state analysis for the SH7709A/29 processor.
- Emulation module or emulation probe The E3469A SH7709A/29 emulation module/probe connects to a debug port designed into your target system or to the analysis probe—it accesses the debugging facilities built into the SH7709A/29 microprocessor to give you control over processor execution, and easy access to processor registers, target system memory, and I/O.
- Target System Your system using a SH7709A/29 processor.

Connecting the Emulator to the Target System

You can connect the emulation module or emulation probe directly to a socket on the target system, or you can connect it using a socket built into the analysis probe.

- “To connect to a target system using a debug port” on page 11
- “To connect the emulator to an analysis probe” on page 12

To connect to a target system using a debug port

In order to connect the emulation module or emulation probe to the microprocessor, a 14-pin debug port must be available on the target system.

To connect the probe to a target system:

1. Turn OFF power to the target system and the emulator.
2. Plug one end of the 50-pin cable into the emulator.
3. Plug the other end of the 50-pin cable into the target interface module.
4. Plug one end of the 14-pin cable into the target interface module. Be sure to align pin 1 of the cable to pin 1 on the target connector.
5. Plug the other end of the 14-pin cable into the debug port on the target system.
6. Turn on the power to the probe.
7. Turn on the power to the target system.

See Also

The manual for your emulation probe or processor solution.

To connect the emulator to an analysis probe

A debug port has been designed into the analysis probe. You can connect the emulator to this port.

The Setup Assistant can guide you through the process of connecting both the analysis probe and the emulator.

If you are not using the Setup Assistant, here is a summary of the steps to connect the emulator to the analysis probe:

1. Turn OFF power to the target system, logic analysis system, and emulator.
2. Connect the analysis probe to the target system as described in the analysis probe or processor solution manual.
3. Plug one end of the 50-pin cable into the emulator.
4. Plug the other end of the cable into the analysis probe's connector.
5. Turn ON power to the emulator.
6. Turn ON power to the logic analysis system.
7. Turn ON power to the target system.

See Also

The Setup Assistant.

The manual for your emulation probe or processor solution.

Configuring the Emulator

Use the *Setup* window to configure the emulator for your target system.

1. Open the Setup window.
2. Make the appropriate selections for the options you wish to change.

The configuration options are:

- “"Trigger Out" Port” on page 13
- “Initialization Timing” on page 14
- “JTAG Clock Speed” on page 14
- “Break point at delay slot” on page 15
- “Memory System Endian Mode” on page 15

The configuration of the emulator is changed immediately when you make a selection.

3. When you have finished changing the configuration options, select *File*, then select *Close*.

See Also

- “To save configuration settings” on page 16
- “To restore saved configuration settings” on page 16
- The manual for your emulator or processor solution.

"Trigger Out" Port

The Trigger Out BNC port can be used to tell devices external to the emulation probe when processor execution is in the *monitor*.

You can use this port to qualify a logic analyzer clock, so that monitor cycles are not captured.

You can also use this port to signal the target system, for example, so

that watchdog timers don't time-out when processor execution is in the monitor.

The options are:

Always High Output is always high.

Always Low Output is always low.

High on Break

Output is high when processor execution is in the monitor.

Low on Break

Output is low when processor execution is in the monitor.

Initialization Timing

Power-On Reset The emulation circuitry in SH7709A/29 (Hitachi-UDI) must be initialized at target power-on and may need to be initialized when it is in an unstable condition. You may specify this option if you want to initialize the SH7709A/29 processor and the SH7709A/29 emulation circuitry only when the target power-on is detected.

Target Reset Choose this option if you want to initialize the emulation circuitry in SH7709A/29 processor when the target power-on or target reset is detected. When the emulation probe/module detects the RESET signal being low, it initializes the emulation circuitry of the SH7709A/29 processor.

JTAG Clock Speed

This configuration option specifies the clock speed at which the emulator communicates with the Hitachi-UDI debug port.

The Hitachi-UDI clock speed is independent of processor clock speed. In general, the default speed of 10.5MHz can be used and provides the

best performance. If your target system has additional loads on the Hitachi-UDI lines, or if it does not meet the requirements described in the Emulation for the Hitachi SH7709A/29 user's guide, using a slower Hitachi-UDI clock speed may enable the emulator to work.

The speeds you can specify are:

```
10.5MHz  
5.25MHz  
2.63MHz  
1.32MHz  
0.656MHz  
0.328MHz  
0.164MHz
```

Break point at delay slot

This configuration option specifies if setting a software break point at delay slot is allowed.

A software break point at delay slot causes illegal slot exception processing in your program.

Enable	Setting software break points at any location are allowed
Disable	When disabled, the emulation module/probe checks if the instruction immediately before the requested software break point address is a delayed branch. The break point command fails if the instruction was the delayed branch.

Memory System Endian Mode

Choose the endian mode.

Big	Choose this option if your program is compiled as big endian.
Little	Choose this option if your program is compiled as little endian.

To save configuration settings

You can save emulation configuration settings as part of a logic analysis system configuration file. This saves all workspace configurations, including the emulation module and emulation probe configuration settings.

See Also

Saving a New Configuration File (see the *Agilent Technologies 16700A/B-Series Logic Analysis System* help volume)

To restore saved configuration settings

If you saved emulation configuration settings as part of a logic analysis system configuration file, you can restore them by loading the configuration file. This restores all workspace configurations, including the emulation module and emulation probe configuration settings.

See Also

Loading Configuration Files (see the *Agilent Technologies 16700A/B-Series Logic Analysis System* help volume)

Controlling Processor Execution

Processor execution is controlled using the Run Control window.



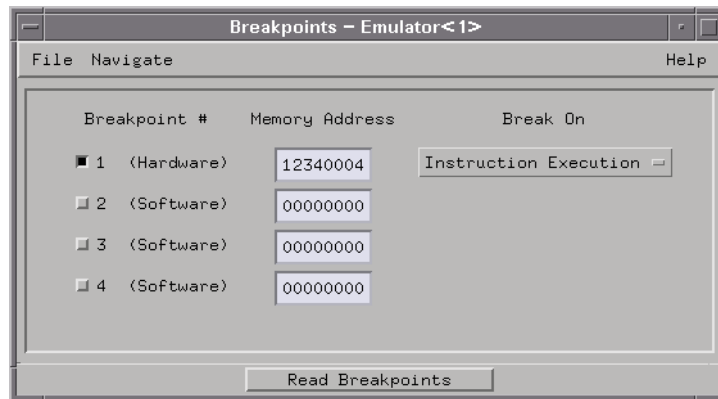
- To run the program, select *Run*.
- To stop program execution, select *Break*.
- To reset the processor, select *Reset*.
- To step a single instruction, select *Step*.

The *status line*, which appears under the run control buttons, shows the current status of the emulator. It shows whether:

- the processor is running the user program,
- the processor is in debug mode;
- there is no power to the target system.

Using Breakpoints

The Breakpoints window allows you to set breakpoints to stop processor execution when an instruction at a particular address is executed, or when a memory location is written or read.



You can enable up to three hardware breakpoints and up to two software instruction breakpoints.

To set a breakpoint


1. Decide whether you want to set a hardware breakpoint or a software breakpoint.
2. Enter an address for the breakpoint in the *Memory Address* field.

Type the address in hexadecimal format. The address must be on an even boundary; that is, the address must end in 0, 2, 4, 6, 8, A, C, or E. Here are a few examples of valid breakpoint addresses:

```
000F0100  
00002ffc
```


3. If you are setting a hardware breakpoint, select whether to *Break On Instruction Execution, Data Writes, Data Reads, or Data Reads or Writes* but not instruction fetches.

4. Select the enable/disable toggle button to enable the breakpoint.

A breakpoint is enabled when the button is in: 

To clear a breakpoint

- Select the enable/disable toggle button to disable the breakpoint.

A breakpoint is disabled when the button is out: 

Read Breakpoints will display the breakpoints which are currently in effect in the target system. If you have used a debugger with the emulator to set breakpoints, you can use this button to read the breakpoints into the Breakpoints window.

Breakpoints are set or cleared in the target system when you select the enable/disable toggle button. If you change the address of an enabled breakpoint, the new breakpoint address is set in the target system when you move the mouse pointer from the address field. When a new breakpoint is being set in the target system, the mouse pointer will appear as an hourglass for a few moments.

See Also

“How hardware breakpoints work” on page 20

“How software breakpoints work” on page 21

How hardware breakpoints work

The Hitachi SH7709A/29 processor provides several built-in breakpoints.

Because these breakpoints are implemented by the processor, you can use them to set breakpoints for addresses in ROM.

When a hardware breakpoint is enabled, the processor compares the address of each instruction to be executed with the values in the development mode comparators. If the processor finds a match, it immediately generates an exception.

If your target has a breakpoint exception routine, it will not be used. Instead, the emulator configures the processor to stop immediately when the exception occurs.

How software breakpoints work

Software breakpoints are implemented by replacing the instruction at the specified address with an interrupt instruction.

When you disable the software breakpoint, the original instruction is restored.

If you *Step* or *Run* from the breakpoint, the original instruction will be executed.

Limitations of software breakpoints

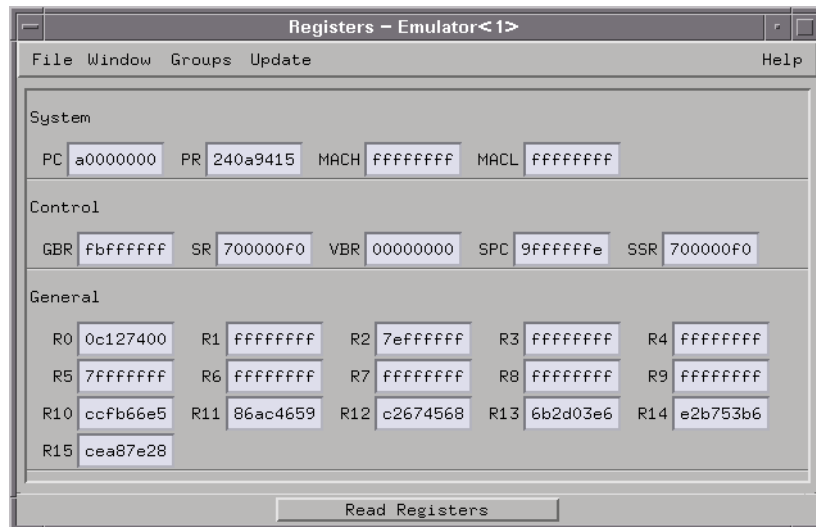
Because software breakpoints write to the breakpoint location, you cannot set software breakpoints in ROM or outside of physical memory. Software breakpoints cannot be used to debug exceptions.

Displaying and Modifying Registers

The Register window lets you display and modify the contents of processor registers.

- “To display registers” on page 22
- “To modify register contents” on page 23

The Emulation Control Interface displays groups (also called "classes") of related registers.



To display registers

- To add a group of registers to the display, select the group from the *Groups* menu.
- To remove a group of registers from the display, select the group from the *Groups* menu.
- To move a group to the bottom of the display, remove the group then add it again.

- To read the register values from the processor, select *Read Registers*.

The registers displayed vary according to the target processor.

The Registers window will be updated as the processor runs. If you want to disable this automatic updating, change *Freeze Window (No)* to *Freeze Window (Yes)* in the Update menu.

To modify register contents

1. Display the group of registers that contains the register whose contents you wish to modify.
2. Select the value field you wish to modify. The underline cursor indicates the field that has been selected.
3. Type the new register value.

The new value is actually written as soon as:

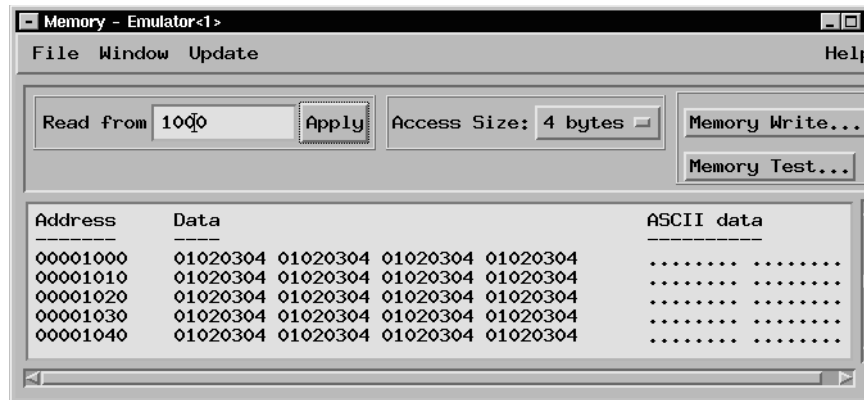
- you press the Enter (or Return) key, or
- the mouse pointer leaves the entry field.

Displaying and Modifying Memory

- “To display memory” on page 24
- “To modify a memory location” on page 25
- “To fill a range of memory locations” on page 25
- “To display memory in mnemonic format” on page 26
- “Addresses” on page 27

To display memory

1. Open the Memory window.
2. Specify the display format by selecting the appropriate *Access Size* and *Base of Data* options.
3. Enter the address (see page 27) you wish to read in the *Read from* field, and select *Apply*.

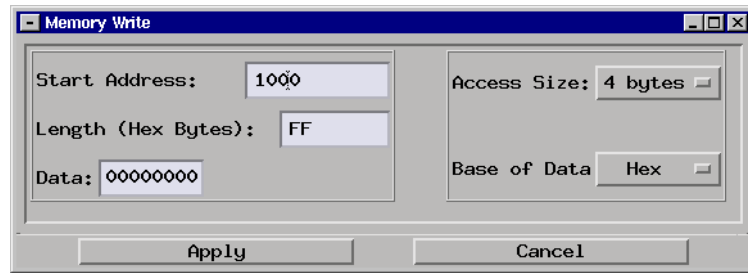


To modify a memory location

1. Open the Memory window.
 2. Select *Memory Write...*
 3. Enter the address (see page 27) of the location in the *Start Address* field.
 4. Enter a length of 1. (Entering a larger value will fill multiple memory locations with the value.)
 5. Enter the value that you want to write in the *Data* field.
 6. Specify the size of the memory location and the format of the value you wish to enter by selecting the appropriate *Access Size* and *Base of Data* options.
 7. Select *Apply*.
-

To fill a range of memory locations

1. Open the Memory window.
 2. Select *Memory Write...*
 3. Specify the size of the memory locations and the format of the value you wish to enter by selecting the appropriate *Access Size* and *Base of Data* options.
 4. Enter the address (see page 27) of the first location in the *Start Address* field, enter the number of addresses to be written with the value in the *Length* field.
 5. Enter the value that you want to write in the *Data* field.
 6. Select *Apply*.
-



To display memory in mnemonic format

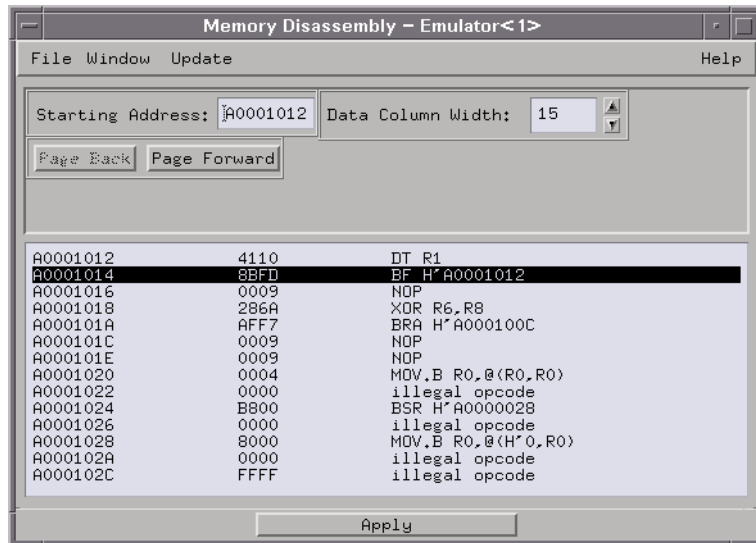
- Open the Memory Disassembly window.

Memory is disassembled beginning at the current program counter value.

The line corresponding to the program counter will be highlighted.

To display memory beginning at another address

1. Enter the first address (see page 27) to disassemble in the *Starting Address* field.
2. Select the appropriate *Data Column Width*.
3. Select *Apply*.



Scrolling

Page Forward and *Page Back* let you scroll the displayed memory locations. You cannot page back beyond the starting address.

Program counter tracking

If you step the processor or run and then stop, the highlighted line will track the current program counter.

If you do not want the highlighted line to track the program counter, select *Freeze Window (No)* in the Update menu.

Addresses

Enter all addresses in hexadecimal format.

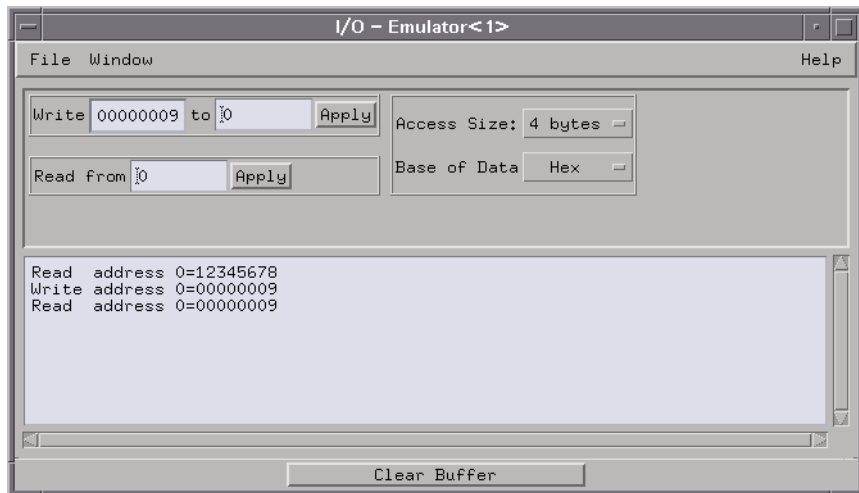
Examples:

```
ABCDEF89  
00000100  
0040
```

Displaying and Modifying I/O

To display I/O locations

1. Open the I/O window.
2. Specify the display format by selecting the appropriate *Access Size* and *Base of Data* options.
3. Enter the address you wish to read in the *Read from* field, and select *Apply*.



Clear Buffer empties the contents of the I/O window.

To modify an I/O location

1. Open the I/O window.
2. Specify the size of the I/O location and the format of the value you wish to enter by selecting the appropriate *Access Size* and *Base of Data* options.
3. Enter the value that you want to write in the *Write* field, enter the address of the location in the *to* field, and select *Apply*.

Downloading an Executable to the Target System

Use the Load Executable window to load executables (or other data) into your target system. You can load your data into RAM or into flash ROM.

- “To download into target RAM” on page 30
- “To download into target flash ROM” on page 32
- “To erase flash ROM” on page 33

NOTE:

You must always erase flash ROM before you program it.

NOTE:

Programming and erasing flash ROM may take a very long time on some processors. Additionally, Intel Quick-Pulse parts take longer to erase than others. The following examples show how long it took to perform various flash tasks on different processors. Your times will be different from the times in the examples. Use the Load Executable window to program or erase flash ROM only if these measurements are acceptable for your needs.

* To program a 1 megabyte file using AMD 5 Volt parts:

* CPU32: 5 minutes * MPC860: 20 minutes * PowerPC 603e: 1 hours, 30 minutes

* To erase 1/2 megabyte Intel Quick-Pulse part:

* CPU32: 2 minutes

* To erase 2 megabyte AMD 5 Volt parts:

* MPC860: 10 seconds * PowerPC 603e: 5 seconds

Note that Intel Quick-Pulse parts always take longer to erase than other parts. PowerPC 60x always takes longer to program than Motorola MPC860 or CPU32.

To download into target RAM

1. Save the executable where the logic analysis system can read it (see page 31).
2. Open (see page 47) the Load Executable window.
3. Select the *Load Executable* operation. The parts of the window relating to flash ROM programming will be "grayed out".
4. Select the format (see page 31) of the file.
5. Change the *Access Size* option, if necessary.
6. If you chose the Motorola S-Records format or the ELF Object format, change the *Set PC after load* option, if necessary. If this option is selected (the button is in), the PC will be set to the execution start address, if it is specified in the file.
7. Enter the name of the file to load.
8. Select *Apply*.

When the file has been successfully loaded, "load completed" message will be displayed.

See Also

- "To access a file from the logic analysis system" on page 31
- "To choose a file format" on page 31
- "Error messages while downloading files" on page 34

To access a file from the logic analysis system

You need to save the executable file where the logic analysis system can read it.

If you will be downloading many files, you should NFS-mount the file system (see the *Agilent Technologies 16700A/B-Series Logic Analysis System* help volume) of the computer where you are compiling your program. If you do this, you can directly access your executable, regardless of how big it is, as soon as it is compiled or assembled. Mounting the file system may require the help of a system administrator.

You can also copy the file (see the *Agilent Technologies 16700A/B-Series Logic Analysis System* help volume) from a floppy disk to the logic analysis system's hard disk. If the file is too big to fit on the floppy disk, use PKZIP to compress the file, then uncompress (see the *Agilent Technologies 16700A/B-Series Logic Analysis System* help volume) the file using the File Manager.

To choose a file format

You can choose one of the following file formats:

- **Motorola S-records** Most compilers for Motorola microprocessors can generate Motorola S-records. (see page 36) This file format represents the binary data as hexadecimal numbers in a ASCII file. Each record in the file includes a load address for the data in the record.
- **Intel Extended Hex** The Intel extended hex (see page 37) format represents binary data as hexadecimal numbers in a ASCII file. Each record in the file includes a load address for the data in the record.
- **Plain binary** If you choose *Plain binary*, the data in the file will be copied directly to the target system. Because plain binary files contain no information about where to load the file in memory, you must enter a start address.
- **ELF Object** Many compilers generate ELF Object files. This option will allow statically linked ELF images to be loaded into the target memory.

Dynamically linked ELF shared libraries cannot be loaded with this option.

If your executable is not in one of these formats, recompile, reassemble, or relink your program with the appropriate options to generate one of these formats.

See Also

- “Details of the Motorola S-record format” on page 36
- “Details of the Intel extended hex format” on page 37

To download into target flash ROM

1. Save the executable where the logic analysis system can read it (see page 31).
2. Open (see page 47) the Load Executable window.
3. Select the *Program Flash* operation. The part of the window relating to "Erase Flash" will be "grayed out."
4. Select the *Algorithm* (see page 38) used by your flash ROM part.
5. Select the *Bus Width* of the data bus connected to your part.
6. Select the *Device Width* of your part.

Notice that the *Bus Width* refers to your target system, but that *Device Width* refers to the flash ROM part.

7. Enter the *ROM Start Address*. This is the first address in memory which maps to your flash ROM part.
8. Enter the *ROM Size*.

This is the total size (in bytes, hexadecimal) of the ROM address space. For example, if you have four flash parts which are each 1 MB in size, enter 400000.

The emulator will not write to or erase addresses outside of the range [Start Address .. Start Address + ROM Size]. If your executable file contains data for both ROM and RAM addresses, only the data corresponding to the flash ROM addresses will be written.

9. If the flash ROM has not been erased, erase (see page 33) it.

10. Select the format (see page 31) of the file.
11. Change the *Access Size* option, if necessary.
12. If you chose the Motorola S-Records format or the ELF Object format, change the *Set PC after load* option, if necessary. If this option is selected (the button is in), the PC will be set to the execution start address, if it is specified in the file.
13. Enter the name of the file to load.
14. Select *Apply*.

When the file has been successfully loaded, "Load completed" message will be displayed.

See Also

- “To choose a flash algorithm” on page 38
- “To erase flash ROM” on page 33
- “To access a file from the logic analysis system” on page 31
- “To choose a file format” on page 31
- “Error messages while downloading files” on page 34

To erase flash ROM

1. Open (see page 47) the Load Executable window.
2. Select *Flash Erase*. The "Load Options" part of the window will be "grayed out."
3. Select the *Algorithm* (see page 38) used by your flash ROM part.
4. Select the *Bus Width* of the data bus connected to your part.
5. Select the *Device Width* of your part.

Notice that the *Bus Width* refers to your target system, but that *Device Width* refers to the flash ROM part.

6. Enter the *ROM Start Address*. This is the first address in memory which maps to your flash ROM part.

7. Enter the *ROM Size*.

This is the total size (in bytes, hexadecimal) of the ROM address space. For example, if you have four flash parts which are each 1 MB in size, enter 400000.

The emulator will not erase addresses outside of the range [Start Address .. Start Address + ROM Size].

8. If the *Erase chip* button label is not "grayed out", select the button to erase the whole part.

The Intel Quick-Pulse and AMD 12 Volt Embedded algorithms only allow erasing of the whole part. The Intel Auto algorithm requires one or more sectors of the part to be specified for erasing. The AMD 5 Volt Embedded algorithm allows you to choose whether to erase the whole part or just specific sectors.

9. If you did not select *Erase chip*, enter the address of each sector you want to erase.

You may erase up to four sectors at once. To erase more than four, simply enter the additional sectors after applying the erase function with the first four.

Error messages while downloading files

- AMD5 Volt algorithm requires either the "Erase chip" option or more sectors to be specified. If you do not select *Erase chip*, then you must select one or more sector addresses to erase. To select a sector to erase, select the box beside one of the sectors then enter a hex number for the address of the sector.
- Bad Load Address The start address which you entered for the plain binary file is invalid.
- Bad ROM Size. Specify a hex number. The number in the field is invalid. Re-enter a hexadecimal value.
- Bad ROM Start Address. Specify a hex number. The number in the field is invalid. Re-enter a hexadecimal value.
- Bad Sector Address. Specify a hex number. The number in the field is

invalid. Re-enter a hexadecimal value.

- Checksum errors found in non-data records. Checksum errors were found in one or more non-data records, but no errors were found in the data records. The data records were loaded.
- ELF file has no object image to load. Load not completed. This means we found a valid ELF Object file, but the target image was not included with the file. With no target image, we had nothing to load.
- File could not be opened. The executable file could not be opened. Check that the file exists, that the file permissions allow reading, and that the file is a data file and not a directory.
- File not in Intel Extended Hex file format. Load not completed, check format selection. Check that you have selected the correct file format button. If you still get this message, compare the file to the description in “Details of the Intel extended hex format” on page 37.
- File not in Motorola S-Record file format. Load not completed, check format selection. Check that you have selected the correct file format button. If you still get this message, compare the file to the description in “Details of the Motorola S-record format” on page 36.
- Flash ROM memory access failure. The emulator is unable to access ROM memory at the specified location. Check that the *Start Address* and *ROM Size* values are correct. Also, check that your target system has been set up correctly. For example, check that the chip select registers are set to allow access to the ROM memory.
- Intel Auto algorithm requires one or more sectors to erase. The Intel Auto algorithm does not support "bulk erasing" the entire part. Select one or more sector addresses to erase. To select a sector to erase, select the box beside one of the sectors then enter a hex number for the address of the sector.
- Load Failed: binary data load exceeds memory boundary. If the plain binary file were to be loaded at the the start address which you entered, some of the data would be written past the end of memory. Check the start address, then check that the file has a size that will fit in your target system's memory.
- Load failed: Checksum Errors found in data record(s). Checksum errors were found in one or more data records. The load was aborted. Generate a new executable file.

- Load Failed: ELF file has a format problem. ELF file has been altered in some way that we can no longer recognize it as an ELF file.
- Load Failed: Refer to Status/Error Log window. The Status/Error Log window will contain additional information about the errors that occurred.
- Non-ROM data encountered and ignored. This message means that a "Program Flash" operation was performed using a file which contained both data within the ROM address range and data outside the ROM address range. The ROM address range is determined by the values you entered: [Start Address .. Start Address + ROM Size]. Every byte in the file which is within the ROM address range was written to ROM; the data outside this range was ignored. If the data file should not have contained data for addresses outside of the ROM, check that the *Start Address* and *ROM Size* values are correct.
- Program AMD12V not erased. A message similar to this results from attempting to program ROM which has not been erased first. Erase the ROM before programming.
- Sector not erased - outside of ROM range. A sector address for the "Erase Flash" operation was outside the range [Start Address .. Start Address + ROM Size]. All sectors specified to be erased must reside within the ROM address range. Check the ROM address range and the sector address.

Details of the Motorola S-record format

An S-Record file has the following format:

```
[$$ [module_record]
symbol records
$$ [module_record]
symbol records
$$]
header_record
data_records
record_count_record
terminator_record
```

Each record in the file consists of

- Record type (2 characters)

- S0 - Header record
- S1,S2,S3 - Data record
- S5 - Record count
- S7,S8,S9 - Terminator
- Record length, in bytes, not including the record type field (2 characters)
- Load address (2-8 characters)
- The data, represented in hexadecimal. (length determined by the record length field)
- Checksum, calculated as the 1's complement of all bytes in the record, not including the record type field (2 characters)

When downloading a file, anything before the header (such as any module or symbol records) is ignored. All optional records are ignored.

Example

Here is an example of an S-Record file:

```
S00600004844521B
S20700665400B24C40
S20500665F45F0
S21400600033FC000A0000B24C202F00046C0622006D
...
S2060066424E758E
S50300728A
S80400624455
```

Details of the Intel extended hex format

Each record in the file consists of

- A colon (:) (1 character)
- Number of bytes in the data field (2 characters)
- Load address (4 characters)
- Record type (2 characters)
 - 00 Data

- 01 End of file
- 02 Extended segment address (bits 4-19 of a segment base address)
- 03 Start segment address
- 04 Extended linear address (the upper 2 bytes of a data load address)
- 05 Start linear address
- The data, represented in hexadecimal. (length determined by the record length field) For the extended address record types, the data consists of 4 characters representing the appropriate bits of the address.
- Checksum, calculated as the 2's complement of the sum of all of the bytes in the record after the colon (2 characters)

When downloading a file, only record types 00, 01, 02, and 04 are parsed. Any additional records (such as any module or symbol records) before the data records are ignored.

Example

Here is an example of a data record followed by an end of file record:

```
:20000000F00100230B340C4510561B6720782B892CAB30BC40CD4CD  
E50EF60F06C01701290  
:20002000AC230101112321453167418951AB61CDF1EF7121D001C01  
F08F9090F18F7190660  
:2000400028F5290438F3390248F1490058FC590D68FE690F78FA790  
988109812A834B865A7  
:20006000C867D889E89A8180A1E0E0ABE1464B00AB00AB21AB32AB4  
3AB54AB65AB76AB874B  
:20008000AB98AB299C309C819CF29CE39CC49CB59CD69CA79C18BBF  
F9B38EC0CEC0DEC0EC1  
:2000A000EC0FEC86EC8AEC8BEC8CEC8DEC87EC08EC04EC00EC01EC0  
2EC03EC06EC07EC8F88  
:0A01A0000000D7200000D780030004  
:00000001FF
```

To choose a flash algorithm

In the Flash Options section of the Load Executable window, you need to select the algorithm which will be used to program or erase your flash ROM part.

The supported algorithms are:

- AMD 5 Volt Embedded
- AMD 12 Volt Embedded
- Intel Auto
- Intel Quick-Pulse (AMD FlashRite)

If you do not know which algorithm your part uses:

- Look for your part in the “Table of Algorithms Used by Common Flash Parts” on page 39.

If your part is listed in the table, select the algorithm listed for your part. If your part is not listed, but you know that it is a new component belonging to one of the listed families, select the algorithm listed for the parts in the family.

- Check the manufacturer's literature to see if one of the supported algorithms is mentioned.

See Also

- “Table of Algorithms Used by Common Flash Parts” on page 39
- “Table of Unsupported Flash Parts” on page 45

Table of Algorithms Used by Common Flash Parts

Choose the manufacturer of your flash ROM part:

- “Table of Algorithms Used by AMD Flash Parts” on page 40
- “Table of Algorithms Used by Fujitsu Flash Parts” on page 44
- “Table of Algorithms Used by Hitachi Flash Parts” on page 43
- “Table of Algorithms Used by Intel Flash Parts” on page 41
- “Table of Algorithms Used by Micron Flash Parts” on page 44
- “Table of Algorithms Used by Mitsubishi Flash Parts” on page 43
- “Table of Algorithms Used by SGS-Thomson Flash Parts” on page 44
- “Table of Algorithms Used by Sharp Flash Parts” on page 45
- “Table of Algorithms Used by TI Flash Parts” on page 43

Information regarding the algorithm used by the listed parts is based on the manufacturer's specifications.

See Also

- “Table of Unsupported Flash Parts” on page 45

Table of Algorithms Used by AMD Flash Parts

FAMILY	Part	Algorithm	
-			
AMD 12V Bulk Erase	Am28F256	Intel Quick-Pulse	
	Am28F512	Intel Quick-Pulse	
	Am28F010	Intel Quick-Pulse	
	Am28F020	Intel Quick-Pulse	
	Am28F256A	AMD 12V Embedded	
	Am28F512A	AMD 12V Embedded	
	Am28F010A	AMD 12V Embedded	
	Am28F020A	AMD 12V Embedded	
	-		
	AMD 5V only Sector erase	Am29F010	AMD 5V Embedded
Am29F100T		AMD 5V Embedded	
Am29F100B		AMD 5V Embedded	
Am29F002T		AMD 5V Embedded	
Am29F002B		AMD 5V Embedded	
Am29F002NT		AMD 5V Embedded	
Am29F002NB		AMD 5V Embedded	
Am29F200T		AMD 5V Embedded	
Am29F200B		AMD 5V Embedded	
Am29F040		AMD 5V Embedded	
Am29F400AT		AMD 5V Embedded	
Am29F400AB		AMD 5V Embedded	
Am29F400BT		AMD 5V Embedded	
Am29F400BB		AMD 5V Embedded	
Am29F080		AMD 5V Embedded	
Am29F800T		AMD 5V Embedded	
Am29F800B		AMD 5V Embedded	
Am29F800BT		AMD 5V Embedded	
Am29F800BB		AMD 5V Embedded	
Am29F016		AMD 5V Embedded	
Am29F017		AMD 5V Embedded	

-		
AMD 3V only Sector Flash	Am29DL800T	AMD 5V Embedded
	Am29DL800B	AMD 5V Embedded
	Am29LV002T	AMD 5V Embedded
	Am29LV002B	AMD 5V Embedded
	Am29LV200T	AMD 5V Embedded
	Am29LV200B	AMD 5V Embedded
	Am29LV004T	AMD 5V Embedded
	Am29LV004B	AMD 5V Embedded
	Am29LV400T	AMD 5V Embedded
	Am29LV400B	AMD 5V Embedded
	Am29LV081	AMD 5V Embedded
	Am29LV008T	AMD 5V Embedded
	Am29LV008B	AMD 5V Embedded
	Am29LV800T	AMD 5V Embedded
	Am29LV800B	AMD 5V Embedded
	Am29LV800BT	AMD 5V Embedded
	Am29LV800BB	AMD 5V Embedded
	Am29LV160BT	AMD 5V Embedded
	Am29LV160BB	AMD 5V Embedded
-		
AMD 2.2V only Sector Sector Flash	Am29LL800T	AMD 5V Embedded
	Am29LL800B	AMD 5V Embedded
-		

Table of Algorithms Used by Intel Flash Parts

FAMILY	Part	Algorithm
-		
Intel High Performance Fast Flash	28F016XD	Intel Auto
	28F016XS	Intel Auto
-		
Intel FlashFile	DD28F032SA	Intel Auto
	28F016SA	Intel Auto
	28F016SV	Intel Auto

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	28F008SA	Intel Auto
	28F008SA-L	Intel Auto

-		
Intel Boot Block	28F001BX-T/B	Intel Auto
	28F001BN-T/B	Intel Auto
	28F002BX-T/B	Intel Auto
	28F002BL-T/B	Intel Auto
	28F002BC	Intel Auto
	28F200BX-T/B	Intel Auto
	28F200BL-T/B	Intel Auto
	28F400BX-T/B	Intel Auto
	28F004BX-T/B	Intel Auto
	28F400BL-T/B	Intel Auto
	28F004BL-T/B	Intel Auto

-		
Intel SmartVoltage Boot Block	28F800BV-T/B	Intel Auto
	28F008BV-T/B	Intel Auto
	28F800CV-T/B	Intel Auto
	28F800CE-T/B	Intel Auto
	28F008BE-T/B	Intel Auto
	28F400BV-T/B	Intel Auto
	28F004BV-T/B	Intel Auto
	28F400CV-T/B	Intel Auto
	28F400CE-T/B	Intel Auto
	28F004BE-T/B	Intel Auto
	28F200BV-T/B	Intel Auto
	28F002BV-T/B	Intel Auto
	28F200CV-T/B	Intel Auto

-		
Intel Bulk erase	28F020	Intel Quick-Pulse
	28F010	Intel Quick-Pulse
	28F512	Intel Quick-Pulse
	28F256A	Intel Quick-Pulse

-		

Table of Algorithms Used by Mitsubishi Flash Parts

FAMILY	Part	Algorithm
-		
Mitsubishi	M5M28F101	Intel Quick-Pulse
	M5M28F102A	Intel Quick-Pulse
	M5M28F800	Intel Auto
-		

Table of Algorithms Used by TI Flash Parts

FAMILY	Part	Algorithm
-		
TI	TMS28F010A	Intel Quick-Pulse
	TMS28F010B	Intel Quick-Pulse
	TMS28F512A	Intel Quick-Pulse
	TMS28F210	Intel Quick-Pulse
	TMS28F020	Intel Quick-Pulse
	TMS28F040	AMD 5V Embedded
	TMS28F400BZT	Intel Auto
	TMS28F400BZB	Intel Auto
	TMS28F200BZT	Intel Auto
	TMS28F200BZB	Intel Auto
	TMS28F004Axy	Intel Auto
	TMS28F400Axy	Intel Auto
	TMS28F002Axy	Intel Auto
	TMS28F200Axy	Intel Auto
-		

Table of Algorithms Used by Hitachi Flash Parts

FAMILY	Part	Algorithm
-		
Hitachi	28F4001	Intel Quick-Pulse
	28F101	Intel Quick-Pulse
-		

See Also

- “Table of Unsupported Flash Parts” on page 45

Table of Algorithms Used by SGS-Thomson Flash Parts

FAMILY	Part	Algorithm
-		
SGS-Thomson	28F410	Intel Auto
	28F420	Intel Auto
-		

Table of Algorithms Used by Fujitsu Flash Parts

FAMILY	Part	Algorithm
-		
Fujitsu 5 Volt Operation	MBM29F002T/B	AMD 5V Embedded
	MBM29F002ST	AMD 5V Embedded
	MBM29F002SB	AMD 5V Embedded
	MBM29F200TA	AMD 5V Embedded
	MBM29F200BA	AMD 5V Embedded
	MBM29F040A	AMD 5V Embedded
	MBM29F400TA	AMD 5V Embedded
	MBM29F400BA	AMD 5V Embedded
	MBM29F080	AMD 5V Embedded
	MBM29F800T/B	AMD 5V Embedded
	MBM29F016	AMD 5V Embedded
	MBM29F017	AMD 5V Embedded
-		
Fujitsu 3 Volt Operation	MBM29LV002T/B	AMD 5V Embedded
	MBM29LV200T/B	AMD 5V Embedded
	MBM29LV004T/B	AMD 5V Embedded
	MBM29LV400T/B	AMD 5V Embedded
	MBM29LV008T/B	AMD 5V Embedded
	MBM29LV800T/B	AMD 5V Embedded
-		

Table of Algorithms Used by Micron Flash Parts

FAMILY	Part	Algorithm
-		
Micron Boot Block	MT28F002	Intel Auto
	MT28SF002	Intel Auto
	MT28F200	Intel Auto

	MT28SF200	Intel Auto
	MT28F004	Intel Auto
	MT28SF004	Intel Auto
	MT28SF004ET	Intel Auto
	MT28F400	Intel Auto
	MT28SF400	Intel Auto
	MT28SF400ET	Intel Auto
	MT28(S)F008	Intel Auto
	MT28F008	Intel Auto
	MT28SF008	Intel Auto

-		
Micron Sectored Erase	MT28(S)F116	Intel Auto
	MT28F161	Intel Auto
	MT28SF161	Intel Auto

-		

Table of Algorithms Used by Sharp Flash Parts

FAMILY	Part	Algorithm

-		
Sharp	LH28F004SU-LC	Intel Auto
	LH28F008SA	Intel Auto
	LH28F016SU	Intel Auto

-		

Table of Unsupported Flash Parts

The following parts cannot be programmed by the emulator:

FAMILY	Part

Atmel	
Hitachi	HN28F101
Toshiba	

Coordinating Trace Measurements

If you are using a logic analyzer (and perhaps an analysis probe) along with an emulation probe to debug your target system, you can coordinate the logic analyzer trace measurements with the execution of your target processor.

- “To trigger an analyzer on a break” on page 46
 - “To omit monitor cycles from the trace” on page 47
-

To trigger an analyzer on a break

If you want to trace execution that occurs before a break:

With an emulation module

1. Configure the "Trigger Out" port to be high when processor execution is in the monitor (see “Configuring the Emulator” on page 13).
2. Set the logic analyzer to trigger on *anystate*.
3. Set the trigger point to *center* or *end*.
4. In the Intermodule Window (see the *Agilent Technologies 16700A/B-Series Logic Analysis System* help volume), select the logic analyzer you want to trigger, then select the emulation module.

The logic analyzer is now set to trigger on a processor halt.

5. Wait for the Run Control window to show that the processor has stopped.

NOTE:

The logic analyzer will store states up until the processor stops, but will continue running. When the processor stops, you may see a "slow clock" message, or the logic analyzer display may not change at all.

6. In the logic analyzer window, select *Stop* to complete the measurement.

With an emulation probe

1. Connect the emulation probe's "Trigger Out" port to the analyzer's input
-

port.

2. Configure the "Trigger Out" port to either be high or low when processor execution is in the monitor (see "Configuring the Emulator" on page 13).
3. Configure the logic analyzer's input port. For example, if "Trigger Out" is low when in the monitor, configure the analyzer to look for a falling edge.
4. Set up the analyzer to trigger on the input signal (storing states that occur before the trigger).
5. Start the trace measurement.
6. Start processor execution. When the break occurs, the analyzer should trigger.

To omit monitor cycles from the trace

If you have an emulation probe, you can omit monitor cycles from a logic analyzer trace by using the "Trigger Out" port signal as an analyzer clock qualifier. That is, the analyzer is only clocked when processor execution is outside the monitor.

1. Connect the emulation probe's "Trigger Out" port to the analyzer's clock qualifier input.
2. Configure the "Trigger Out" port to either be high or low when processor execution is in the monitor (see "Configuring the Emulator" on page 13).
3. Configure the logic analyzer's clock qualifier input. For example, if "Trigger Out" is low when in the monitor, configure the analyzer to clock only when the qualifier input is high.
4. Set up and start analyzer trace measurements normally. The processor must be executing user code (not executing in the monitor) in order for data to be clocked into the analyzer.

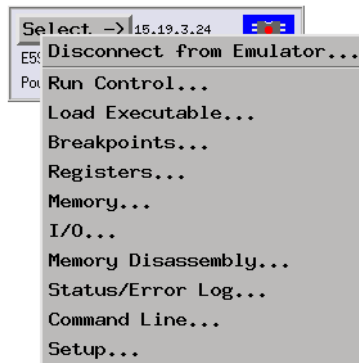
To open windows

The Emulation Control Interface gives you several ways to open new

windows:

Opening windows from the Emulation Control Interface icon

1. Move the mouse cursor over the Emulation Control Interface icon in the system window or in the workspace window.
2. Press and hold the right mouse button.
3. Move the mouse cursor over the menu selection for the window you wish to open.
4. Release the right mouse button.



Opening windows from the Window menu

- In any emulation window menu bar, select *Window*.
- Select the emulator.
- Select the window you want to open.

Creating and naming new windows

You can open several copies of certain windows, such as the Memory window.

1. In the menu bar, select *File* then select *New Window*. The new window will be given a number, such as *Memory <<3>>*.
2. (Optional) In the new window, select *File* then select *Rename*. Enter a new name for the window and select *OK*.

The new window can be opened from the Emulation Control Interface icon or from the Window menu.

To close windows

- In the menu bar, select *File* then select *Close*.

Auto-close

You can turn on Auto-close so that when you select a new window from the *Window* menu, the current window will be closed. To turn on Auto-close, select *Window* in the menu bar, then select *Auto-Close [ON]*.

Deleting windows

When you create a new window using *File->New*, the window will still be listed in the *Window* menu after you have closed it. To delete the window from the list, open the window then select *File->Delete*.

Managing Run Control Tool Windows

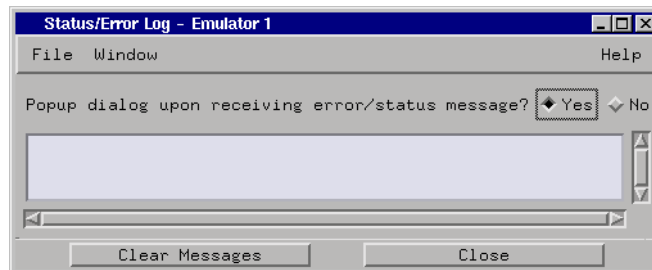
- “To open windows” on page 47
- “To close windows” on page 49
- “To use the Status/Error Log window” on page 50

To use the Status/Error Log window

The Status/Error Log window is the central repository for error and status messages.

To specify when the Status/Error Log window appears:

1. Open the Status/Error Log window.



2. If you want the Status/Error Log window to automatically appear every time an error or status message occurs, select *Yes* for *Popup dialog upon receiving error/status message?*. If you only want the Status/Error Log window to appear when you open it, select *No*.
3. Close the Status/Error Log window.

Clear Messages empties the contents of the Status/Error Log window.

See Also

“Error/Status Messages” on page 57

To Use the Command Line Interface

1. Open the Command Line window.
2. Enter commands in the *Command Input* field.

The `help` command provides command syntax and other information. For example, for help on the `m` command, enter the `help m` command.

Enter comments by beginning a line with the `#` character.

3. Each line begins with a status prompt, such as `M>` or `U>`.
 - `M>` indicates your target system is in the debug mode, not running user code.
 - `U>` indicates your target system is running user program code.

For definitions of all of the status prompts you might see in the Command Line window, type, *help proc*.

The command line interface is useful, for example, for creating scripts that initialize the target system to a known state. For example, scripts can set initial register or memory values or write an I/O sequence.

Playback Script will execute commands that have been saved in a script file.

Edit Script opens a simple text editor that lets you enter and save a sequence of commands in a file.

Clear Buffer clears the Command Output buffer.

Memory Test... displays the Memory Test window where you can determine the condition of your target system memory hardware.

Use the up and down arrow keys to scroll through a list of the last 20 commands which you have entered.

Use the `log` (see page 53) command to save command line output to a file.

Example

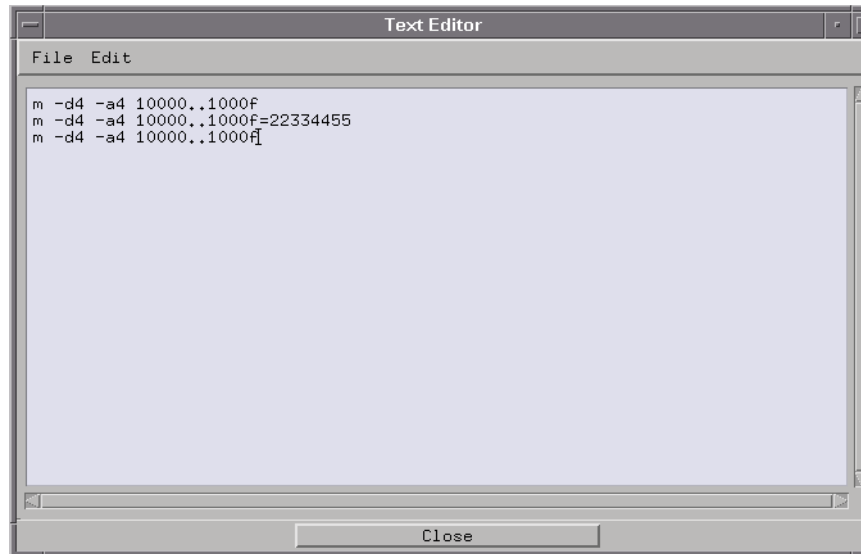
To create a script that reads a range of memory addresses, writes

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Managing Run Control Tool Windows

22334455 to those addresses, and then reads the memory address range again:

1. Select *Edit Script*.
2. In the Text Editor window, enter the commands:



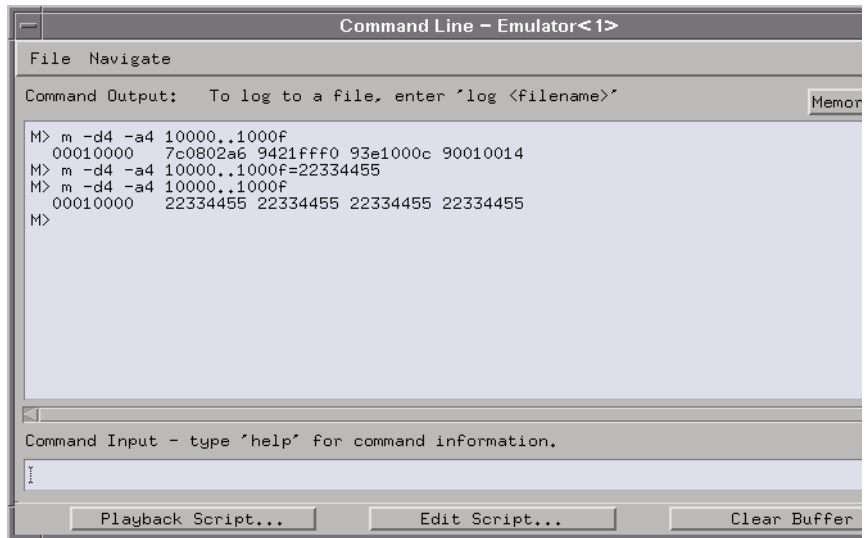
3. Select the *File->Save* command from the menu bar, enter the name of your file in the File Selection dialog, and select *OK*.

4. Close the Text Editor window.

To play back the script just created:

1. Select *Playback Script*.
2. Select the name of the probe configuration settings script file in the File Selection dialog, and select *OK*.

The output will look similar to the following:



Limitations

- Some of the commands listed when you type `help` are not available. In particular, the `pv` and `init` commands cannot be used.
- In *demo mode*, commands entered in this window (including the `help` command) have no effect.

See Also

- “To save command line output in a log file” on page 53
- “To create a script from a log file” on page 54
- “To cancel a command” on page 54
- “Timeouts in the Command Line window” on page 55
- “Commands not available in the Command Line window” on page 55
- “Testing Target System Memory” on page 65

To save command line output in a log file

1. In the Command Line window, enter the `log filename` command.
Enter the full path for the log file.
2. Enter commands or playback a script. The commands and their output will

be saved to the file.

3. To stop logging to the file, enter the `log off` command.

Example

To save the values of all of the registers to the file "reglog01.log" enter:

```
log /logic/mylogs/reglog01.log
reg
log off
```

To create a script from a log file

1. Select *Edit Script*.
2. Select *File->Load Script*, then choose the log file.
3. Edit the text to remove:
 - the ">" prompt
 - the output of the command
 - the "Logging to" line
 - the "Logging turned off" line
4. Save the script.

To cancel a command

Select the *Cancel* button in the Busy dialog to cancel the currently executing command.

Commands that create no output cannot be cancelled and will cause the connection to the emulator to timeout (see page 55).

If you use the **rep** command to write a loop, make sure that there is a command in the loop which will generate some output.

For example, **rep 0 {m 0..100=0}** will repetitively write 0 to the entire memory range 0..100. Because the **m address=value** command produces no output, the command cannot be cancelled. By changing the command to **rep 0 {m 0..100=0;echo .}** a dot is written after every complete write of the range 0..100 and you will be able to

cancel the command.

Timeouts in the Command Line window

Timeout is one minute.

Every command must generate output that occurs at a rate of at least once a minute. Faster rates of output are desirable. For example, the command `w 70` (wait 70 seconds) will cause the system to timeout and should not be used. In addition, commands like `m 0..10000=0` which fill large segments of memory may cause the system to timeout. Use *Memory Fill* in the Memory Window to fill memory.

Commands not available in the Command Line window

Some of the commands listed when you type `help` in the Command Line window are not available.

The unavailable commands are:

- `cf_var`
- `cfsave`
- `cl`
- `dump`
- `end`
- `init`
- `lan`
- `load`
- `mo`
- `po`
- `pv`
- `sio`
- `sioget`
- `sioput`

- slist
- start
- stty
- ureg

Error/Status Messages

Select the messages below for additional information on some of the error/status messages that can occur when using the Emulation Control Interface.

The following messages can appear in either the Error/Status Log window or in the Command Line Interface window.

Debug Mode Access Error (see page 58)

Debugger: memory update (see page 58)

Debugger: register update (see page 58)

Hardware breakpoint (see page 59)

Memory access failed (see page 59)

Software breakpoint (see page 59)

Stepping failed (see page 59)

Target power is off (see page 60)

Unable to break (see page 60)

Unable to modify register: PC=value (see page 60)

Unknown break cause (see page 60)

Unimplemented opcode/register (see page 60)

The following error messages appear in the Breakpoint window:

Address is a duplicate of Breakpoint #_ (see page 58)

Address is not on an instruction (4-byte) boundary (see page 58)

Enable breakpoint failed (see page 59)

See Also

“To use the Status/Error Log window” on page 50

Address is a duplicate of Breakpoint #_

This error occurs if you try to set a breakpoint at an address which already has a breakpoint. Only one breakpoint is allowed at a given address.

Address is not on an instruction (4-byte) boundary

This error occurs if the address ends in a hexadecimal digit other than 0, 4, 8, or C. Breakpoints can only be set on 4-byte instruction boundaries.

Debug Mode Access Error

This error occurs if there has been a communication error between the emulator and the target system.

Try the operation again. If the error occurs again, check all connections. If the emulator is connected directly to the target board (through a target interface module), check that the target's debug port meets the guidelines in the emulator *Installation and Service Guide*.

Debugger: memory update

This message occurs when target system memory has been modified by another external connection (presumed to be a debugger).

Debugger: register update

This message occurs when a processor register has been modified by

another external connection (presumed to be a debugger).

Enable breakpoint failed

This error occurs if an attempt to write a software breakpoint at the indicated memory address failed. If you are setting a software breakpoint, check that the address is in RAM, not ROM.

Hardware breakpoint

This message occurs when the processor has stopped at a hardware breakpoint at the specified address.

Memory access failed

This error occurs if the processor was unable to access memory (processor-generated exception).

Software breakpoint:

This message occurs when the processor has stopped at a software breakpoint at the specified address.

Stepping failed

This error occurs if the step command was unsuccessful because attempt to write to the program counter failed.

Target power is off

This error occurs if the emulator detects that power is off on the target processor.

Unable to break

This error occurs if the processor does not return a status message to the emulator indicating that it has stopped.

Unable to modify register: PC=value

This error occurs if a register command was unsuccessful because attempt to write to the program counter failed.

Unknown break cause

Something other than the emulator caused a break. Possible causes include a "break" button on the target system, a trap instruction, or noise in the target system circuitry.

Unimplemented opcode/register

This error occurs if the processor tried to execute an illegal instruction (processor-generated exception).

SH7709A/29 Run Control Tool—New Features in This Version

- This is the first version of the SH7709A/29 Run Control tool.

To update firmware

Update the firmware if:

- The emulation module or emulation probe is being connected to a new analysis probe or *TIM*, or
- The emulation module was not shipped already installed in the logic analysis system, or
- You have an updated version of the firmware.

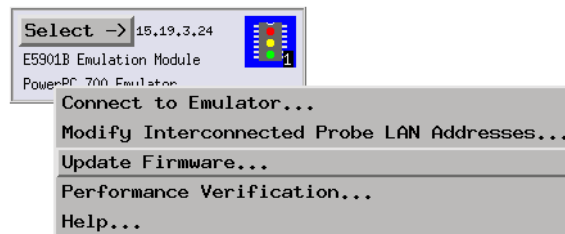
To install firmware from a CD-ROM to the hard disk

- Follow the instructions printed on the CD-ROM jacket.

This will install the firmware onto the logic analysis system hard disk. Continue with either the "To update emulation module firmware" or the "To update emulation probe firmware" instructions.

To update emulation module firmware

1. End any emulation sessions that may be running. Remove any emulation module icons from the workspace in the Workspace window.
2. Install the firmware onto the logic analysis system's hard disk, if necessary.
3. In the system window, select the emulation module and select *Update Firmware*.



4. In the Update Firmware window, select the firmware version to load.

Select the *Additional Information* button to display additional information about the firmware you selected.

5. Select *Update Firmware*.

To update emulation probe firmware

1. End any emulation sessions that may be running.
2. Install the firmware onto the logic analysis system's hard disk, if necessary.
3. In the workspace window, drag the emulation probe icon onto the workspace.
4. Select the emulation probe icon and select *Update Firmware...*
5. In the Update Firmware window, enter the LAN name or address of the emulation probe.
6. In the Update Firmware window, select the firmware version to load.

Select the *Additional Information* button to display additional information about the firmware you selected.

7. Select *Update Firmware*.
8. Cycle power on the emulation probe.

To display the current firmware version

- Select *Display Current Version* to see what firmware version is already installed in your emulation module or emulation probe.

To install firmware from another source

If you obtained firmware from another source, such as from an ftp server or a World Wide Web site: [//www.agilent.com/find/sw-updates](http://www.agilent.com/find/sw-updates)

- Follow the instructions provided with the firmware, OR
- Copy the firmware files into `/logic/run_cntrl/firmware` on the logic analysis system hard disk. Be sure to copy *all* of the files which begin with the product number of the firmware for your microprocessor.

Disconnecting from the Emulator

1. Select the Emulation Module icon or Emulation Control Interface icon and then select *Disconnect from Emulator*.
2. In the Connect - Emulator window, select *Disconnect from Emulator*.

Testing Target System Memory

Many times when a system under test fails to operate as expected, you will need to determine whether the failure is in the hardware or the software. These tests verify operation of the memory hardware in the system under test.

To Test Target System Memory

1. Open the Memory Test window (see page 80).
2. Specify the Memory Test (see page 67) to be performed.
3. Specify the Memory Range (see page 79) to be tested.
4. Specify the Data Value (see page 79) to be used when performing the test.
5. Specify the Options (see page 79), number of times the test is to be repeated and type of error message information to be presented during the test.
6. Open the Command Line window if it's not already open.
7. Select the *Execute Test* button.
8. View test results in the Command Line window.

The Command Input line in the Command Line window will show the equivalent terminal interface command during each test.

The Busy dialog box appears while the test executes. It also shows the equivalent terminal interface command during each test. A *Cancel* button in the Busy dialog box can be used to stop a test in progress.

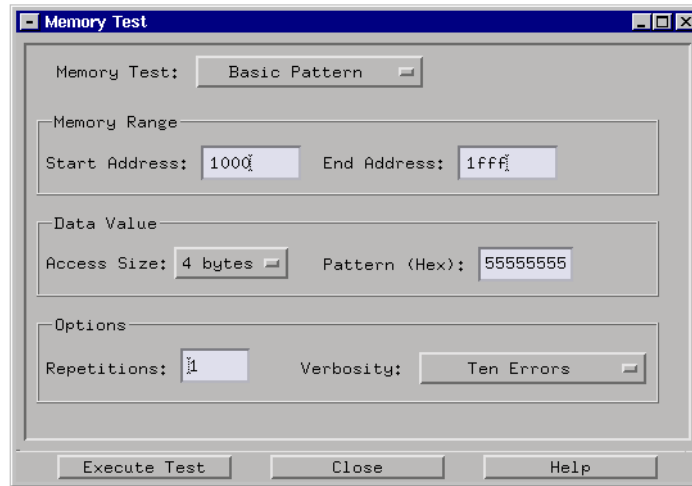
To check untested memory hardware, follow the “Recommended Test Procedure” on page 80.

Example

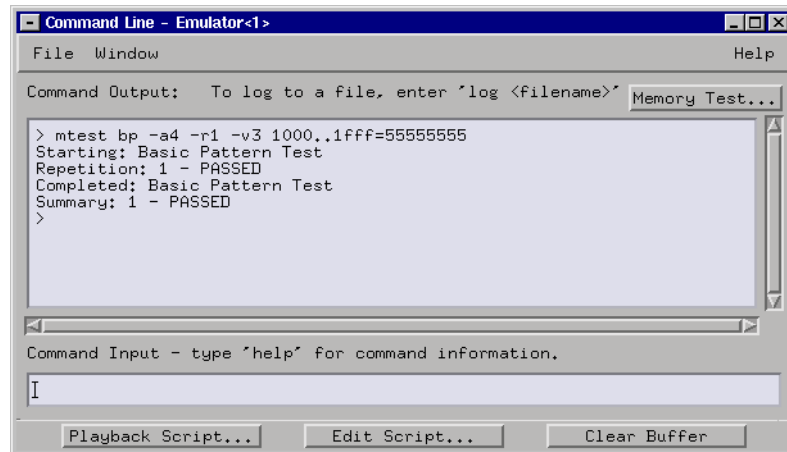
The following example writes the value "55555555" to addresses 1000 through 1fff (hexadecimal). Then it compares the values in memory with the values that were written. Next, the test writes the compliment "aaaaaaaa" to the same range of addresses and compares the new

values in memory with the values that were written.

1. Open the Command Line window and select the *Memory Test* button.
2. In the Memory Test window, specify the memory test shown below.



3. Select the *Execute Test* button.
4. View the test results in the Command Line window.



See Also

- “Recommended Test Procedure” on page 80

Memory Test:

The Memory Test feature of the Emulation Control Interface can perform seven different types of tests. Use these tests to find problems in address lines, data lines, and data storage. Use these tests in combination because no single test can perform a complete evaluation of the target system memory.

Basic Pattern

- Use this test to validate data read-write lines.
- “To perform the Basic Pattern test” on page 68
- “How the Basic Pattern test works” on page 69

Address Pattern

- Use this test to validate address read-write lines.
- “To perform the Address Pattern test” on page 70
- “How the Address Pattern test works” on page 71

Rotate Pattern

- Use this test to validate data read-write lines, and test voltage and ground bounce.
- “To perform the Rotate Pattern test” on page 71
- “How the Rotate Pattern test works” on page 73

Walking Ones

- Use this test to validate individual storage bits in memory.
- “To perform the Walking Ones test” on page 74
- “How the Walking Ones test works” on page 74

Walking Zeros

- Use this test to validate individual storage bits in memory.
- “To perform the Walking Zeros test” on page 75

- “How the Walking Zeros test works” on page 76

Oscilloscope Read

- Use this test to generate the signals associated with reading from memory so they can be viewed on an oscilloscope.
- “To perform the Oscilloscope Read test” on page 76
- “How the Oscilloscope Read test works” on page 77

Oscilloscope Write

- Use this test to generate the signals associated with writing to memory so they can be viewed on an oscilloscope.
- “To perform the Oscilloscope Write test” on page 77
- “How the Oscilloscope Write test works” on page 78

To perform the Basic Pattern test

1. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
2. In the *Memory Test* dialog box, select the *Basic Pattern* Memory Test.
3. Type in the *Memory Range* to be tested.
4. Select the *Access Size* to be written, and type in the *Pattern* to be written.
5. Set *Repetitions* to 1. This causes the test to be performed one time.
6. Set *Verbosity* to *Ten Errors*. This is the recommended verbosity for the first test in a series of tests.
7. Select the *Execute Test* button.
8. When the test is complete, the Command Line window will show the test results. Error messages will be shown if any errors were found during the test.

This test verifies that the data lines of the selected memory range are without error. This test also checks the individual memory locations in the memory range specified.

Consistent errors such as a particular bit incorrect every four bytes typically indicate a problem with the data lines. Random or sparse errors may indicate hardware data memory errors—check individual locations with the Walking Ones and Walking Zeros tests.

This test will halt and generate an error message if your Memory Range specification causes this test to be performed outside the range of valid memory in your target system.

This test will not halt but it will generate an error message if it is run on ROM or on locations with data line or location errors.

You can open a memory window on your logic analyzer to view the memory content. Expect to see the pattern and the compliment of the pattern that was specified.

NOTE:

This test will not always detect errors in the address lines. For example, if a bit in the address lines is stuck high or low, the Pattern Test will write to a different location in memory. Then the read from memory for comparison will also be made from that different location so the data will be correct. Use the Address Pattern test with this test to completely evaluate the memory range.

See Also:

- “How the Basic Pattern test works” on page 69
- “If problems were found by the Basic Pattern test” on page 81

How the Basic Pattern test works

This test writes the *Pattern* and the compliment of the *Pattern* to the *Memory Range*, and then compares the values in memory with what was written. The compliment of the *Pattern* and then the *Pattern* are then written, read, and compared.

Example:

	First Write/Read	Second Write/Read
00000000	5555	AAAA
00000002	AAAA	5555
00000004	5555	AAAA
00000008	AAAA	5555

The Basic Pattern test finds data bits in memory that are stuck high or low. It also detects data lines that may be tied to power ground, or not connected at all.

To perform the Address Pattern test

1. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
2. In the *Memory Test* dialog box, select the *Address Pattern* Memory Test.
3. Type in the *Memory Range* to be tested.
4. Select the *Access Size* to be tested.
5. Set *Repetitions* to 1. This causes the test to be performed one time.
6. Set *Verbosity* to *Ten Errors*. This is the recommended verbosity for the first test in a series of tests.
7. Select the *Execute Test* button.
8. When the test is complete, the Command Line window will show the test results. Error messages will be shown if any errors were found during the test.

This test verifies that the address lines of the selected memory range are without error.

This test does not ensure that the data lines or individual data locations are without error. If a bit is stuck in a memory location, but is stuck in the written value, the stuck bit will not be detected.

You can view the memory in an analyzer memory window. You should see direct correlation between each address and the data stored at that address.

Consistent errors typically indicate problems in the address lines. This is especially likely if the results of the Basic Pattern test were without errors.

Errors in specific memory locations may indicate errors in the memory hardware instead of the address lines.

See Also:

- “How the Address Pattern test works” on page 71
- “If problems were found by the Address Pattern test” on page 82

How the Address Pattern test works

This test writes the address of each memory location as data to each location. The data is then read back to see if it matches the addresses.

The pattern written to the memory is generated at the start of the test and is dependent upon the start address, access size, and the number of bytes in the memory range.

Depending on the last *Access Size* selected, subsets of the addresses may be written to memory. For example, if the last access size was 1 byte, address 00000001 will have 01 written to it, and address 00000002 will have 02 written to it.

For example, the data written in address 00001000 will look like this, depending on the last *Access Size*.

```
1 Byte = 00001000 00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f
2 Byte = 00001000 1000 1002 1004 1006 1008 100a 100c 100e
4 Byte = 00001000 00001000 00001004 00001008 0000100c
8 Byte = 00001000 0000000000001000 0000000000001008
```

The upper four bytes of an 8 Byte access size are not tested for a 4 Byte address. The upper four bytes will always be zeros. Use a smaller access size to test these locations with the Address Pattern test.

Unless the access size is 1 Byte, the odd bits of the memory locations will not be tested. Use the Basic Pattern test to check the odd bits.

To perform the Rotate Pattern test

1. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
2. In the *Memory Test* dialog box, select the *Rotate Pattern* Memory Test.

Testing Target System Memory

3. Type in the *Memory Range* to be tested.
4. Select the *Access Size* to be written, and type in the *Pattern* to be written. A good pattern to use is 01, 0001, or 00000001.
5. Set *Repetitions* to 1. This causes the test to be performed one time.
6. Set *Verbosity* to *Ten Errors*. This is the recommended verbosity for the first test in a series of tests.
7. Select the *Execute Test* button.
8. When the test is complete, the Command Line window will show the test results. Error messages will be shown if any errors were found during the test.

This test can be used to test voltage and ground bounce problems associated with the selected memory range. This test verifies that the data lines of the selected memory range are without error. This test also checks the individual memory locations in the memory range specified.

Consistent errors such as a particular bit incorrect every four bytes typically indicate a problem with the data lines. Random or sparse errors may indicate hardware data memory errors—check individual locations with the Walking Ones and Walking Zeros tests.

This test will halt and generate an error message if your Memory Range specification causes this test to be performed outside the range of valid memory in your target system.

This test will not halt but it will generate an error message if it is run on ROM or on locations with data line or location errors.

You can open a memory window on your logic analyzer to view the memory content. Expect to see the pattern and the compliment of the pattern that was specified.

See Also:

- “How the Rotate Pattern test works” on page 73

How the Rotate Pattern test works

This test writes the *Pattern* and the compliment of the *Pattern* to the *Memory Range*, and then compares the values in memory with what was written. Next, the rotated *Pattern* and the rotated compliment of the *Pattern* are written, read, and compared. Now the *Pattern* is rotated again, and again it is written, read, and compared. This continues until the rotations of the pattern return it to its original arrangement. That constitutes one *Repetition* of the Rotate Pattern test.

Example:

Address	First Write/Read	Second Write/Read	Third Write/Read
00000000	01	FE	02
00000001	FE	02	FD
00000002	02	FD	04
00000003	FD	04	FB
00000004	04	FB	08
00000005	FB	08	F7
00000006	08	F7	10
00000007	F7	10	EF
00000008	10	EF	20

Larger *Access Size* selections take more time because they require more patterns to be written to all locations (2-byte *Access Size* requires writing 32 patterns, and 4-byte *Access Size* requires writing 64 patterns).

The *Access Size* you select will affect the appearance of memory when you view memory after a test. When a test is complete, memory contains the last set of patterns that was written to it. For example, consider the following listing from a Rotate Pattern test that was performed one time with an *Access Size* of 2 bytes, and an initial pattern of 0001.

What you see below is the 32nd set of patterns written to memory during the test.

```

00000000  7fff 0001 fffe 0002 fffd 0004 fffb 0008
00000010  ff7f 0010 ffe7 0020 fddf 0040 fbf7 0080
00000020  ff7f 0100 feff 0200 fdff 0400 fbff 0800
00000030  f7ff 1000 efff 2000 dfff 4000 bfff 8000
00000040  7fff 0001 fffe 0002 fffd 0004 fffb 0008
00000050  ff7f 0010 ffe7 0020 fddf 0040 fbf7 0080
00000060  ff7f 0100 feff 0200 fdff 0400 fbff 0800

```

```
00000070 f7ff 1000 efff 2000 dfff 4000 bfff 8000
```

The Rotate Pattern test finds data bits in memory that are stuck high or low. It also detects data lines that may be tied to power ground, or not connected at all. This test more than any other in this set of tests will detect problems with voltage and ground bounce associated with the selected memory range.

To perform the Walking Ones test

1. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
2. In the *Memory Test* dialog box, select the *Walking Ones* Memory Test.
3. Type in the *Memory Range* to be tested.
4. Select the *Access Size* to be tested.
5. Set *Repetitions* to 1. This causes the test to be performed one time.
6. Set *Verbosity* to *Ten Errors*. This is the recommended verbosity for the first test in a series of tests.
7. Select the *Execute Test* button.
8. When the test is complete, the Command Line window will show the test results. Error messages will be shown if any errors were found during the test. You can also select the Memory window to see the content of memory.

The Walking Ones test finds data bits stuck in logical "0".

See Also:

- “How the Walking Ones test works” on page 74

How the Walking Ones test works

This test cycles "1" through each bit position in memory, and checks results. It does this by writing and then reading a pattern sequence of ones and zeros from all memory locations in the range.

For example, the hexadecimal values 01, 02, 04, ... are written to each

location in the *Memory Range*.

Address	1st	2nd	3rd	4th	5th	6th	7th	8th
00000000	01	02	04	08	10	20	40	80
00000001	02	04	08	10	20	40	80	01
00000002	04	08	10	20	40	80	01	02
00000003	08	10	20	40	80	01	02	04
00000004	10	20	40	80	01	02	04	08

NOTE:

1st, 2nd, 3rd, etc. are the first, second, third, etc. complete passes through the memory.

Larger *Access Size* selections take more time because they require more patterns to be written to all locations (2-byte *Access Size* requires writing 16 patterns, and 4-byte *Access Size* requires writing 32 patterns).

Example of 2-byte Access Size writing 16 patterns:

Address	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	...	16th
00000000	0001	0002	0004	0008	0010	0020	0040	0080	0100	...	8000
00000001	0002	0004	0008	0010	0020	0040	0080	0100	0200	...	0001
00000002	0004	0008	0010	0020	0040	0080	0100	0200	0400	...	0002
00000003	0008	0010	0020	0040	0080	0100	0200	0400	0800	...	0004
00000004	0010	0020	0040	0080	0100	0200	0400	0800	1000	...	0008

This test finds data bits stuck in logical "0".

To perform the Walking Zeros test

1. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
2. In the *Memory Test* dialog box, select the *Walking Zeros* Memory Test.
3. Type in the *Memory Range* to be tested.
4. Select the *Access Size* to be tested.
5. Set *Repetitions* to 1. This causes the test to be performed one time.
6. Set *Verbosity* to *Ten Errors*. This is the recommended verbosity for the first test in a series of tests.
7. Select the *Execute Test* button.
8. When the test is complete, the Command Line window will show the test

results. Error messages will be shown if any errors were found during the test. You can also select the Memory window to see the content of memory.

The Walking Zeros test finds data bits stuck in logical "1".

See Also:

- “How the Walking Zeros test works” on page 76

How the Walking Zeros test works

This test cycles "0" through each bit position in memory, and checks results.

For example, the hex values FE, FD, FB, ... are written to each location in the *Memory Range*.

Address	1st	2nd	3rd	4th	5th	6th	7th	8th
00000000	FE	FD	FB	F7	EF	DF	BF	7F
00000001	FD	FB	F7	EF	DF	BF	7F	FE
00000002	FB	F7	EF	DF	BF	7F	FE	FD
00000003	F7	EF	DF	BF	7F	FE	FD	FB
00000004	EF	DF	BF	7F	FE	FD	FB	F7

NOTE:

1st, 2nd, 3rd, etc. are the first, second, third complete pass through the memory.

Larger *Access Size* selections take more time because they require more patterns to be written to all locations (2-byte *Access Size* requires writing 16 patterns, and 4-byte *Access Size* requires writing 32 patterns).

Example of 2-byte Access Size writing 16 patterns:

Address	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	...	16th
00000000	FFFE	FFFD	FFFB	FFF7	FFEF	FFDF	FFBF	FF7F	FEFF	...	7FFF
00000001	FFFD	FFFB	FFF7	FFEF	FFDF	FFBF	FF7F	FEFF	FDFE	...	FFFE
00000002	FFFB	FFF7	FFEF	FFDF	FFBF	FF7F	FEFF	FDFE	FBFF	...	FFFD
00000003	FFF7	FFEF	FFDF	FFBF	FF7F	FEFF	FDFE	FBFF	F7FF	...	FFFB
00000004	FFEF	FFDF	FFBF	FF7F	FEFF	FDFE	FBFF	F7FF	FFFF	...	FFF7

This test finds data bits stuck in logical "1".

To perform the Oscilloscope Read test

1. Connect your oscilloscope to view signals on the lines to be tested. These

will be the signals generated to perform read transactions from the memory in your target system.

2. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
3. In the *Memory Test* dialog box, select the *Oscilloscope Read Memory Test*.
4. Type in the *Memory Range* to be read.
5. Select the *Access Size* to be read.
6. Set *Repetitions* to 0. This repeats the test continuously until you cancel the test.
7. Set *Verbosity* to *Summary Only*.
8. Select the *Execute Test* button.
9. When you have finished using your oscilloscope to view the read-from-memory signals, select the *Cancel* button in the *Busy* dialog box that appears on screen.

You will see an error message if your test attempts to read memory addresses outside the range of available memory.

See Also:

- “How the Oscilloscope Read test works” on page 77

How the Oscilloscope Read test works

This test repetitively reads the present content from the *Memory Range* for the number of *Repetitions* specified, typically reads continuously until cancelled.

The Oscilloscope Read test does not print or store the data it has read.

To perform the Oscilloscope Write test

1. Connect your oscilloscope to view signals on the lines to be tested. These will be the signals generated to perform write transactions to the memory

in your target system.

2. Open the *Memory Test* dialog box from either the Memory window or the Command Line window.
3. In the *Memory Test* dialog box, select the *Oscilloscope Write Memory Test*.
4. Type in the *Memory Range* to be written.
5. Select the *Access Size* to be written, and type in the *Pattern* to be written.
6. Set *Repetitions* to 0. This repeats the test continuously until you cancel the test.
7. Set *Verbosity* to *Summary Only*.
8. Select the *Execute Test* button.
9. When you have finished using your oscilloscope to view the write-to-memory signals, select the *Cancel* button in the *Busy* dialog box that appears on screen.

You will see an error message if your test attempts to write to memory addresses outside the range of available memory.

See Also:

- “How the Oscilloscope Write test works” on page 78

How the Oscilloscope Write test works

- This test repetitively writes your selected *Pattern* to the *Memory Range* for the number of *Repetitions* specified, typically continuously until cancelled.
- If your pattern is larger than the access size, it will be truncated to fit. If your pattern is smaller than the access size, it will be zero-padded to fit.
- This test does not generate error messages for unsuccessful write transactions, such as writes to ROM.
- If desired, you can open a memory window in the logic analyzer and view the memory where the pattern was written. If the memory is ROM or if it contains errors, it may not contain the pattern that was written.

Memory Range

A memory test can be performed in one range of memory addresses in your system under test.

1. Type the lowest address value of the range to be tested in the *Starting Address* text box.
2. Type the highest address value of the range in the *Ending Address* text box.

NOTE:

If you wish to test only one location, enter the address in both the *Starting Address* and *Ending Address* text boxes.

Data Value

- *Access Size*: Specify the desired memory access size. If you are performing the Address Pattern test, the *Access Size* you choose will affect the value that is written to each memory location.

If you are performing the Walking Ones, Walking Zeros, or Rotate Pattern test, larger access sizes will take more time because more patterns will be written to the memory locations.

- *Pattern*: Specify the pattern (in hexadecimal) to be used when performing the Oscilloscope Write, Basic Pattern, or Rotate Pattern test.

Options

- *Repetitions*: Enter the number of times you want the memory test to be repeated in the Repetitions text box. The maximum number of Repetitions is 10,000.

If you enter *Repetitions: 0*, the test activity will run continuously until you select the *Cancel* button in the *Busy* dialog box. This is the normal selection when performing the Oscilloscope Read or Oscilloscope Write test.

Testing Target System Memory

- *Verbosity*: Select the type of error message presentation desired in the Verbosity selection box. The available options are:

Summary Only

Show no error messages during the tests. At the end of the last repetition, show a summary of the errors that were found during the tests.

Repetition Summary

Show no error messages during the tests. At the end of each repetition, show a summary of the errors that were found.

Ten Errors

Show error messages for the first ten errors found during each repetition. Then complete the repetition, but show no more error messages. At the end of the tests, show a summary of the errors that were found.

All Errors

Show a complete error message each time an error condition is found. At the end of the tests, show a summary of the errors that were found.

To open the Memory Test window

There are two ways to open the Memory Test window.

- Open the Command Line window and select the *Memory Test* button.
- Open the Memory window and select the *Memory Test* button.

Recommended Test Procedure

Two types of tests are offered for testing target memory: oscilloscope tests, and memory functionality tests.

Oscilloscope Tests

1. Connect the oscilloscope to view activity on the bits of interest.
2. Start an Oscilloscope Read (see page 76) or Oscilloscope Write (see page 77) test, as desired.

The test activity will be written onto the bits you specified continuously until you cancel the test.

Use both the Oscilloscope Read test and the Oscilloscope Write test to thoroughly check the connections of interest.

Memory Functionality Tests

1. Run the Basic Pattern (see page 68) test on the entire Memory Range.

Result:

- No Problems. Perform the Address Pattern (see page 70) test next.
- Problems found. Refer to “If problems were found by the Basic Pattern test” on page 81.

2. Run the Address Pattern (see page 70) test on the entire Memory Range.

Result:

- No Problems.
- Problems found. Refer to “If problems were found by the Address Pattern test” on page 82.

If no problems were found by the Basic Pattern test and the Address Pattern test above, you can ignore the rest of the tests. The memory in your system has been tested thoroughly and it is good.

If problems were found by the Basic Pattern test

Below are two examples of problems found by the Basic Pattern test:

- If there is a consistent error, such as:

```
Starting: Basic Pattern Test
Error: 1 at address 00000200:
  Read    5557 (0101 0101 0101 0111)
  Expected 5555 (0101 0101 0101 0101)
```

```
Error: 2 at address 00000204:  
  Read  5557 (0101 0101 0101 0111)  
  Expected 5555 (0101 0101 0101 0101)  
Error: 3 at address 00000208:  
  Read  5557 (0101 0101 0101 0111)  
  Expected 5555 (0101 0101 0101 0101)  
Error: ...  
  Read  ...  
  Expected ...
```

Assume the data line bit associated with the error is stuck high. This could happen if the suspected data line bit were soldered to power.

NOTE:

For an additional test of suspected memory, perform the Walking Ones (see page 74) and Walking Zeros (see page 75) tests on the problem memory range.

- If there are random errors, such as indicated by the following output:

```
Starting: Basic Pattern Test  
Error: 1 at address 00000200:  
  Read  8000 (1000 0000 0000 0000)  
  Expected 0000 (0000 0000 0000 0000)  
Error: 2 at address 000004a2:  
  Read  efff (1110 1111 1111 1111)  
  Expected ffff (1111 1111 1111 1111)  
Repetition: 1 - FAILED found 2 errors  
Completed: Basic Pattern Test  
Summary: 1 of 1 - FAILED (2 errors total)
```

From the above listing, we assume there are two location errors in memory. At location 200, there is a bit stuck high. At location 4a0, there is bit stuck low. Use the Walking Ones and Walking Zeros tests to verify the errors.

There is one bit stuck high at location 200 so the Walking Zeros test will print one error message when it tests this location. Use the Walking Ones test to isolate the bit that is stuck low at location 4a0. Again, this will print only one error message.

See Also:

- “If problems were found by the Address Pattern test” on page 82

If problems were found by the Address Pattern test

You may see no errors in the Basic Pattern test, but errors in the Address Pattern test. For example, you might see the following result in the Address Pattern test:

```
Error: 1 at address 00000000:  
  Read    0020 (0000 0000 0010 0000)  
  Expected 0000 (0000 0000 0000 0000)  
Error: 2 at address 00000002:  
  Read    0022 (0000 0000 0010 0010)  
  Expected 0002 (0000 0000 0000 0010)
```

You would see that the data stored at locations 00 through 0f is the data that should be at locations 20 through 2f. This indicates an address line problem. Address bit 5 must be stuck low because the addresses that should have been written to the range 20 through 2f were written instead to 00 through 0f.

NOTE:

Random errors typically do not indicate address line errors. Use the Walking Ones (see page 74) and Walking Zeros (see page 75) tests to check the locations of random errors.

See Also:

- “If problems were found by the Basic Pattern test” on page 81

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absolute Denotes the time period or count of states between a captured state and the trigger state. An absolute count of -10 indicates the state was captured ten states before the trigger state was captured.

acquisition Denotes one complete cycle of data gathering by a measurement module. For example, if you are using an analyzer with 128K memory depth, one complete acquisition will capture and store 128K states in acquisition memory.

analysis probe A probe connected to a microprocessor or standard bus in the device under test. An analysis probe provides an interface between the signals of the microprocessor or standard bus and the inputs of the logic analyzer. Also called a *preprocessor*.

analyzer 1 In a logic analyzer with two *machines*, refers to the machine that is on by default. The default name is *Analyzer<N>*, where N is the slot letter.

analyzer 2 In a logic analyzer with two *machines*, refers to the machine that is off by default. The default name is *Analyzer<N2>*, where N is the slot letter.

arming An instrument tool must be

armed before it can search for its trigger condition. Typically, instruments are armed immediately when *Run* or *Group Run* is selected. You can set up one instrument to arm another using the *Intermodule Window*. In these setups, the second instrument cannot search for its trigger condition until it receives the arming signal from the first instrument. In some analyzer instruments, you can set up one analyzer *machine* to arm the other analyzer machine in the *Trigger Window*.

asterisk (*) See *edge terms*, *glitch*, and *labels*.

bits Bits represent the physical logic analyzer channels. A bit is a *channel* that has or can be assigned to a *label*. A bit is also a position in a label.

card This refers to a single instrument intended for use in the Agilent Technologies 16700A/B-series mainframes. One card fills one slot in the mainframe. A module may comprise a single card or multiple cards cabled together.

channel The entire signal path from the probe tip, through the cable and module, up to the label grouping.

click When using a mouse as the

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pointing device, to click an item, position the cursor over the item. Then quickly press and release the *left mouse button*.

clock channel A logic analyzer *channel* that can be used to carry the clock signal. When it is not needed for clock signals, it can be used as a *data channel*, except in the Agilent Technologies 16517A.

context record A context record is a small segment of analyzer memory that stores an event of interest along with the states that immediately preceded it and the states that immediately followed it.

context store If your analyzer can perform context store measurements, you will see a button labeled *Context Store* under the Trigger tab. Typical context store measurements are used to capture writes to a variable or calls to a subroutine, along with the activity preceding and following the events. A context store measurement divides analyzer memory into a series of context records. If you have a 64K analyzer memory and select a 16-state context, the analyzer memory is divided into 4K 16-state context records. If you have a 64K analyzer memory and select a 64-state context, the analyzer memory will be

divided into 1K 64-state records.

count The count function records periods of time or numbers of state transactions between states stored in memory. You can set up the analyzer count function to count occurrences of a selected event during the trace, such as counting how many times a variable is read between each of the writes to the variable. The analyzer can also be set up to count elapsed time, such as counting the time spent executing within a particular function during a run of your target program.

cross triggering Using intermodule capabilities to have measurement modules trigger each other. For example, you can have an external instrument arm a logic analyzer, which subsequently triggers an oscilloscope when it finds the trigger state.

data channel A *channel* that carries data. Data channels cannot be used to clock logic analyzers.

data field A data field in the pattern generator is the data value associated with a single label within a particular data vector.

data set A data set is made up of all labels and data stored in memory of any single analyzer machine or

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instrument tool. Multiple data sets can be displayed together when sourced into a single display tool. The Filter tool is used to pass on partial data sets to analysis or display tools.

debug mode See *monitor*.

delay The delay function sets the horizontal position of the waveform on the screen for the oscilloscope and timing analyzer. Delay time is measured from the trigger point in seconds or states.

demo mode An emulation control session which is not connected to a real target system. All windows can be viewed, but the data displayed is simulated. To start demo mode, select *Start User Session* from the Emulation Control Interface and enter the demo name in the *Processor Probe LAN Name* field. Select the *Help* button in the *Start User Session* window for details.

deskewing To cancel or nullify the effects of differences between two different internal delay paths for a signal. Deskewing is normally done by routing a single test signal to the inputs of two different modules, then adjusting the Intermodule Skew so that both modules recognize the signal at the same time.

device under test The system under test, which contains the circuitry you are probing. Also known as a *target system*.

don't care For *terms*, a "don't care" means that the state of the signal (high or low) is not relevant to the measurement. The analyzer ignores the state of this signal when determining whether a match occurs on an input label. "Don't care" signals are still sampled and their values can be displayed with the rest of the data. Don't cares are represented by the X character in numeric values and the dot (.) in timing edge specifications.

dot (.) See *edge terms*, *glitch*, *labels*, and *don't care*.

double-click When using a mouse as the pointing device, to double-click an item, position the cursor over the item, and then quickly press and release the *left mouse button* twice.

drag and drop Using a Mouse: Position the cursor over the item, and then press and hold the *left mouse button*. While holding the left mouse button down, move the mouse to drag the item to a new location. When the item is positioned where you want it, release the mouse button.

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Using the Touchscreen:

Position your finger over the item, then press and hold finger to the screen. While holding the finger down, slide the finger along the screen dragging the item to a new location. When the item is positioned where you want it, release your finger.

edge mode In an oscilloscope, this is the trigger mode that causes a trigger based on a single channel edge, either rising or falling.

edge terms Logic analyzer trigger resources that allow detection of transitions on a signal. An edge term can be set to detect a rising edge, falling edge, or either edge. Some logic analyzers can also detect no edge or a *glitch* on an input signal. Edges are specified by selecting arrows. The dot (.) ignores the bit. The asterisk (*) specifies a glitch on the bit.

emulation module A module within the logic analysis system mainframe that provides an emulation connection to the debug port of a microprocessor. An E5901A emulation module is used with a target interface module (TIM) or an analysis probe. An E5901B emulation module is used with an E5900A emulation probe.

emulation probe The stand-alone equivalent of an *emulation module*. Most of the tasks which can be performed using an emulation module can also be performed using an emulation probe connected to your logic analysis system via a LAN.

emulator An *emulation module* or an *emulation probe*.

Ethernet address See *link-level address*.

events Events are the things you are looking for in your target system. In the logic analyzer interface, they take a single line. Examples of events are *Label1 = XX* and *Timer 1 > 400 ns*.

filter expression The filter expression is the logical *OR* combination of all of the filter terms. States in your data that match the filter expression can be filtered out or passed through the Pattern Filter.

filter term A variable that you define in order to specify which states to filter out or pass through. Filter terms are logically *OR*'ed together to create the filter expression.

Format The selections under the logic analyzer *Format* tab tell the

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logic analyzer what data you want to collect, such as which channels represent buses (labels) and what logic threshold your signals use.

frame The Agilent Technologies or 16700A/B-series logic analysis system mainframe. See also *logic analysis system*.

gateway address An IP address entered in integer dot notation. The default gateway address is 0.0.0.0, which allows all connections on the local network or subnet. If connections are to be made across networks or subnets, this address must be set to the address of the gateway machine.

glitch A glitch occurs when two or more transitions cross the logic threshold between consecutive timing analyzer samples. You can specify glitch detection by choosing the asterisk (*) for *edge terms* under the timing analyzer Trigger tab.

grouped event A grouped event is a list of *events* that you have grouped, and optionally named. It can be reused in other trigger sequence levels. Only available in Agilent Technologies 16715A or higher logic analyzers.

held value A value that is held until

the next sample. A held value can exist in multiple data sets.

immediate mode In an oscilloscope, the trigger mode that does not require a specific trigger condition such as an edge or a pattern. Use immediate mode when the oscilloscope is armed by another instrument.

interconnect cable Short name for *module/probe interconnect cable*.

intermodule bus The intermodule bus (IMB) is a bus in the frame that allows the measurement modules to communicate with each other. Using the IMB, you can set up one instrument to *arm* another. Data acquired by instruments using the IMB is time-correlated.

intermodule Intermodule is a term used when multiple instrument tools are connected together for the purpose of one instrument arming another. In such a configuration, an arming tree is developed and the group run function is designated to start all instrument tools. Multiple instrument configurations are done in the Intermodule window.

internet address Also called Internet Protocol address or IP address. A 32-bit network address. It

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is usually represented as decimal numbers separated by periods; for example, 192.35.12.6. Ask your LAN administrator if you need an internet address.

labels Labels are used to group and identify logic analyzer channels. A label consists of a name and an associated bit or group of bits. Labels are created in the Format tab.

line numbers A line number (Line #s) is a special use of *symbols*. Line numbers represent lines in your source file, typically lines that have no unique symbols defined to represent them.

link-level address Also referred to as the Ethernet address, this is the unique address of the LAN interface. This value is set at the factory and cannot be changed. The link-level address of a particular piece of equipment is often printed on a label above the LAN connector. An example of a link-level address in hexadecimal: 0800090012AB.

local session A local session is when you run the logic analysis system using the local display connected to the product hardware.

logic analysis system The Agilent Technologies 16700A/B-series

mainframes, and all tools designed to work with it. Usually used to mean the specific system and tools you are working with right now.

machine Some logic analyzers allow you to set up two measurements at the same time. Each measurement is handled by a different machine. This is represented in the Workspace window by two icons, differentiated by a 1 and a 2 in the upper right-hand corner of the icon. Logic analyzer resources such as pods and trigger terms cannot be shared by the machines.

markers Markers are the green and yellow lines in the display that are labeled *x*, *o*, *G1*, and *G2*. Use them to measure time intervals or sample intervals. Markers are assigned to patterns in order to find patterns or track sequences of states in the data. The *x* and *o* markers are local to the immediate display, while *G1* and *G2* are global between time correlated displays.

master card In a module, the master card controls the data acquisition or output. The logic analysis system references the module by the slot in which the master card is plugged. For example, a 5-card Agilent Technologies 16555D would be referred to as *Slot C*:

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machine because the master card is in slot C of the mainframe. The other cards of the module are called *expansion cards*.

menu bar The menu bar is located at the top of all windows. Use it to select *File* operations, tool or system *Options*, and tool or system level *Help*.

message bar The message bar displays mouse button functions for the window area or field directly beneath the mouse cursor. Use the mouse and message bar together to prompt yourself to functions and shortcuts.

module/probe interconnect cable

The module/probe interconnect cable connects an E5901B emulation module to an E5900B emulation probe. It provides power and a serial connection. A LAN connection is also required to use the emulation probe.

module An instrument that uses a single timebase in its operation. Modules can have from one to five cards functioning as a single instrument. When a module has more than one card, system window will show the instrument icon in the slot of the *master card*.

monitor When using the Emulation Control Interface, running the monitor means the processor is in debug mode (that is, executing the debug exception) instead of executing the user program.

panning The action of moving the waveform along the timebase by varying the delay value in the Delay field. This action allows you to control the portion of acquisition memory that will be displayed on the screen.

pattern mode In an oscilloscope, the trigger mode that allows you to set the oscilloscope to trigger on a specified combination of input signal levels.

pattern terms Logic analyzer resources that represent single states to be found on labeled sets of bits; for example, an address on the address bus or a status on the status lines.

period (.) See *edge terms*, *glitch*, *labels*, and *don't care*.

pod pair A group of two pods containing 16 channels each, used to physically connect data and clock signals from the unit under test to the analyzer. Pods are assigned by pairs in the analyzer interface. The number of pod pairs available is determined

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by the channel width of the instrument.

pod See *pod pair*

point To point to an item, move the mouse cursor over the item, or position your finger over the item.

preprocessor See *analysis probe*.

primary branch The primary branch is indicated in the *Trigger sequence step* dialog box as either the *Then find* or *Trigger on* selection. The destination of the primary branch is always the next state in the sequence, except for the Agilent Technologies 16517A. The primary branch has an optional occurrence count field that can be used to count a number of occurrences of the branch condition. See also *secondary branch*.

probe A device to connect the various instruments of the logic analysis system to the target system. There are many types of probes and the one you should use depends on the instrument and your data requirements. As a verb, "to probe" means to attach a probe to the target system.

processor probe See *emulation probe*.

range terms Logic analyzer resources that represent ranges of values to be found on labeled sets of bits. For example, range terms could identify a range of addresses to be found on the address bus or a range of data values to be found on the data bus. In the trigger sequence, range terms are considered to be true when any value within the range occurs.

relative Denotes time period or count of states between the current state and the previous state.

remote display A remote display is a display other than the one connected to the product hardware. Remote displays must be identified to the network through an address location.

remote session A remote session is when you run the logic analyzer using a display that is located away from the product hardware.

right-click When using a mouse for a pointing device, to right-click an item, position the cursor over the item, and then quickly press and release the *right mouse button*.

sample A data sample is a portion of a *data set*, sometimes just one point. When an instrument samples the target system, it is taking a single

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measurement as part of its data acquisition cycle.

Sampling Use the selections under the logic analyzer Sampling tab to tell the logic analyzer how you want to make measurements, such as State vs. Timing.

secondary branch The secondary branch is indicated in the *Trigger sequence step* dialog box as the *Else on* selection. The destination of the secondary branch can be specified as any other active sequence state. See also *primary branch*.

session A session begins when you start a *local session* or *remote session* from the session manager, and ends when you select *Exit* from the main window. Exiting a session returns all tools to their initial configurations.

skew Skew is the difference in channel delays between measurement channels. Typically, skew between modules is caused by differences in designs of measurement channels, and differences in characteristics of the electronic components within those channels. You should adjust measurement modules to eliminate as much skew as possible so that it does not affect the accuracy of your

measurements.

state measurement In a state measurement, the logic analyzer is clocked by a signal from the system under test. Each time the clock signal becomes valid, the analyzer samples data from the system under test. Since the analyzer is clocked by the system, state measurements are *synchronous* with the test system.

store qualification Store qualification is only available in a *state measurement*, not *timing measurements*. Store qualification allows you to specify the type of information (all samples, no samples, or selected states) to be stored in memory. Use store qualification to prevent memory from being filled with unwanted activity such as no-ops or wait-loops. To set up store qualification, use the *While storing* field in a logic analyzer trigger sequence dialog.

subnet mask A subnet mask blocks out part of an IP address so that the networking software can determine whether the destination host is on a local or remote network. It is usually represented as decimal numbers separated by periods; for example, 255.255.255.0. Ask your LAN administrator if you need a the subnet mask for your network.

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symbols Symbols represent patterns and ranges of values found on labeled sets of bits. Two kinds of symbols are available:

- Object file symbols - Symbols from your source code, and symbols generated by your compiler. Object file symbols may represent global variables, functions, labels, and source line numbers.
- User-defined symbols - Symbols you create.

Symbols can be used as *pattern* and *range* terms for:

- Searches in the listing display.
- Triggering in logic analyzers and in the source correlation trigger setup.
- Qualifying data in the filter tool and system performance analysis tool set.

system administrator The system administrator is a person who manages your system, taking care of such tasks as adding peripheral devices, adding new users, and doing system backup. In general, the system administrator is the person you go to with questions about implementing your software.

target system The system under test, which contains the microprocessor you are probing.

terms Terms are variables that can be used in trigger sequences. A term can be a single value on a label or set of labels, any value within a range of values on a label or set of labels, or a glitch or edge transition on bits within a label or set of labels.

TIM A TIM (Target Interface Module) makes connections between the cable from the emulation module or emulation probe and the cable to the debug port on the system under test.

time-correlated Time correlated measurements are measurements involving more than one instrument in which all instruments have a common time or trigger reference.

timer terms Logic analyzer resources that are used to measure the time the trigger sequence remains within one sequence step, or a set of sequence steps. Timers can be used to detect when a condition lasts too long or not long enough. They can be used to measure pulse duration, or duration of a wait loop. A single timer term can be used to delay trigger until a period of time after detection of a significant event.

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timing measurement In a timing measurement, the logic analyzer samples data at regular intervals according to a clock signal internal to the timing analyzer. Since the analyzer is clocked by a signal that is not related to the system under test, timing measurements capture traces of electrical activity over time. These measurements are *asynchronous* with the test system.

tool icon Tool icons that appear in the workspace are representations of the hardware and software tools selected from the toolbox. If they are placed directly over a current measurement, the tools automatically connect to that measurement. If they are placed on an open area of the main window, you must connect them to a measurement using the mouse.

toolbox The Toolbox is located on the left side of the main window. It is used to display the available hardware and software tools. As you add new tools to your system, their icons will appear in the Toolbox.

tools A tool is a stand-alone piece of functionality. A tool can be an instrument that acquires data, a display for viewing data, or a post-processing analysis helper. Tools are represented as icons in the main window of the interface.

trace See *acquisition*.

trigger sequence A trigger sequence is a sequence of events that you specify. The logic analyzer compares this sequence with the samples it is collecting to determine when to *trigger*.

trigger specification A trigger specification is a set of conditions that must be true before the instrument triggers.

trigger Trigger is an event that occurs immediately after the instrument recognizes a match between the incoming data and the trigger specification. Once trigger occurs, the instrument completes its *acquisition*, including any store qualification that may be specified.

workspace The workspace is the large area under the message bar and to the right of the toolbox. The workspace is where you place the different instrument, display, and analysis tools. Once in the workspace, the tool icons graphically represent a complete picture of the measurements.

zooming In the oscilloscope or timing analyzer, to expand and contract the waveform along the time base by varying the value in the s/Div

field. This action allows you to select specific portions of a particular waveform in acquisition memory that will be displayed on the screen. You can view any portion of the waveform record in acquisition memory.

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