

Hitachi Microcomputer Development Environment System

SuperH™ RISC engine
Simulator/Debugger

User's Manual

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Preface

Read First

READ this user's manual before using the Hitachi Debugging Interface (hereinafter, referred to as the HDI).

KEEP the user's manual handy for future reference.

Do not attempt to use the system until you fully understand its mechanism.

About this Manual

This manual explains the use of the simulator debugger and the HDI and for Hitachi microcomputer development tools. The following section will provide a brief *Introduction* to the debugging interface and simulator/debugger, and list its key features.

The following sections, *System Overview*, *Simulator/Debugger Functions*, *Menus*, *Windows and Dialog Boxes*, *Command Lines*, and *Messages*, give reference information about the operation and facilities available from these respective areas.

The following sections, *Looking at Your Program*, *Working with Memory*, *Executing Your Program*, *Stopping Your Program*, *Looking at Variables*, *Overlay Function*, *Selecting Functions*, and *Configuring the User Interface*, provide a “how to” guide to using HDI for debugging.

Co-verification Functions describes how to debug the user program by using the co-verification tool.

This manual assumes that the HDI is used on the English version of Microsoft® Windows®95 operating system running on the IBM PC.

Assumptions

It is assumed that the reader has a competent knowledge of the C/C++ programming language, assembly-language mnemonics for the processor being debugged and is experienced in using Microsoft® Windows® applications.

Document Conventions

This manual uses the following typographic conventions:

Table 1 Typographic Conventions

CONVENTION	MEANING
[Menu->Menu Option]	Bold text with '->' is used to indicate menu options (for example, [File->Save As...]).
FILENAME.C	Uppercase names are used to indicate file names.
<u>“enter this string”</u>	Used to indicate text that must be entered (excluding the “ ” quotes).
Key+Key	Used to indicate required key presses. For example, Ctrl+N means press the Ctrl key and then, while holding the Ctrl key down, press the N key.
 (The “how to” symbol)	When this symbol is used, it is always located in the left-hand margin. It indicates that the text to its immediate right is describing “how to” do something.

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Section 1 Overview

The Hitachi Debugging Interface (HDI) is a Graphical User Interface intended to ease the development and debugging of applications written in C/C++ programming language and assembly language for Hitachi microcomputers. Its aim is to provide a powerful yet intuitive way of accessing, observing and modifying the debugging platform in which the application is running.

Key Features

- **Windows® GUI for debugging**
- **Intuitive interface**
- **On-line help**
- **Common “Look & Feel”**

Note: The HDI does not run on Windows® version 3.1.

The simulator/debugger provides simulation functions for SuperH™ RISC engine series (SH-1, SH-2, SH-2E, SH-3, SH-3E, SH-3DSP, SH-4, and SH-DSP series) microprocessors and provides debugging functions for programs written in C, C++, or assembly language. Therefore, the simulator/debugger promotes efficient debugging of programs. In “the SH-4 series”, there are two types of microprocessors, “SH-4” and “SH-4 (SH7750R)”, which have different cache specifications. In addition, “the SH-4” consists of two different-version microprocessors; one improves the simulation speed by limiting a part of simulation functions (called “SH-4” in this manual) and one provides high-level functions (called “SH-4BSC” in this manual). “The SH-DSP series” consists of “the SH-DSP”, “the SH-2DSP”, and “the SH-DSP (SH7065)” which do not have cache, and “the SH-DSP with Cache”, which has on-chip cache. Note that, in this manual, “the SH-4 series” means “the SH-4”, “SH-4BSC”, and “SH-4 (SH7750R)”, and “the SH-DSP series” means “the SH-DSP”, “the SH-2DSP”, “the SH-DSP (SH7065)”, and “the SH-DSP with Cache”.

When used with the following software, the simulator/debugger reduces the time required for software development.

- Hitachi Embedded Workshop (HEW)
- SuperH™ RISC engine series C/C++ compiler
- SuperH™ RISC engine series cross assembler
- Optimizing linkage editor

1.1 Features

- Since the simulator/debugger runs on a host computer, software debugging can start without using an actual user system, thus reducing overall system development time.
- The simulator/debugger performs a pipeline simulation to calculate the number of instruction execution cycles for a program, thus enabling performance evaluation without using an actual user system.
- The simulator/debugger offers the following features and functions that enable efficient program testing and debugging.
 - The ability to handle all of the SuperH™ RISC engine series CPUs
 - Functions to trace instructions or subroutines
 - Functions to stop or continue execution when an error occurs during user program execution
 - Profile data acquisition and function-unit performance measurement
 - A comprehensive set of break functions
 - Functions to set or edit memory maps
 - Functions to display function call history
- The breakpoint, memory map, performance, and trace can be set through the dialog box under Windows®. Environments corresponding to each memory map of the SuperH™ RISC engine microprocessors can be set through the dialog box.

1.2 Target User Program

Load modules in ELF/DWARF format and S-type format can be debugged with the simulator/debugger. These load modules are called user programs in this manual.

Figure 1.1 shows the creation of target user programs to be debugged.

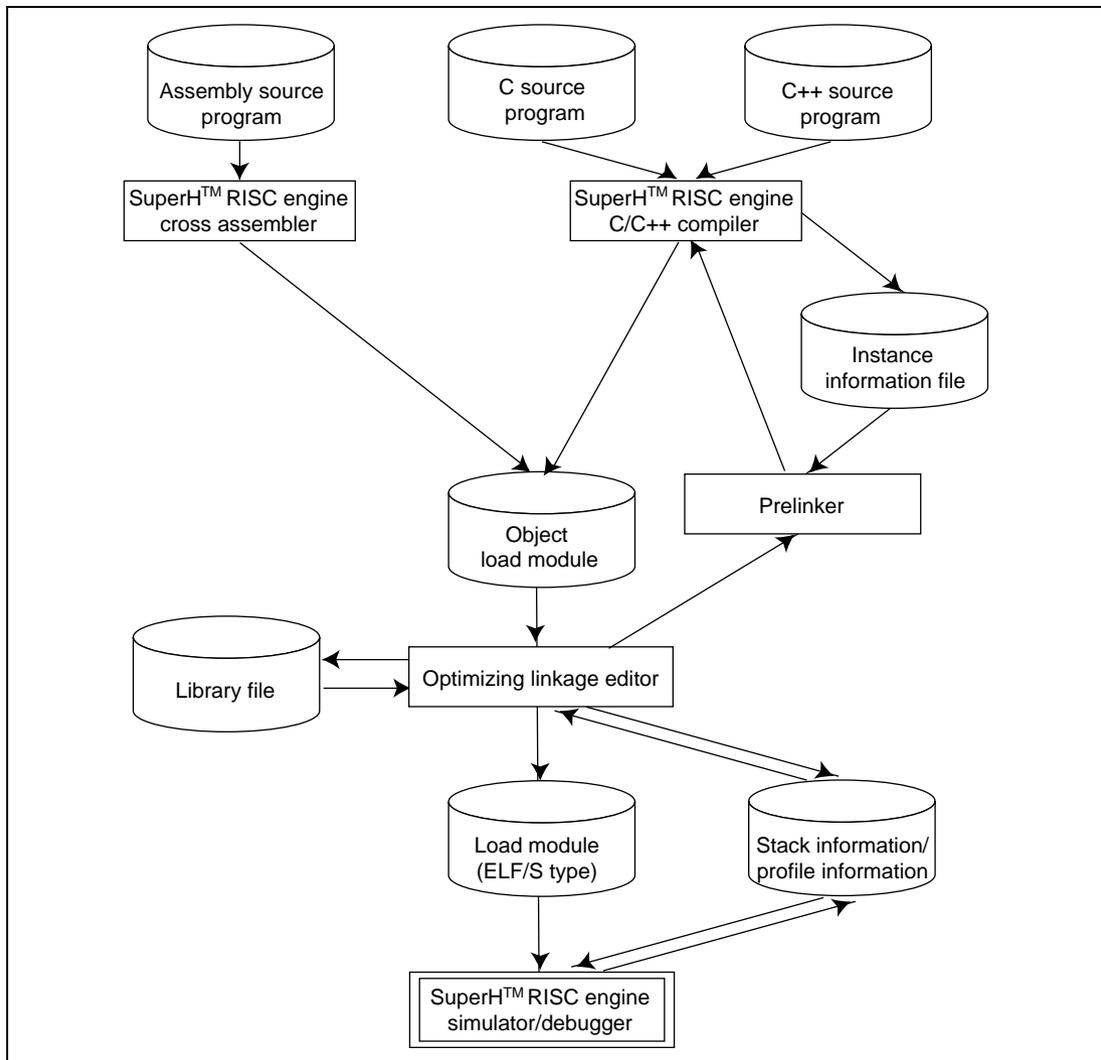


Figure 1.1 Creation of Target User Programs

1.3 Simulation Range

The simulator/debugger supports the following SuperH™ RISC engine series microcomputer functions:

- All CPU instructions (pipeline simulation)
- Exception processing
- Registers
- All address areas
- MMU (only for SH-3, SH-3E, SH-3DSP, and SH-4 series)
- Cache (only for SH-3, SH-3E, SH-3DSP, SH-4 series, and SH-DSP with Cache)
- DMAC (only for SH-4BSC)
- BSC (only for the SH-4 series. Note that some functions are not supported for microprocessors other than SH-4BSC.)

The simulator/debugger does not support the following SuperH™ RISC engine series MCU functions. Programs that use these functions must be debugged with the SuperH™ RISC engine series emulator.

- 16-bit free-running timer (FRT)
- Serial communication interface (SCI)
- I/O ports
- Interrupt controller (INTC)

Section 2 System Overview

HDI is a modular software system, utilizing self-contained modules for specific tasks. These modules are linked to a general purpose Graphical User Interface, which provides a *common look & feel* independent of the particular modules with which the system is configured.

2.1 User Interface

The HDI Graphical User Interface is a Windows[®] application that presents the debugging platform to you and allows you to set up and modify the system. Refer to a standard Windows[®] user manual for details on how to operate within a Windows[®] application.

2.2 Data Entry

When entering numbers in any dialog box or field you can always enter an expression instead of a simple number. This expression can contain symbols and can use the operators in the C/C++ programming languages. Use of C/C++ programming language features such as arrays and structures is only available if an object DLL that supports C/C++ programming language debugging is in use.

In some dialogs, where there is a control expecting an end address, it is possible to enter a range by prefixing the value with a + sign. This will set the actual end address to be equal to the start address plus the entered the value.

2.2.1 Operators

The C/C++ programming language operators are available:

+, -, *, /, &, |, ^, ~, !, >>, <<, %, (,), <, >, <=, >=, ==, !=, &&, ||

2.2.2 Data Formats

Unprefixed data values will be taken as being in the default radix set by the [**Setup->Radix**] menu option. The exception is count field which use decimal values by default (independent of the current default system radix).

Symbols may be used by name and ASCII character strings can be entered if surrounded by single quote characters, e.g. 'demo'.

The following prefixes can be used to identify radices:

O'	Octal
B'	Binary
D'	Decimal
H'	Hexadecimal
0x	Hexadecimal

The contents of a register may be used by specifying the register name, prefixed by the # character, e.g.:

```
#R1, #FR2
```

2.2.3 Precision

All mathematics in expression evaluation is done using 32 bits (signed). Any values exceeding 32 bits are truncated.

2.2.4 Expression Examples

```
Buffer_start + 0x1000
#R1 | B'10001101
((pointer + (2 * increment_size)) & H'FFFF0000) >> D'15
!(flag ^ #ER4)
```

2.2.5 Symbol Format

You can specify and reference symbols in the same format as in C/C++ programming language. Cast operators may be used together with symbols, and you can reference data after its type has been converted. Note the following limitations.

- Pointers can be specified up to four levels.
- Arrays can be specified up to three dimensions.
- No typedef name can be used.

2.2.6 Symbol Examples

<code>Object.value</code>	: Specifies direct reference of a member (C/C++)
<code>p_Object->value</code>	: Specifies indirect reference of a member (C/C++)
<code>Class::value</code>	: Specifies reference of a member with class (C++)
<code>*value</code>	: Specifies a pointer (C/C++)
<code>array[0]</code>	: Specifies an array (C/C++)
<code>Object.*value</code>	: Specifies reference of a pointer to member (C++)
<code>::g_value</code>	: Specifies reference of a global variable (C/C++)
<code>Class::function(short)</code>	: Specifies a member function (C++)
<code>(struct STR) *value</code>	: Specifies cast operation (C/C++)

2.3 Help

HDI has a standard Windows[®] context sensitive help system. This provides on-line information about using the debugging system.

Help can be invoked by pressing the **F1** key or via the Help menu. Additionally, some windows and dialog boxes have a dedicated help button to launch the help file at the appropriate content.

2.3.1 Context Sensitive Help

To get help on a specific item in the HDI help cursor can be used. To enable the help cursor, press **SHIFT+F1** or click the button on tool bar.

Your cursor then changes to include a question mark. You can then click on the item for which you require help and the help system will be opened at the appropriate content.

Section 3 Simulator/Debugger Functions

This section describes the functions of the SuperH™ RISC engine series simulator/debugger. Note that the endian, MMU, cache, control registers, BSC, and DMAC can be used only in the CPUs listed in table 3.1.

Table 3.1 Simulator/Debugger Functions Supported by Each CPU

Debugging Platform Name	Endian selection	MMU	Cache	Control Registers	BSC	DMAC
SH-1	—	—	—	—	—	—
SH-2, SH-2E	—	—	—	—	—	—
SH-3, SH-3E	O	O	O	O	—	—
SH-3DSP	O	O	O	O	—	—
SH-4	O	O	O	O	Δ	—
SH-4BSC	O	O	O	O	O	O
SH-4 (SH7750R)	O	O	O	O	Δ	—
SH-DSP	—	—	—	—	—	—
SH-2DSP	—	—	—	—	—	—
SH-DSP (SH7065)	O	—	—	—	—	—
SH-DSP with Cache	O	—	O	O	—	—

Note: O: Supported

Δ: Partly supported

—: Not supported

3.1 Simulator/Debugger Memory Management

3.1.1 Memory Map Specification

A memory map can be specified in the **System Configuration** dialog box to calculate the number of memory access cycles during simulation.

The following items can be specified:

- Memory type
- Start and end addresses of the memory area
- Number of memory access cycles
- Memory data bus width

The memory types that can be specified depend on the CPU. For details, refer to section 5.18, System Configuration Dialog Box. The user program can be executed in all areas except for the internal I/O area.

3.1.2 Memory Resource Specification

A memory resource must be specified to load and execute a user program.

The memory resource, including the following items, can be specified in the **System Memory Resource Modify** dialog box.

- Start address
- End address
- Access type

The access type can be read/write, read-only, or write-only. Since an error occurs if the user program attempts an illegal access (for example, trying to write to a read-only memory), such an illegal access in the user program can be easily detected.

3.2 Endian

In the SH-3, SH-3E, SH-3DSP, SH-4 series, SH-DSP (SH7065), and SH-DSP with Cache, little endian as well as big endian can be specified as the data allocation format in the memory; a user program created in the little endian format can also be simulated and debugged. Use **[Endian]** in the **System Configuration** dialog box to specify the endian.

The specified endian is valid for all accesses to external memory, and in the SH-3DSP it is also valid for accesses to the X or Y memory; word or longword data is written to or read from the memory in the specified byte order.

Note: The specified endian is applied to all accesses to external memory in common. The actual SH-DSP with Cache and SH-DSP (SH7065) have the function for specifying endian in memory area units, but the simulator/debugger does not support this function.

3.3 Pipeline Reset Processing

The simulator/debugger, which simulates the pipeline execution, resets the pipeline when:

- The program counter (PC) is modified after the instruction simulation stops and before it restarts.
- The Run command to which the execution start address has been specified is executed.
- Initialization is performed, or a program is loaded.

- Memory data being currently fetched and decoded is rewritten.

When the pipeline is reset, data already fetched and decoded is cleared, and new data is fetched and decoded from the current PC. In addition, the number of executed instructions and the number of instruction execution cycles are zero-cleared.

3.4 Memory Management Unit (MMU)

For the SH-3, SH-3E, SH-3DSP, and SH-4 series, the simulator/debugger simulates MMU operations such as TLB operations, address translation, or MMU-related exceptions (TLB miss exception, TLB protection exception, TLB invalid exception, and initial page write exception). The user program using address translation by the MMU can be simulated and debugged. In addition, the MMU-related exception handler routines can be simulated and debugged. The MMU functions depend on the CPU.

SH-3, SH-3E, and SH-3DSP Series:

The following dialog boxes are provided to manipulate the 32-entry 4-way TLB contents.

- **TLB** dialog box: Displays and flushes the TLB contents
- **TLB Modify** dialog box: Modifies the TLB contents
- **TLB Find** dialog box: Searches the TLB contents

For details, refer to section 5.50, TLB Dialog Box, section 5.51, TLB Modify Dialog Box, and section 5.52, TLB Find Dialog Box.

The TLB is mapped in the range H'F2000000 to H'F3FFFFFFF, that is, all entries of the TLB are allocated within this range.

SH-4 Series:

The following dialog boxes are provided to manipulate the 4-entry instruction TLB (ITLB) and 64-entry unified TLB (UTLB) contents:

- **Instruction TLB** dialog box: Displays and flushes the ITLB contents
- **Instruction TLB Modify** dialog box: Modifies the ITLB contents
- **Instruction TLB Find** dialog box: Searches the ITLB contents
- **Unified TLB** dialog box: Displays and flushes the UTLB contents
- **Unified TLB Modify** dialog box: Modifies the UTLB contents
- **Unified TLB Find** dialog box: Searches the UTLB contents

For details, refer to section 5.54, Instruction TLB Dialog Box, through section 5.59, Unified TLB Find Dialog Box.

The ITLB is mapped in the range H'F2000000 to H'F3FFFFFF, and the UTLB is mapped in the range H'F6000000 to H'F7FFFFFF. The simulator/debugger does not support data array 2 for both ITLB and UTLB.

As well as during user program execution, the MMU translates virtual addresses into physical addresses during address display or input in the dialog boxes or windows. Therefore, in the dialog boxes and windows, memory can be accessed with the virtual addresses used in the user program. However, note that physical addresses must be used in the [Memory map] and [System memory resource].

Note: If an associative write to a TLB entry is performed by using the Memory window, the entry may not be modified correctly. In this case, use the Edit dialog box in the longword format. To open the Edit dialog box in the longword format, open the Memory window in the longword format and double-click the data to be modified.

3.5 Cache

For the SH-3, SH-3E, SH-3DSP, SH-4 series, and SH-DSP with Cache, the simulator/debugger simulates cache operations and displays the cache contents and cache hit rate. Cache operations during user program execution can be monitored. The cache functions depend on the CPU.

3.5.1 Displaying Cache Contents

SH-3, SH-3E, SH-3DSP series, and SH-DSP with Cache:

The following dialog boxes are provided to manipulate the cache:

- **Cache** dialog box: Displays and flushes the cache contents
- **Cache Modify** dialog box: Modifies the cache contents

For the SH-3 and SH-3E series, the **Cache** dialog box enables the cache capacity to be modified and the half of the cache to be used as internal RAM. Table 3.2 shows the cache capacity and the ways to be used.

Table 3.2 Specifiable Cache Capacity for SH-3 and SH-3E Series Simulator/Debugger

Cache Capacity	Ways to Be Used	Internal RAM Specification (Ways that Can Be Used as Internal RAM)
8 kbytes	Ways 0 to 3	Ways 2 and 3 can be used as internal RAM
4 kbytes	Ways 0 and 1	Way 1 can be used as internal RAM
2 kbytes	Way 0	No way can be used as internal RAM

For details, refer to section 5.60, Cache Dialog Box, and section 5.61, Cache Modify Dialog Box. For the cache control register, refer to section 5.32, CCR Dialog Box, and section 5.33, CCR2 Dialog Box (only for SH-3DSP series).

The cache is mapped in the range H'F0000000 to H'F1FFFFFF in the SH-3, SH-3E, and SH-3DSP series. In the SH-DSP with Cache, the address array is mapped in the range H'60000000 to H'7FFFFFFF, and the data array is mapped in the range H'C0000000 to H'C0000FFF.

SH-4/SH-4BSC:

The simulator/debugger simulates operations of the 8-kbyte instruction cache (IC), the 16-kbyte operand cache (OC), and two 32-byte store queues (SQ).

The following dialog boxes are provided to manipulate the IC and OC contents:

- **Instruction Cache** dialog box: Displays and flushes the IC contents
- **Instruction Cache Modify** dialog box: Modifies the IC contents
- **Operand Cache** dialog box: Displays and flushes the OC contents
- **Operand Cache Modify** dialog box: Modifies the OC contents

For details, refer to section 5.63, Instruction Cache Dialog Box, through section 5.66, Operand Cache Modify Dialog Box. For the cache control registers, refer to section 5.32, CCR Dialog Box, and section 5.34, QACR0 and QACR1 Dialog Boxes.

The IC is mapped in the range H'F0000000 to H'F1FFFFFF, the OC is mapped in the range H'F4000000 to H'F5FFFFFF, and the SQ is mapped in the range H'E0000000 to H'E3FFFFFF.

Note: If an associative write to a cache entry or modification of a cache address array is performed by using the Memory window, the entry or array may not be modified correctly. In this case, use the Edit dialog box in the longword format. To open the Edit dialog box in the longword format, open the Memory window in the longword format and double-click the data to be modified.

The simulator/debugger does not change the high-order three bits of the address tag stored in a cache address array to zeros.

When loading a program, by using the **Load Object File** dialog box, to the area where the cache is mapped, or copying memory data to this area by using the **Copy Memory** dialog box, clear the AT bit of the MMUCR to zero to disable the MMU.

SH-4 (SH7750R):

The simulator/debugger simulates operations of the 16-kbyte instruction cache (IC), the 32-kbyte operand cache (OC), and two 32-byte store queues (SQ).

The following dialog boxes are provided to manipulate the IC and OC contents:

- **Instruction Cache** dialog box: Displays and flushes the IC contents
- **Instruction Cache Modify** dialog box: Modifies the IC contents
- **Operand Cache** dialog box: Displays and flushes the OC contents
- **Operand Cache Modify** dialog box: Modifies the OC contents

For details, refer to section 5.63, Instruction Cache Dialog Box, through section 5.66, Operand Cache Modify Dialog Box. For the cache control registers, refer to section 5.32, CCR Dialog Box, and section 5.34, QACR0 and QACR1 Dialog Boxes.

The IC is mapped in the range H'F0000000 to H'F1FFFFFF, the OC is mapped in the range H'F4000000 to H'F5FFFFFF, and the SQ is mapped in the range H'E0000000 to H'E3FFFFFF.

Note: If an associative write to a cache entry or modification of a cache address array is performed by using the Memory window, the entry or array may not be modified correctly. In this case, use the Edit dialog box in the longword format. To open the Edit dialog box in the longword format, open the Memory window in the longword format and double-click the data to be modified.

The simulator/debugger does not change the high-order three bits of the address tag stored in a cache address array to zeros.

When loading a program, by using the **Load Object File** dialog box, to the area where the cache is mapped, or copying memory data to this area by using the **Copy Memory** dialog box, clear the AT bit of the MMUCR to zero to disable the MMU.

3.5.2 Cache Hit Rate

Checking and Displaying the Cache Hit Rate: The simulator/debugger displays the cache hit rate in percentage in the **Platform** sheet in the **System Status** window. The cache hit rate is obtained by dividing the cache hit count by the cache access count (the sum of the cache hit count and cache miss count). The cache hit count and the cache miss count are also displayed.

Initializing the Cache Hit Rate: The displayed cache hit rate is reset to zero when the simulator/debugger is initiated, the pipeline is reset, or the CCR register value is modified. In the SH-3DSP series, the cache hit rate is reset to zero also when the CCR2 control register value is modified.

3.6 Bus State Controller (BSC)

For the SH-4BSC, the simulator/debugger has the functions for specifying and modifying the memory map to use the BSC; the user program using the BSC can be debugged.

Table 3.3 lists the memory types that can be specified for the SH-4BSC.

Table 3.3 Memory Types for the SH-4BSC Simulator/Debugger

Address	Specifiable Memory Types
H'00000000 to H'03FFFFFF (area 0)	Normal memory, burst ROM, and MPX
H'04000000 to H'07FFFFFF (area 1)	Normal memory, byte control SRAM, and MPX
H'08000000 to H'0BFFFFFF (area 2)	Normal memory, DRAM, SDRAM, and MPX
H'0C000000 to H'0FFFFFFF (area 3)	Normal memory, DRAM, SDRAM, and MPX
H'10000000 to H'13FFFFFF (area 4)	Normal memory, byte control SRAM, and MPX
H'14000000 to H'17FFFFFF (area 5)	Normal memory, burst ROM, and MPX
H'18000000 to H'1BFFFFFF (area 6)	Normal memory, burst ROM, and MPX
H'1C000000 to H'1FFFFFFF (area 7)	Cannot be specified
H'7C000000 to H'7C001FFF	Internal RAM (cannot be changed)
H'E0000000 to H'FFFFFFF	I/O (cannot be changed)

The high-order three bits of the addresses for areas 0 to 7 in table 3.3 must be ignored; H'00000000 and H'20000000 are both in area 0.

The simulator/debugger does not support the PCMCIA.

For details on memory mapping, refer to section 5.21, Memory Map Dialog Box. For details on BSC control register setting, refer to section 5.40, MCR Dialog Box, through section 5.49, RFCR Dialog Box.

3.7 Direct Memory Access Controller (DMAC)

For the SH-4BSC, the simulator/debugger simulates the 4-channel DMAC operations; the user program using the DMAC can be debugged.

For details on DMAC control register setting, refer to section 5.35, SAR0-SAR3 Dialog Boxes, through section 5.39, DMAOR Dialog Box.

3.8 SH-4/SH-4 (SH7750R) Supporting Functions

3.8.1 BSC

For the SH-4/SH-4 (SH7750R), by eliminating the bus control function in the BSC, only SRAM, bus width, and the number of states can be specified.

Table 3.4 lists the memory types that can be specified for the SH-4/SH-4(7750R).

Table 3.4 Memory Types for the SH-4/SH-4(7750R) Simulator/Debugger

Address	Specifiable Memory Types
H'00000000 to H'03FFFFFF (area 0)	SRAM
H'04000000 to H'07FFFFFF (area 1)	
H'08000000 to H'0BFFFFFF (area 2)	
H'0C000000 to H'0FFFFFFF (area 3)	
H'10000000 to H'13FFFFFF (area 4)	
H'14000000 to H'17FFFFFF (area 5)	
H'18000000 to H'1BFFFFFF (area 6)	
H'1C000000 to H'1FFFFFFF (area 7)	Cannot be specified
H'7C000000 to H'7C001FFF	Internal RAM (cannot be changed)
H'E0000000 to H'FFFFFFF	I/O (cannot be changed)

3.8.2 DMA

The DMA function cannot be used.

3.8.3 External/Internal Clock Ratio

The external/internal clock ratio is 1:1.

3.8.4 Control Registers

Table 3.5 lists the control registers supported by the SH-4/SH-4 (SH7750R) simulator/debugger.

**Table 3.5 Control Registers Supported by the SH-4/SH-4 (SH7750R) Simulator/Debugger
(1)**

Register Name	Whether or Not Supported
PTEH	Supported
PTEL	Supported
TTB	Supported
TEA	Supported
MMUCR	Supported
EXPEVT	Supported
INTEVT	Supported
TRA	Supported
CCR	Supported
QACR0, QACR1	Supported
SAR0-SAR3	Not supported
DAR0-DAR3	Not supported
DMATCR0-DMATCR3	Not supported
CHCR0-CHCR3	Not supported
DMAOR	Not supported
MCR	Not supported
BCR1, BCR2	Partly supported
WCR1, WCR2	Partly supported
WCR3	Not supported
RTCSR	Not supported
RTCNT	Not supported
RTCOR	Not supported
RFCR	Not supported

Note: Even if values are modified or referenced for the registers that are not supported via a dialog box that controls registers, etc., the simulator/debugger execution will not be affected.

The following shows how each control register is supported by each field.

Table 3.6 Control Registers Supported by the SH-4/SH-4 (SH7750R) Simulator/Debugger (2)

Register Name	Field Name	Whether or Not Supported
BCR1	ENDIAN	Supported
	MASTER	Not supported
	A0MPX	Not supported
	A0BST	Not supported
	A5BST	Not supported
	A6BST	Not supported
	DRAMTP	Not supported
	IPUP	Not supported
	OPUP	Not supported
	A1MBC	Not supported
	A4MBC	Not supported
	BREQEN	Not supported
	PSHR	Not supported
	MEMMPX	Not supported
	HIZMEM	Not supported
	HIZCNT	Not supported
A56PCM	Not supported	
BCR2	A6SZ-A0SZ	Supported
	PORTEN	Not supported
WCR1	DMAW	Not supported
	A6IW-A0IW	Supported
WCR2	A6W-A0W	Supported
	A6B	Not supported
	A5B	Not supported
	A0B	Not supported

Note: If values are modified or referenced for the registers that are not supported via a dialog box that controls registers, etc., the simulator/debugger execution will not be affected.

3.9 Exception Processing

The simulator/debugger detects the generation of exceptions corresponding to TRAPA instructions, general illegal instructions, slot illegal instructions, and address errors. In addition, for the SH-3, SH-3E, SH-3DSP, and SH-4 series, the simulator/debugger simulates MMU-related exception processing (TLB miss, TLB protection exception, TLB invalid exception, and initial page write). For the SH-2E, SH-3E, and SH-4 series, the simulator/debugger also simulates FPU exception processing.

The simulator/debugger simulates exception processing with the following procedures, depending on the **[Execution Mode]** setting in the **System Configuration** dialog box.

SH-1, SH-2, SH-2E and SH-DSP Series:

- When **[Continue]** is selected (continuation mode):
 1. Detects an exception during instruction execution.
 2. Saves the PC and SR in the stack area.
 3. Reads the start address from the vector address corresponding to the vector number.
 4. Starts instruction execution from the start address. If the start address is 0, the simulator/debugger stops exception processing, displays that an exception processing error has occurred, and enters the command input wait state.
- When the **[Stop]** is selected (stop mode):

Executes steps 1 to 3 above, then stops.

SH-3, SH-3E, and SH-3DSP Series:

- When **[Continue]** is selected (continuation mode):
 1. Detects an exception during instruction execution.
 2. Saves the PC and SR to the SPC and SSR, respectively.
 3. Sets the BL bit, RB bit, and MD bit in the SR to 1s.
 4. Sets an exception code in control register EXPEVT. If necessary, appropriate values are set in other control registers.
 5. Sets the PC to the vector address corresponding to the exception cause. (If an exception is detected when the BL bit in the SR is 1, reset vector address H'A0000000 is set in the PC regardless of the exception cause.)
 6. Starts instruction execution from the address set in the PC.
- When the **[Stop]** is selected (stop mode):

Executes steps 1 to 5 above, then stops.

SH-4 Series:

- When [**Continue**] is selected (continuation mode):
 1. Detects an exception during instruction execution.
 2. Saves the PC and SR to the SPC and SSR, respectively.
 3. Sets the BL bit, RB bit, and MD bit in the SR to 1s.
 4. Sets the FD (FPU disable) bit in the SR to 0 at reset.
 5. Sets an exception code in control register EXPEVT. If necessary, appropriate values are set in other control registers.
 6. Sets the PC to the vector address corresponding to the exception cause. (If an exception is detected when the BL bit in the SR is 1, reset vector address H'A0000000 is set in the PC regardless of the exception cause.)
 7. Starts instruction execution from the address set in the PC.
- When the [**Stop**] is selected (stop mode):

Executes steps 1 to 6 above, then stops.

3.10 Control Registers

For the SH-3, SH-3E, SH-3DSP, and SH-4 series, the simulator/debugger supports the memory-mapped control registers that are used for exception processing, MMU control, and cache control. In addition, for the SH-4 series, the simulator/debugger also supports the control registers that are used for BSC and DMAC control. For the SH-DSP with Cache, the simulator/debugger only supports the CCR register that is used for cache control. Therefore, a user program using exception processing, MMU control, cache control, BSC control, and DMAC control can be simulated and debugged.

The registers supported by the simulator/debugger are listed below.

MMU	PTEH: Page table entry high register
	PTL: Page table entry low register
	TTB: Translation table base register
	TEA: TLB exception address register
	MMUCR: MMU control register
Exception processing	TRA: TRAPA exception register
	EXPEVT: Exception event register
	INTEVT: Interrupt event register
Cache	CCR: Cache control register
	CCR2 ^{*1} : Cache control register 2
	QACR0 and QACR1 ^{*2} : Queue address control registers 0 and 1

BSC	BCR1 and BCR2 ^{*2} :	Bus control registers 1 and 2
	WCR1 to WCR3 ^{*2} :	Wait state control registers 1 to 3
	MCR ^{*2} :	Individual memory control register
	RTCSR ^{*2} :	Refresh timer control/status register
	RTCNT ^{*2} :	Refresh timer/counter
	RTCOR ^{*2} :	Refresh time constant register
	RFCR ^{*2} :	Refresh count register
DMAC	SAR0 to SAR3 ^{*2} :	DMA source address registers 0 to 3
	DAR0 to DAR3 ^{*2} :	DMA destination address registers 0 to 3
	DMATCR0 to DMATCR3 ^{*2} :	DMA transfer count registers 0 to 3
	CHCR0 to CHCR3 ^{*2} :	DMA channel control registers 0 to 3
	DMAOR ^{*2} :	DMA operation register

- Notes:**
- 1. The register marked with *1 is supported only for the SH-3DSP series.**
 - 2. The registers marked with *2 are supported only for the SH-4 series.**
 - 3. Only the CCR register is supported for the SH-DSP with Cache.**

The simulator/debugger does not support the PCMCIA interface and the synchronous DRAM mode register.

To modify or display a control register value, use the **Control Registers** window and the dialog box for each register. For details, refer to section 5.23, Control Registers Window, through section 5.49, RFCR Dialog Box.

3.11 Trace

The simulator/debugger writes the results of each instruction execution into the trace buffer. The conditions for the trace information acquisition can be specified in the **Trace Acquisition** dialog box. Click the right mouse button in the **Trace** window and choose [**Acquisition**] from the popup menu to display the **Trace Acquisition** dialog box. The acquired trace information is displayed in the **Trace** window. The trace information displayed in the **Trace** window depends on the target CPU as follows.

SH-1, SH-2, SH-2E, and SH-DSP Series:

- Total number of instruction execution cycles
- Instruction address
- Pipeline execution status
- Instruction mnemonic
- Data access information (destination and accessed data)
- C/C++ or assembly-language source programs

SH-3 and SH-3E Series:

- Total number of instruction execution cycles
- Data on the address bus
- Data on the data bus
- Instruction code
- Instruction number
- Instruction mnemonic
- Instruction number that was fetched (enclosed by [] when the instruction did not access memory)
- Instruction number that was decoded
- Instruction number that was executed
- Instruction number that accessed memory
- Instruction number that wrote back data
- Data access information (destination and accessed data)
- C/C++ or assembly-language source programs

SH-3DSP Series:

- Total number of instruction execution cycles
- Program counter value
- Instruction code
- Instruction number that was fetched (enclosed by [] when the instruction did not access memory)
- Instruction number that was decoded
- Instruction number that was executed
- Instruction number that accessed memory
- Instruction number that wrote back data
- Instruction number
- Instruction mnemonic
- Data access information (destination and accessed data)
- C/C++ or assembly-language source programs

SH-4 Series:

- Total number of instruction execution cycles (CPU internal clock)
- Program counter value
- Fetched instruction code
- Instruction number that was executed, accessed memory, or wrote back data in the EX pipeline
- Instruction number that was executed, accessed memory, or wrote back data in the LS pipeline
- Instruction number that was executed, accessed memory, or wrote back data in the BR pipeline
- Instruction number that was executed, accessed memory, or wrote back data in the FP pipeline
- Instruction number assigned to the instruction to be executed
- Memory address, instruction code, and mnemonic of the instruction to be executed
- Data access information (destination and accessed data)
- C/C++ or assembly-language source programs

The trace information can be searched. The search conditions can be specified in the **Trace Search** dialog box. Click the right mouse button in the **Trace** window and choose **[Find]** from the popup menu to display the **Trace Search** dialog box.

For details, refer to section 5.14, Trace Window.

3.12 Standard I/O and File I/O Processing

The simulator/debugger provides the **Simulated I/O** window to enable the standard I/O and file I/O processing listed in table 3.7 to be executed by the user program. When the I/O processing is executed, the **Simulated I/O** window must be open.

Table 3.7 I/O Functions

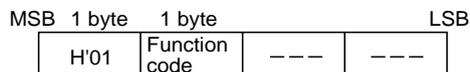
No.	Function Code	Function Name	Description
1	H'21	GETC	Inputs one byte from the standard input device
2	H'22	PUTC	Outputs one byte to the standard output device
3	H'23	GETS	Inputs one line from the standard input device
4	H'24	PUTS	Outputs one line to the standard output device
5	H'25	FOPEN	Opens a file
6	H'06	FCLOSE	Closes a file
7	H'27	FGETC	Inputs one byte from a file
8	H'28	FPUTC	Outputs one byte to a file
9	H'29	FGETS	Inputs one line from a file
10	H'2A	FPUTS	Outputs one line to a file
11	H'0B	FEOF	Checks for end of file
12	H'0C	FSEEK	Moves the file pointer
13	H'0D	FTELL	Returns the current position of the file pointer

To perform I/O processing, use the **[System Call Address]** in the **System Configuration** dialog box in the following procedure.

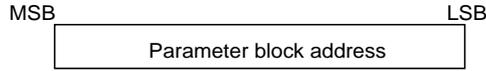
1. Set the address specialized for I/O processing in the **[System Call Address]**, select **[Enable]** and execute the program.
2. When detecting a subroutine call instruction (BSR, JSR, or BSRF), that is, a system call to the specialized address during user program execution, the simulator/debugger performs I/O processing by using the R0 and R1 values as the parameters.

Therefore, before issuing a system call, set as follows in the user program:

- Set the function code (table 3.7) to the R0 register



- Set the parameter block address to the R1 register (for the parameter block, refer to each function description)



- Reserve the parameter block and input/output buffer areas

Each parameter of the parameter block must be accessed in the parameter size.

After the I/O processing, the simulator/debugger resumes simulation from the instruction that follows the system call instruction.

Note: When a JSR, BSR, or BSRF instruction is used as a system call instruction, the instruction following the JSR, BSR, or BSRF instruction is executed as a normal instruction, not a slot instruction. Therefore, the instruction placed immediately after the system call instruction (JSR, BSR, or BSRF) must not be one that produces different results depending on whether executed as a normal instruction or as a slot instruction.

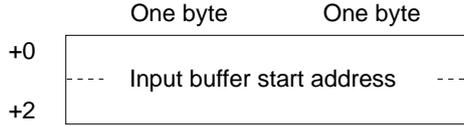
Each I/O function is described in the following format:

(1)	(2)	(4)
	(3)	
Parameter Block		
(5)		
Parameters		
(6)		

- (1) Number corresponding to table 3.7
- (2) Function name
- (3) Function code
- (4) I/O overview
- (5) I/O parameter block
- (6) I/O parameters

1	GETC	Inputs one byte from the standard input device
	H'21	

Parameter Block

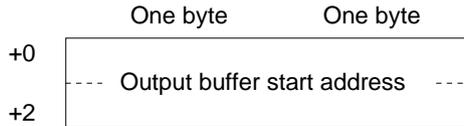


Parameters

- Input buffer start address (input)
Start address of the buffer to which the input data is written to.

2	PUTC	Outputs one byte to the standard output device
	H'22	

Parameter Block

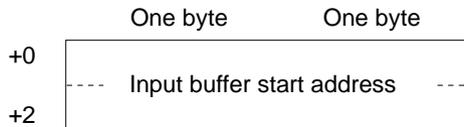


Parameters

- Output buffer start address (input)
Start address of the buffer in which the output data is stored.

3	GETS	Inputs one line from the standard input device
	H'23	

Parameter Block

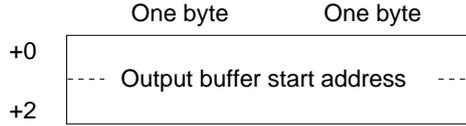


Parameters

- Input buffer start address (input)
Start address of the buffer to which the input data is written to.

4	PUTS	Outputs one line to the standard output device
	H'24	

Parameter Block



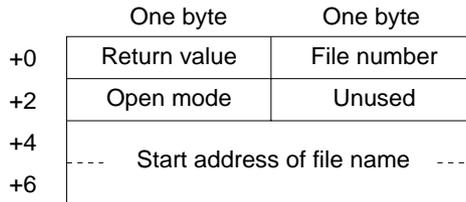
Parameters

- Output buffer start address (input)
Start address of the buffer in which the output data is stored.

5	FOPEN	Opens a file
	H'25	

The FOPEN opens a file and returns the file number. After this processing, the returned file number must be used to input, output, or close files. A maximum of 256 files can be open at the same time.

Parameter Block



Parameters

- Return value (output)
0: Normal completion
-1: Error
- File number (output)
The number to be used in all file accesses after opening.
- Open mode (input)
H'00: "r"
H'01: "w"
H'02: "a"
H'03: "r+"

H'04: "w+"
 H'05: "a+"
 H'10: "rb"
 H'11: "wb"
 H'12: "ab"
 H'13: "r+b"
 H'14: "w+b"
 H'15: "a+b"

These modes are interpreted as follows.

"r": Open for reading.

"w": Open an empty file for writing.

"a": Open for appending (write starting at the end of the file).

"r+": Open for reading and writing.

"w+": Open an empty file for reading and writing.

"a+" : Open for reading and appending.

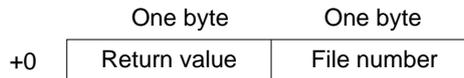
"b" : Open in binary mode.

- Start address of file name (input)

The start address of the area for storing the file name.

6	FCLOSE	Closes a file
	H'06	

Parameter Block



Parameters

- Return value (output)

0: Normal completion

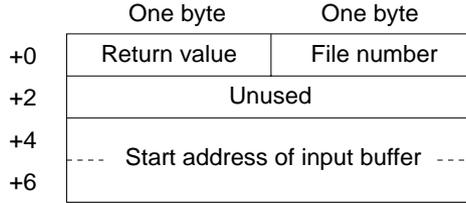
-1: Error

- File number (input)

The number returned when the file was opened.

7	FGETC	Inputs one byte from a file
	H'27	

Parameter Block

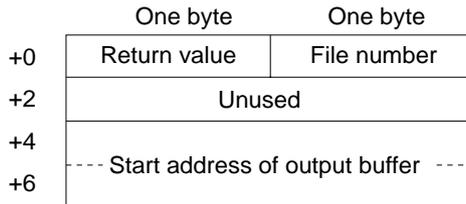


Parameters

- Return value (output)
0: Normal completion
-1: EOF detected
- File number (input)
The number returned when the file was opened.
- Start address of input buffer (input)
The start address of the buffer for storing input data.

8	FPUTC	Outputs one byte to a file
	H'28	

Parameter Block



Parameters

- Return value (output)
0: Normal completion
-1: Error
- File number (input)
The number returned when the file was opened.

- Start address of output buffer (input)

The start address of the buffer used for storing the output data.

9	FGETS	Reads character string data from a file
	H'29	

Reads character string data from a file. Data is read until either a new line code or a NULL code is read, or until the buffer is full.

Parameter Block

	One byte	One byte
+0	Return value	File number
+2	Buffer size	
+4	----- Start address of input buffer -----	
+6		

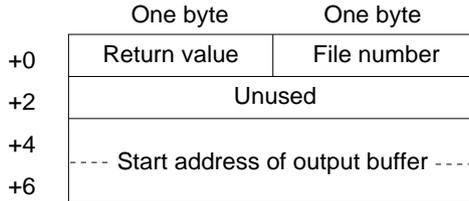
Parameters

- Return value (output)
 - 0: Normal completion
 - 1: EOF detected
- File number (input)
 - The number returned when the file was opened.
- Buffer size (input)
 - The size of the area for storing the read data. A maximum of 256 bytes can be stored.
- Start address of input buffer (input)
 - The start address of the buffer for storing input data.

10	FPUTS	Writes character string data to a file
	H'2A	

Writes character string data to a file. The NULL code that terminates the character string is not written to the file.

Parameter Block

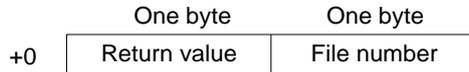


Parameters

- Return value (output)
0: Normal completion
-1: Error
- File number (input)
The number returned when the file was opened.
- Start address of output buffer (input)
The start address of the buffer used for storing the output data.

11	FEOF	Checks for end of file
	H'0B	

Parameter Block



Parameters

- Return value (output)
0: File pointer is not at EOF
-1: EOF detected
- File number (input)
The number returned when the file was opened.

12	FSEEK	Moves the file pointer to the specified position
	H'0C	

Parameter Block

	One byte	One byte
+0	Return value	File number
+2	Direction	Unused
+4	Offset	
+6		

Parameters

- Return value (output)
 - 0: Normal completion
 - 1: Error
- File number (input)
 - The number returned when the file was opened.
- Direction (input)
 - 0: The offset specifies the position as a byte count from the start of the file.
 - 1: The offset specifies the position as a byte count from the current file pointer.
 - 2: The offset specifies the position as a byte count from the end of the file.
- Offset (input)
 - The byte count from the location specified by the direction parameter.

13	FTELL	Returns the current position of the file pointer
	H'0D	

Parameter Block

	One byte	One byte
+0	Return value	File number
+2	Unused	
+4	Offset	
+6		

Parameters

- Return value (output)
0: Normal completion
-1: Error
- File number (input)
The number returned when the file was opened.
- Offset (output)
The current position of the file pointer, as a byte count from the start of the file.

The following shows an example for inputting one character as a standard input (from a keyboard)

```
        MOV .L      PAR_ADR , R1
        MOV .L      REQ_COD , R0
        MOV .L      CALL_ADR , R3
        JSR        @R3
        NOP
STOP    NOP
SYS_CALL NOP
        .ALIGN     4
CALL_ADR .DATA .L  SYS_CALL
REQ_COD  .DATA .L  H'01210000
PAR_ADR  .DATA .L  PARM
PARM     .DATA .L  INBUF
INBUF    .RES .B   2
        .END
```

3.13 Break Conditions

The simulator/debugger provides the following conditions for interrupting the simulation of a user program during execution.

- Break due to the satisfaction of a break command condition
- Break due to the detection of an error during execution of the user program
- Break due to a trace buffer overflow
- Break due to execution of the SLEEP instruction
- Break due to the [STOP] button

3.13.1 Break Due to the Satisfaction of a Break Command Condition

There are five break commands as follows:

- **BREAKPOINT:** Break based on the address of the instruction executed
- **BREAK_ACCESS:** Break based on access to a range of memory
- **BREAK_DATA:** Break based on the value of data written to memory
- **BREAK_REGISTER:** Break based on the value of data written to a register
- **BREAK_SEQUENCE:** Break based on a specified execution sequence

When a break condition is satisfied during user program execution, the instruction at the breakpoint may or may not be executed before a break depending on the type of break, as listed in table 3.8.

Table 3.8 Processing When a Break Condition is Satisfied

Command	Instruction When a Break Condition is Satisfied
BREAKPOINT	Not executed
BREAK_ACCESS	Executed
BREAK_DATA	Executed
BREAK_REGISTER	Executed
BREAK_SEQUENCE	Not executed

For BREAKPOINT and BREAK_SEQUENCE, if a breakpoint is specified at an address other than the beginning of the instruction, the break condition will not be detected.

When a break condition is satisfied during user program execution, a break condition satisfaction message is displayed on the status bar and execution stops.

3.13.2 Break Due to the Detection of an Error During Execution of the User Program

The simulator/debugger detects simulation errors, that is, program errors that cannot be detected by the CPU exception generation functions. The **System Configuration** dialog box specifies whether to stop or continue the simulation when such an error occurs. Table 3.9 lists the error messages, error causes, and the action of the simulator/debugger in the continuation mode.

Table 3.9 Simulation Errors

Error Message	Error Cause	Processing in Continuation Mode
Memory Access Error	Access to a memory area that has not been allocated	On memory write, nothing is written; on memory read, all bits are read as 1.
	Write to a memory area having the write protect attribute	
	Read from a memory area having the read disable attribute	
	Access to an area where memory does not exist	
Illegal Operation	Zero division executed by the DIV1 instruction	Operates in the same way as the actual device operation.
	Writing zero by the SETRC instruction	
Illegal DSP Operation	Shift of more than 32 bits executed by the PSHA instruction	
	Shift of more than 16 bits executed by the PSHL instruction	
Invalid DSP Instruction Code	Invalid DSP instruction code	Always stops.
TLB Multiple Hit	Hit to multiple TLB entries at MMU address translation (only for the SH-3, SH-3E, and SH-3DSP series)	Undefined.

When a simulation error occurs in the stop mode, the simulator/debugger returns to the command wait state after stopping instruction execution and displaying the error message. Table 3.10 lists the states of the program counter (PC) at simulation error stop. The status register (SR) value does not change at simulation error stop.

Table 3.10 Register States at Simulation Error Stop

Error Message	PC Value
Memory Access Error	<ul style="list-style-type: none"> • When an instruction is read: <ul style="list-style-type: none"> — SH-3DSP and SH-DSP series The third instruction address before the instruction that caused the error. — SH-1, SH-2, SH-2E, SH-3, SH-3E, and SH-4 series The instruction address before the instruction that caused the error. The slot address if an error occurs when a branch destination is read. • When an instruction is executed: The instruction address following the instruction that caused the error.
Illegal Operation	The instruction address following the instruction that caused the error.
Illegal DSP Operation	The second instruction address following the instruction that caused the error.
Invalid DSP Instruction Code	The second instruction address following the instruction that caused the error.
TLB Multiple Hit	The address of the instruction that caused the error.

Use the following procedure when debugging programs which include instructions that generate simulation errors.

- a. First execute the program in the stop mode and confirm that there are no errors except those in the intended locations.
- b. After confirming the above, execute the program in the continuation mode.

Note: If an error occurs in the stop mode and simulation is continued after changing the simulator mode to the continuation mode, simulation may not be performed correctly. When restarting a simulation, always restore the register contents (general, control, and system registers) and the memory contents to the state prior to the occurrence of the error.

3.13.3 Break Due to a Trace Buffer Overflow

After the [Break] mode is specified with [Trace buffer full handling] in the Trace Acquisition dialog box, the simulator/debugger stops execution when the trace buffer becomes full. The following message is displayed when execution is stopped.

3.13.4 Break Due to Execution of the SLEEP Instruction

When the SLEEP instruction is executed during instruction execution, the simulator/debugger stops execution. The following message is displayed when execution is stopped.

Sleep

Note: When restarting execution, change the PC value to the instruction address at the restart location.

3.13.5 Break Due to the [STOP] Button

Users can forcibly terminate execution by clicking the [STOP] button during instruction execution. The following message is displayed when execution is terminated.

Stop

Execution can be resumed with the GO or STEP command.

3.14 Floating-Point Data

Floating-point numbers can be displayed and input for the following real-number data, which makes floating-point data processing easier.

- Data in the **Set Break** dialog box when the break type is set to **[Break Data]** or **[Break Register]**
- Data in the **Memory** window
- Data in the **Fill Memory** dialog box
- Data in the **Search Memory** dialog box
- Register values displayed in the **Registers** window
- Input data in the **Register** dialog box

The floating-point data format conforms to the ANSI C standard.

In the simulator/debugger, the rounding mode for floating-point decimal-to-binary conversion can be selected in the **System Configuration** dialog box. One of the following two modes can be selected:

- Round to nearest (RN)
- Round to zero (RZ)

If a denormalized number is specified for binary-to-decimal or decimal-to-binary conversion, it is converted to zero in RZ mode, and it is left as a denormalized number in RN mode. If an overflow

occurs during decimal-to-binary conversion, the maximum floating-point value is returned in RZ mode, and the infinity is returned in RN mode.

3.15 Display of Function Call History

The simulator/debugger displays the function call history in the **Stack Trace** window when simulation stops, which enables program execution flow to be checked easily. Selecting a function name in the **Stack Trace** window displays the corresponding source program in the **Source** window; the function that has called the current function can also be checked.

The displayed function call history is updated in the following cases:

- When simulation stops under the break conditions described in section 3.13, Break Conditions.
- When register values are modified while simulation stops due to the above break conditions.
- While single-step execution is performed.

For details, refer to section 5.68, Stack Trace Window.

Section 4 Menus

This document uses the standard Microsoft® menu naming convention.

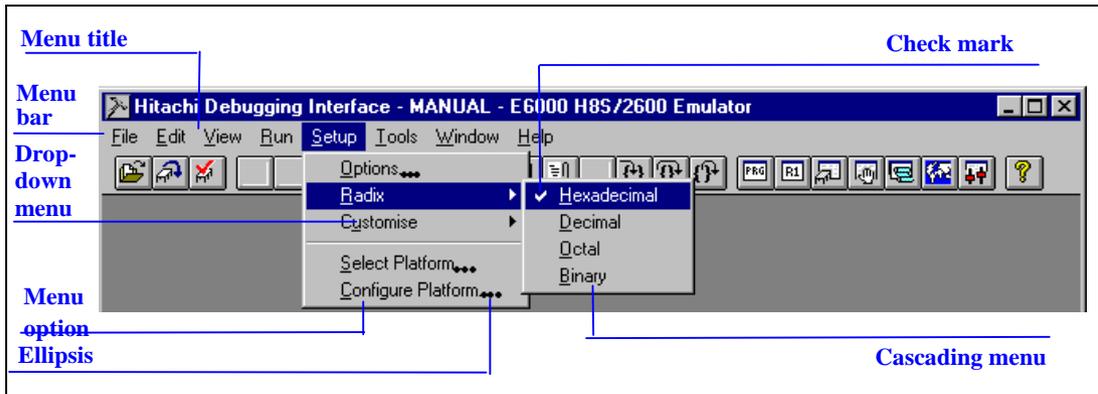


Figure 4.1 Menus

Check marks indicate that the feature provided by the menu option is selected.

Ellipsis indicates that selecting the menu option will open a dialog box that requires extra information to be entered.

Refer to your Windows® user manual for details on how to use the Windows® menu system.

4.1 File

The File menu is used for aspects of the program that access program files.

4.1.1 New Session...



Launches the **Select Session** dialog box allowing the user to select a new debugging platform.

4.1.2 Load Session...



Launches the **Select Session** dialog box allowing the user to load a session from a selected session file (*.hds extension). A session file contains the debugging platform's settings, and the current program and the position of open child windows (views) - it contains symbols, breakpoints, or current register values.

4.1.3 Save Session



Updates the session file for the current session file. If there is no current session file defined, this acts in a similar manner to the [**Save Session As...**] menu option.

4.1.4 Save Session As...

Launches the **Save As** dialog box allowing the user to save the current session details under a new file name. A session file contains the debugging platform's settings, and the current program and the position of open child windows (views) - it contains symbols, breakpoints, or current register values.

4.1.5 Load Program...



Launches the **Load Program** dialog box, allowing the user to select an object file in either S-Record (*.mot; *.s20; and *.obj extensions) or ELF/DWARF (*.abs extension) format and download it to the debugging platform's memory. This will also load the symbols if they are available in the selected file.

4.1.6 Initialize



This will attempt to re-initialize the debugging system. It will close down any open child windows and shut down the link to the debugging platform. If this is successful, an attempt to re-establish the link to the debugging platform will be made. The message 'Link up' will appear in the left-most box of the status bar if this is successful. (See also section 4.4.1, Reset CPU)

4.1.7 Exit

This will close down the HDI. The actions that are carried out by the HDI can be defined by the user in the 'On Exit' section of the **HDI Options** dialog box. (See also section 4.6.2, Options...)

4.2 Edit

The Edit menu is used for aspects of the program that access or modify data in the child windows and debugging platform.

4.2.1 Cut



Only available if a block is highlighted in a child window whose contents can be modified.

This will remove the contents of the highlighted block from the window and place it on the clipboard in the standard Windows® manner.

4.2.2 Copy



Only available if a block is highlighted in a child window whose contents can be modified. This will copy the contents of the highlighted block to the clipboard in the standard Windows® manner.

4.2.3 Paste



Only available if the contents of the child window can be modified. This will copy the contents of the Windows® clipboard into the child window at the current cursor position.

4.2.4 Find...



Only available if the window contains text. This will launch the **Find** dialog box allowing the user to enter a word and locate occurrences within the text. If a match is found, the cursor will move to the start of the word.

4.2.5 Evaluate...



Launches the **Evaluate** dialog box allowing the user to enter a numeric expression, e.g. " $(\#pc + 205) * 2$ ", and display the result in all currently supported radices.

4.3 View

The View menu is used to select and open new child windows. If the menu option is grayed, then the features provided by the window are not available with the current debugging platform.

4.3.1 Breakpoints



Opens the **Breakpoints** window allowing the user to view and edit current breakpoints.

4.3.2 Command Line



Opens the **Command Line** window allowing the user to enter text-based commands to control the debugging platform. These commands can be piped in from a batch file, and the results piped out to a log file, allowing automatic tests to be performed.

4.3.3 Disassembly...



Launches the **Set Address** dialog box allowing the user to enter the address that you wish to view.

4.3.4 Labels



Launches the **Labels** window allowing the user to manipulate the current program's symbols (labels).

4.3.5 Locals



Opens the **Locals** window allowing the user to view and edit the values of the variables defined in the current function. The contents are blank unless the PC is within a C/C++ source-level function.

4.3.6 Memory...



Launches the **Open Memory Window** dialog box allowing the user to specify a memory block and view format to display within a **Memory** window.

4.3.7 Performance Analysis



Launches the **Performance Analysis** window allowing the user to set up and view the number of times that particular sections of the user program have been called.

4.3.8 Profile-List



Opens the **Profile-List** window allowing the user to view the address and size of a function or a global variable, the number of times the function is called, and profile data.

4.3.9 Profile-Tree



Opens the **Profile-Tree** window allowing the user to view the relation of function calls in a tree structure. The **Profile-Tree** window also displays the address, size, and stack size of each function, number of function calls, and profile data. The stack size, number of function calls, and profile data are values when the function is called.

4.3.10 Registers



Opens the **Registers** window allowing the user to view all the current CPU registers and their contents.

4.3.11 Source...



Launches the **Open** dialog box allowing the user to enter a file name of the source file (in either C/C++ or assembly language format) to view. If the source file is not included within the current program or there is no debugging information for the file within the 'absolute' (*.abs) file, then the message "Cannot load program. No Source level debugging available" is displayed.

4.3.12 Status



Opens the **System Status** window allowing the user to view the debugging platform's current status and the current session and program names.

4.3.13 Trace



Opens the **Trace** window allowing the user to see the current trace information.

4.3.14 Watch



Opens the **Watch** window allowing the user to enter C/C++-source level variables and view and modify their contents.

4.3.15 TLB

Opens the **TLB** window allowing the user to view and modify the TLB contents.

4.3.16 TLB...

Opens the **Open TLB** dialog box allowing the user to enter the type of TLB that you wish to view.

4.3.17 Cache

Opens the **Cache** window allowing the user to view and modify the cache array contents.

4.3.18 Cache...

Opens the **Open Cache** dialog box allowing the user to enter the type of cache that you wish to view.

4.3.19 Simulated I/O

Opens the **Simulated I/O** window enabling the standard I/O and file I/O.

4.3.20 Control Register

Opens the **Control Registers** window allowing the user to view and modify the control register contents.

4.3.21 Stack Trace

Opens the **Stack Trace** window displaying the current stack trace information.

4.3.22 External Tool

Opens the **External Tools** window allowing the user to use the co-verification tool.

4.4 Run

The Run menu controls the execution of the user program in the debugging platform.

4.4.1 Reset CPU



Resets the user system hardware and sets the PC to the reset vector address. (See also section 4.1.6, Initialize).

4.4.2 Go



Starts executing the user program at the current PC.

4.4.3 Reset Go



Executes the user program from the reset vector address.

4.4.4 Go To Cursor



Starts executing the user program at the current PC and continues until the PC equals the address indicated by the current text cursor (not mouse cursor) position.

4.4.5 Set PC To Cursor



Changes the value of the Program Counter (PC) to the address at the row of the text cursor (not mouse cursor). Disabled if no address is available for the current row.

4.4.6 Run...

Launches the **Run Program** dialog box allowing the user to enter temporary breakpoints before executing the user program.

4.4.7 Step In



Executes a block of user program before breaking. The size of this block is normally a single instruction but may be set by the user to more than one instruction or a C/C++-source line (see also section 4.4.10, Step...). If a subroutine call is reached, then the subroutine will be entered and the view is updated to include its code.

4.4.8 Step Over



Executes a block of user program before breaking. The size of this block is normally a single instruction but can be set by the user to more than one instruction or a C/C++-source line (see also section 4.4.10, Step...). If a subroutine call is reached, then the subroutine will not be entered and sufficient user program will be executed to set the current PC position to the next line in the current view.

4.4.9 Step Out



Executes sufficient user program to reach the end of the current function and set the PC to the next line in the calling function before breaking.

4.4.10 Step...



Launches the **Step Program** dialog box allowing the user to modify the settings for stepping.

4.4.11 Halt



Stops the execution of the user program.

4.5 Memory

The Memory menu is used for aspects of the user program that access memory.

4.5.1 Refresh

Forces a manual update of the contents of all open **Memory** windows.

4.5.2 Load...



Launches the **Load Memory** dialog box, allowing the user to select an offset address in the memory area, and file name to load from an S-Record format file on disk.

4.5.3 Save...



Launches the **Save Memory As** dialog box, allowing the user to select a start and an end address in the memory area, to save to an S-Record format file on disk. If a block of memory is highlighted in a **Memory** window, these will be automatically entered as the start and end addresses when the dialog box is displayed.

4.5.4 Verify...



Launches the **Verify S-Record File with Memory** dialog box, allowing the user to select a start and an end address in the memory area to check against the contents of an S-Record file on disk.

4.5.5 Test...



Launches the **Test Memory** dialog box allowing the user to specify a block of memory to test for correct read/write operation. The exact test is target dependent. However, in all cases the current contents of the memory will be overwritten - **YOUR PROGRAM AND DATA WILL BE ERASED**. This simulator/debugger does not support this function.

4.5.6 Fill...



Launches the **Fill Memory** dialog box allowing the user to fill a block of the debugging platform's memory with a value. The start and end fields can be specified in the same way as that with the Save option (refer to section 4.5.3, Save...).

4.5.7 Copy...



Launches the **Copy Memory** dialog box allowing the user to copy a block of the debugging platform's memory to an address within the same memory area. The blocks may overlap, in which case any data within the overlapped region of the source block will be overwritten. The start and end fields can be specified in the same way as that with the Save option (refer to section 4.5.3, Save...).

4.5.8 Compare...



Launches the **Compare Memory** dialog box, allowing the user to select a start and an end address in the memory area, to check against another area in memory. The start and end fields can be specified in the same way as that with the Save option (refer to section 4.5.3, Save...).

4.5.9 Configure Map...



Opens the **Memory Mapping** window allowing the user to view and edit the debugging platform's current memory map. In some debugging platforms, the **Memory Map** dialog box will open.

4.5.10 Configure Overlay...



Launches the **Overlay** dialog box. When the overlay function is used, the target section group can be selected in the dialog box.

4.6 Setup

The Setup menu is used to modify the settings of the HDI user interface, and the configuration of the debugging platform.

4.6.1 Status Bar

Toggles the status bar feature on and off. If the feature is enabled then a check mark will be displayed to the left of the menu text.

4.6.2 Options...



Launches the **HDI Options** dialog box allowing the user to modify the settings that are specific to the HDI (not debugging platform dependent settings).

4.6.3 Radix



Cascades a menu displaying a list of radix in which the numeric values will be displayed and entered by default (without entering the radix prefix). The current radix has a check mark to its left and the associated toolbar button is locked down.

For example, if the current radix is decimal then the number ten will be displayed as "10" and may be entered as "10", "H'A", "0x0a", etc.; if the current radix is hexadecimal then the number ten will be displayed as "0A" and entered as "A", "D'10", etc.

4.6.4 Customize



Cascades a menu displaying a list of options that can be customized by the user.

Toolbar :When this cascade menu option is selected, the **Customize** dialog box is launched.

Font :When this cascade menu option is selected, the **Font** dialog box is launched, allowing a fixed width font to be selected.

File Filter : When this cascade menu option is selected, the **Customize File Filter** dialog box is launched, allowing the browser file filters for object, source and memory files to be changed to match the user's requirements.

4.6.5 Configure Platform...



Launches a **set-up** dialog box allowing the user to modify the debugging platform settings. Refer to section 5.18, System Configuration Dialog Box for more details.

4.7 Window

The Window menu modifies the display of currently open child windows. The following menu options are always displayed, and a numbered list of current child windows will be appended - the topmost child window will have a check mark.

4.7.1 Cascade



Arranges the child windows in the standard cascade manner, i.e. from the top left such that the title bar of each child window is visible.

4.7.2 Tile



Arranges the child windows in the standard tile manner, i.e. sizes each window such that all are displayed without overlapping.

4.7.3 Arrange Icons



Lines up any iconized windows neatly along the bottom of the parent frame in the standard manner.

4.7.4 Close All

Closes all the child windows.

4.8 Help

The Help menu accesses additional information on how to use the functionality provided by HDI.

4.8.1 Index



Opens the main help file at the index.

4.8.2 Using Help

Opens a help file allowing the user to find out how to use Windows® hypertext help system.

4.8.3 Search for Help on

Opens the main help file and launches the **Search** dialog box allowing the user to enter and browse through the file's keywords.

4.8.4 About HDI

Launches the **About HDI** dialog box allowing the user to view the version of HDI and the currently loaded DLLs.

Section 5 Windows and Dialog Boxes

This section describes types of windows and dialog boxes, the features that they support and the options available through their associated popup menu.

5.1 Breakpoints Window

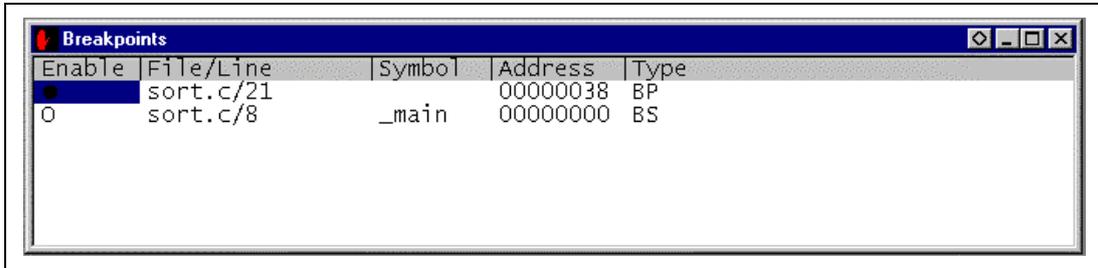


Figure 5.1 Breakpoints Window

This window displays all of the specified breakpoints. Items that can be displayed are listed below.

- [Enable] Displays whether the breakpoint is enabled or disabled. Breakpoints with mark ● or O are enabled.
- [File/Line] Displays file names and line numbers where breakpoints are specified.
- [Symbol] Displays symbols that correspond to breakpoint setting addresses. When no symbol exists, nothing is displayed.
- [Address] Displays addresses where breakpoints are specified.
- [Type] Displays break types
 - BP: PC break
 - BA: Break access
 - BD: Break data
 - BR: Break register (Register name)
 - BS: Break sequence

When a breakpoint is double clicked in this window, the **Set Break** dialog box is opened and break conditions can be modified. If a break sequence is double clicked, the **Break Sequence** dialog box is opened.

A popup menu containing the following options is available by right clicking within the window.

5.1.1 Add...

Sets breakpoints. Clicking this item will open the **Set Break** dialog box and break conditions can be specified.

5.1.2 Edit...

Only enabled if a breakpoint is selected. Select a breakpoint to be edited and click this item. The **Set Break** dialog box will open and break conditions can be changed. Note that if a break sequence is selected for editing, the **Break Sequence** dialog box will open.

5.1.3 Delete

Only enabled if a breakpoint is selected. Removes the selected breakpoint. To retain the details of the breakpoint but not have it cause a break when its conditions are met, use the Disable option (see section 5.1.5, Disable/Enable).

5.1.4 Delete All

Removes all breakpoints from the list.

5.1.5 Disable/Enable

Only enabled if a breakpoint is selected. Toggles the selected breakpoint between enabled and disabled (when disabled, a breakpoint remains in the list, but does not cause a break when the specified conditions are satisfied). When a breakpoint is enabled, a check mark is shown to the left of the menu text (and a circle is shown in the **Enable** column for the breakpoint).

5.1.6 Go to Source

Opens **Source** or **Disassembly** window at address of breakpoint.

5.2 Set Break Dialog Box

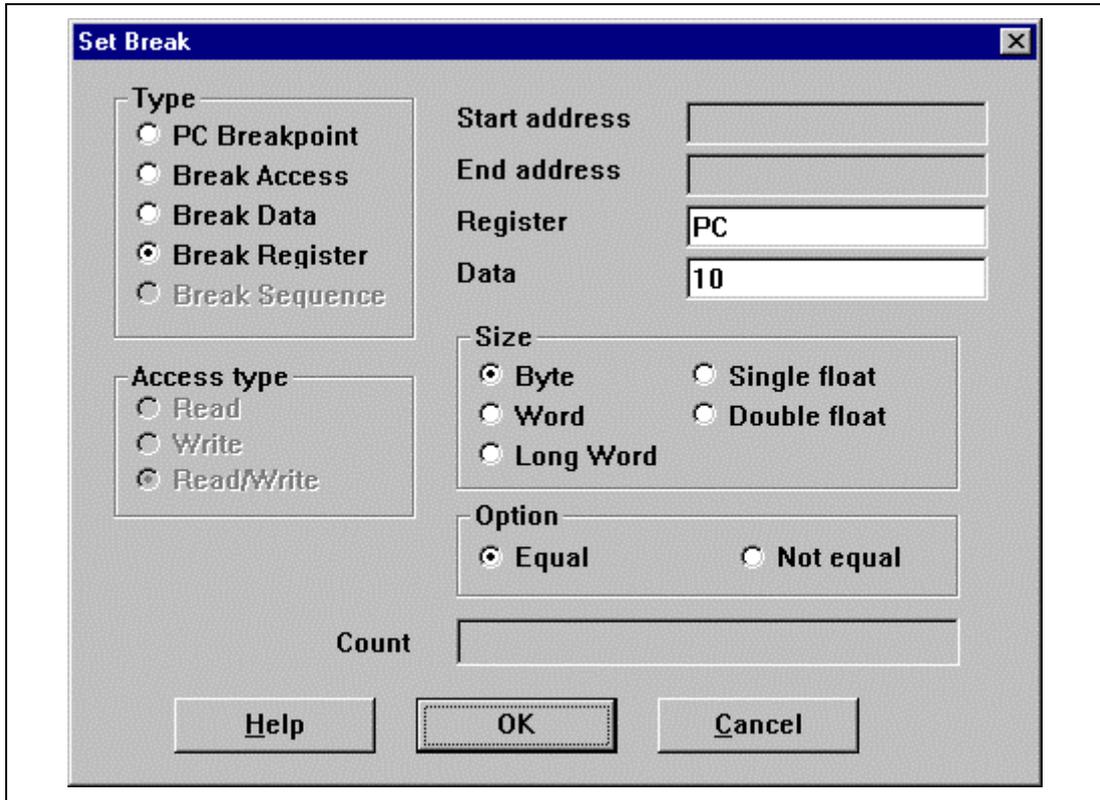


Figure 5.2 Set Break Dialog Box

This dialog box specifies break conditions.

A break type to be set is specified using the radio buttons in the **[Type]** box. Items that can be specified are listed below.

[PC Breakpoint]	[Start address]	Address where a break occurs
	[Count]	Number of times that a specified instruction is fetched (default: 1)
[Break Access]	[Start address]	Start address of memory where a break occurs if the memory is accessed
	[End address]	End address of memory where a break occurs if the memory is accessed (If no data is input, only the start address is break range)
	[Access type]	Read, Write, or Read/Write

[Break Data]	[Start Address]	Address of memory where a break occurs
	[Data]	Data value that causes a break
	[Size]	Data size
	[Option]	Data match/mismatch
[Break Register]	[Register]	Register name where break conditions are specified
	[Data]	Data value that causes a break (If no data is input, a break occurs whenever data is written to the register)
	[Size]	Data size
	[Option]	Data match/mismatch

Note that when [**Break Sequence**] is selected under [**Type**], the **Break Sequence** dialog box opens.

When [**PC Breakpoint**] is selected, if an overloaded function or class name including a member function is specified in [**Start Address**], the **Select Function** dialog box opens. In the dialog box, select a function. For details, refer to section 14, Selecting Functions.

Clicking the [**OK**] button sets the break conditions. Clicking the [**Cancel**] button closes this dialog box without setting the break conditions.

Note: For the SH-3DSP series, specify values within the range H'A5000000 to H'A501FFFF (X and Y memory virtual addresses, corresponding to physical addresses H'05000000 to H'0501FFFF) as the [Start address] and [End address] in [Break Access] and as the [Start address] in [Break Data] for X or Y memory accesses by the MOVX or MOVY instruction.

5.3 Break Sequence Dialog Box

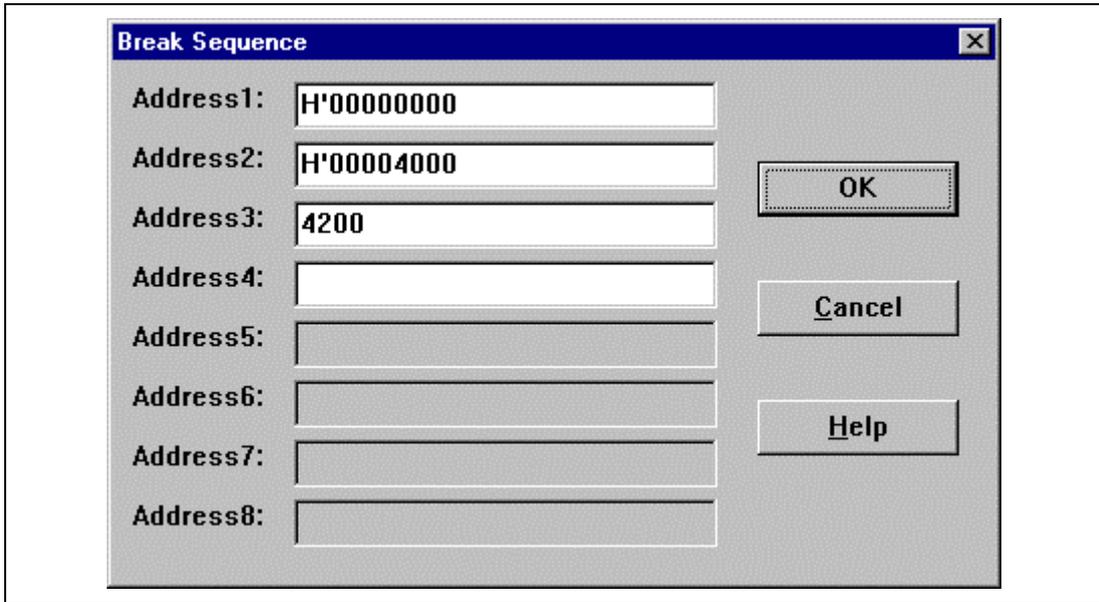


Figure 5.3 Break Sequence Dialog Box

This dialog box specifies the pass addresses as break conditions.

Specify addresses in [Address1] to [Address8]. Not all eight addresses need to be specified. When an overloaded function or a class name including a member function is specified as a pass address, the **Select Function** dialog box will open; select the function name in the dialog box. For details, refer to section 14, Selecting Functions.

Clicking the [OK] button sets the pass addresses. Clicking the [Cancel] button closes this dialog box without adding a new pass address.

5.4 Command Line Window

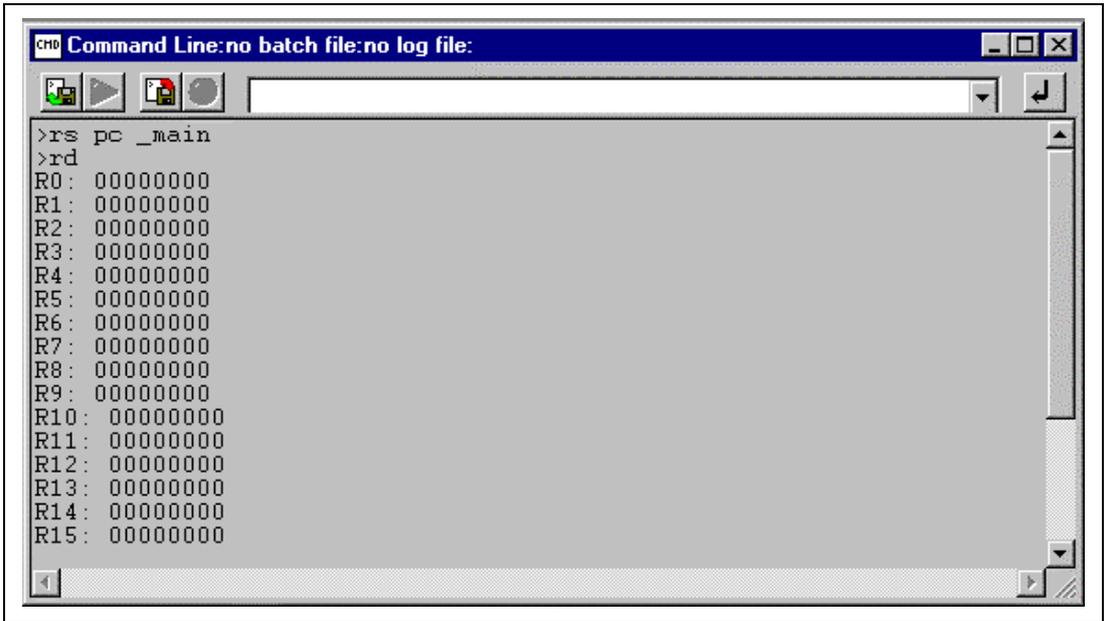


Figure 5.4 Command Line Window

Allows the user to control the debugging platform by sending text-based commands instead of the window menus and commands. It is useful if a series of predefined commands need to be sent to the debugging platform by calling them from a batch file and, optionally, recording the output in a log file. The command can be executed by pressing 'Enter' after the command is input to the text box (Or, the **Enter** button in the right of the text box is clicked). For information about the available commands, refer to the on-line help.

If available, the window title displays the current batch and log file names separated by colons.

The functionality of the toolbar buttons is identical to the popup menu options shown below.

5.4.1 Set Batch File...



Launches the **Set Batch File** dialog box, allowing the user to enter the name of an HDI command file (*.hdc). The batch file is then run automatically. The name of the file is shown on the window title bar.

5.4.2 Play



Runs the last entered HDI command file (*.hdc). It is displayed in a recessed state while the batch file is running and can be used to stop an executing batch file and return control to the user.

5.4.3 Set Log File...



Launches the **Open Log File** dialog box, allowing the user to enter the name of an HDI log file (*.log). The logging option is automatically set and the name of the file shown on the window title bar.

Opening a previous log file will ask the user if they wish to append or over-write the current log.

5.4.4 Logging



Toggles logging to file on and off. When logging is active, the button becomes effective. Note that the contents of the log file cannot be viewed until logging is completed, or temporarily disabled by clearing the check box. Re-enabling logging will append to the log file.

5.4.5 Select All

Selects all contents output in the **Command Line** window.

5.4.6 Copy

Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.5 Disassembly

This window is used to display code at the assembly-language level.

This window layout has a different layout to the **Source** window, with an additional column Label which displays the symbol/label name (if available) for that address. Assembler information is obtained by disassembling the memory contents, and may be edited or viewed directly from memory without requiring debug information from the object file.

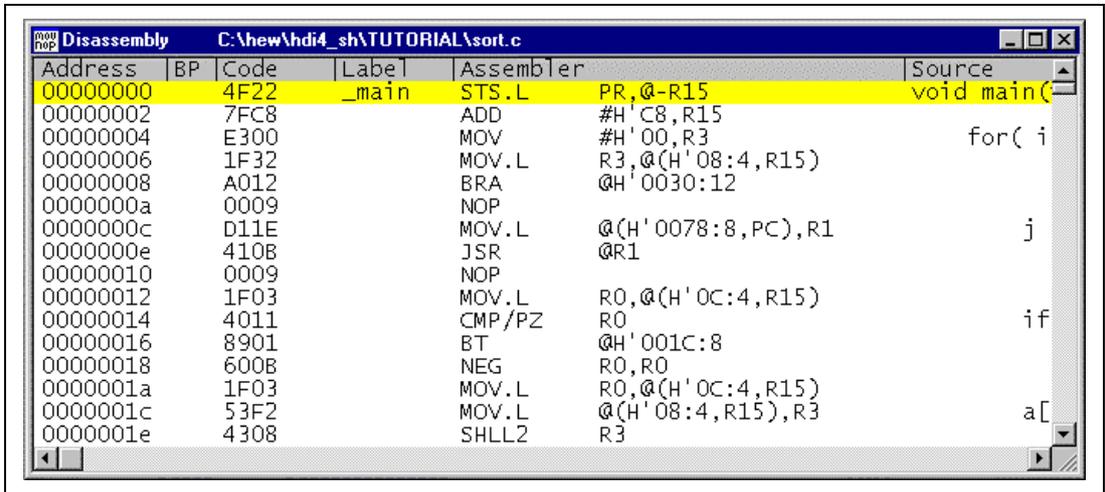


Figure 5.5 Disassembly Window

It supports column-specific double-click actions:

- BP - Toggles standard event types at that address.
- Address - Launches the **Set Address** dialog box, allowing the user to enter a new address. If the address is in a source file, then that file will be opened in a new window (a current source view will be brought into focus) with the cursor set to the specified address. Finally, if the address does not correspond to a source file, then this window will scroll to that location. When an overloaded function or a class name is entered in the Set Address edit field, the **Select Function** dialog box opens for you to select a function.
- Code and Assembler - Launches the **Assembler** dialog box allowing the user to modify the instruction at that address. Note that changes to the machine code do not modify the source file, and any changes will be lost at the end of the session.
- Label - Launches the **Label** dialog box, allowing the user to enter a new label, or to clear or edit the name of an existing label.
- Source - Launches editor at location in source (set by optional startup parameters in Windows® Start menu HDI shortcut).

Within the BP column a list of currently supported standard breakpoint types can be displayed by right clicking. The currently selected standard breakpoint is shown by a check mark to the left of the menu text.

A popup menu containing the following options is available by right clicking within the window, but outside the BP column:

5.5.1 Copy



Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.5.2 Set Address...

Launches the **Set Address** dialog box, allowing the user to enter a new start address. The window will be updated so that this is the first address displayed in the top-left corner. When an overloaded function or a class name is entered, the **Select Function** dialog box opens for you to select a function.

5.5.3 Go To Cursor



Commences to execute the user program starting from the current PC address. The program will continue to run until the PC reaches the address indicated by the text cursor (not the mouse cursor) or another break condition is satisfied.

5.5.4 Set PC Here

Changes the value of the PC to the address indicated by the text cursor (not the mouse cursor).

5.5.5 Instant Watch

Launches the **Instant Watch** dialog box with the name extracted from the view at the current text cursor (not mouse cursor) position. Only available when the selected source line is valid.

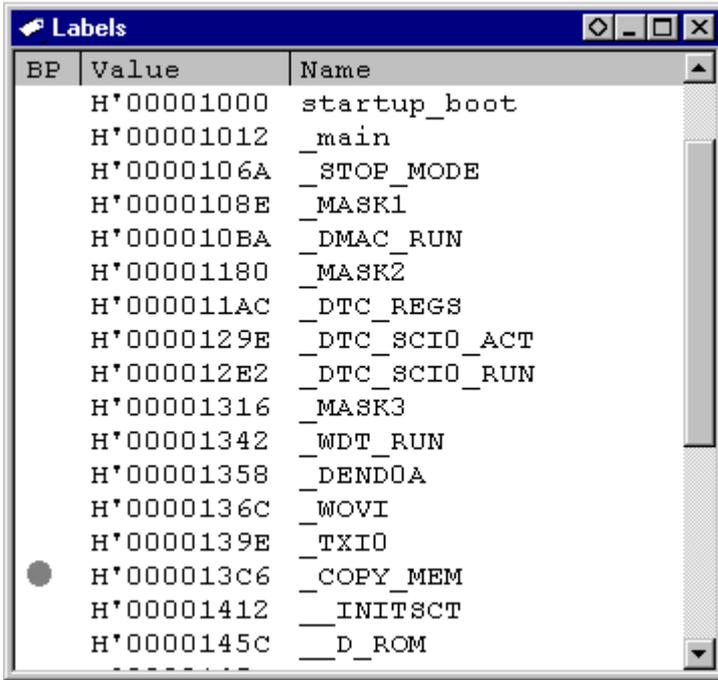
5.5.6 Add Watch

Adds the name extracted from the view at the current text cursor (not mouse cursor) position to the list of watched variables. If a **Watch** window is not open, then it is opened and brought to the top of the child windows. Only available when the selected source line is valid.

5.5.7 Go to Source

Opens the **Source** window including the source program corresponding to the text cursor (not the mouse cursor) position. Only available when the selected source line is valid.

5.6 Labels Window



The screenshot shows a window titled "Labels" with a table of memory addresses and labels. The table has three columns: BP, Value, and Name. The BP column contains a single checkmark in the row for address H'000013C6. The Value column contains hexadecimal addresses, and the Name column contains corresponding labels.

BP	Value	Name
	H'00001000	startup_boot
	H'00001012	_main
	H'0000106A	_STOP_MODE
	H'0000108E	_MASK1
	H'000010BA	_DMAC_RUN
	H'00001180	_MASK2
	H'000011AC	_DTC_REGS
	H'0000129E	_DTC_SCIO_ACT
	H'000012E2	_DTC_SCIO_RUN
	H'00001316	_MASK3
	H'00001342	_WDT_RUN
	H'00001358	_DEND0A
<input checked="" type="checkbox"/>	H'0000136C	_WOVI
	H'0000139E	_TXIO
	H'000013C6	_COPY_MEM
	H'00001412	__INIT_SCT
	H'0000145C	__D_ROM

Figure 5.6 Labels Window

You can view symbols sorted either alphabetically (by ASCII code) or by address value by clicking on the respective column heading.

It supports column-specific double-click actions:

- BP - Sets or cancels a standard breakpoint at that address.
- Address - **Opens a Source** window at the start of the function.
- Name - Launches the **Edit Label** dialog box.

Within the BP column a list of currently supported standard breakpoint types can be displayed by right clicking. The currently selected standard breakpoint is shown by a check mark to the left of the menu text.

A popup menu containing the following options is available by right clicking within the window, but outside the BP column:

5.6.1 Add...

Launches the **Add Label** dialog box:

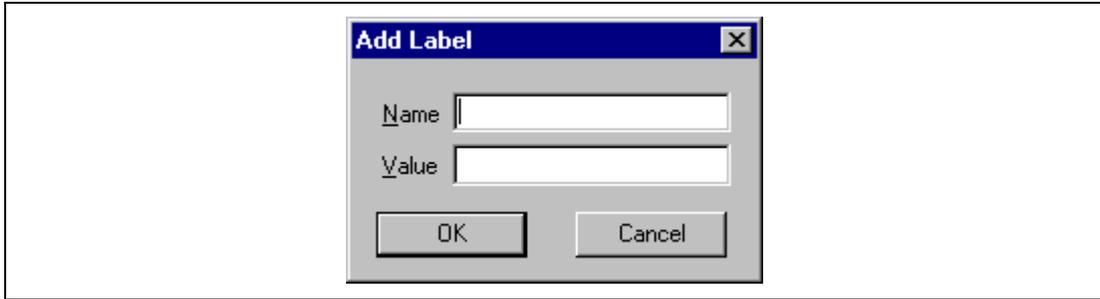


Figure 5.7 Add Label Dialog Box

Enter the new label name into the Name field and the corresponding value into the Value field and press [OK]. The **Add Label** dialog box closes and the label list is updated to show the new label. When an overloaded function or a class name is entered in the Value field, the **Select Function** dialog box opens for you to select a function. For details, refer to section 14, Selecting Functions.

5.6.2 Edit...

Launches the **Edit Label** dialog box:

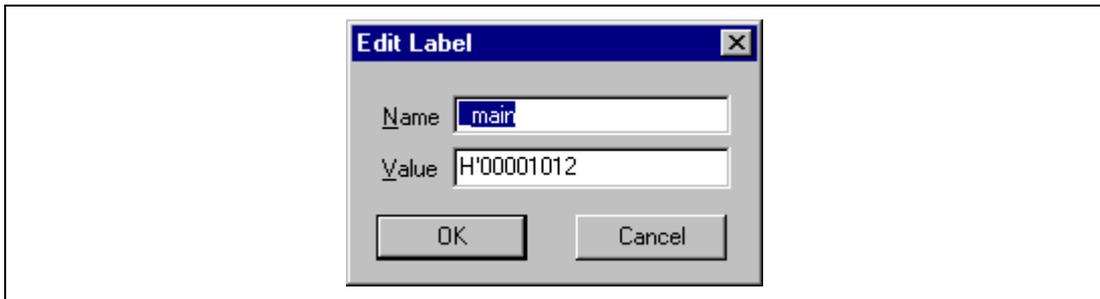


Figure 5.8 Edit Label Dialog Box

Edit the label name and value as required and then press [OK] to save the modified version in the label list. The list display is updated to show the new label details. When an overloaded function or a class name is entered in the Name field, the **Select Function** dialog box opens for you to select a function. For details, refer to section 14, Selecting Functions.

5.6.3 Find...

Launches the **Find Label Containing** dialog box:



Figure 5.9 Find Label Containing Dialog Box

Enter all or part of the label name that you wish to find into the edit box and click **[OK]** or press **ENTER**. The dialog box closes and HDI searches the label list for a label name containing the text that you entered.

Note: Only the label is stored by 1024 characters of the start, therefore the label name must not overlap mutually in 1024 characters or less. Labels are case sensitive.

5.6.4 Find Next

Finds the next occurrence of the label containing the text that you entered.

5.6.5 View Source

Opens the **Source** or **Disassembly** window containing the address corresponding to the label.

5.6.6 Copy



Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.6.7 Delete

Deletes the currently selected label from the symbol list. Alternatively use the Delete accelerator key. A confirmation message box appears:



Figure 5.10 Message Box for Confirming Label Deletion

If you click on the [Yes] button the label is removed from label list and the window display is updated. If the message box is not required then do not select the Delete Label option of the Confirmation seat in the **HDI Options** dialog box.

5.6.8 Delete All

Deletes all the labels from the list. A confirmation message box appears:



Figure 5.11 Message Box for Confirming All Label Deletion

If you click on the [Yes] button all the labels are removed from the HDI system's symbol table and the list display will be cleared. If the message box is not required then do not select the Delete All Labels option of the Confirmation seat in the **HDI Options** dialog box.

5.6.9 Load...

Merges a symbol file into HDI's current symbol table. The **Load Symbols** dialog box opens:

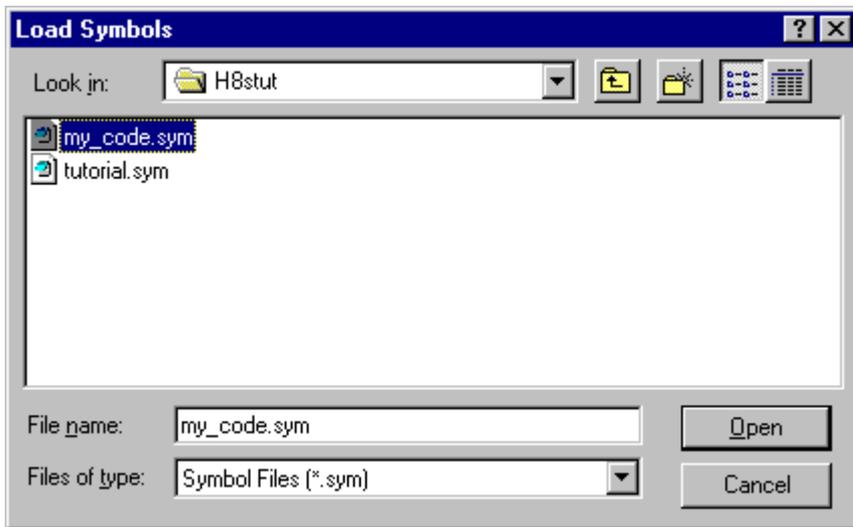


Figure 5.12 Load Symbols Dialog Box

The dialog box operates like a standard Windows[®] open file dialog box; select the file and click **[Open]** to start loading. The standard file extension for symbol files is “.sym”. When the symbol loading is complete a confirmation message box may be displayed showing how many symbols have been loaded (this can be switched off in the Confirmations sheet on the HDI Options dialog).

5.6.10 Save

Saves HDI’s current symbol table to a symbol file.

5.6.11 Save As...

The **Save Symbols** dialog box operates like a standard Windows[®] **Save File As** dialog box. Enter the name for the file in the **File name** field and click **[Open]** to save HDI's current label list to a symbol file. The standard file extension for symbol files is “.sym”.

See appendix C for symbol file format.

5.7 Locals Window

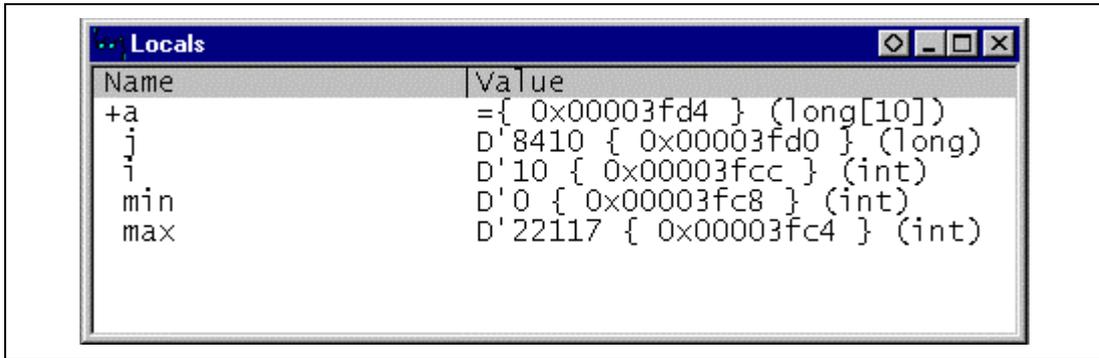


Figure 5.13 Locals Window

Allows the user to view and modify the values of all the local variables. The contents of this window are blank unless the current PC can be associated to a function containing local variables in the source files *via* the debugging information available in the object file.

The following items are displayed.

[Name] Name of the variable

[Value] Value, assigned location, and type.
The assigned location is enclosed by { } and the type is enclosed by ().

The variables are listed with a plus indicating that the information may be expanded by double-clicking on the variable name, and a minus indicating that the information may be collapsed. Alternatively, the plus and minus keys may be used. For more information on the display of information, refer to section 12.3.2, Expanding a Watch.

A popup menu containing the following options is available by right clicking within the window:

5.7.1 Copy



Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

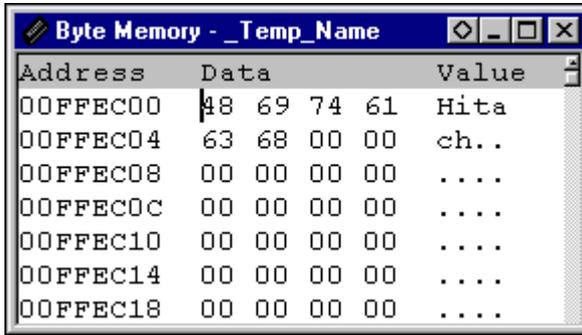
5.7.2 Edit Value...

Launches a dialog box to modify the selected variable's value.

5.7.3 Radix

Changes the radix for the selected local variable display.

5.8 Memory Window



The screenshot shows a window titled "Byte Memory - _Temp_Name". It contains a table with three columns: "Address", "Data", and "Value". The data is as follows:

Address	Data	Value
00FFEC00	48 69 74 61	Hita
00FFEC04	63 68 00 00	ch..
00FFEC08	00 00 00 00
00FFEC0C	00 00 00 00
00FFEC10	00 00 00 00
00FFEC14	00 00 00 00
00FFEC18	00 00 00 00

Figure 5.14 Memory Window

Allows the user to view and modify the contents of the debugging platform's memory. Memory may be viewed in ASCII, byte, word, long word, single-precision floating-point, and double-precision floating-point formats, and the title bar indicates the current view style and the address shown as the offset from the previous label (symbol).

The contents of memory may be edited by either typing at the current cursor position, or by double-clicking on a data item. The latter will launch the **Edit** dialog box, allowing the user to enter a new value using a complex expression. If the data at that address cannot be modified (i.e. within ROM or guarded memory) then the message "Invalid address value" is displayed.

Double-clicking within the Address column will launch the **Set Address** dialog box, allowing the user to enter an address. Clicking the **[OK]** button will update the window so that the address entered in the **Set Address** dialog box is the first address displayed in the top-left corner.

A popup menu containing the following options is available by right clicking within the window:

5.8.1 Refresh

Forcibly updates the **Memory** window contents.

5.8.2 Load...

Launches the **Load Memory** dialog box, allowing the user to load to the debugging platform's memory from an S-Record file (*.mot) without deleting the current debug information. The offset

field may be used to move the address values specified in the file to a different set of addresses. The optional verify flag can be used to check that the information has been downloaded correctly.

5.8.3 Save...

Launches the **Save Memory As** dialog box, allowing the user to save a block of the debugging platform's memory to an S-Record file (*.mot). The start and end fields may be set similarly to the Search option(see section 5.8.8, Search...).

5.8.4 Test...

Launches the **Test Memory** dialog box, allowing the user to validate a block of memory within the debugging platform. The details of the test depend on the debugging platform. The start and end fields may be set similarly to the Search option(see section 5.8.8, Search...).

5.8.5 Fill...

This function is not supported by this simulator/debugger version.

Launches the **Fill Memory** dialog box, allowing the user to fill a block of the debugging platform's memory with a specified value. The start and end fields may be set similarly to the Search option (see section 5.8.8, Search...).

5.8.6 Copy...

Launches the **Copy Memory** dialog box, allowing the user to copy a block of memory within the debugging platform to another location within the same memory space. The blocks may overlap. The start and end fields may be set similarly to the Search option(see section 5.8.8, Search...).

5.8.7 Compare...

Launches the **Compare Memory** dialog box, allowing the user to select a start and an end address in the memory area, to check against another area in memory. If a block of memory is highlighted in a **Memory** window, these will be automatically set as the start and end addresses when the dialog box is displayed.

Similar to Verify memory, but compares two blocks in memory.

5.8.8 Search...

Launches the **Search Memory** dialog box, allowing the user to search a block of the debugging platform's memory for a specified data value. If a block of memory is highlighted, the start and

end fields in the dialog box will be set automatically with the start and end addresses corresponding to the highlighted block, respectively.

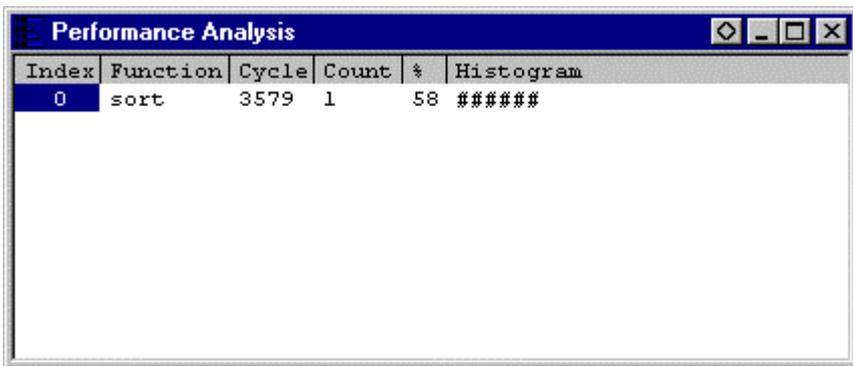
5.8.9 Set Address...

Launches the **Set Address** dialog box, allowing the user to enter a new start address. The window will be updated so that this is the first address displayed in the top-left corner. When an overloaded function or a class name including a member function is entered, the **Select Function** dialog box opens for you to select a function.

5.8.10 ASCII/Byte/Word/Long/Single Float/Double Float

A check mark next to these six options indicates the current view format. The user may select a different option to change to that format.

5.9 Performance Analysis Window



Index	Function	Cycle	Count	%	Histogram
0	sort	3579	1	58	#####

Figure 5.15 Performance Analysis Window

This window displays the number of execution cycles required for the specified functions.

The number of execution cycles can be obtained from the difference between the total number of execution when the target function is called and that when execution returns from the function.

The following items are displayed:

[Index] Index number of the set condition

[Function] Name of the function to be measured (or the start address of the function)

[Cycle] Total number of execution cycles required for the function

[Count]	Total number of calls for the function
[%]	Ratio of execution cycle count required for the function to the execution cycle count required for the whole program
[Histogram]	Histogram display of the above ratio

Double-clicking a function to be evaluated displays the **Performance Option** dialog box. In this dialog box, functions can be modified. Up to 255 functions can be specified.

A popup menu containing the following options is available by right clicking within the view area:

5.9.1 Add Range...

Adds a new function to be evaluated. Clicking this option launches the **Performance Option** dialog box, allowing the user to add a function.

5.9.2 Edit Range...

Only enabled when the highlighting bar is on a user-defined range. Launches the **Performance Option** dialog box, allowing the user to modify the range's settings.

5.9.3 Delete Range

Only enabled when the highlighting bar is on a user-defined range. Deletes the range and immediately recalculates the data for the other ranges.

5.9.4 Reset Counts/Times

Clears the current performance analysis data.

5.9.5 Delete All Ranges

Deletes all the current user-defined ranges, and clears the performance analysis data.

5.9.6 Enable Analysis

Toggles the collection of performance analysis data. When performance analysis is active, a check mark is shown to the left of the text.

5.10 Performance Option Dialog Box

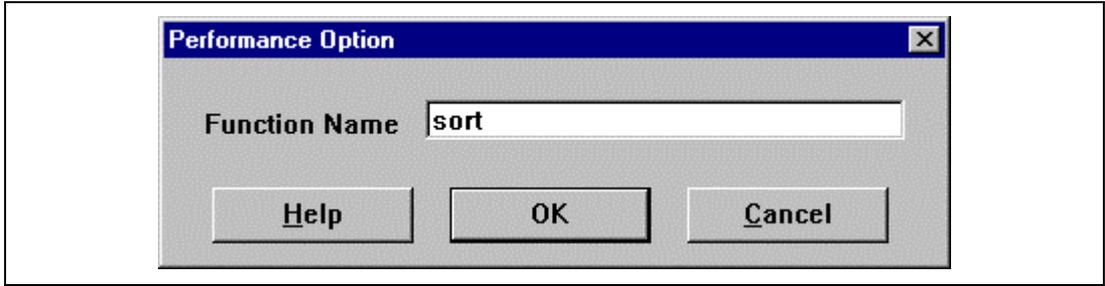


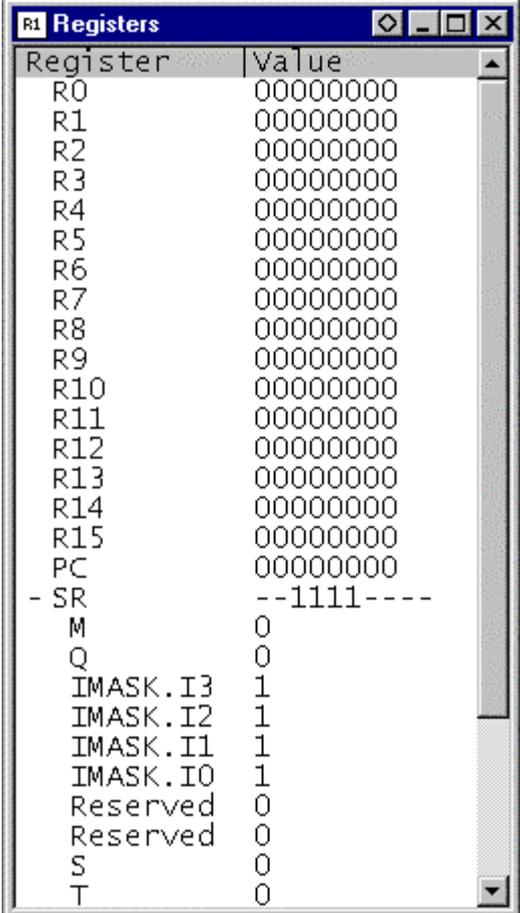
Figure 5.16 Performance Option Dialog Box

This dialog box specifies functions (including labels) to be evaluated. Evaluation results are displayed in the **Performance Analysis** window.

Note that when an overloaded function or a class name including a member function is specified, the **Select Function** dialog box opens. In the dialog box, select a function. For details, refer to section 14, **Selecting Functions**.

Clicking the **[OK]** button stores the setting. Clicking the **[Cancel]** button closes this dialog box without setting the function to be evaluated.

5.11 Registers Window



The screenshot shows a window titled "R1 Registers" with a table of registers and their values. The registers listed are R0 through R15, PC, -SR, M, Q, IMASK.I3 through IMASK.I0, Reserved, S, and T. The values are mostly 0, except for IMASK.I3 through IMASK.I0 which are 1, and -SR which is --1111----

Register	Value
R0	00000000
R1	00000000
R2	00000000
R3	00000000
R4	00000000
R5	00000000
R6	00000000
R7	00000000
R8	00000000
R9	00000000
R10	00000000
R11	00000000
R12	00000000
R13	00000000
R14	00000000
R15	00000000
PC	00000000
-SR	--1111----
M	0
Q	0
IMASK.I3	1
IMASK.I2	1
IMASK.I1	1
IMASK.I0	1
Reserved	0
Reserved	0
S	0
T	0

Figure 5.17 Registers Window

Allows the user to view and modify the current register values.

A popup menu containing the following options is available by right clicking within the window:

5.11.1 Copy



Only available if a block of text is highlighted. This copies the selected text into the Windows® clipboard, allowing it to be pasted into other applications.

5.11.2 Edit...

Launches the **Register** dialog box, allowing the user to set the value of the register indicated by the text cursor (not mouse cursor).

5.11.3 Toggle Bit

Only available if the text cursor is placed on a bit-field, e.g. a flag within a status register. Changes the current state of the bit to its other state, e.g. a set overflow flag can be cleared.

5.12 Source Window

The **Source** window can be used to view any source file that was included within the object file's debug information - this may be C/C++ and assembly language.

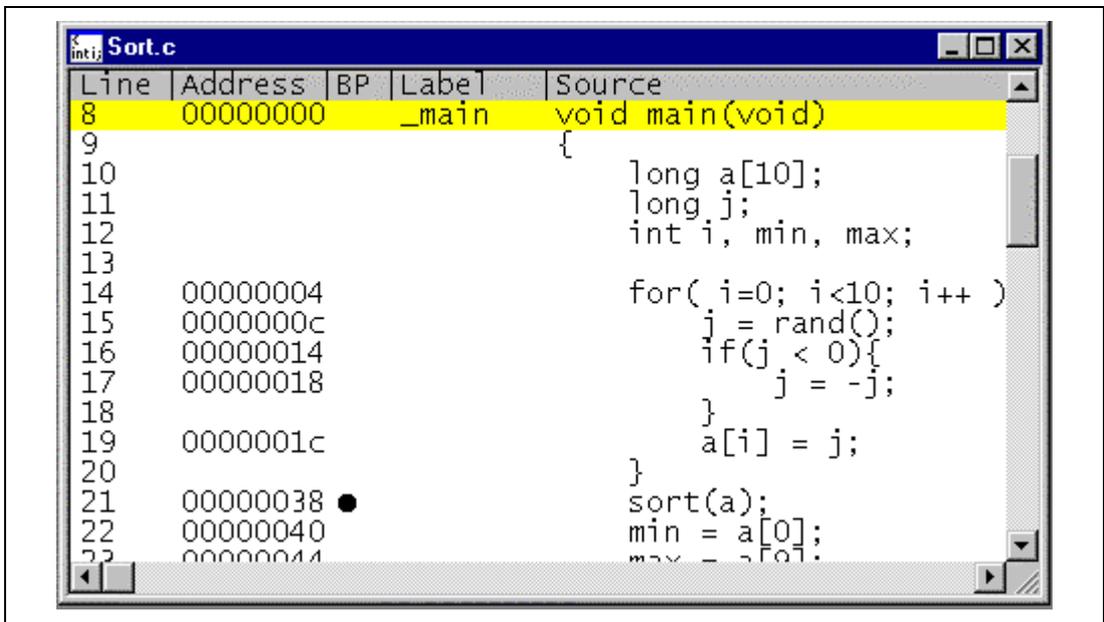


Figure 5.18 Source Window

It supports column-specific double-click actions:

- BP - Sets/clears a program (PC) breakpoint at that address.
- Address - Launches the **Set Address** dialog box, allowing the user to enter a new address. If the address is within the range of this file, then the view will scroll such that the cursor can be positioned correctly. If the address is in a different source file, then that file will be opened in a new window with the cursor set to the specified address. Finally, if the address does not correspond to a source file, then a new **Disassembly** window will be opened. When an

overloaded function or a class name is entered, the **Select Function** dialog box opens for you to select a function.

- **Label** - Launches the **Label** dialog box, allowing the user to enter a new label and edit the name of an existing label.
- **Line** - Launches the **Set Line** dialog box, allowing the user to go directly to a line in the source file.
- **Source** - Opens the source file in the editor (specified in the Startup menu HDI shortcut) at this source line.

Within the BP column a list of currently supported standard breakpoint types can be displayed by right clicking. The currently selected standard breakpoint is shown by a check mark to the left of the menu text.

A popup menu containing the following options is available by right clicking in any of the other columns within the window:

5.12.1 Copy



Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.12.2 Find



Launches the **Find** dialog box, allowing the user to search the source file for a string.

5.12.3 Set Address

Launches the **Set Address** dialog box, allowing the user to enter a new start address. The window will be updated so that this is the first address displayed in the top-left corner. When an overloaded function or a class name is entered, the **Select Function** dialog box opens for you to select a function.

5.12.4 Set Line

Launches the **Set Line** dialog box, allowing the user to display and move the text cursor (not the mouse cursor) to a specific line.

5.12.5 Go To Cursor



Commences to execute the user program starting from the current PC address. The program will continue to run until the PC reaches the address indicated by the text cursor (not the

mouse cursor) or another break condition is satisfied. Grayed if not supported by the debugging platform.

5.12.6 Set PC Here

Changes the value of the PC to the address indicated by the text cursor (not the mouse cursor).

5.12.7 Instant Watch...

Launches the **Instant Watch** dialog box with the name extracted from the view at the current text cursor (not mouse cursor) position.

5.12.8 Add Watch

Adds the name extracted from the view at the current text cursor (not mouse cursor) position to the list of watched variables. If the **Watch** window is not open, then it is opened and brought to the top of the child windows.

5.12.9 Go to Disassembly

Opens a Disassembly view at the address matching the current source line.

5.13 System Status Window

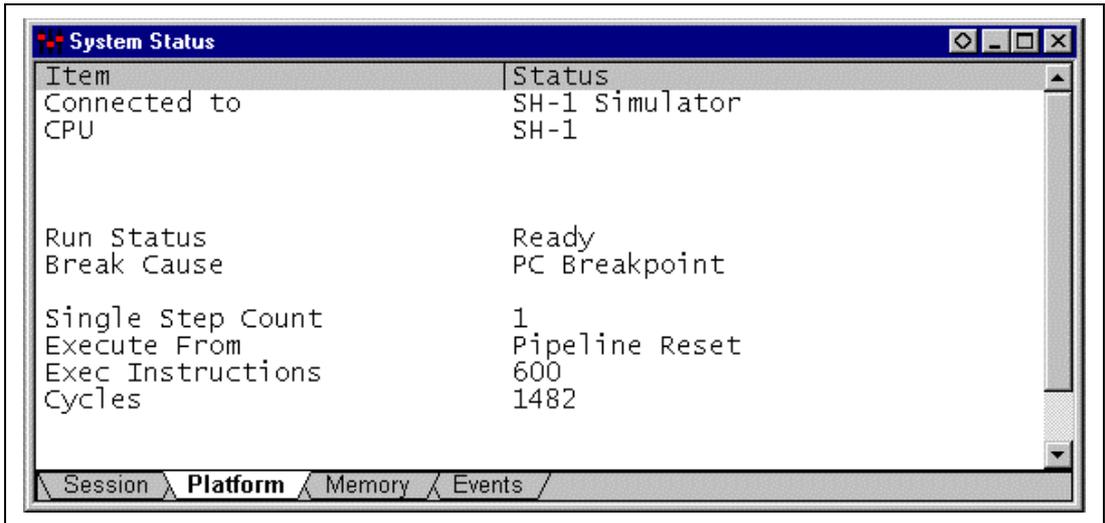


Figure 5.19 System Status Window

Allows the user to view the current status of the debugging platform.

The **System Status** window is split into four panes:

1. Session - contains information about the current session including the connected debugging platform and the names of loaded files.
2. Platform - contains information about the current status of the debugging platform, typically including CPU type and mode; run status; and timing information.
3. Memory - contains information about the current memory status including the memory mapping resources and the areas used by the currently loaded object file.
4. Events - contains information about the current event (breakpoint) status, including resource information.

A popup menu containing the following options is available by right clicking within the window:

5.13.1 Update

Updates the displayed data.

5.13.2 Copy



Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.14 Trace Window

This window displays trace information. The displayed information items depend on the target CPU. The trace acquisition conditions can be specified in the **Trace Acquisition** dialog box.

SH-1, SH-2, SH-2E, and SH-DSP Series:

PTR	CYCLE	--ADDR--	--PIPELINE--	-----INSTRUCTION-----	Source
-0660	0000000000			: PIPELINE RESET	void main(void)
-0659	0000000002	00000000	FFDE>MM	: STS.L PR, @-R15 00003FFC<-00000000	void main(void)
-0658	0000000004	00000002	fD>E>	: ADD #C8, R15 R15<-00003FC4	
-0657	0000000006	00000004	FFD>E>	: MOV #00, R3 R3<-00000000	for(i=0; i<10; i++){
-0656	0000000008	00000006	f>D>EMM	: MOV.L R3, @(00000008, R15) 00003FCC<-00000000	
-0655	0000000009	00000008	FFDE>	: BRA 00000030 PC<-00000030	
-0654	0000000013	0000000A	f->D>E	: NOP	
-0653	0000000014	00000030	FFDE>	: MOV #0A, R2 R2<-0000000A	
-0652	0000000016	00000032	fD>EMMW	: MOV.L @(00000008, R15), R1 R1<-00000000	
-0651	0000000019	00000034	FFD<<E>	: CMP/GE R2, R1 T<-(0)	
-0650	0000000021	00000036	f<<D>E>	: BF 0000000C T(0), PC<-0000000C	
-0649	0000000023	00000038	FFD	:	sort(a);
-0648	0000000023	0000003A	f	:	
-0647	0000000025	0000000C	FFDE>MMW	: MOV.L @(00000078, PC), R1 R1<-00000190	j = rand();
-0646	0000000029	0000000E	fD<<E	: JSR @R1 PC<-00000190	
-0645	0000000032	00000010	FF<<D>E	: NOP	

Figure 5.20 Trace Window (for SH-1, SH-2, SH-2E, and SH-DSP Series)

This window displays the following trace information items:

- [PTR] Pointer in the trace buffer (0 for the last executed instruction)
- [CYCLE] Total number of instruction execution cycles (cleared by pipeline reset)
- [ADDR] Instruction address
- [PIPELINE] Pipeline execution status

Each symbol has the following meaning:

- F: Instruction fetch (with memory access)
- f: Instruction fetch (without memory access)
- D: Instruction decode
- E: Instruction execution
- M: Memory access
- W: Write back
- P: DSP
- m: Multiplier execution
- : Stall inherent in the instruction
- >: Split
- <: Stall due to conflict

Refer to the programming manual of each device for more information on pipeline operation.

- [INSTRUCTION] Instruction mnemonic and data access (displayed in the form of [Transfer destination <- Transfer data])

- [Source] C/C++ or assembly-language source programs

SH-3 and SH-3E Series:

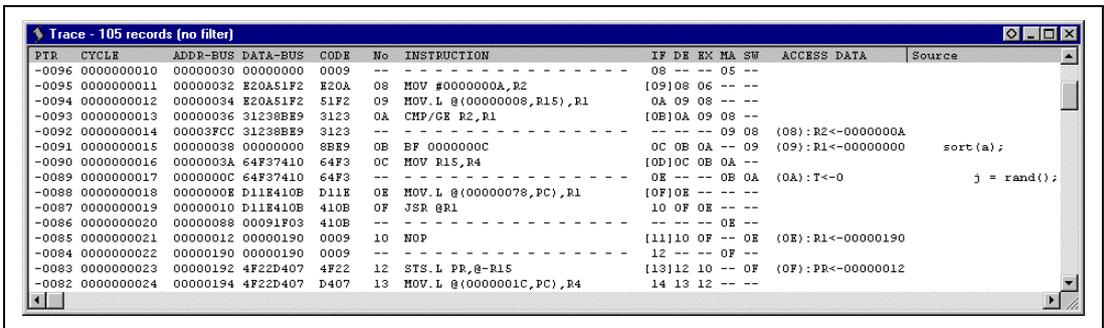


Figure 5.21 Trace Window (for SH-3 and SH-3E Series)

This window displays the following trace information items:

[PTR]	Pointer in the trace buffer (0 for the last executed instruction)
[CYCLE]	Total number of instruction execution cycles (cleared by pipeline reset)
[ADDR-BUS]	Data on the address bus
[DATA-BUS]	Data on the data bus
[CODE]	Instruction code
[No]	Instruction number (corresponds to execution number in each stage)
[INSTRUCTION]	Instruction mnemonic
[IF]	Instruction number that was fetched (enclosed by [] when the instruction did not access memory)
[DE]	Instruction number that was decoded
[EX]	Instruction number that was executed
[MA]	Instruction number that accessed memory
[SW]	Instruction number that wrote back data
[ACCESS DATA]	Data access information (display format: destination <- accessed data)
[Source]	C/C++ or assembly-language source programs

SH-3DSP Series:

PTR	CYCLE	ADDRESS	CODE	IF DE EX MA SW	No	INSTRUCTION	Source
-00101	000000000	-----	0009	-- -- -- -- --	--	-----	-----
-00100	000000001	-----	0009	01 -- -- 00 --	--	-----	-----
-00099	000000002	00000000	4F22	02 01 -- -- --	01	STS.L PR,@-R15	void main(void)
-00098	000000003	00000002	7FC8	03 02 01 -- --	02	ADD #CS,R15	
-00097	000000004	00000004	E300	[04]03 02 01 --	03	MOV #00000000,R3	for(i=0; i<10; i++){
-00096	000000006	00000006	1F32	05 04 03 02 01	04	MOV.L R3,@(00000008,R15)	
-00095	000000007	00000008	A012	[06]05 04 03 02	05	BRA 00000030	
-00094	000000008	0000000A	0009	-- 06 05 04 03	06	NOP	
-00093	000000010	-----	0009	08 -- -- 05 --	--	-----	-----
-00092	000000011	00000030	E20A	09 08 06 -- --	08	MOV #0000000A,R2	
-00091	000000012	00000032	51F2	0A 09 08 -- --	09	MOV.L @ (00000008,R15),R1	
-00090	000000013	00000034	3123	[0E]0A 09 08 --	0A	CHP/GE R2,R1	
-00089	000000014	-----	3123	-- -- -- 09 08	--	-----	-----
-00088	000000015	00000036	8BE9	0C 0B 0A -- 09	0B	BF 0000000C	
-00087	000000016	00000038	64F3	[0D]0C 0B 0A --	0C	MOV R15,R4	sort(a);

Figure 5.22 Trace Window (for SH-3DSP Series)

This window displays the following trace information items:

[PTR]	Pointer in the trace buffer (0 for the last executed instruction)
-------	---

[CYCLE]	Total number of instruction execution cycles (cleared by pipeline reset)
[ADDRESS]	Program counter value
[CODE]	Instruction code
[IF]	Instruction number that was fetched (enclosed by [] when the instruction did not access memory)
[DE]	Instruction number that was decoded
[EX]	Instruction number that was executed
[MA]	Instruction number that accessed memory
[SW]	Instruction number that wrote back data
[No]	Instruction number (corresponds to execution number in each stage)
[INSTRUCTION]	Instruction mnemonic and data access information (display format: destination <- accessed data)
[Source]	C/C++ or assembly-language source programs

PTR	CYCLE	ADDRESS	code1	code2	EX-EAS	LS-EAS	BR-EAS	FP-EXASD	INSTRUCTION	ACCESS DATA	Source	
-0789	0000036005	00000034	xxxx	*1F32	2	x	x	x	x	x	x	
-0788	0000036006	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0787	0000036007	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0786	0000036008	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0785	0000036009	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0784	0000036010	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0783	0000036011	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0782	0000036012	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0781	0000036013	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0780	0000036014	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0779	0000036015	00000038	E20A	*1F32	2	x	x	x	x	x	x	sort(a);
-0778	0000036016	00000038	xxxx	*51F2	4	2	x	x	x	x	x	[4 (00000030): E20A MOV #0A, R2] R3<-00000008 sort(a);
-0777	0000036017	00000038	xxxx	xxxx	x	4	2	5	3	x	x	[5 (00000032): 51F2 MOV.L @(8, R15), R1] sort(a);
-0776	0000036018	00000038	xxxx	xxxx	x	4	x	5	3	x	x	R3<-00000009 sort(a);
-0775	0000036019	00000038	xxxx	xxxx	x	4	x	5	3	x	x	00003FCC<-00000009 sort(a);
-0774	0000036020	00000038	xxxx	xxxx	x	4	x	5	3	x	x	sort(a);
-0773	0000036021	00000038	xxxx	xxxx	x	4	x	5	3	x	x	sort(a);

Figure 5.23 Trace Window (for SH-4 Series)

This window displays the following trace information items:

- [PTR] Pointer within the trace buffer (The latest instruction is 0)

- [CYCLE] Total number of instruction execution cycles (cleared by pipeline reset). The CPU internal clock cycles are counted as execution cycles. For the SH-4BSC, one execution cycle is equivalent to three external cycles.

- [ADDRESS] Program counter value

- [code1] Fetched code 1

- [code2] Fetched code 2

The code currently decoded is marked with *. If the two codes are executed in parallel, the code fetched at the smaller address is marked with *.

- [EX-EAS] Instruction number that was executed (in the E stage), accessed memory (in the A stage), or wrote back data (in the S stage) in the EX pipeline

- [LS-EAS] Instruction number that was executed, accessed memory, or wrote back data in the LS pipeline

- [BR-EAS] Instruction number that was executed, accessed memory, or wrote back data in the BR pipeline

- [FP-EXASD] Instruction number that was executed, accessed memory, or wrote back data in the FP pipeline (only for FSCA, FSRRA, FIPR, and FTRV instructions in the X stage, and for FDIV and FSQRT instructions in the D stage)

[INSTRUCTION] Instruction number assigned to the instruction to be executed, memory address, instruction code, and mnemonic of that instruction.

[ACCESS DATA] Data access information (display format: destination <- transfer data)

[Source] C/C++ or assembly-language source programs

Double-clicking a line in the **Trace** window opens the **Source** window or **Disassembly** window. In the window, the source code is displayed and the selected line is indicated by the cursor.

A popup menu containing the following options is available by right clicking within the window:

5.14.1 Find...

Launches the **Trace Search** dialog box, allowing the user to search the current trace buffer for a specific trace record.

5.14.2 Find Next

If a find operation is successful, and the item found is non-unique, then this will move to the next similar item.

5.14.3 Filter...

This function is not supported by this simulator/debugger version.

Launches the **Filter Trace** dialog box, allowing the user to mask out all unnecessary trace entries.

5.14.4 Acquisition

Launches the **Trace Acquisition** dialog box, allowing the user to define the area of user program to be traced. This is useful to focus tracing on problem areas.

5.14.5 Halt

This function is not supported by this simulator/debugger version.

Stops tracing data and updates the trace information without stopping execution of the user program.

5.14.6 Restart

Starts tracing data.

5.14.7 Snapshot

This function is not supported by this simulator/debugger version.

Updates the trace information to show the debugging platform's current status without stopping user program execution.

5.14.8 Clear

Empties the trace buffer in the debugging platform. If more than one trace window is open, all **Trace** windows will be cleared as they all access the same buffer.

5.14.9 Save...

Launches the **Save As** file dialog box, allowing the user to save the contents of the trace buffer as a text file. It is possible to define a numeric range based on the Cycle number or to save the complete buffer (saving the complete buffer may take several minutes). Note that this file cannot be reloaded into the trace buffer.

5.14.10 View Source

Opens a **Source** or **Disassembly** window for the address.

5.14.11 Trim Source

Removes white space from the left side of the source.

5.15 Trace Acquisition Dialog Box

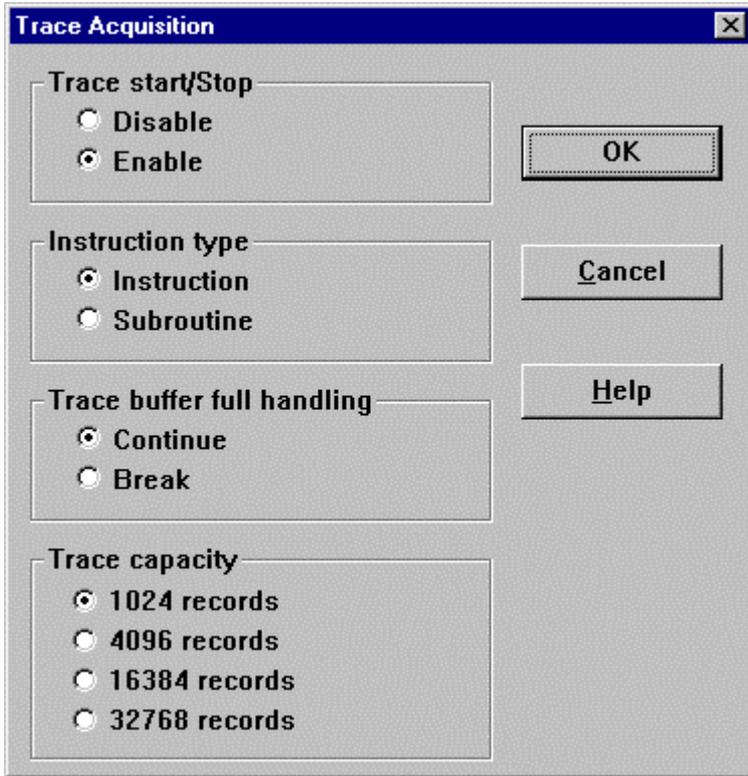


Figure 5.24 Trace Acquisition Dialog Box

This dialog box specifies the conditions for trace information acquisition.

[Trace start/Stop]

- [Disable] Disables trace information acquisition.
- [Enable] Enables trace information acquisition.

[Instruction type]

- [Instruction] Acquires trace information for all instructions.
- [Subroutine] Acquires trace information for the subroutine instructions only.

[Trace buffer full handling]

- [Continue] Continues acquiring trace information even if the trace information acquisition buffer becomes full.
- [Break] Stops execution when the trace information acquisition buffer becomes full.

The trace buffer capacity can be selected from 1024 records, 4096 records, 16384 records, and 32768 records in the [Trace capacity].

Clicking the [OK] button stores the settings. Clicking the [Cancel] button closes this dialog box without modifying the settings.

5.16 Trace Search Dialog Box

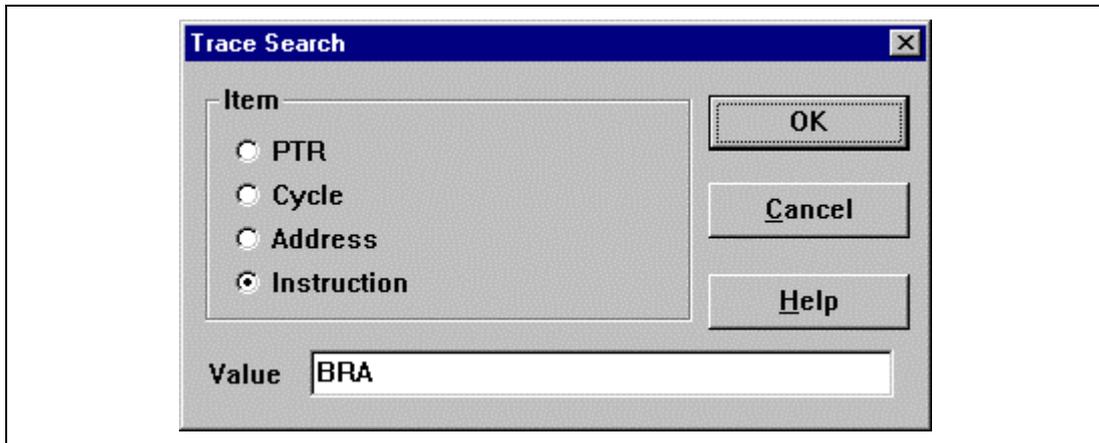


Figure 5.25 Trace Search Dialog Box

This dialog box specifies the conditions for searching trace information. Specify a search item in [Item] and search for the specified contents in [Value].

- | | |
|---------------|--|
| [PTR] | Pointer in the trace buffer (0 for the last executed instruction, specify in the form of -nnn) |
| [Cycle] | Total number of instruction execution cycles |
| [Address] | Instruction address |
| [Instruction] | Instruction mnemonic |

Clicking the [OK] button stores the settings. Clicking the [Cancel] button closes this dialog box without searching.

5.17 Watch Window

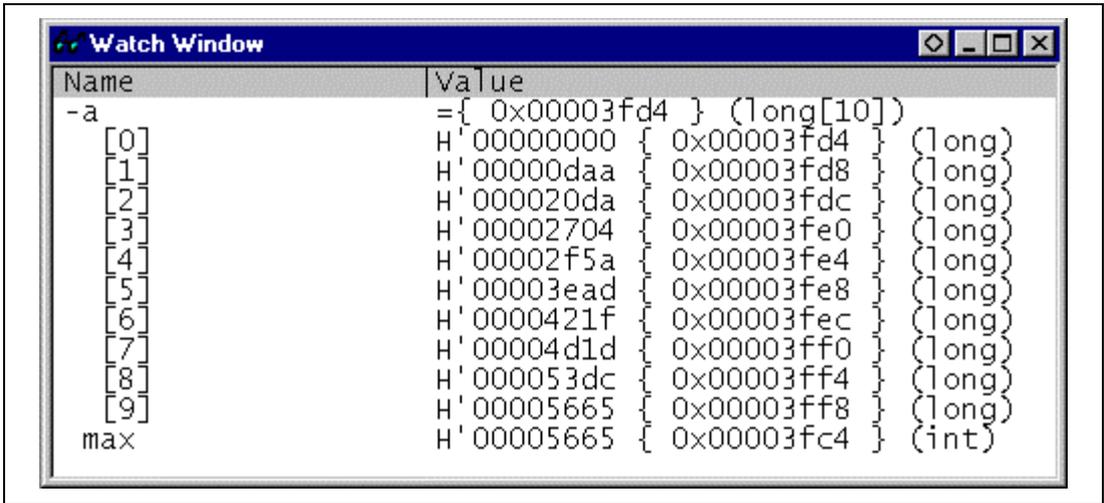


Figure 5.26 Watch Window

Allows the user to view and modify C/C++-source level variables. The contents of this window are blank unless the current user program can be associated to a C/C++-source file *via* the debugging information available in the absolute file (*.abs).

The following items are displayed.

[Name] Name of the variable

[Value] Value, assigned location, and type.
The assigned location is enclosed by { } and the type is enclosed by ().

The variables are listed with a plus indicating that the information may be expanded by double-clicking on the variable name, and a minus indicating that the information may be collapsed. Alternatively, the plus and minus keys may be used.

A popup menu containing the following options is available by right clicking within the windows:

5.17.1 Copy



Only available if a block of text is highlighted. This copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.17.2 Delete

Removes the variable indicated by the text cursor (not the mouse cursor) from the **Watch** window.

5.17.3 Delete All

Removes all the variables from the **Watch** window.

5.17.4 Add Watch...

Launches the **Add Watch** dialog box, allowing the user to enter a variable or expression to be watched.

5.17.5 Edit Value...

Launches the **Value** dialog box, allowing the user to change the variable's value. Particular care should be taken when the value of a pointer is changed as it may no longer point to valid data.

5.17.6 Radix

Modifies the radix for the selected watch item display.

5.18 System Configuration Dialog Box

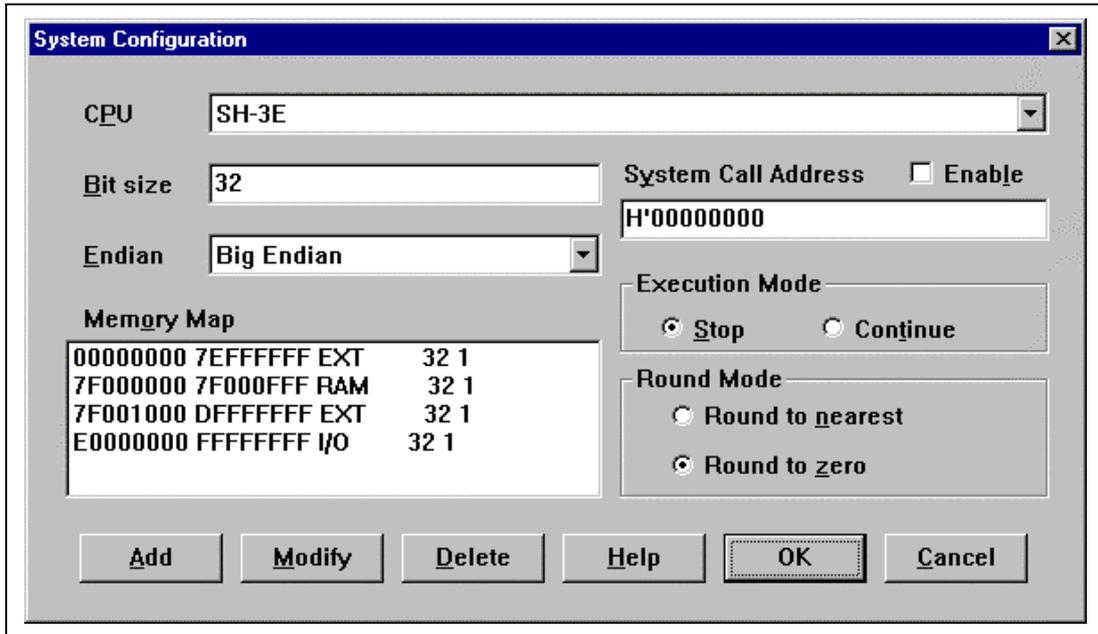


Figure 5.27 System Configuration Dialog Box

This dialog box specifies the endian, system call start location, execution mode, floating-point rounding mode, and memory map.

[CPU] Displays the current CPU. (The CPU must be specified in the **Select Session** dialog box.)

For the SH-DSP, Internal Mode or External Mode is selected.

For SH-DSP (SH7065), one of the following is selected:

- [ROM Disable/Fast Mode] Specifies internal ROM disabled/fast access mode.
- [ROM Disable/Slow Mode] Specifies internal ROM disabled/slow access mode.
- [ROM Enable/Fast Mode] Specifies internal ROM enabled/fast access mode.
- [ROM Enable/Slow Mode] Specifies internal ROM enabled/slow access mode.

For SH-2DSP, one of the following is selected:

- [ROM Disable] Specifies internal ROM disabled mode.
- [ROM Enable] Specifies internal ROM enabled mode.

[Bit size] Displays the address bus width. It is fixed to 32 bits.

[Endian] Specifies big endian or little endian (for the SH-1, SH-2, SH-2E series, SH-DSP, and SH-2DSP, this item is fixed as Big Endian)

[System Call Address] Specifies the start address of a system call that performs standard input/output or file input/output processing from the user system.
[Enable] Specifies whether the system call is enabled or disabled.

[Execution Mode] Specifies whether the simulator/debugger stops or continues operating when a simulation error occurs.

- [Stop] Stops the simulation.
- [Continue] Continues the simulation.

[Round Mode] Specifies the rounding mode for floating-point decimal-to-binary conversion.

- [Round to nearest] Rounds to the nearest value.
- [Round to zero] Rounds toward zero.

In the **[Memory Map]**, the start address, end address, memory type, data bus width, and access cycles are displayed in that order. The memory types are as follows:

- SH-1, SH-2, SH-2E, SH-3, SH-3E, and SH-3DSP Series
ROM (internal ROM), RAM (internal RAM), EXT (external memory), I/O (internal I/O)
- SH-DSP
XROM (internal XROM), YROM (internal YROM), XRAM (internal XRAM), YRAM (internal YRAM), EXT (external memory), I/O (internal I/O)
- SH-DSP with Cache
XRAM (internal XRAM), YRAM (internal YRAM), INTRAM (internal RAM), EXT (external memory), I/O (internal I/O)

- SH-DSP (SH7065)
XRAM (internal XRAM), YRAM (internal YRAM), INTROM (internal ROM), EXT (external memory), I/O (internal I/O)
- SH-2DSP
XRAM (internal XRAM), YRAM (internal YRAM), INTROM (internal ROM), INTRAM (internal RAM), EXT (external memory), I/O (internal I/O)
- SH-4/SH-4 (SH7750R)
NORMAL (normal memory), INTRAM (internal RAM), I/O (internal I/O)
- SH-4 BSC
NORMAL (normal memory), MPX (Multiplex), BCSRAM (byte-control SRAM), BSTROM (burst ROM and burst count), DRAM (DRAM), SDRAM (synchronous DRAM), INTRAM (internal RAM), I/O (internal I/O)

[Memory Map] can be specified, modified, or deleted using the following buttons:

- [Add]** Specifies **[Memory Map]** items. Clicking this button opens the **Memory Map Modify** dialog box, and memory map items can be specified.
- [Modify]** Modifies **[Memory Map]** items. Select an item to be modified in the list box and click the **[Modify]** button. The **Memory Map Modify** dialog box opens and memory map items can be modified.
- [Delete]** Deletes **[Memory Map]** items. Select an item to be deleted in the list box and click the **Delete** button.

Notes: For the SH-4BSC, the following must be noted:

1. The access cycle count is displayed as --.
2. Memory map entries cannot be newly created or canceled. Therefore, only the **[Modify]** button can be used for **[Memory Map]**.
3. For the internal RAM and I/O, the memory map entries cannot be modified. To enable or disable the internal RAM, use the ORA bit of the CCR control register.
4. The memory map contents depend on the BSC settings. If the memory map contents cannot be determined due to BSC incorrect settings, this dialog box shows ?????? for memory types and ?? for the bus width.

Clicking the **[OK]** button stores the modified settings. Clicking the **[Cancel]** button closes this dialog box without modifying the settings.

5.19 Memory Map Modify Dialog Box

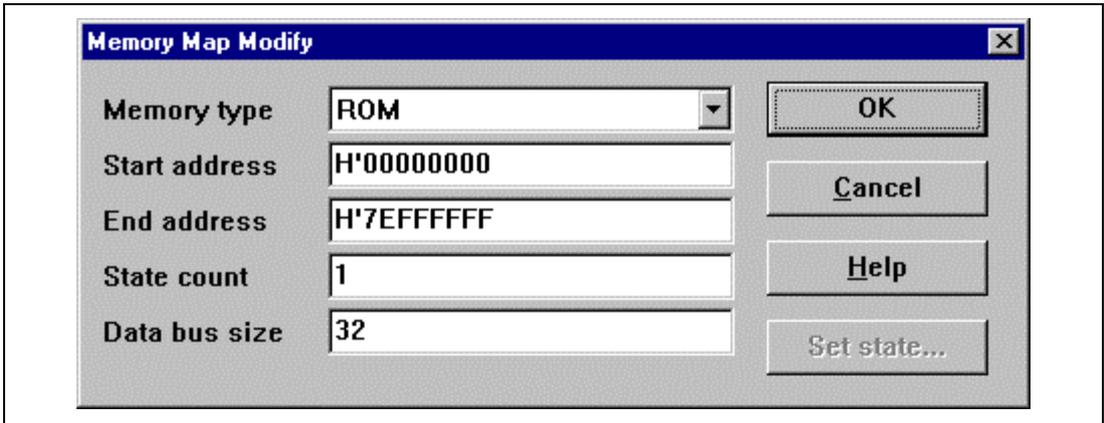


Figure 5.28 Memory Map Modify Dialog Box

This dialog box specifies the memory map of the target CPU of the simulator/debugger.

The contents displayed in this dialog box depend on the target CPU. The specified data is used to calculate the number of cycles for memory access.

[Memory type] Memory type

[Start address] Start address of the memory corresponding to a memory type

[End address] End address of the memory corresponding to a memory type

[State count] Number of memory access cycles

[Data bus size] Memory data bus width

For the SH-4 series, [Start address] and [End address] cannot be modified. Specify [Memory type] and [Data bus size].

In addition, for the SH-4 series, clicking the [Set state...] button opens the Set State dialog box, and the number of wait states to be inserted in areas 0 to 7 can be specified. The specified values correspond to the values in the WCR1 and WCR2 control registers.

Clicking the [OK] button stores the settings. Clicking the [Cancel] button closes this dialog box without modifying the settings.

Note: The memory map setting for the area allocated to a system memory resource cannot be deleted or modified. First delete the system memory resource allocation with the Memory Map dialog box, then delete or modify the memory map setting.

5.20 Set State Dialog Box

This dialog box specifies the wait state to be inserted in each area. This dialog box is provided only for the SH-4 series.

Note that only the normal memory is supported for the SH-4/SH-4 (SH7750R).

The **Set State** dialog box contents depend on the memory type allocated to the target area. The values set in this dialog box are also set to the WCR1 and WCR2 control registers.

Normal Memory, Burst ROM, and Byte-Control SRAM:



Figure 5.29 Set State Dialog Box (Normal Memory)

[Inserted Idle Cycle] Specifies the number of idle cycles to be inserted when the access type changes from read to write, or when the access area changes (corresponds to the AnIW in WCR1).

[Inserted Wait Cycle] Specifies the number of wait cycles to be inserted in all accesses (corresponds to the AnW in WCR2).

DRAM:

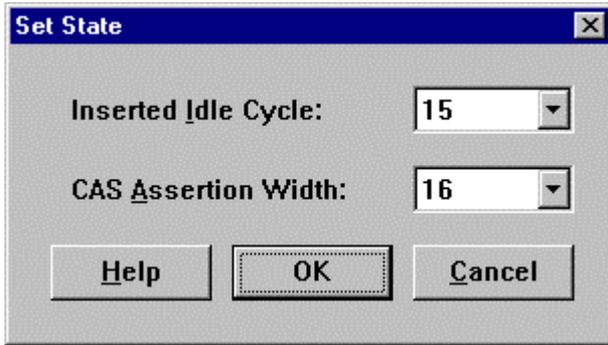


Figure 5.30 Set State Dialog Box (DRAM)

[Inserted Idle Cycle] Specifies the number of idle cycles to be inserted when the access type changes from read to write, or when the access area changes (corresponds to the AnIW in WCR1).

[CAS Assertion Width] Specifies the $\overline{\text{CAS}}$ assertion period (corresponds to the AnW in WCR2).

SDRAM:

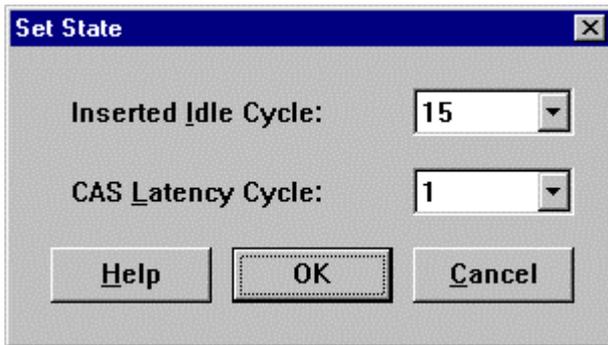


Figure 5.31 Set State Dialog Box (SDRAM)

[Inserted Idle Cycle] Specifies the number of idle cycles to be inserted when the access type changes from read to write, or when the access area changes (corresponds to the AnIW in WCR1).

[CAS Latency Cycle] Specifies the number of $\overline{\text{CAS}}$ latency cycles (corresponds to AnW in WCR2).

MPX:

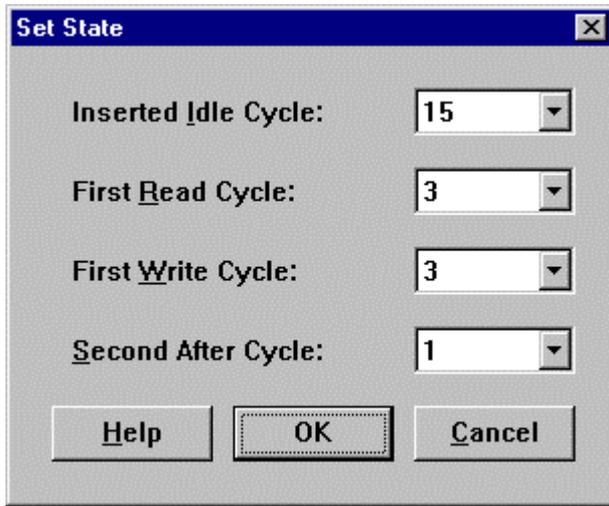


Figure 5.32 Set State Dialog Box (MPX)

- [Inserted Idle Cycle] Specifies the number of idle cycles to be inserted when the access type changes from read to write, or when the access area changes (corresponds to the AnIW in WCR1).
- [First Read Cycle]* Specifies the number of cycles to be inserted in the first cycle for the read access.
- [First Write Cycle]* Specifies the number of cycles to be inserted in the first cycle for the write access.
- [Second After Cycle]* Specifies the number of cycles to be inserted in the second and the following cycles for the burst transfer.

The items marked with * correspond to the AnW in WCR2.

5.21 Memory Map Dialog Box

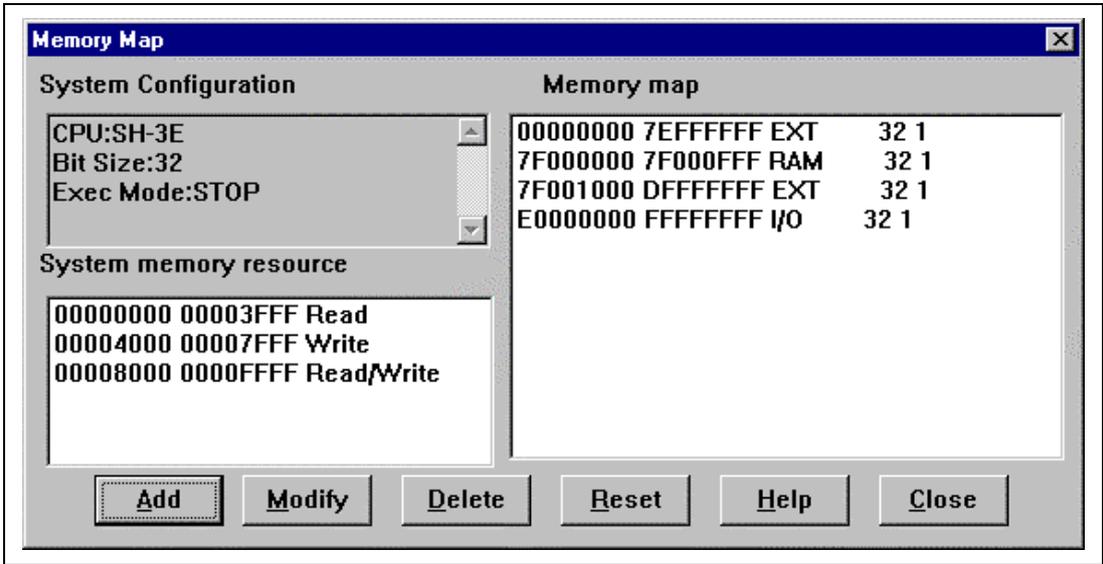


Figure 5.33 Memory Map Dialog Box

This dialog box displays a memory map and information on the target CPU.

[System Configuration] Displays the target CPU, address bus width, and execution mode of the simulator/debugger.

[System memory resource] Displays the access type, start address, and end address of the current memory resources.

[Memory map] Displays the start address, end address, memory type, data bus width, and access cycles.

[System memory resource] can be specified, modified, and deleted using the following buttons:

[Add] Specifies [System memory resource] items. Clicking this button opens the **System Memory Resource Modify** dialog box, and [System memory resource] items can be specified.

[Modify] Modifies [System memory resource] items. Select an item to be modified in the list box and click this button. The **System Memory Resource Modify** dialog box opens and [System memory resource] items can be modified.

[Delete] Deletes [System memory resource] items. Select an item to be deleted in the list box and click this button.

Note that the **[Reset]** button can reset the **[Memory map]** and **[System memory resource]** to the default value. Clicking the **[Close]** button closes this dialog box.

5.22 System Memory Resource Modify Dialog Box

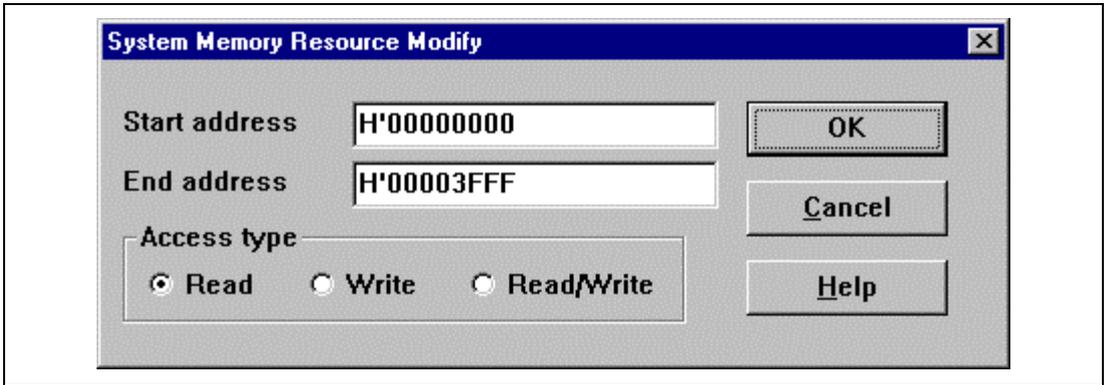


Figure 5.34 System Memory Resource Modify Dialog Box

This dialog box specifies or modifies system memory settings.

[Start address] Start address of the memory area to be allocated

[End address] End address of the memory area to be allocated

[Access type] Access type

Read: Read only

Write: Write only

Read/Write: Read and write

Click the [OK] button after specifying the [Start address], [End address], and [Access type].

Clicking the [Cancel] button closes this dialog box without modifying the setting.

5.23 Control Registers Window

This window displays the following control register values. This window is provided only for the SH-3, SH-3E, SH-3DSP, SH-4 series, and SH-DSP with Cache. The displayed contents depend on the target CPU.

SH-3 and SH-3E Series:

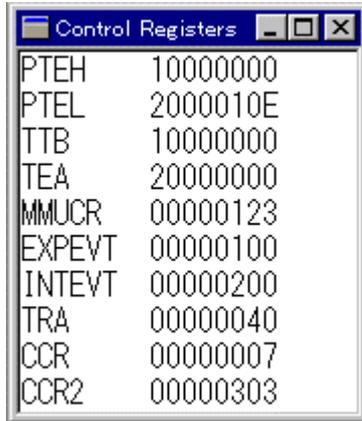


Register Name	Value
PTEH	10000000
PTEL	2000010E
TTb	10000000
TEA	20000000
MMUCR	00000123
EXPEVT	00000100
INTEVT	00000200
TRA	00000040
CCR	00000023

Figure 5.35 Control Registers Window (for SH-3 and SH-3E Series)

[PTEH]	Page table entry high register
[PTEL]	Page table entry low register
[TTb]	Translation table base register
[TEA]	TLB exception address register
[MMUCR]	MMU control register
[EXPEVT]	Exception event register
[INTEVT]	Interrupt event register
[TRA]	TRAPA exception register
[CCR]	Cache control register

SH-3DSP Series:

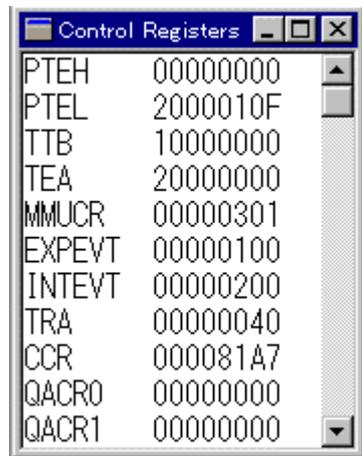


Register	Value
PTEH	10000000
PTEL	2000010E
TTB	10000000
TEA	20000000
MMUCR	00000123
EXPEVT	00000100
INTEVT	00000200
TRA	00000040
CCR	00000007
CCR2	00000303

Figure 5.36 Control Registers Window (for SH-3DSP Series)

In addition to the registers displayed for the SH-3 and SH-3E series, the CCR2 (cache control register 2) is displayed for the SH-3DSP series.

SH-4 Series:



Register	Value
PTEH	00000000
PTEL	2000010F
TTB	10000000
TEA	20000000
MMUCR	00000301
EXPEVT	00000100
INTEVT	00000200
TRA	00000040
CCR	000081A7
QACR0	00000000
QACR1	00000000

Figure 5.37 Control Registers Window (for SH-4 Series)

In addition to the registers displayed for the SH-3 and SH-3E series, the following registers are displayed for the SH-4 series.

[QACR0 and QACR1] Queue address control registers 0 and 1

[SAR0 to SAR3]	DMA source address registers 0 to 3
[DAR0 to DAR3]	DMA destination address registers 0 to 3
[DMATCR0 to DMATCR3]	DMA transfer count registers 0 to 3
[CHCR0 to CHCR3]	DMA channel control registers 0 to 3
[DMAOR]	DMA operation register
[MCR]	Individual memory control register
[BCR1 and BCR2]	Bus control registers 1 and 2
[WCR1 to WCR3]	Wait state control registers 1 to 3
[RTCSR]	Refresh timer control/status register
[RTCNT]	Refresh timer counter
[RTCOR]	Refresh time constant register
[RFCR]	Refresh count register

SH-DSP with Cache:



Figure 5.38 Control Registers Window (for SH-DSP with Cache)

Only the CCR (cache control register) is displayed for the SH-DSP with Cache.

The control register values can be directly modified in the window. Double-clicking a register opens the corresponding dialog box. In this dialog box, the register value can be modified in bit or field units.

5.24 PTEH Dialog Box

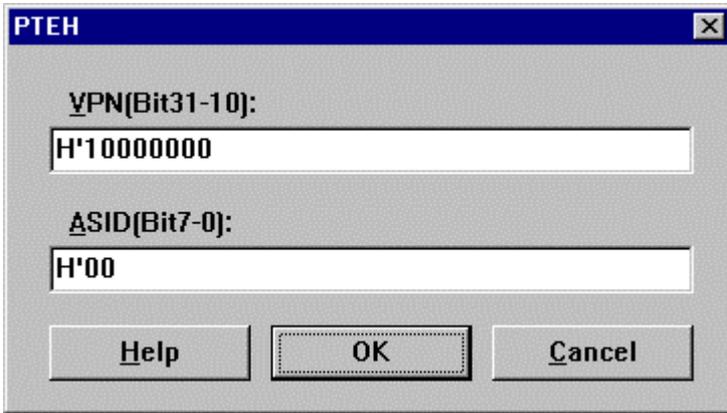


Figure 5.39 PTEH Dialog Box

This dialog box specifies the following values of the page table entry high register (PTEH). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series.

[VPN] Virtual page number in longword size.

[ASID] Address space ID.

Clicking the [OK] button stores the modified values in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified values.

5.25 PTEL Dialog Box

This dialog box specifies the following values of the page table entry low register (PTEL). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series. The displayed contents depend on the target CPU.

SH-3, SH-3E, and SH-3DSP Series:

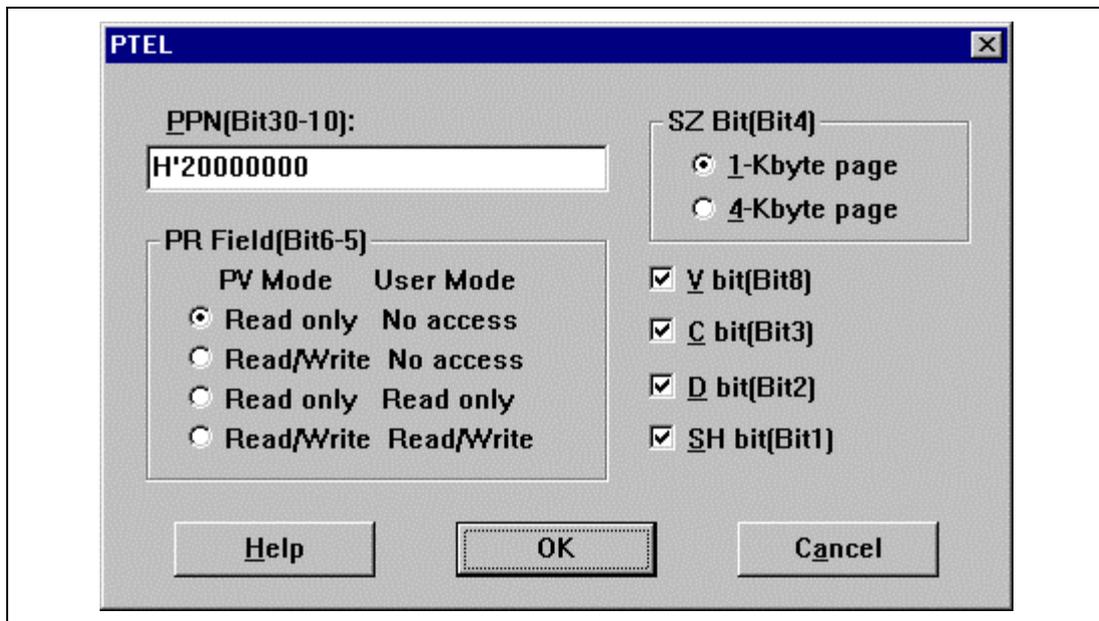


Figure 5.40 PTEL Dialog Box (for SH-3, SH-3E, and SH-3DSP Series)

[PPN]	Physical page number in longword size.															
[PR Field]	Page protection status.															
	<table> <thead> <tr> <th>PV Mode</th> <th>User Mode</th> <th></th> </tr> </thead> <tbody> <tr> <td><input checked="" type="radio"/> Read only</td> <td><input type="radio"/> No access</td> <td>Enables read in privileged mode.</td> </tr> <tr> <td><input type="radio"/> Read/Write</td> <td><input type="radio"/> No access</td> <td>Enables read and write in privileged mode.</td> </tr> <tr> <td><input type="radio"/> Read only</td> <td><input type="radio"/> Read only</td> <td>Enables read in privileged or user mode.</td> </tr> <tr> <td><input type="radio"/> Read/Write</td> <td><input type="radio"/> Read/Write</td> <td>Enables read and write in privileged or user mode.</td> </tr> </tbody> </table>	PV Mode	User Mode		<input checked="" type="radio"/> Read only	<input type="radio"/> No access	Enables read in privileged mode.	<input type="radio"/> Read/Write	<input type="radio"/> No access	Enables read and write in privileged mode.	<input type="radio"/> Read only	<input type="radio"/> Read only	Enables read in privileged or user mode.	<input type="radio"/> Read/Write	<input type="radio"/> Read/Write	Enables read and write in privileged or user mode.
PV Mode	User Mode															
<input checked="" type="radio"/> Read only	<input type="radio"/> No access	Enables read in privileged mode.														
<input type="radio"/> Read/Write	<input type="radio"/> No access	Enables read and write in privileged mode.														
<input type="radio"/> Read only	<input type="radio"/> Read only	Enables read in privileged or user mode.														
<input type="radio"/> Read/Write	<input type="radio"/> Read/Write	Enables read and write in privileged or user mode.														
[SZ Bit]	Page size bit.															
[V bit]	Valid bit.															
[C bit]	Cacheable bit.															

- [D bit] Dirty bit.
- [SH bit] Sharing bit.

SH-4 Series:

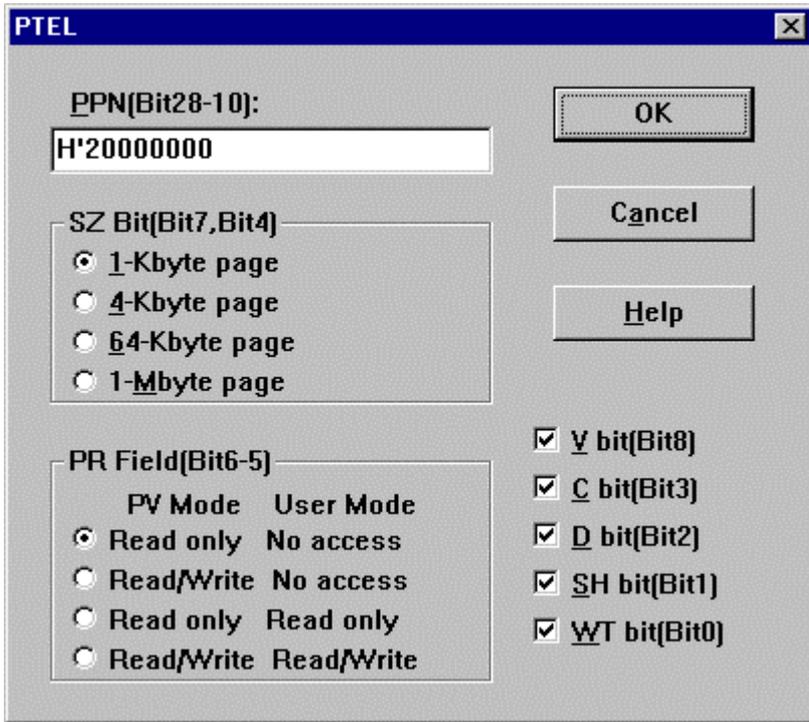


Figure 5.41 PTEL Dialog Box (for SH-4 Series)

In addition to the items set for the SH-3, SH-3E, and SH-3DSP series, the following item must be specified for the SH-4 series.

- [WT bit] Write-through bit. Specifies the writing mode for the cache.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.26 TTB Dialog Box

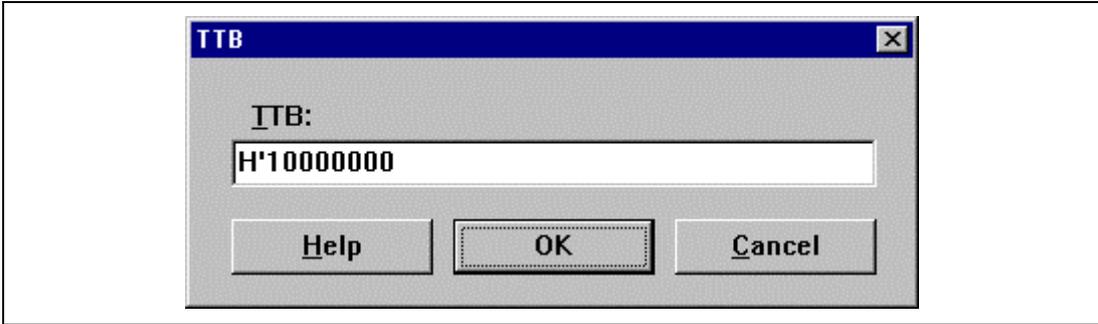


Figure 5.42 TTB Dialog Box

This dialog box specifies the value of the translation table base register (TTB) in longword size. This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.27 TEA Dialog Box

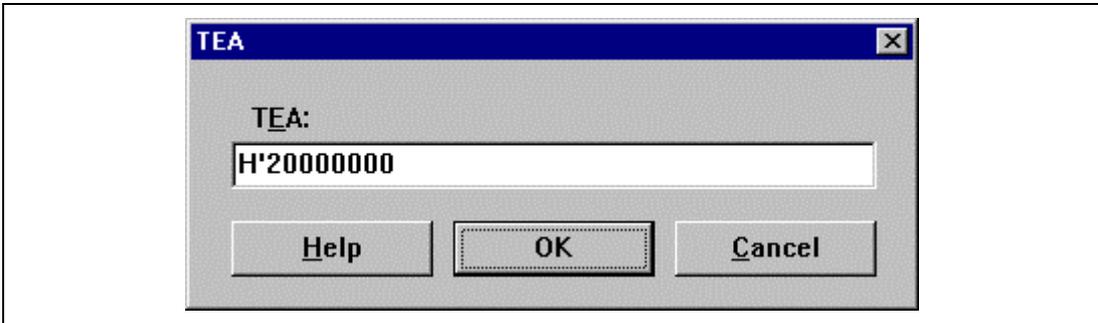


Figure 5.43 TEA Dialog Box

This dialog box specifies the value of the TLB exception address register (TEA) in longword size. This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.28 MMUCR Dialog Box

This dialog box specifies the following values of the MMU control register (MMUCR). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series. The displayed contents depend on the target CPU.

SH-3, SH-3E, and SH-3DSP Series:

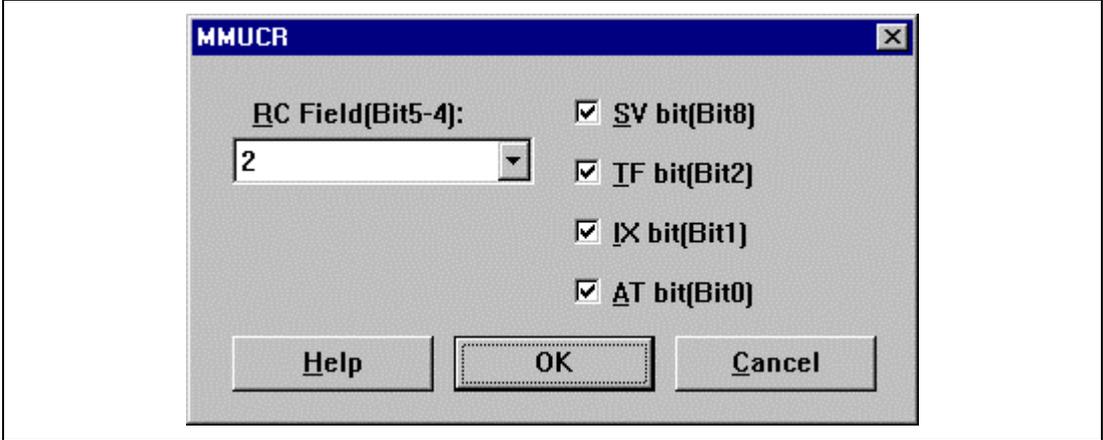


Figure 5.44 MMUCR Dialog Box (for SH-3, SH-3E, and SH-3DSP Series)

The following items must be specified. Selecting each item turns the setting on.

- | | |
|------------|--|
| [RC Field] | Random counter. |
| [SV bit] | Single virtual memory mode bit. |
| [TF bit] | TLB flush bit. Selecting this box and clicking the [OK] button flushes TLB. |
| [IX bit] | Index mode bit. |
| [AT bit] | Address translation bit. Specifies whether or not to enable the MMU. |

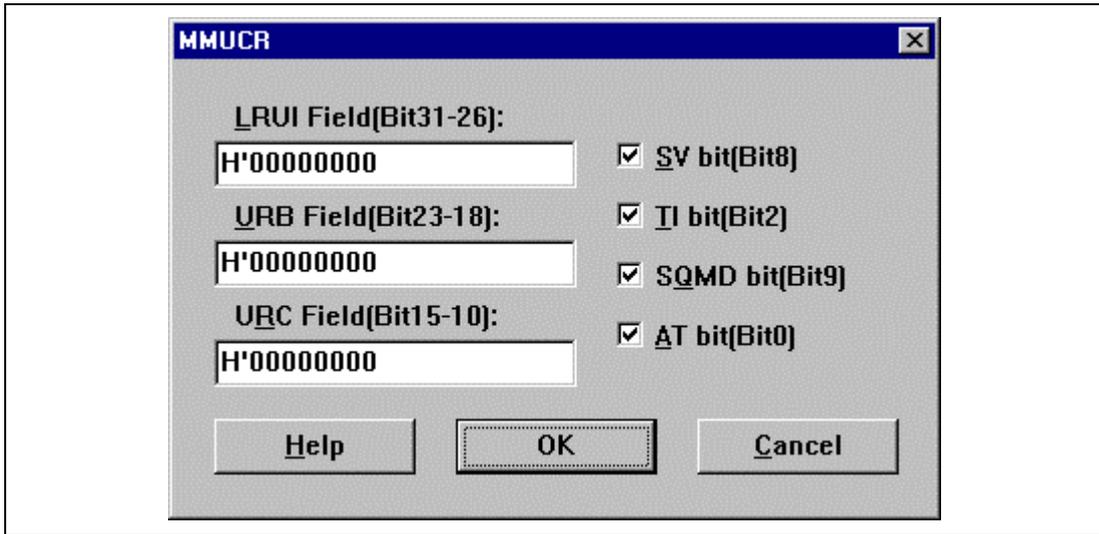


Figure 5.45 MMUCR Dialog Box (for SH-4 Series)

The following items must be specified. Selecting each item turns the setting on.

- | | |
|--------------|---|
| [LRUI Field] | Number indicating the ITLB entry to be replaced when an ITLB miss occurs. |
| [URB Field] | Boundary value of the UTLB entry to be replaced. |
| [URC Field] | Random counter value, which indicates the UTLB entry to be replaced by the LDTLB instruction. |
| [SV bit] | Single virtual memory mode bit. |
| [TI bit] | TLB invalidating bit. Selecting this box and clicking the [OK] button flushes UTLB and ITLB. |
| [SQMD bit] | Store queue mode bit. |
| [AT bit] | Address translation bit. Specifies whether or not to enable the MMU. |

Clicking the [OK] button stores the modified values in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified values.

5.29 EXPEVT Dialog Box



Figure 5.46 EXPEVT Dialog Box

This dialog box specifies the value of the exception event register (EXPEVT). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series.

[**Exception Code**] specifies an exception code. (H'000 to H'FFF)

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.30 INTEVT Dialog Box

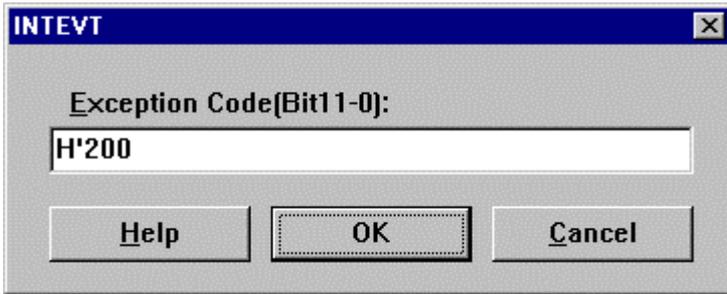


Figure 5.47 INTEVT Dialog Box

This dialog box specifies the value of the interrupt event register (INTEVT). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series.

[**Exception Code**] specifies an exception code. (H'000 to H'FFF)

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.31 TRA Dialog Box

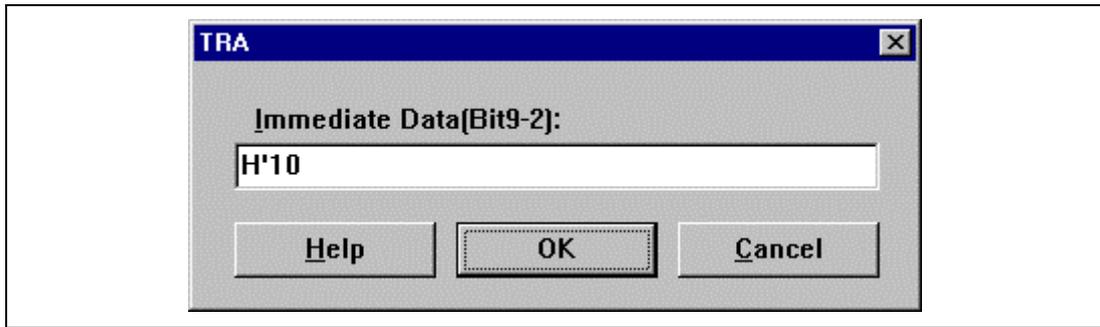


Figure 5.48 TRA Dialog Box

This dialog box specifies the value of the TRAPA exception register (TRA). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, and SH-4 series.

[Immediate Data] specifies an immediate value (H'00 to H'FF). The specified value is multiplied by four, and the result is set in the TRA register.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.32 CCR Dialog Box

This dialog box specifies the following values of the cache control register (CCR). This dialog box is provided only for the SH-3, SH-3E, SH-3DSP, SH-4 series, and SH-DSP with Cache. The displayed contents depend on the target CPU.

SH-3 and SH-3E Series:

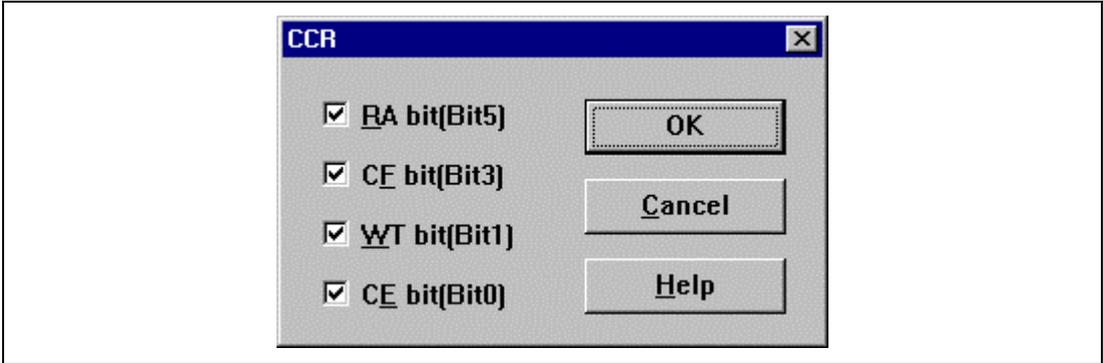


Figure 5.49 CCR Dialog Box (for SH-3 and SH-3E Series)

The following items must be specified. Selecting each item turns the setting on.

- | | |
|----------|--|
| [RA bit] | RAM bit. Specifies the cache operating mode. |
| [CF bit] | Cache flush bit. Selecting this box and clicking the [OK] button flushes the V, U, and LRU bits of all entries in the cache. |
| [WT bit] | Write-through bit. Specifies the cache operating mode in the P0, U0, and P3 areas. |
| [CE bit] | Cache enable bit. |

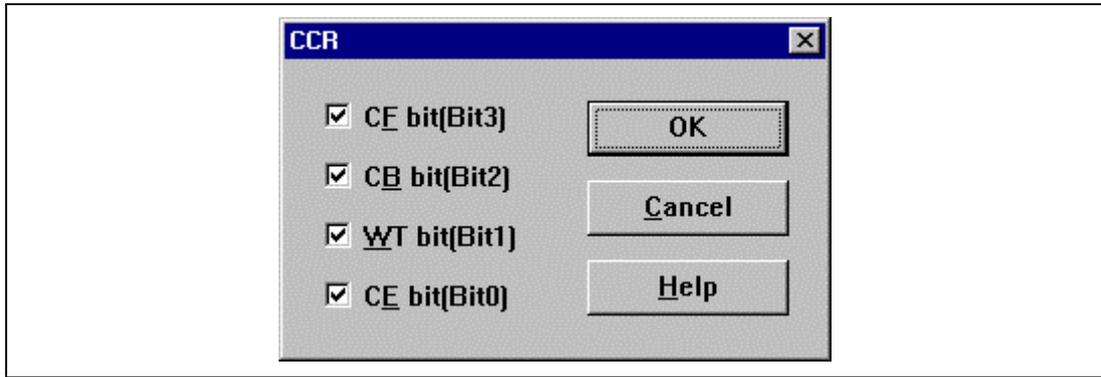


Figure 5.50 CCR Dialog Box (for SH-3DSP Series)

The following items must be specified. Selecting each box turns the setting on.

- | | |
|----------|--|
| [CF bit] | Cache flush bit. Selecting this box and clicking the [OK] button flushes the V, U, and LRU bits of all entries in the cache. |
| [CB bit] | Copy-back bit. Specifies the cache writing mode in the P1 area. |
| [WT bit] | Write-through bit. Specifies the cache operating mode in the P0, U0, and P3 areas. |
| [CE bit] | Cache enable bit. |



Figure 5.51 CCR Dialog Box (for SH-4/SH-4BSC)

The following items must be specified. Selecting each box turns the setting on.

[IIX bit] IC index enable bit.

[ICI bit] IC disable bit. Selecting this box and clicking the **[OK]** button flushes the V bits of all entries in the IC.

[ICE bit] IC enable bit. Specifies whether or not to use the IC.

[OIX bit] OC index enable bit.

[OCI bit] OC disable bit. Selecting this box and clicking the **[OK]** button clears the V and the U bits of all entries in the OC to zero.

[OCE bit] OC enable bit. Specifies whether or not to use the OC.

[ORA bit] OC RAM bit.

[CB bit] Copy-back bit. Specifies the cache writing mode in the P1 area.

[WT bit] Write-through bit. Specifies the cache writing mode in the P0, U0, and P3 areas.

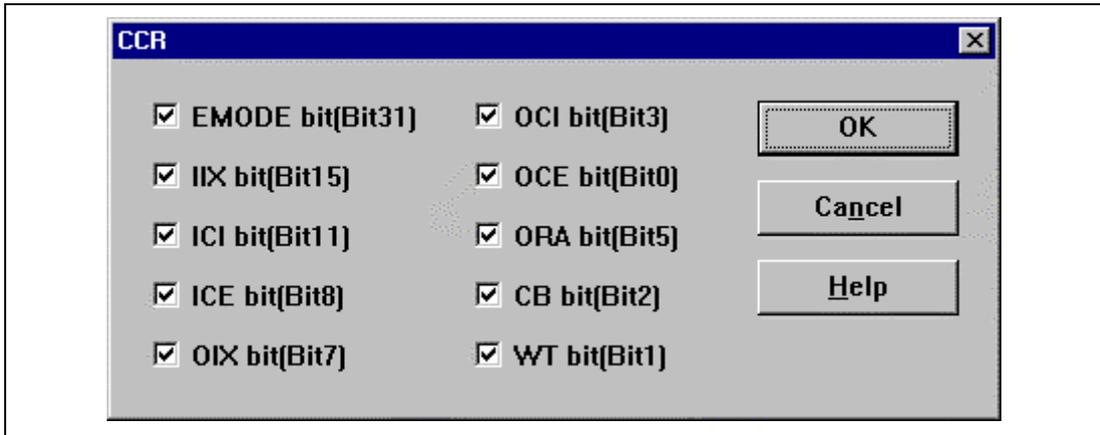


Figure 5.52 CCR Dialog Box (for SH-4 (SH7750R))

The following items must be specified. Selecting each box turns the setting on.

[EMODE bit] Cache doubled mode bit.

[IIX bit] IC index enable bit.

[ICI bit] IC disable bit. Selecting this box and clicking the [OK] button flushes the V bits of all entries in the IC.

[ICE bit] IC enable bit. Specifies whether or not to use the IC.

[OIX bit] OC index enable bit.

[OCI bit] OC disable bit. Selecting this box and clicking the [OK] button clears the V and the U bits of all entries in the OC to zero.

[OCE bit] OC enable bit. Specifies whether or not to use the OC.

[ORA bit] OC RAM bit.

[CB bit] Copy-back bit. Specifies the cache writing mode in the P1 area.

[WT bit] Write-through bit. Specifies the cache writing mode in the P0, U0, and P3 areas.

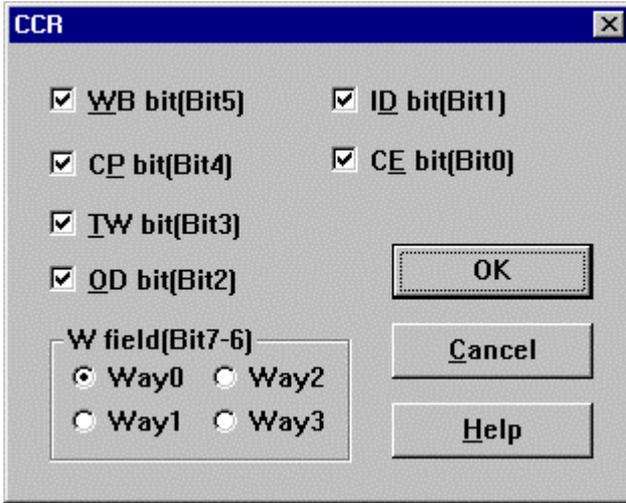


Figure 5.53 CCR Dialog Box (for SH-DSP with Cache)

The following items must be specified. Selecting each box turns the setting on.

- | | |
|-----------|--------------------------------------|
| [WB bit] | Write-back bit. |
| [CP bit] | Cache purge bit. |
| [TW bit] | Two way mode bit. |
| [OD bit] | Operand replacement disable bit. |
| [ID bit] | Instruction replacement disable bit. |
| [CE bit] | Cache enable bit. |
| [W field] | Way specification bit. |

Clicking the [OK] button stores the modified values in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified values.

5.33 CCR2 Dialog Box

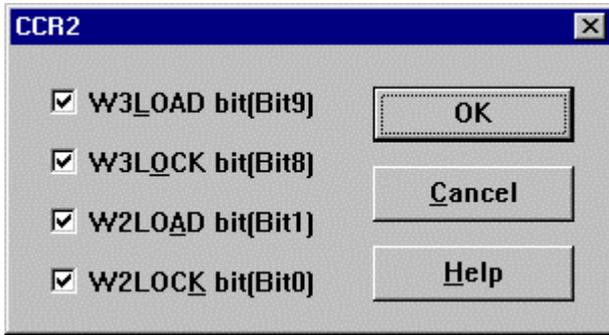


Figure 5.54 CCR2 Dialog Box

This dialog box specifies the following values of the cache control register 2 (CCR2). This dialog box is provided only for the SH-3DSP series.

The following items must be specified. Selecting each item turns the setting on.

[W3LOAD bit] Way 3 load bit.

[W3LOCK bit] Way 3 lock bit.

[W2LOAD bit] Way 2 load bit.

[W2LOCK bit] Way 2 lock bit.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.34 QACR0 and QACR1 Dialog Boxes



Figure 5.55 QACR0 Dialog Box

These dialog boxes specify the values of the queue address control registers 0 and 1 (QACR0 and QACR1). The **QACR1** dialog box has the same functions as the **QACR0** dialog box shown in figure 5.55. These dialog boxes are provided only for the SH-4 series.

In these dialog boxes, specify the areas where the store queues (0 and 1) are mapped when the MMU is disabled.

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.35 SAR0 to SAR3 Dialog Boxes

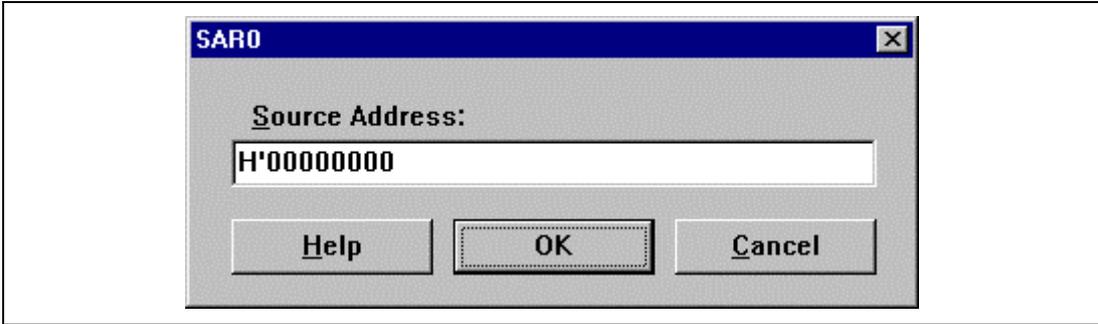


Figure 5.56 SAR0 Dialog Box

These dialog boxes specify the values of the DMA source address registers 0 to 3 (SAR0 to SAR3). The **SAR1** to **SAR3** dialog boxes have the same functions as the **SAR0** dialog box shown in figure 5.56. These dialog boxes are provided only for the SH-4 series.

In these dialog boxes, specify the DMA transfer source addresses corresponding to channels 0 to 3.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.36 DAR0 to DAR3 Dialog Boxes



Figure 5.57 DAR0 Dialog Box

These dialog boxes specify the values of the DMA destination address registers 0 to 3 (DAR0 to DAR3). The **DAR1** to **DAR3** dialog boxes have the same functions as the **DAR0** dialog box shown in figure 5.57. These dialog boxes are provided only for the SH-4 series.

In these dialog boxes, specify the DMA transfer destination addresses corresponding to channels 0 to 3.

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.37 DMATCR0 to DMATCR3 Dialog Boxes

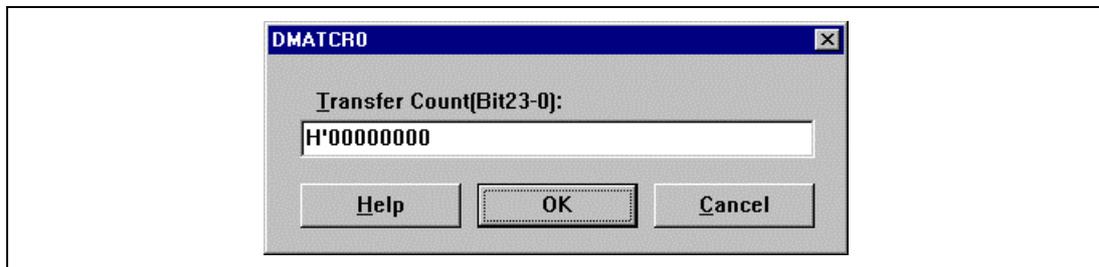


Figure 5.58 DMATCR0 Dialog Box

These dialog boxes specify the values of the DMA transfer count registers 0 to 3 (DMATCR0 to DMATCR3). The **DMATCR1** to **DMATCR3** dialog boxes have the same functions as the **DMATCR0** dialog box shown in figure 5.58. These dialog boxes are provided only for the SH-4 series.

In these dialog boxes, specify the transfer count corresponding to channels 0 to 3.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.38 CHCR0 to CHCR3 Dialog Boxes

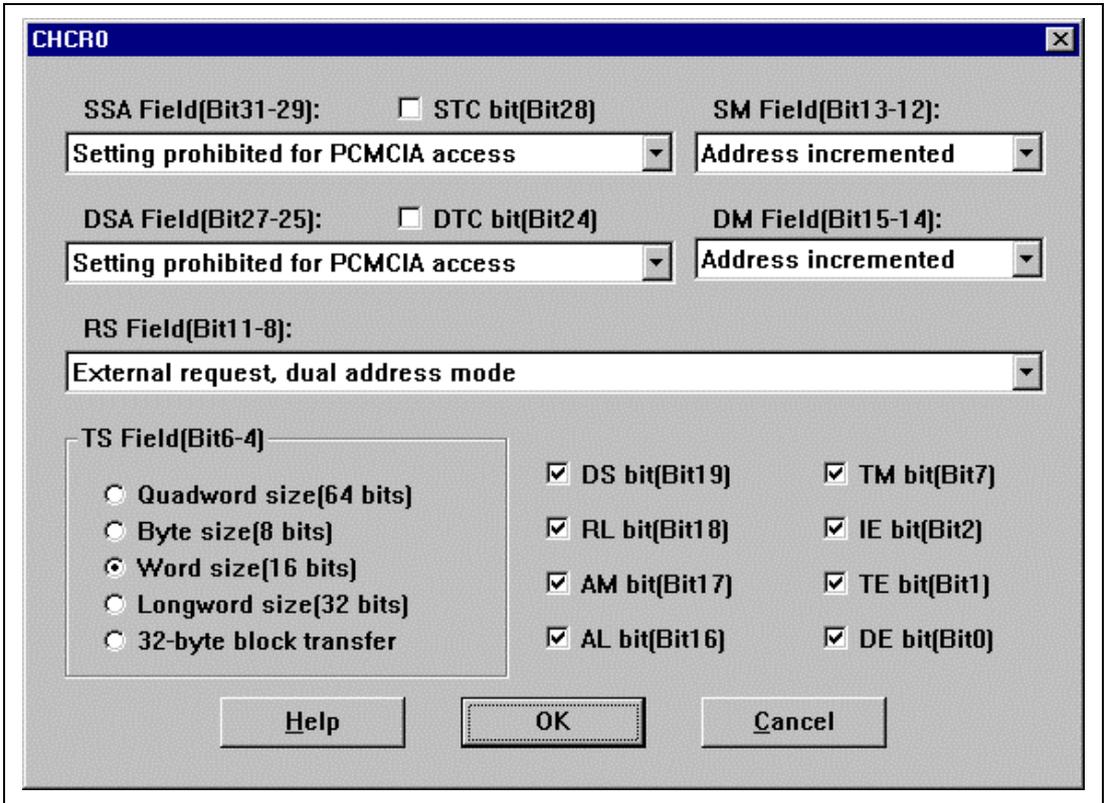


Figure 5.59 CHCR0 Dialog Box

These dialog boxes specify the values of the DMA channel control registers 0 to 3 (CHCR0 to CHCR3). The **CHCR1** to **CHCR3** dialog boxes have the same functions as the **CHCR0** dialog box shown in figure 5.59. These dialog boxes are provided only for the SH-4 series.

In these dialog boxes, specify the following values. Selecting each box turns the setting on.

- | | |
|-------------|---|
| [SSA Field] | Specifies attributes for the source address space. |
| [STC bit] | Specifies wait control for the source address space. |
| [DSA Field] | Specifies attributes for the destination address space. |
| [DTC bit] | Specifies wait control for the destination address space. |
| [SM Field] | Source address mode. Specifies whether the DMA transfer source address is incremented or decremented. |

[DM Field]	Destination address mode. Specifies whether the DMA transfer destination address is incremented or decremented.
[RS Field]	Resource select. Specifies the transfer request source.
[TS Field]	Transmit size. Specifies the transfer data size.
[DS bit]	$\overline{\text{DREQ}}$ select bit.
[RL bit]	Request check level bit.
[AM bit]	Acknowledge mode bit.
[AL bit]	Acknowledge level bit.
[TM bit]	Transmit mode bit. Specifies the bus mode for transfer.
[IE bit]	Interrupt enable bit.
[TE bit]	Transfer end bit. This bit is set when transfer has been completed for the count specified in the DMATCR.
[DE bit]	DMA enable bit. This bit is enabled when the user program execution starts.

This simulator/debugger does not support PCMCIA. For the [RS Field] setting, only the automatic request and the external area can be selected.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.39 DMAOR Dialog Box

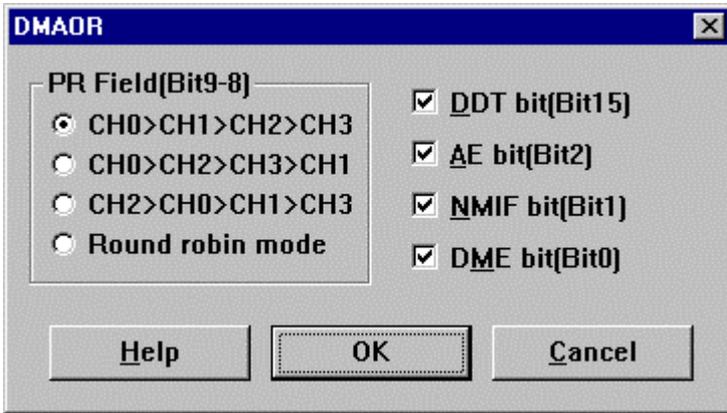


Figure 5.60 DMAOR Dialog Box

This dialog box specifies the values of the DMA operation register (DMAOR). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values. Selecting each box turns the setting on.

- | | |
|-------------|--|
| [PR Field] | Priority mode. Specifies the priority of the channels when transfer is requested to two or more channels at the same time. |
| [DDT bit]* | On-demand data transfer bit. |
| [AE bit] | Address error flag. |
| [NMIF bit]* | NMI flag. |
| [DME bit] | DMAC master enable bit. Enables whole DMAC operations. This bit becomes valid when the user program execution starts. |

The simulator/debugger does not support the functions marked with *.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.40 MCR Dialog Box

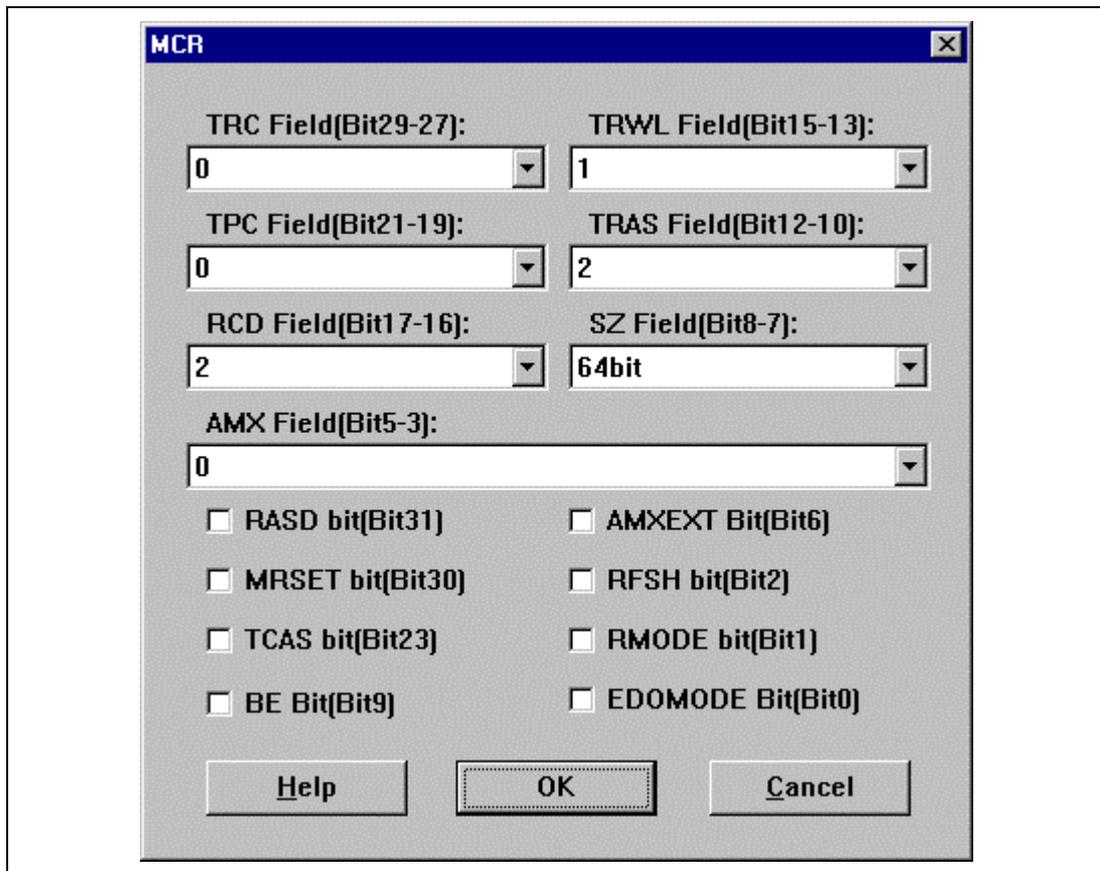


Figure 5.61 MCR Dialog Box

This dialog box specifies the values of the individual memory control register (MCR). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values. Selecting each box turns the setting on.

[TRC Field] Specifies the RAS precharge period after refresh.

[TPC Field] RAS precharge period.

[RCD Field] RAS-CAS delay.

[TRWL Field] Write precharge delay.

[TRAS Field] $\overline{\text{RAS}}$ assertion period for CAS-before-RAS refresh.

[SZ Field]	Memory data size.
[AMX Field]	Address multiplexing.
[RASD bit]	RAS down mode bit.
[MRSET]	Mode register set.
[TCAS bit]	CAS negation period.
[BE Bit]	Burst enable bit.
[AMXEXT Bit]	Address multiplex bit.
[RFSH bit]	Refresh control bit.
[RMODE bit]	Refresh mode bit.
[EDOMODE bit]	EDO mode bit.

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.41 BCR1 Dialog Box

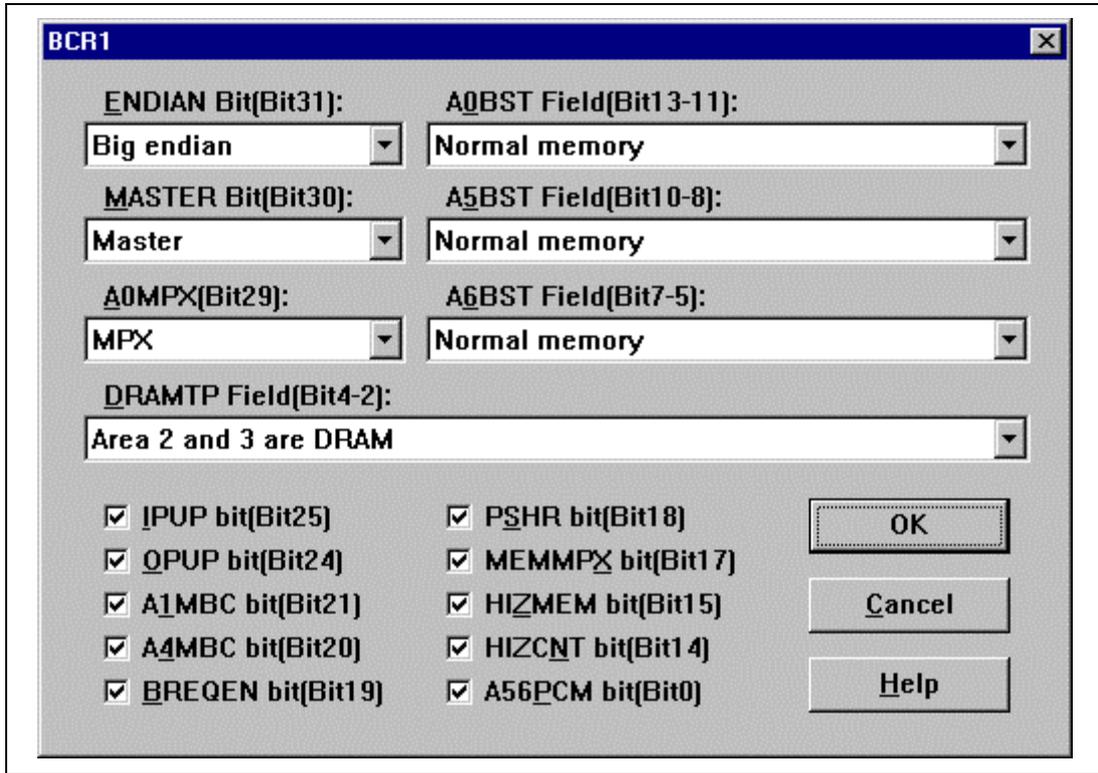


Figure 5.62 BCR1 Dialog Box

This dialog box specifies the values of the bus control register 1 (BCR1). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values. Selecting each box turns the setting on.

[ENDIAN Bit]	Endian flag.
[MASTER Bit]	Master/slave flag.
[A0MPX]	Memory type of area 0.
[A0BST Field]	Burst ROM control in area 0. When using the burst ROM, specify the burst count together.
[A5BST Field]	Burst ROM control in area 5. When using the burst ROM, specify the burst count together.

[A6BST Field]	Burst ROM control in area 6. When using the burst ROM, specify the burst count together.
[DRAMTP Field]	Memory type for areas 2 and 3.
[IPUP bit]*	Pull-up resistor state for control input pins.
[OPUP bit]*	Pull-up resistor state for control output pins.
[A1MBC bit]	SRAM byte control mode for area 1.
[A4MBC bit]	SRAM byte control mode for area 4.
[BREQEN bit]*	BREQ enable bit.
[PSHR bit]*	Partial sharing mode bit.
[MEMMPX bit]	MPX bus bit for areas 1 to 6.
[HIZMEM bit]*	High-impedance control bit.
[HIZCNT bit]*	High-impedance control bit.
[A56PCM bit]	Bus type for areas 5 and 6.

The simulator/debugger does not support the functions marked with *, and does not support PCMCIA.

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.42 BCR2 Dialog Box

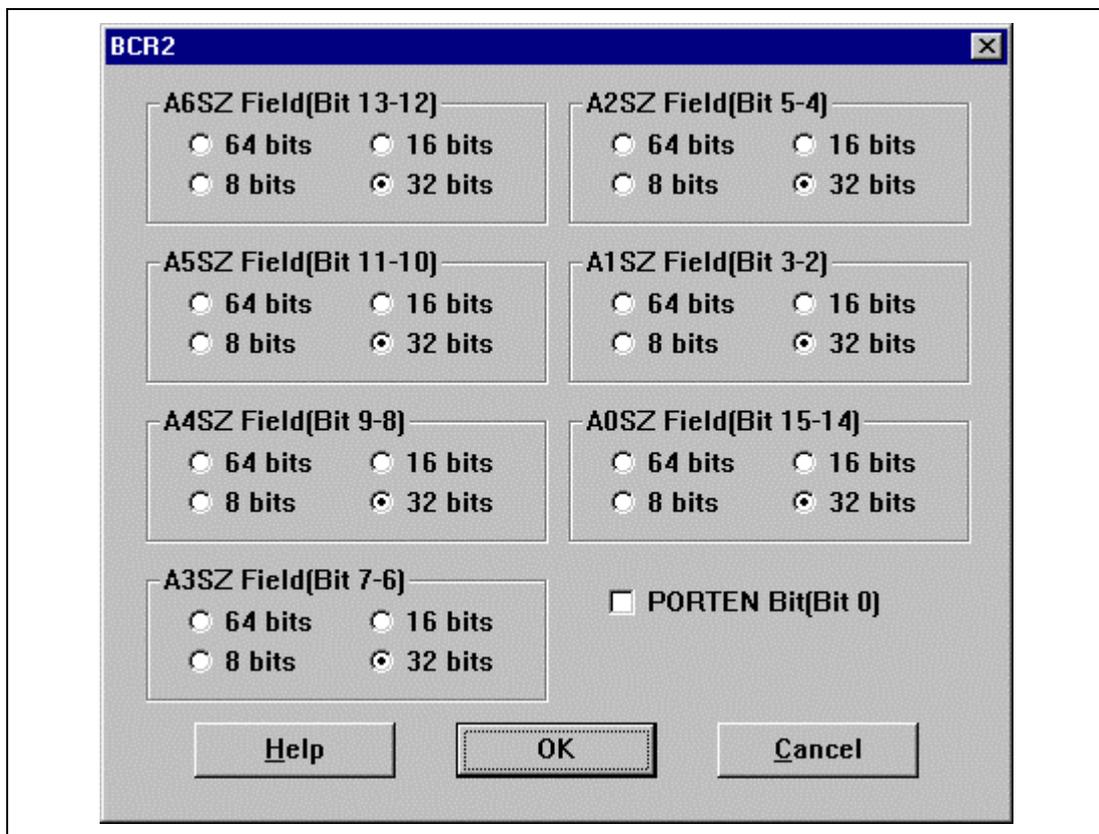


Figure 5.63 BCR2 Dialog Box

This dialog box specifies the values of the bus control register 2 (BCR2). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values:

[A0SZ Field] to [A6SZ Field] Bus width of the corresponding area (0 to 6).

[PORTEN Bit] Port function enable bit. When this box is selected, the pins are used as ports.

Clicking the [OK] button stores the modified values in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified values.

5.43 WCR1 Dialog Box

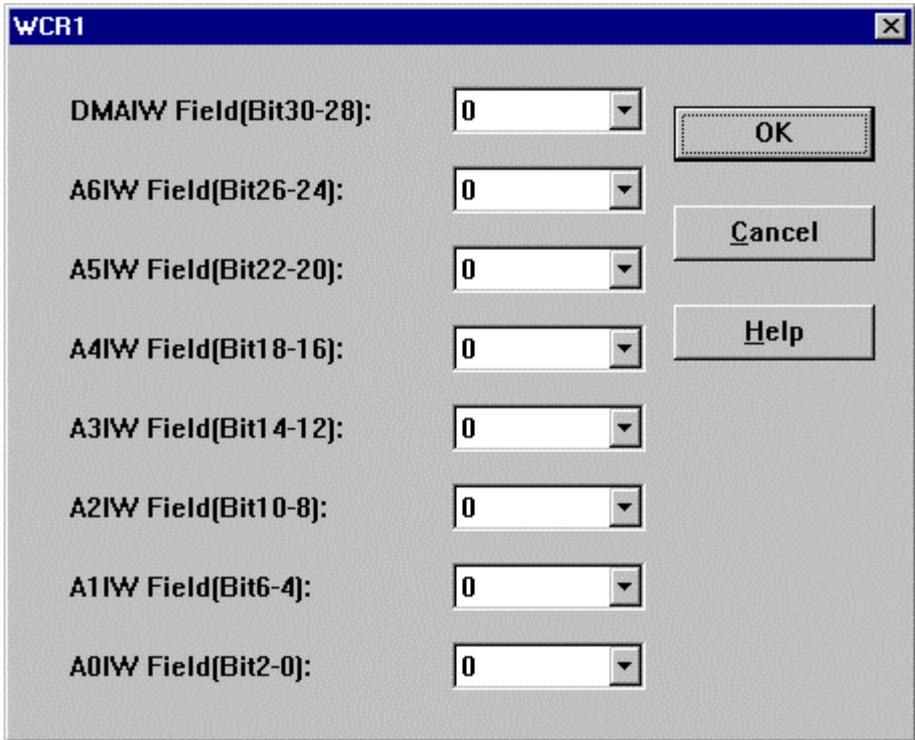


Figure 5.64 WCR1 Dialog Box

This dialog box specifies the values of the wait control register 1 (WCR1). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values:

[DMAIW Field]* Idle cycle count specification for the DMAIW-DACK devices.

[A0IW Field] to [A6IW Field] Idle cycle count specification for areas 0 to 6.

The simulator/debugger does not support the function marked with *.

Clicking the [OK] button stores the modified values in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified values.

5.44 WCR2 Dialog Box

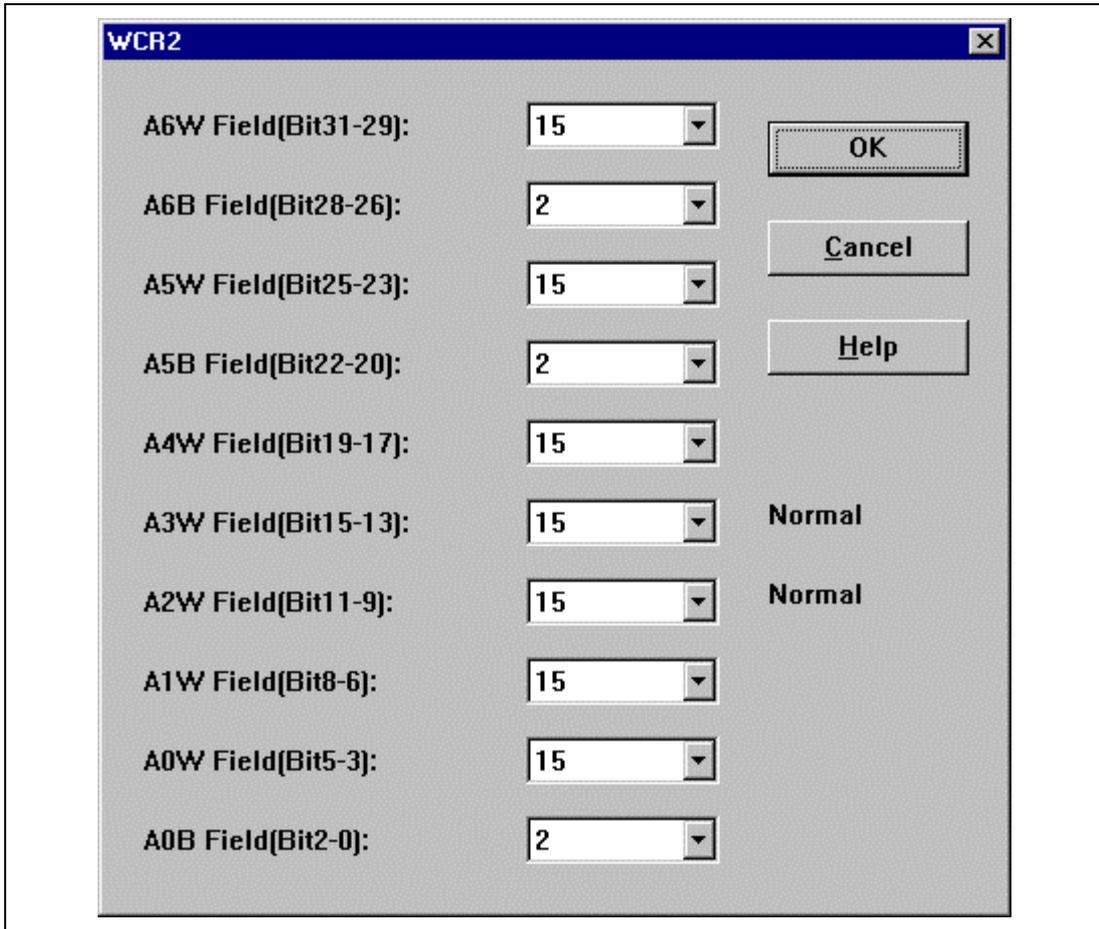


Figure 5.65 WCR2 Dialog Box

This dialog box specifies the values of the wait control register 2 (WCR2). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values:

[A0W Field] to [A6W Field] Wait state control for the corresponding area (0 to 6). Note that the specifications for areas 2 and 3 are valid only for normal memory. Memory types for areas 2 and 3 are indicated on the right side of [A3W Field] and [A2W Field].

[A6B Field]* Burst pitch count for the burst transfer in area 6.

[A5B Field]*

Burst pitch count for the burst transfer in area 5.

[A0B Field]*

Burst pitch count for the burst transfer in area 0.

This simulator/debugger does not support the functions marked with *.

Clicking the [**OK**] button stores the modified values in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified values.

5.45 WCR3 Dialog Box

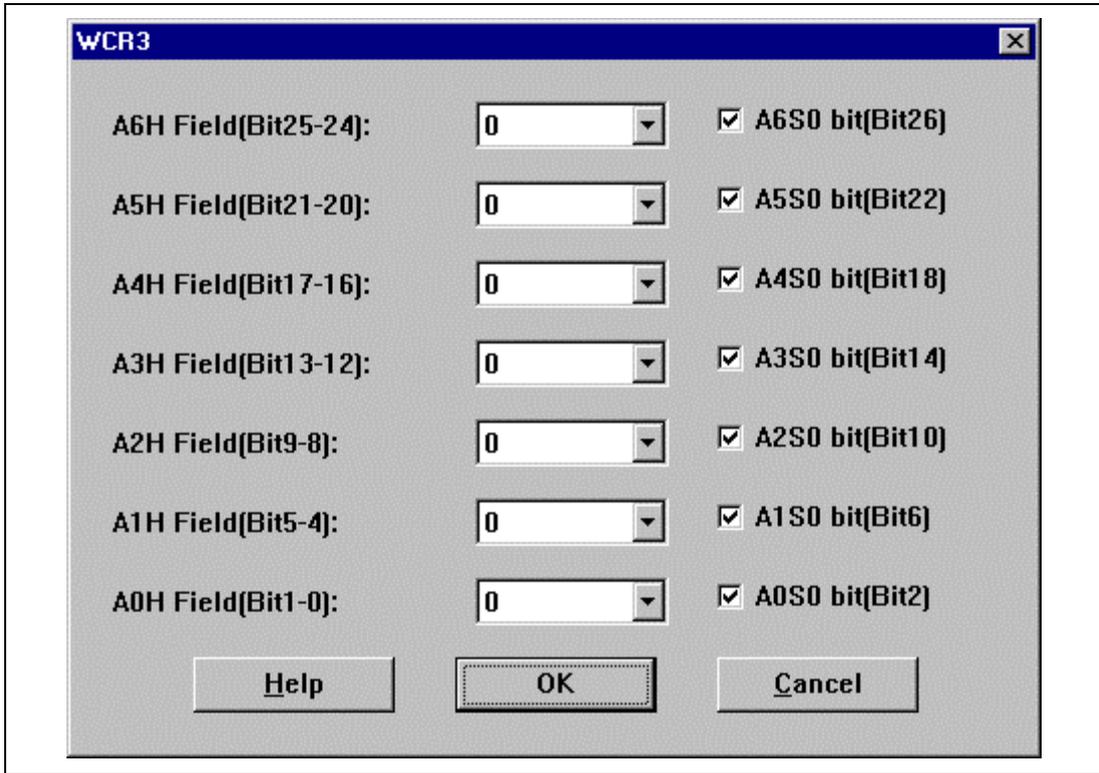


Figure 5.66 WCR3 Dialog Box

This dialog box specifies the values of the wait control register 3 (WCR3). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values:

- | | |
|----------------------------|--|
| [A0H Field] to [A6H Field] | Data hold time for the corresponding area (0 to 6). |
| [A0S0 bit] to [A6S0 bit] | Setup time of the write strobe signal for the corresponding area (0 to 6). |

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.46 RTCSR Dialog Box

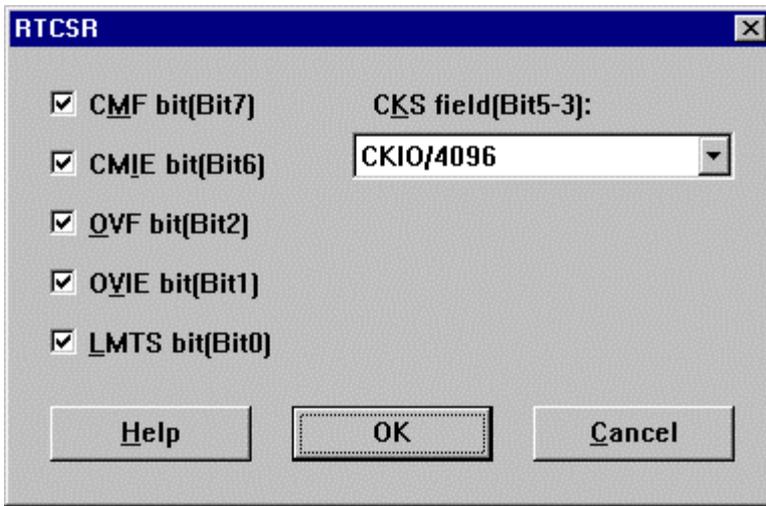


Figure 5.67 RTCSR Dialog Box

This dialog box specifies the values of the refresh timer control/status register (RTCSR). This dialog box is provided only for the SH-4 series.

In this dialog box, specify the following values. Selecting each box turns the setting on.

- | | |
|-------------|--|
| [CMF bit] | Compare match flag. |
| [CMIE bit]* | Compare match interrupt enable bit. |
| [OVF bit]* | Refresh count overflow flag. |
| [OVIE bit]* | Refresh count overflow interrupt enable bit. |
| [LMTS bit] | Refresh count overflow limit select bit. |
| [CKS Field] | Clock select bit. |

The simulator/debugger does not support the functions marked with *.

Clicking the [OK] button stores the modified values in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified values.

5.47 RTCNT Dialog Box

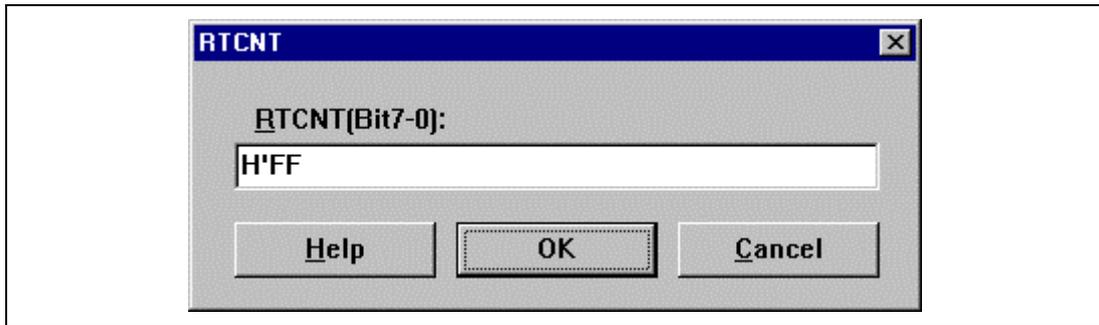


Figure 5.68 RTCNT Dialog Box

This dialog box specifies the values of the refresh timer counter (RTCNT). This dialog box is provided only for the SH-4 series.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.48 RTCOR Dialog Box

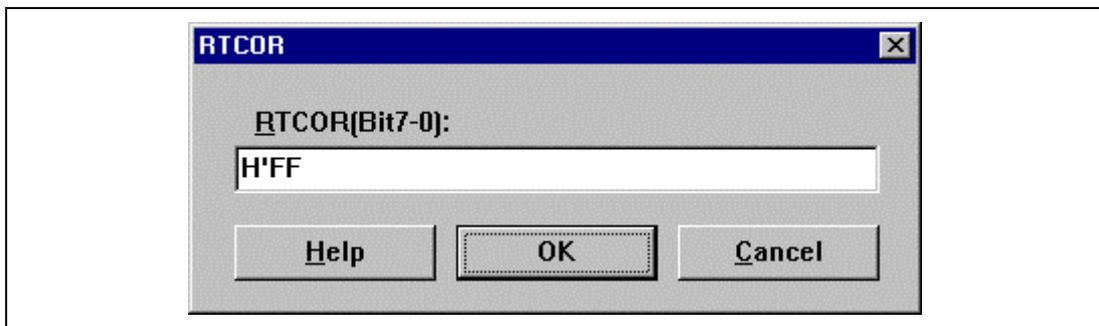


Figure 5.69 RTCOR Dialog Box

This dialog box specifies the values of the refresh time constant register (RTCOR). This dialog box is provided only for the SH-4 series.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.49 RFCR Dialog Box



Figure 5.70 RFCR Dialog Box

This dialog box specifies the values of the refresh count register (RFCR). This dialog box is provided only for the SH-4 series.

Clicking the **[OK]** button stores the modified values in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified values.

5.50 TLB Dialog Box

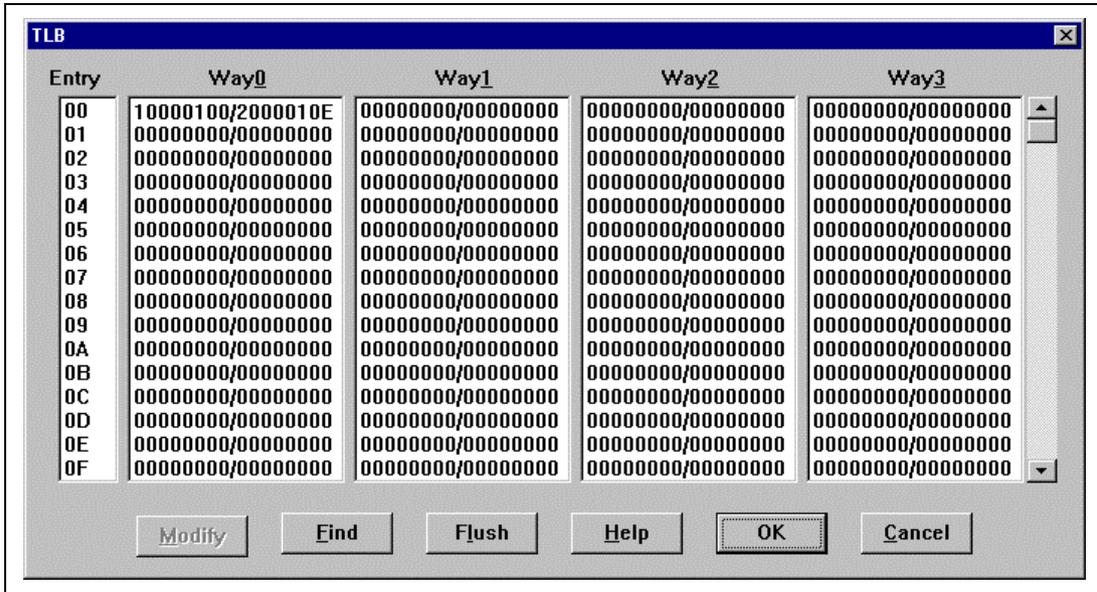


Figure 5.71 TLB Dialog Box

This dialog box displays the TLB contents. This dialog box is provided only for the SH-3, SH-3E, and SH-3DSP series.

The following items are displayed.

[Entry] Entry number in the TLB (H'00 to H'1F)

[Way0]-[Way3] Address array and data array in each way

The TLB contents can be modified, searched, and flushed using the following buttons.

[Modify] Modifies the TLB contents. After selecting the entry to be modified in the list box, click the button. The **TLB Modify** dialog box will open and the TLB contents can be modified.

[Find] Searches the TLB contents. Clicking the button will open the **TLB Find** dialog box and the search condition can be specified.

[Flush] Flushes all TLB contents. Clicking the button clears the valid bits of all address arrays and data arrays, and invalidates all TLB entries.

Clicking the **[OK]** button stores the modified contents in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified contents.

5.51 TLB Modify Dialog Box

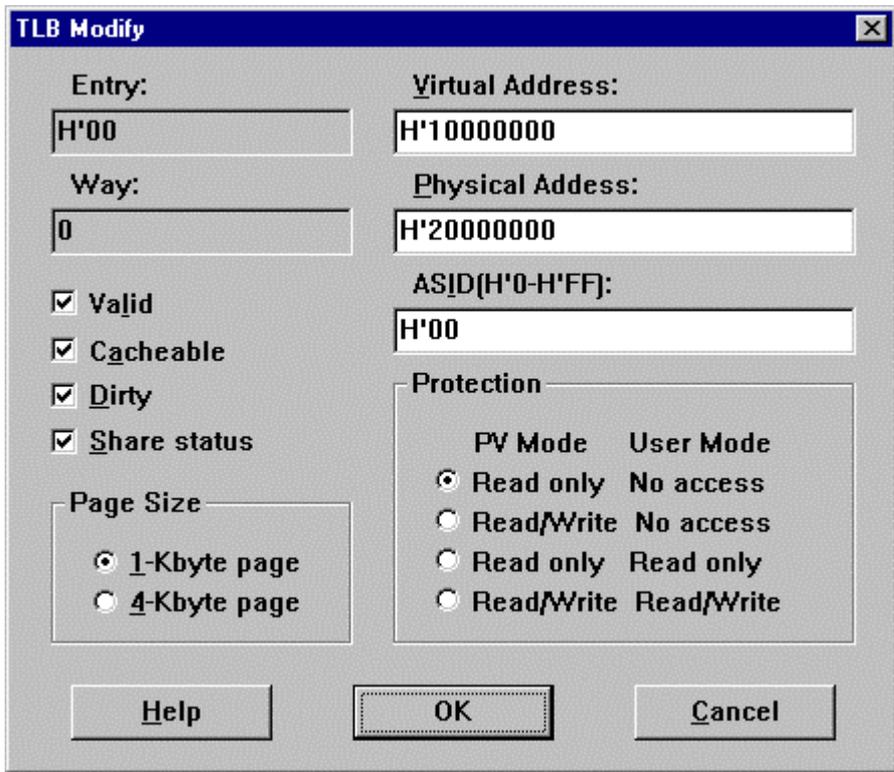


Figure 5.72 TLB Modify Dialog Box

This dialog box specifies the TLB contents of the entry and way selected in the **TLB** dialog box. This dialog box is provided only for the SH-3, SH-3E, and SH-3DSP series.

The following items can be specified.

- [Entry] Entry number selected by the **TLB** dialog box.
- [Way] Way number selected by the **TLB** dialog box.
- [Virtual Address] Virtual address in longword size. Bits 16 to 12 are set to 0 regardless of the input value. Bits 31 to 10 are used as the virtual address.
- [Physical Address] Physical address in longword size. Bits 31 to 10 are valid.
- [ASID] Address space ID, which specifies the process that can access the virtual page.

[Valid]	Specifies whether or not the entry is valid. Selecting this box makes the entry valid.
[Cacheable]	Enables or disables caching. Selecting this box enables caching of the page.
[Dirty]	Specifies whether or not the page has been written to. Selecting this box assumes that the page has been written to.
[Share status]	Specifies whether or not to share the page with multiple processes. Selecting this box specifies that the page is shared.
[Page Size]	Specifies the page size.

The page protection status can be selected by **[Protection]**.

PV Mode	User Mode	
Read only	No access	Enables read in privileged mode.
Read/Write	No access	Enables read and write in privileged mode.
Read only	Read only	Enables read in privileged or user mode.
Read/Write	Read/Write	Enables read and write in privileged or user mode.

Clicking the **[OK]** button displays the modified contents in the **TLB** dialog box. Clicking the **[Cancel]** button closes the dialog box without modifying the TLB contents.

5.52 TLB Find Dialog Box

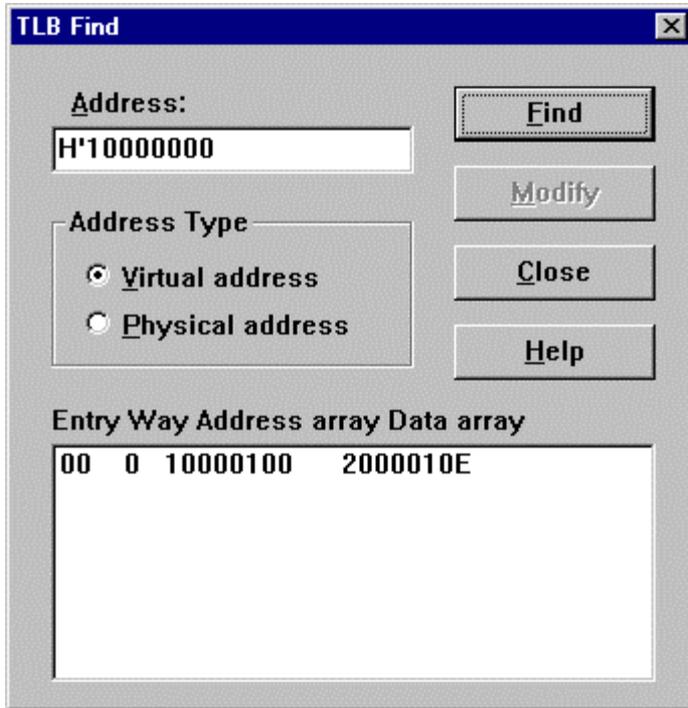


Figure 5.73 TLB Find Dialog Box

This dialog box searches the TLB contents. This dialog box is provided only for the SH-3, SH-3E, and SH-3DSP series.

The following search conditions can be specified.

[Address] Specifies the address to be searched for.

[Address Type] Specifies whether the address to be searched for is virtual or physical.

After specifying the search condition, clicking the **[Find]** button starts search. The search results are displayed in the list box at the bottom of the dialog box, in the order of TLB entry, way, address array, and data array.

To modify the displayed TLB contents, select the TLB entry in the list box, and click the **[Modify]** button. The **TLB Modify** dialog box will open and the TLB contents can be modified.

This dialog box is closed by clicking the **[Close]** button.

5.53 Open TLB Dialog Box

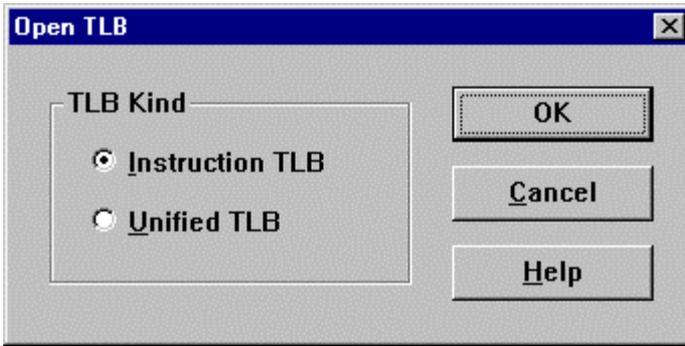


Figure 5.74 Open TLB Dialog Box

This dialog box selects the TLB to be displayed. This dialog box is provided only for the SH-4 series.

In this dialog box, select one of the following TLBs:

[Instruction TLB] Selects the instruction TLB (ITLB).

[Unified TLB] Selects the unified TLB (UTLB).

Clicking the **[OK]** button displays the selected **TLB** dialog box. Clicking the **[Cancel]** button closes the **Open TLB** dialog box.

5.54 Instruction TLB Dialog Box

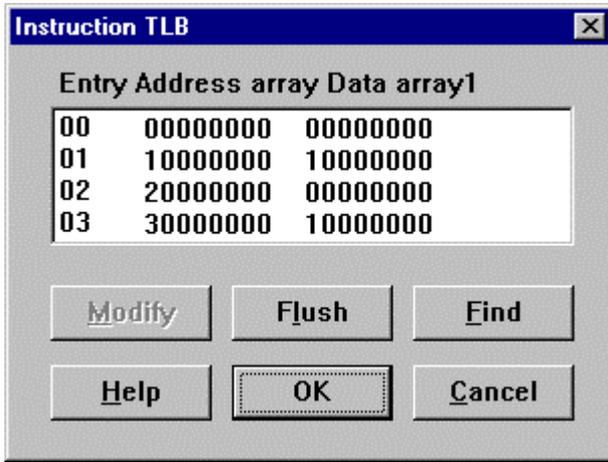


Figure 5.75 Instruction TLB Dialog Box

This dialog box displays the ITLB contents. This dialog box is provided only for the SH-4 series.

The following items are displayed.

- [Entry] Entry number in the ITLB (H'00 to H'03)
- [Address array] Address array in each entry of the ITLB
- [Data array1] Data array 1 in each entry of the ITLB

The ITLB contents can be modified, flushed, and searched using the following buttons.

- [Modify] Modifies the ITLB contents. After selecting the entry to be modified in the list box, click the button. The **Instruction TLB Modify** dialog box will open and the ITLB contents can be modified.
- [Flush] Flushes all ITLB contents. Clicking the button clears the V bits of all address arrays and data arrays 1 to zero, and invalidates all ITLB entries.
- [Find] Searches the ITLB contents. Clicking the button will open the **Instruction TLB Find** dialog box and the search condition can be specified.

Clicking the [OK] button stores the modified contents in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified contents.

5.55 Instruction TLB Modify Dialog Box

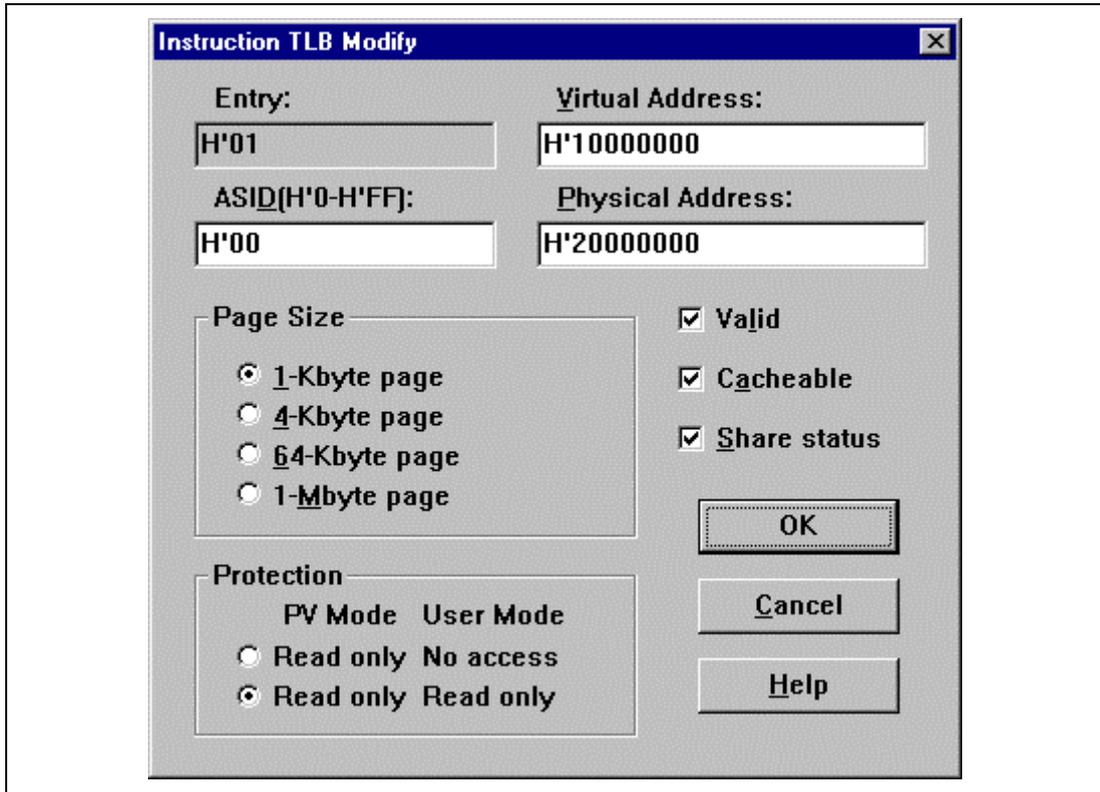


Figure 5.76 Instruction TLB Modify Dialog Box

This dialog box modifies the ITLB contents of the entry selected in the **Instruction TLB** dialog box. This dialog box is provided only for the SH-4 series.

The following items can be specified.

- | | |
|--------------------|---|
| [Entry] | Entry number selected by the Instruction TLB dialog box. |
| [ASID] | Address space ID, which specifies the process that can access the virtual page. |
| [Virtual Address] | Virtual address in longword size. Bits 31 to 10 are valid. |
| [Physical Address] | Physical address in longword size. Bits 31 to 10 are valid. |
| [Page Size] | Specifies the page size. |

- [Protection] Specifies the page protection status.
- | | | |
|-----------|-----------|--|
| PV Mode | User Mode | |
| Read only | No access | Enables read in privileged mode. |
| Read only | Read only | Enables read in privileged or user mode. |
- [Valid] Specifies whether or not the entry is valid. Selecting this box makes the entry valid.
- [Cacheable] Enables or disables caching. Selecting this box enables caching of the page.
- [Share status] Specifies whether or not to share the page with multiple processes. Selecting this box specifies that the page is shared.

Clicking the **[OK]** button displays the modified contents in the **Instruction TLB** dialog box.
 Clicking the **[Cancel]** button closes the dialog box without modifying the ITLB contents.

5.56 Instruction TLB Find Dialog Box

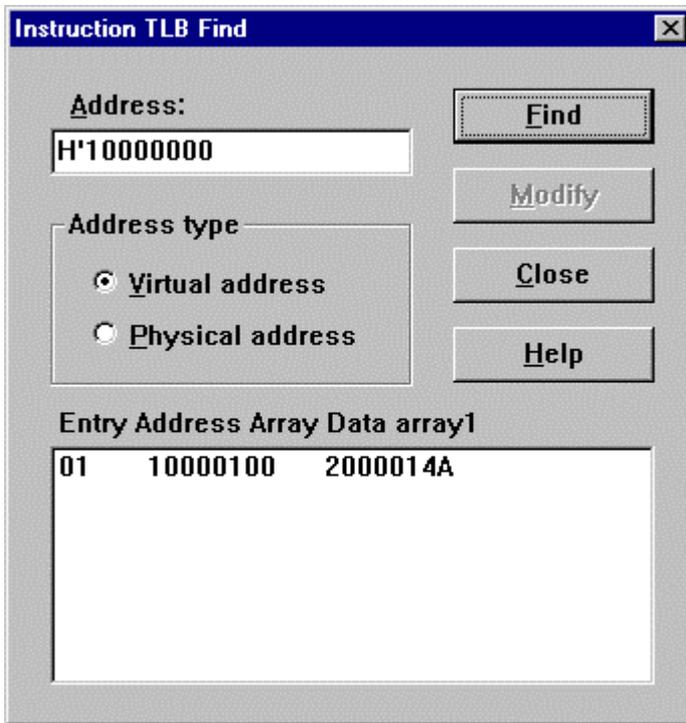


Figure 5.77 Instruction TLB Find Dialog Box

This dialog box searches the ITLB contents. This dialog box is provided only for the SH-4 series.

The following search conditions can be specified.

[Address] Specifies the address to be searched for.

[Address type] Specifies whether the address to be searched for is virtual or physical.

After specifying the search condition, clicking the [**F**ind] button starts search. The search results are displayed in the list box at the bottom of the dialog box, in the order of ITLB entry, address array, and data array 1.

To modify the displayed ITLB contents, select the ITLB entry in the list box, and click the [**M**odify] button. The **Instruction TLB Modify** dialog box will open and the ITLB contents can be modified.

Clicking the [**C**lose] button closes this dialog box.

5.57 Unified TLB Dialog Box

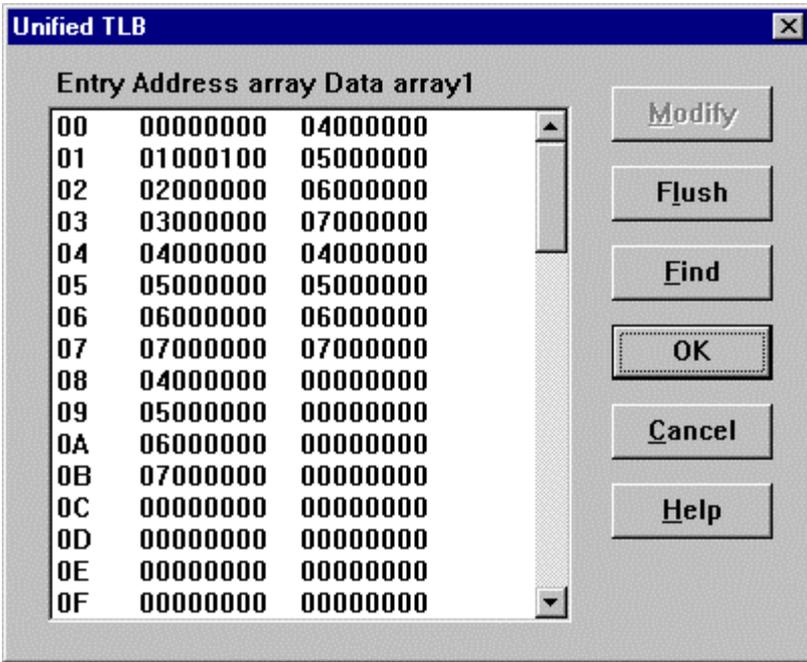


Figure 5.78 Unified TLB Dialog Box

This dialog box displays the UTLB contents. This dialog box is provided only for the SH-4 series.

The following items are displayed.

[Entry] Entry number in the UTLB (H'00 to H'3F)

[Address array] Address array in each entry of the UTLB

[Data array1] Data array 1 in each entry of the UTLB

The UTLB contents can be modified, flushed, and searched using the following buttons.

[Modify] Modifies the UTLB contents. After selecting the entry to be modified in the list box, click the button. The **Unified TLB Modify** dialog box will open and the UTLB contents can be modified.

[Flush] Flushes all UTLB contents. Clicking the button clears the V bits of all address arrays and data arrays 1 to zero, and invalidates all UTLB entries.

[Find] Searches the UTLB contents. Clicking the button will open the **Unified TLB Find** dialog box and the search condition can be specified.

Clicking the **[OK]** button stores the modified contents in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified contents.

5.58 Unified TLB Modify Dialog Box

Unified TLB Modify

Entry: H'01

Virtual Address: H'01000000

ASID(H'0-H'FF): H'00

Physical Address: H'01000000

Page Size

- 1-Kbyte page
- 4-Kbyte page
- 64-Kbyte page
- 1-Mbyte page

Protection

	PV Mode	User Mode
<input checked="" type="radio"/>	Read only	No access
<input type="radio"/>	Read/write	No access
<input type="radio"/>	Read only	Read only
<input type="radio"/>	Read/write	Read/write

Valid

Cacheable

Dirty

Share status

Write through

OK

Cancel

Help

Figure 5.79 Unified TLB Modify Dialog Box

This dialog box specifies the UTLB contents of the entry selected in the **Unified TLB** dialog box. This dialog box is provided only for the SH-4 series.

The following items can be specified.

[Entry] Entry number selected by the **Unified TLB** dialog box.

[ASID] Address space ID, which specifies the process that can access the virtual page.

[Virtual Address] Virtual address in longword size. Bits 31 to 10 are valid.

[Physical Address] Physical address in longword size. Bits 31 to 10 are valid.

[Page Size] Specifies the page size.

[Protection]	Specifies the page protection status.		
	PV Mode	User Mode	
	Read only	No access	Enables read in privileged mode.
	Read only	Read only	Enables read in privileged or user mode.
	Read/Write	No access	Enables read and write in privileged mode.
	Read/Write	Read/Write	Enables read and write in privileged or user mode.
[Valid]	Specifies whether or not the entry is valid. Selecting this box makes the entry valid.		
[Cacheable]	Enables or disables caching. Selecting this box enables caching of the page.		
[Dirty]	Specifies whether or not the page has been written to. Selecting this box makes the simulator/debugger assume that the page has been written to.		
[Share status]	Specifies whether or not to share the page with multiple processes. Selecting this box specifies that the page is shared.		
[Write through]	Write through bit. Specifies the cache writing mode.		

Clicking the **[OK]** button displays the modified contents in the **Unified TLB** dialog box. Clicking the **[Cancel]** button closes the dialog box without modifying the UTLB contents.

5.59 Unified TLB Find Dialog Box

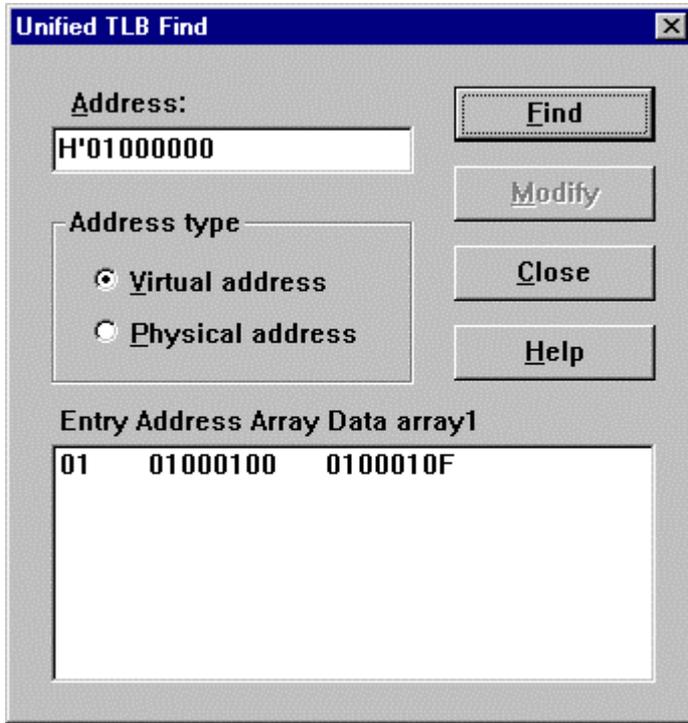


Figure 5.80 Unified TLB Find Dialog Box

This dialog box searches the UTLB contents. This dialog box is provided only for the SH-4 series.

The following search conditions can be specified.

[Address] Specifies the address to be searched for.

[Address type] Specifies whether the address to be searched for is virtual or physical.

After specifying the search condition, clicking the **[Find]** button starts search. The search results are displayed in the list box at the bottom of the dialog box, in the order of UTLB entry, address array, and data array 1.

To modify the displayed UTLB contents, select the UTLB entry in the list box, and click the **[Modify]** button. The **Unified TLB Modify** dialog box will open and the UTLB contents can be modified.

Clicking the **[Close]** button closes this dialog box.

5.60 Cache Dialog Box

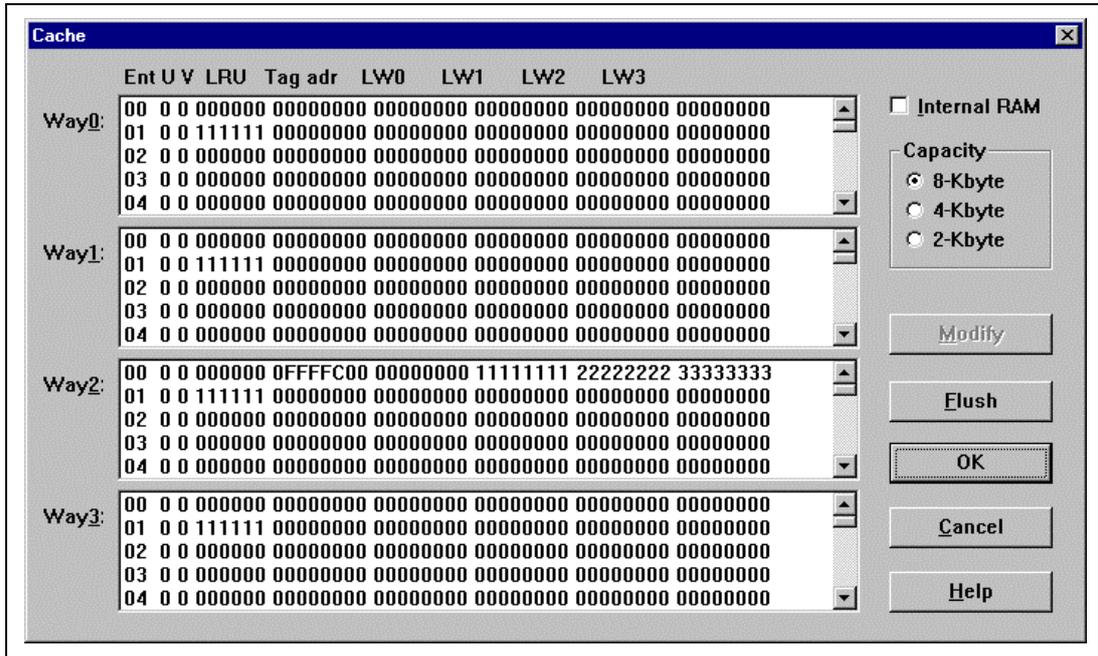


Figure 5.81 Cache Dialog Box (for SH-3 and SH-3E Series)

This dialog box displays the cache contents in [Way0] to [Way3]. This dialog box is provided only for the SH-3, SH-3E, SH-3DSP series, and SH-DSP with Cache.

The following items are displayed.

- [Ent] Entry number in the cache. The specifiable value depends on the CPU.
SH-3 and SH-3E series: H'00 to H'7F
SH-3DSP series: H'00 to H'FF
SH-DSP with Cache: H'00 to H'3F
- [U] Update bit. When this bit is 1, the entry has been written to.
- [V] Validity bit. When this bit is 1, the entry is valid.
- [LRU] Numerical string that determines which way's entry should be replaced when a cache miss occurs. (The same LRU value is assigned to the same entry in all ways.)
- [Tag adr] Tag address.
- [LW0] to [LW3] Longword data 0 to 3 stored in cache.

[Internal RAM]* Internal RAM mode. Selecting this box enables a half of the cache to be used as the internal RAM when **8-Kbyte** or **4-Kbyte** is selected in [**Capacity**].

[Capacity]* Cache capacity.

Note: The items marked with * are displayed only for the SH-3 and SH-3E series.

The cache contents can be modified and flushed using the following buttons.

[Modify] Modifies the cache contents. After selecting the entry to be modified in the list box, click the button. The **Cache Modify** dialog box will open and the cache contents can be modified.

[Flush] Flushes all cache contents. Clicking the button clears the V, U, and LRU bits of all entries to zero, and invalidates all cache entries.

Clicking the [**OK**] button stores the modified contents in the memory. Clicking the [**Cancel**] button closes the dialog box without storing the modified contents.

5.61 Cache Modify Dialog Box

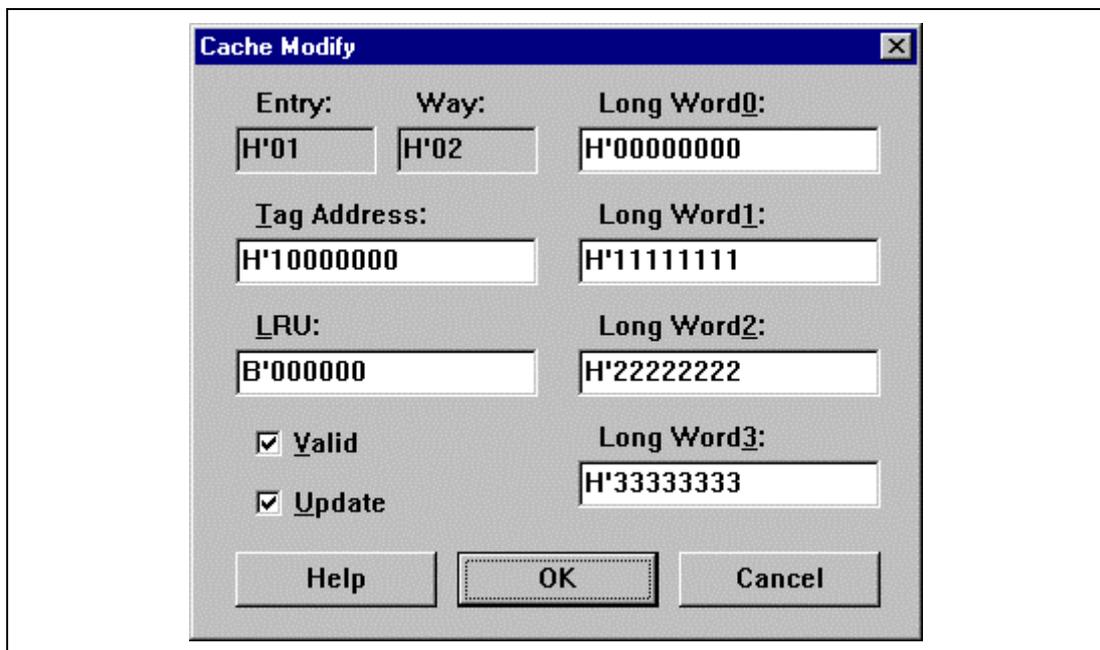


Figure 5.82 Cache Modify Dialog Box

This dialog box modifies the cache contents of the way and entry selected in the **Cache** dialog box. This dialog box is provided only for the SH-3, SH-3E, SH-3DSP series, and the SH-DSP with cache.

The following items can be specified.

- | | |
|---------------|---|
| [Entry] | Entry number selected by the Cache dialog box. |
| [Way] | Way number selected by the Cache dialog box. |
| [Tag Address] | Tag address. A longword physical address must be specified. Bits 31 to 10 are valid. |
| [LRU] | Numerical string that determines which way's entry should be replaced when a cache miss occurs. The LRU values for the same entries in the other ways are also modified to the specified value. |
| [Valid] | Specifies whether or not the entry is valid. Selecting this box makes the entry valid. |

[Update] Indicates whether or not the entry has been written to. Selecting this box makes the simulator/debugger assume that the entry has been written to.

[Long Word0] to
[Long Word3] Longword data 0 to 3 to be set to cache entries.

Clicking the [**OK**] button displays the modified contents in the **Cache** dialog box. Clicking the [**Cancel**] button closes the dialog box without displaying the modified contents in the **Cache** dialog box.

5.62 Open Cache Dialog Box

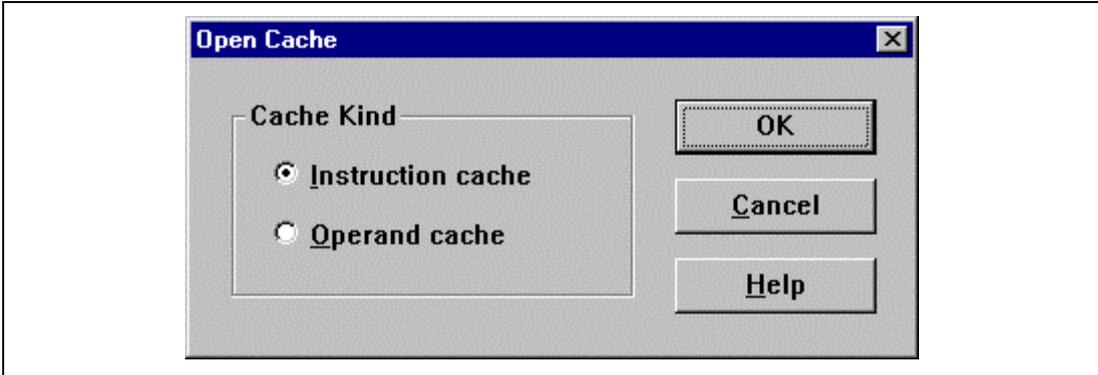


Figure 5.83 Open Cache Dialog Box

This dialog box selects the cache to be displayed. This dialog box is provided only for the SH-4 series.

In this dialog box, select one of the following caches:

[Instruction cache] Selects the instruction cache (IC).

[Operand cache] Selects the operand cache (OC).

Clicking the **[OK]** button displays the selected cache dialog box. Clicking the **[Cancel]** button closes the **Open Cache** dialog box.

5.63 Instruction Cache Dialog Box

This dialog box displays the contents of the IC. This dialog box is provided only for the SH-4 series, and the displayed contents differ according to the target CPU.

SH-4/SH-4BSC:

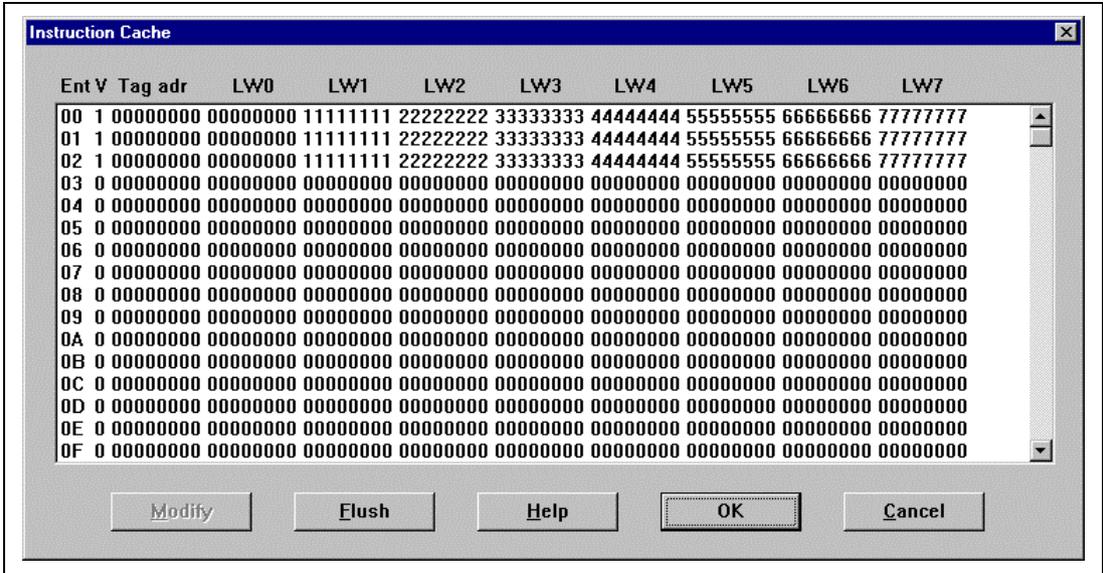


Figure 5.84 Instruction Cache Dialog Box (for SH-4/SH-4BSC)

The following items are displayed.

- [Ent] Entry number in the IC (H'00 to H'FF).
- [V] Validity bit. When this bit is 1, the entry is valid.
- [Tag adr] Tag address.
- [LW0] to [LW7] Longword data 0 to 7 stored in IC entries.

The IC contents can be modified and flushed using the following buttons.

- [Modify] Modifies the IC contents. After selecting the entry to be modified in the list box, click the button. The **Instruction Cache Modify** dialog box will open and the IC contents can be modified.
- [Flush] Flushes all IC entries. Clicking the button clears the V bits of all entries to zero, and invalidates all IC entries.

Clicking the [OK] button stores the modified contents in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified contents.

SH-4 (SH7750R):

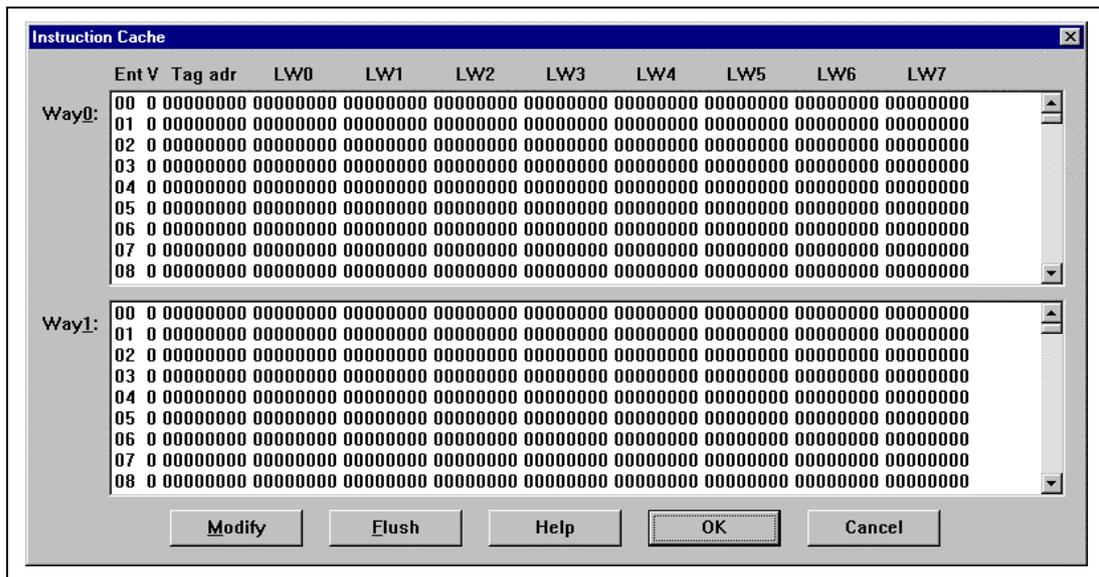


Figure 5.85 Instruction Cache Dialog Box (for SH-4 (SH7750R))

This dialog box displays the contents of the cache set on Way0 and Way1. The following items are displayed.

- [Ent] Entry number in the IC (H'00 to H'FF).
- [V] Validity bit. When this bit is 1, the entry is valid.
- [Tag adr] Tag address.
- [LW0] to [LW7] Longword data 0 to 7 stored in IC entries.

The IC contents can be modified and flushed using the following buttons.

- [Modify] Modifies the IC contents. After selecting the entry to be modified in the list box, click the button. The **Instruction Cache Modify** dialog box will open and the IC contents can be modified.
- [Flush] Flushes all IC entries. Clicking the button clears the V bits of all entries to zero, and invalidates all IC entries.

Clicking the [OK] button stores the modified contents in the memory. Clicking the [Cancel] button closes the dialog box without storing the modified contents.

5.64 Instruction Cache Modify Dialog Box

This dialog box modifies the IC contents of the entry selected in the **Instruction Cache** dialog box. This dialog box is provided only for the SH-4 series, and the displayed contents differ according to the target CPU.

SH-4/SH-4BSC:

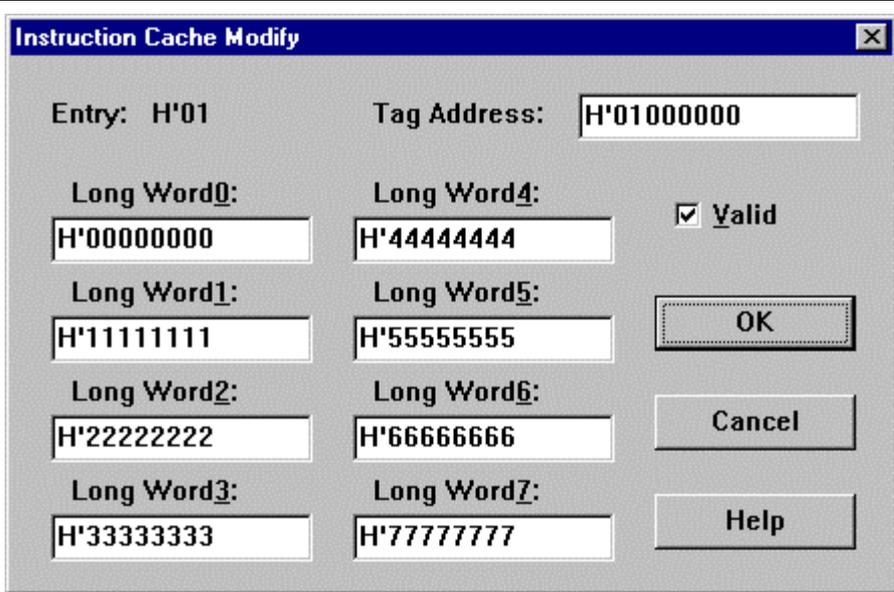


Figure 5.86 Instruction Cache Modify Dialog Box (for SH-4/SH-4BSC)

The following items can be specified.

- | | |
|------------------------------|--|
| [Entry] | Displays the entry number selected by the Instruction Cache dialog box. |
| [Tag Address] | Tag address. A longword physical address must be specified. Bits 31 to 10 are valid. |
| [Valid] | Indicates whether or not the entry is valid. Selecting this box makes the entry valid. |
| [Long Word0] to [Long Word7] | Longword data 0 to 7 to be set to IC entries. |

Clicking the **[OK]** button displays the modified contents in the **Instruction Cache** dialog box. Clicking the **[Cancel]** button closes the dialog box without displaying the modified contents in the **Instruction Cache** dialog box.

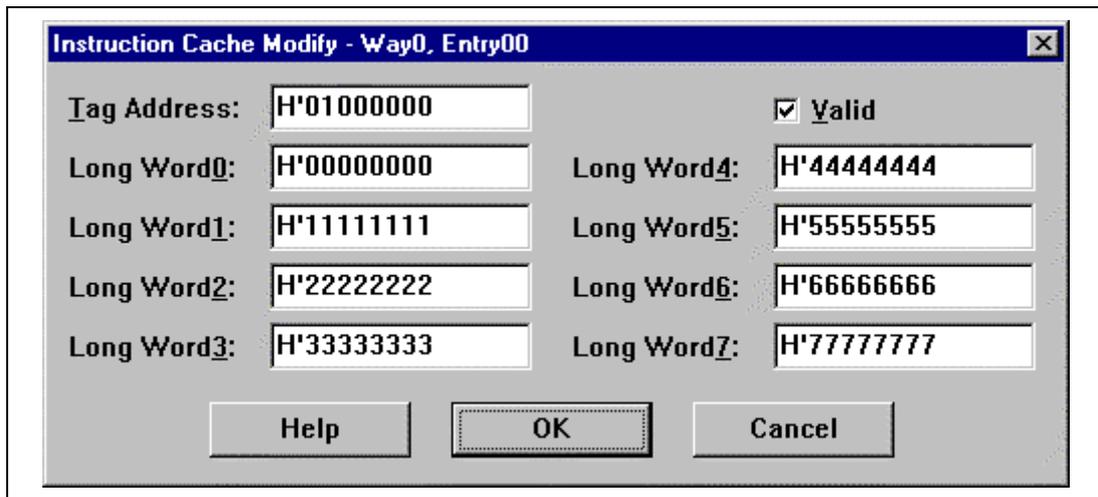


Figure 5.87 Instruction Cache Modify Dialog Box (for SH-4 (SH7750R))

The following items can be specified.

[Tag Address] Tag address. A longword physical address must be specified. Bits 31 to 10 are valid.

[Valid] Indicates whether or not the entry is valid. Selecting this box makes the entry valid.

[Long Word0] to

[Long Word7] Longword data 0 to 7 to be set to IC entries.

Clicking the [OK] button displays the modified contents in the **Instruction Cache** dialog box.

Clicking the [Cancel] button closes the dialog box without displaying the modified contents in the **Instruction Cache** dialog box.

5.65 Operand Cache Dialog Box

This dialog box displays the contents of the OC. This dialog box is provided only for the SH-4 series, and the displayed contents differ according to the target CPU.

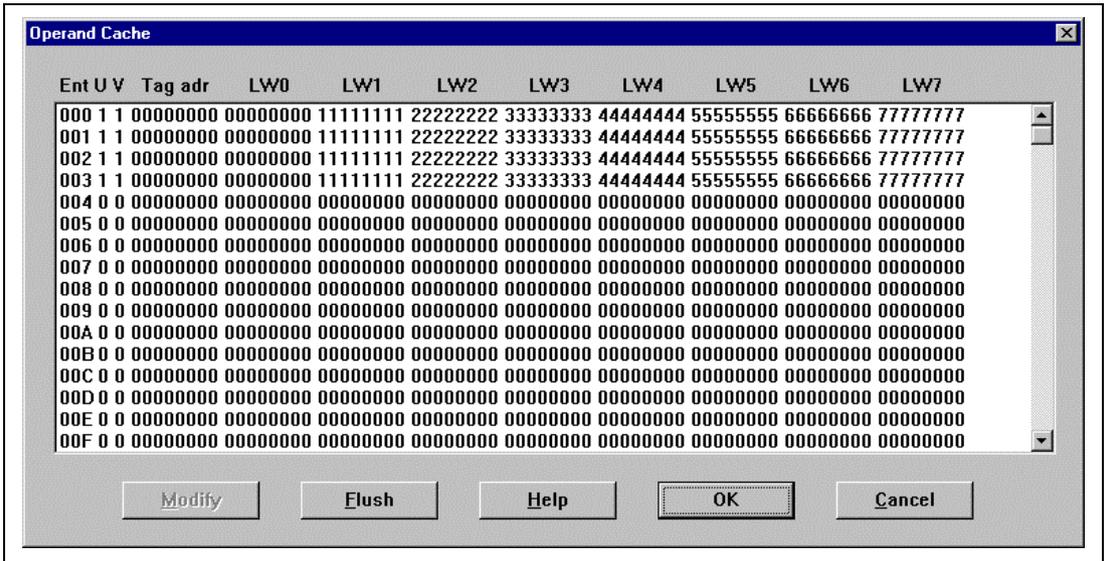


Figure 5.88 Operand Cache Dialog Box (for SH-4/SH-4BSC)

The following items are displayed.

- [Ent] Entry number in the OC (H'000 to H'1FF).
- [U] Update bit. When this bit is 1, the entry has been written to.
- [V] Validity bit. When this bit is 1, the entry is valid.
- [Tag adr] Tag address.
- [LW0] to [LW7] Longword data 0 to 7 stored in OC entries.

The OC contents can be modified and flushed using the following buttons.

- [Modify] Modifies the OC contents. After selecting the entry to be modified in the list box, click the button. The **Operand Cache Modify** dialog box will open and the OC contents can be modified.
- [Flush] Flushes all OC entries. Clicking the button clears the U and V bits of all entries to zero, and invalidates all OC entries.

Clicking the **[OK]** button stores the modified contents in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified contents.

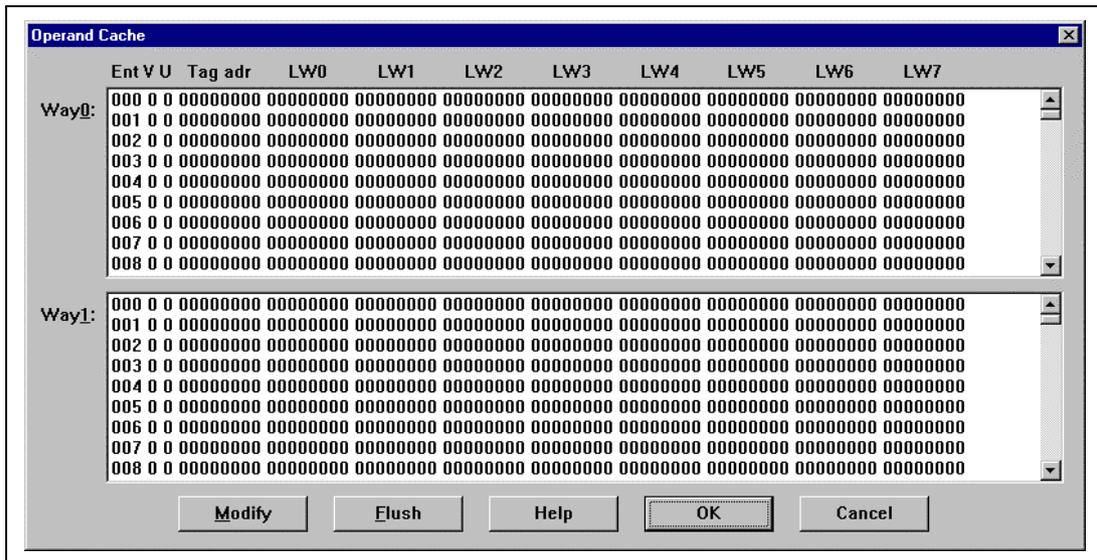


Figure 5.89 Operand Cache Dialog Box (for SH-4 (SH7750R))

This dialog box displays the contents of the cache set on Way0 and Way1. The following items are displayed.

- [Ent] Entry number in the OC (H'000 to H'1FF).
- [V] Validity bit. When this bit is 1, the entry is valid.
- [U] Update bit. When this bit is 1, the entry has been written to.
- [Tag adr] Tag address.
- [LW0] to [LW7] Longword data 0 to 7 stored in OC entries.

The OC contents can be modified and flushed using the following buttons.

- [Modify] Modifies the OC contents. After selecting the entry to be modified in the list box, click the button. The **Operand Cache Modify** dialog box will open and the OC contents can be modified.
- [Flush] Flushes all OC entries. Clicking the button clears the U and V bits of all entries to zero, and invalidates all OC entries.

Clicking the **[OK]** button stores the modified contents in the memory. Clicking the **[Cancel]** button closes the dialog box without storing the modified contents.

5.66 Operand Cache Modify Dialog Box

This dialog box modifies the OC contents of the entry selected in the **Operand Cache** dialog box. This dialog box is provided only for the SH-4 series, and the displayed contents differ according to the target CPU.

SH-4/SH-4BSC:

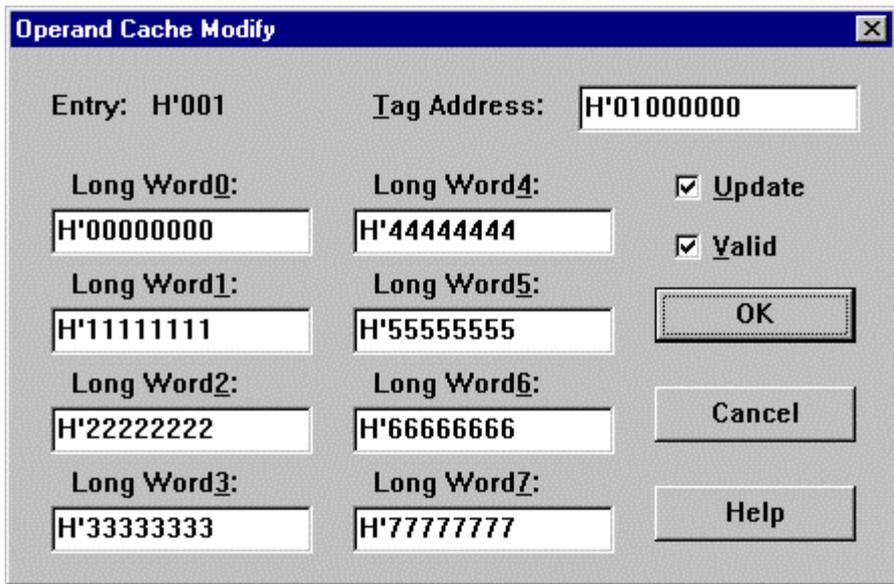


Figure 5.90 Operand Cache Modify Dialog Box (for SH-4/SH-4BSC)

The following items can be specified.

- | | |
|------------------------------|--|
| [Entry] | Entry number selected by the Operand Cache dialog box. |
| [Tag Address] | Tag address. A longword physical address must be specified. Bits 31 to 10 are valid. |
| [Update] | Indicates whether or not the entry has been written to. Selecting this box makes the simulator/debugger assume that the entry has been written to. |
| [Valid] | Indicates whether or not the entry is valid. Selecting this box makes the entry valid. |
| [Long Word0] to [Long Word7] | Longword data 0 to 7 to be set to OC entries. |

Clicking the **[OK]** button displays the modified contents in the **Operand Cache** dialog box. Clicking the **[Cancel]** button closes the dialog box without displaying the modified contents in the **Operand Cache** dialog box.

SH-4 (SH7750R):

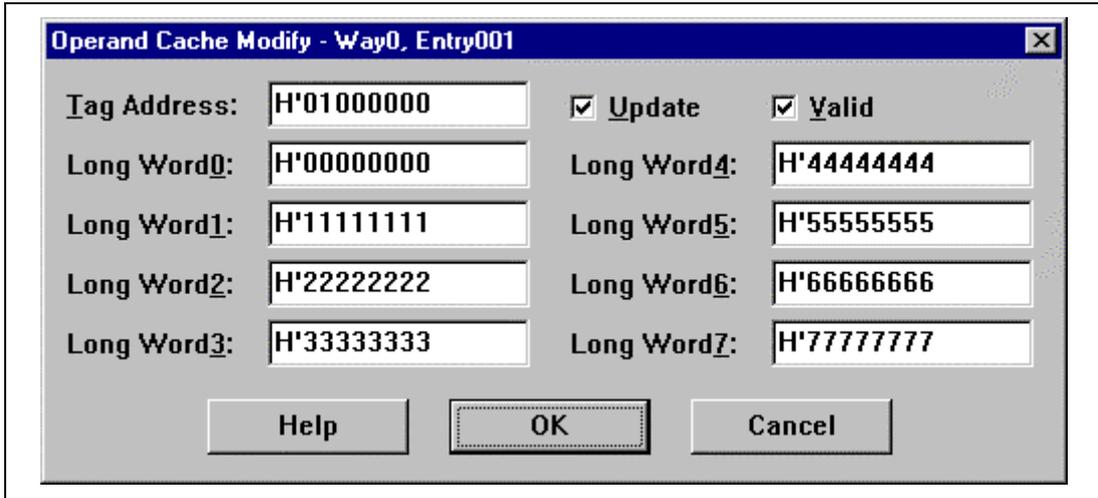


Figure 5.91 Operand Cache Modify Dialog Box (for SH-4 (SH7750R))

The following items can be specified.

[Tag Address] Tag address. A longword physical address must be specified. Bits 31 to 10 are valid.

[Update] Indicates whether or not the entry has been written to. Selecting this box makes the simulator/debugger assume that the entry has been written to.

[Valid] Indicates whether or not the entry is valid. Selecting this box makes the entry valid.

[Long Word0] to [Long Word7] Longword data 0 to 7 to be set to OC entries.

Clicking the **[OK]** button displays the modified contents in the **Operand Cache** dialog box. Clicking the **[Cancel]** button closes the dialog box without displaying the modified contents in the **Operand Cache** dialog box.

5.67 Simulated I/O Window

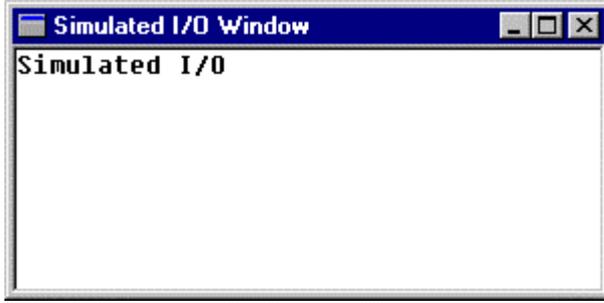


Figure 5.92 Simulated I/O Window

This window is for standard I/O and file I/O system calls from the user program.

Clicking the right mouse button on the **Simulated I/O** window displays the following popup menus.

- [Copy] Copies the highlighted text to the Windows® clipboard so that the text can be pasted to another application.
- [Paste] Pastes the text from the Windows® clipboard to the **Simulated I/O** window.
- [Clear Window] Clears the contents of the **Simulated I/O** window.

For the I/O processing, refer to section 3.12, Standard I/O and File I/O Processing.

5.68 Stack Trace Window

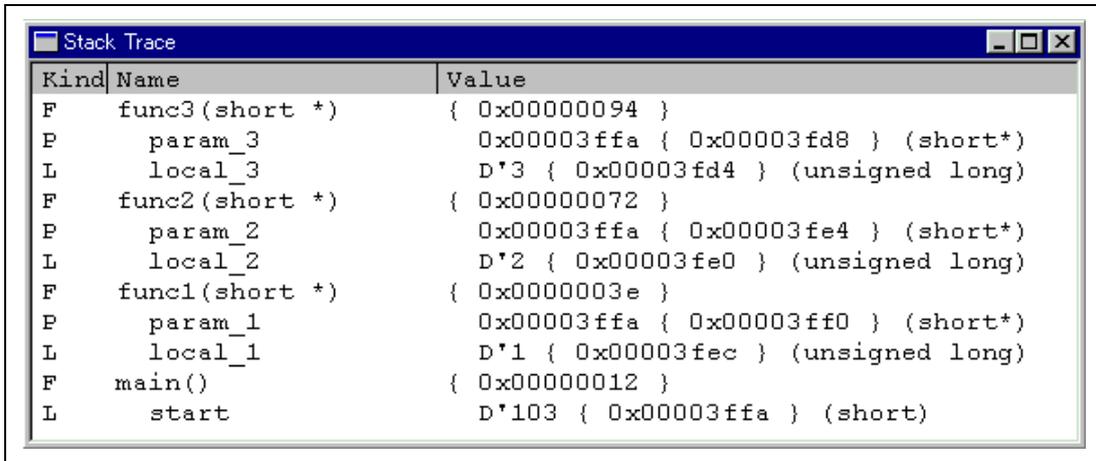


Figure 5.93 Stack Trace Window

This window displays the function call history.

The following items are displayed.

[Kind] Indicates the type of the symbol.
F: Function
P: Function parameter
L: Local variable

[Name] Indicates the symbol name.

[Value] Indicates the value, address, and type of the symbol.

Right-clicking on the mouse within the window displays a popup menu. Supported menu options are described in the following sections:

5.68.1 Copy

Copies the highlighted text into the Windows® clipboard, allowing it to be pasted into other applications.

5.68.2 Go to Source

Displays, in the **Source** window, the source program corresponding to the selected function.

5.68.3 View Setting...

Launches the **Stack Trace Setting** dialog box, allowing the user to specify the **Stack Trace** window settings.

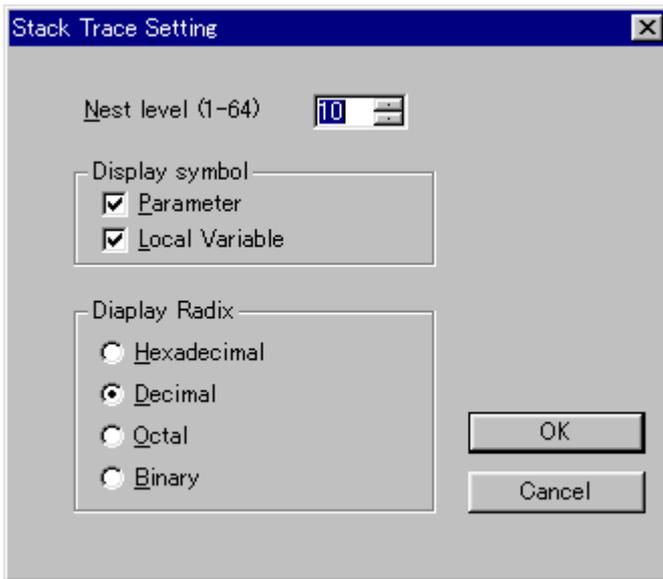


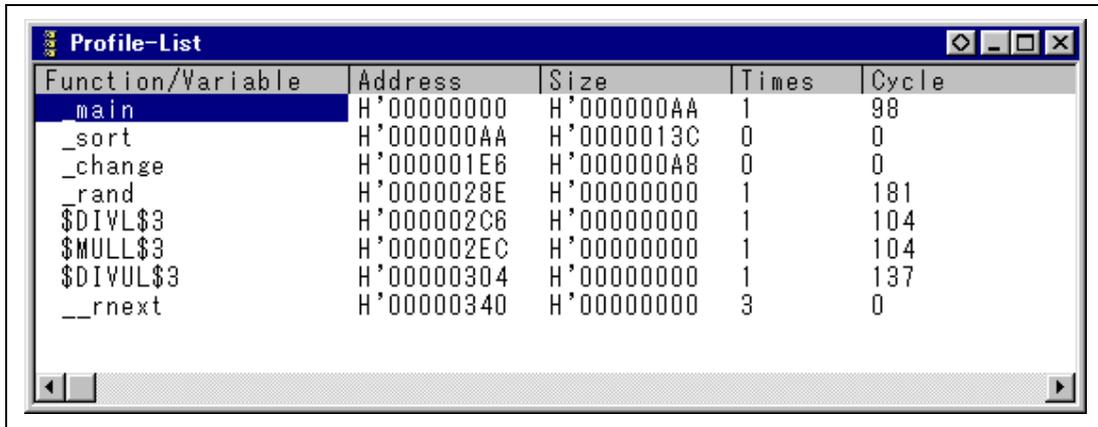
Figure 5.94 Stack Trace Setting Dialog Box

[Nest level] specifies the level of function call nestings to be displayed in the **Stack Trace** window.

[Display symbol] group check boxes specify the symbol types to be displayed in addition to functions.

[Display Radix] group radio buttons specify the radix for displays in the **Stack Trace** window.

5.69 Profile-List Window



The screenshot shows a window titled "Profile-List" with a table containing the following data:

Function/Variable	Address	Size	Times	Cycle
main	H'00000000	H'000000AA	1	98
_sort	H'000000AA	H'0000013C	0	0
_change	H'000001E6	H'000000A8	0	0
_rand	H'0000028E	H'00000000	1	181
\$DIVL\$3	H'000002C6	H'00000000	1	104
\$MULL\$3	H'000002EC	H'00000000	1	104
\$DIVUL\$3	H'00000304	H'00000000	1	137
__rnext	H'00000340	H'00000000	3	0

Figure 5.95 Profile-List Window

This window displays the address and size of a function or a global variable, the number of times the function is called or the global variable is accessed, and profile data. Displayed profile data differs according to the target CPU as follows:

SH-1/SH-2/SH-2E Series, SH-DSP, SH-2DSP, and SH-DSP (SH7065):

Called (the number of times a global variable is accessed)

Cycle (the number of execution cycles)

SH-3/SH-3E/SH-3DSP Series and SH-DSP with Cache:

Called (the number of times a global variable is accessed)

Cycle (the number of execution cycles)

Cache miss (the number of cache misses)

SH-4 Series:

Called (the number of times a global variable is accessed)

Cycle (the number of execution cycles)

ICache miss (the number of instruction cache misses)

OCache miss (number of operand cache misses)

The number of execution cycles and cache misses are calculated by subtracting the total execution cycles or cache misses at a specific function call instruction execution from the total execution cycles or cache misses at a return instruction execution of a specific function.

When the column header is clicked, data are sorted in alphabetic or ascending/descending order.

Double-clicking the Function/Variable or Address column displays the source program or disassembled memory contents corresponding to the address in the line. Right-clicking on the

mouse within the window displays a popup menu. Supported menu options are described in the following sections:

5.69.1 View Source

Displays the source program or disassembled memory contents for the address in the selected line. If a line of a global variable is selected, this menu option is displayed in gray characters.

5.69.2 View Profile-Tree

Displays the **Profile-Tree** window.

5.69.3 View Profile-Chart

Displays the **Profile-Chart** window focused on the function in the specified line.

5.69.4 Enable Profiler

Toggles acquisition of profile data. When profile data acquisition is active, a check mark is shown to the left of the text. Profile data and performance analysis data cannot be acquired at a time. If the profile data acquisition is going to be enabled when the performance analysis data acquisition is active (when the “Enable Analysis” in the **Performance Analysis** window is checked), a warning message box is displayed.

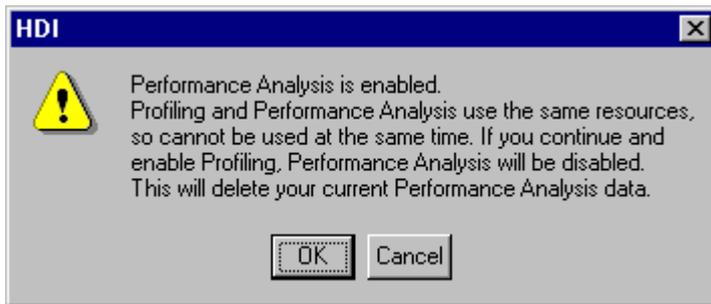


Figure 5.96 Warning Message Box Showing Profiler and Analysis Cannot Be Set at a Time

When [OK] is clicked, the performance analysis data acquisition is disabled and the profile data acquisition is enabled.

5.69.5 Find...

Displays the **Find Text** dialog box to find a character string in the Function/Variable column. Search is started by inputting a character string to be found in the edit box and clicking [**Find Next**] or pressing ENTER.

5.69.6 Clear Data

Clears the number of times functions are called and profile data. Data in the **Profile-Tree** window and the **Profile-Chart** window are also cleared.

5.69.7 Profile Information File...

Displays the **Save Profile Information File** dialog box. Profiling results are saved in a profile information file (.pro extension). The optimizing linkage editor optimizes user programs according to the profile information in this file. For details of the optimization using the profile information, refer to the manual of the optimizing linkage editor.

5.69.8 Output Text File...

Displays the **Save Text of Profile Data** dialog box. Displayed contents are saved in a text file.

5.69.9 Select Data...

Selects profile data types. The types of profile data differ according to the debugging platform. If this menu option is not supported by the debugging platform, it is displayed in gray characters.

5.69.10 Setting...

Displays the **Setting Profile-List** dialog box to set displayed contents.

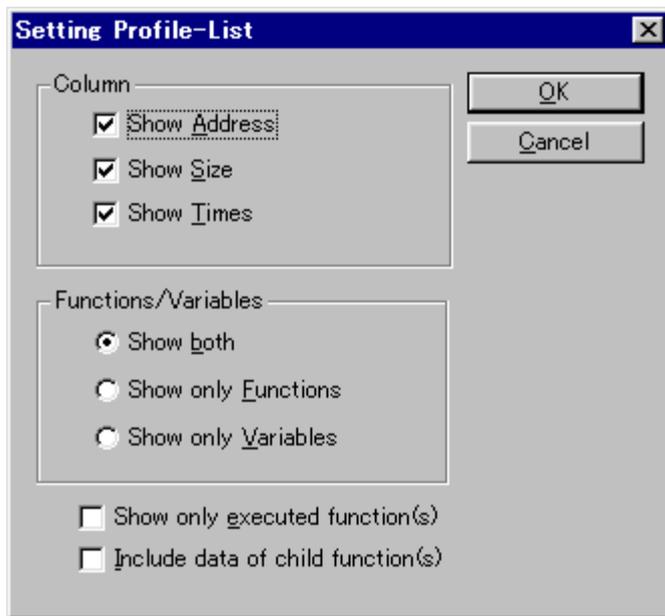


Figure 5.97 Setting Profile-List Dialog Box

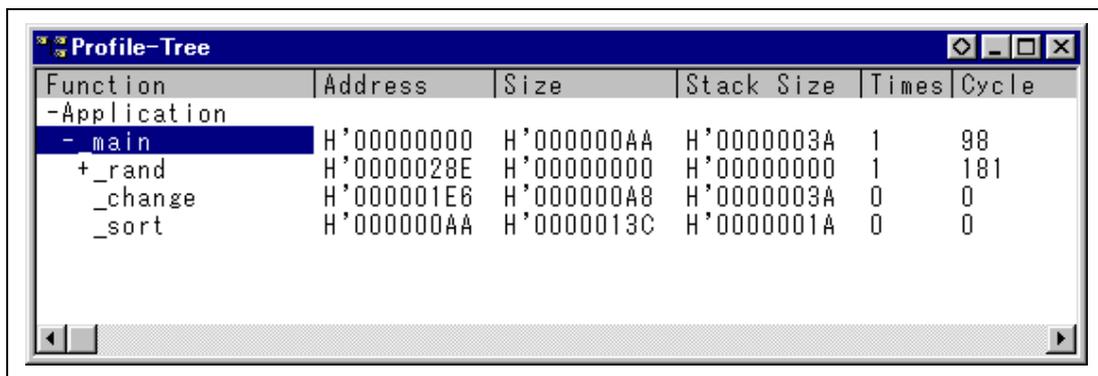
[Column] group check boxes set to display or not to display a specific column.

[Function/Variables] group radio buttons specify whether to display both the functions and global variables or to display either one of them in the Function/Variable column.

Checking in the **[Show Only Executed Function(s)]** check box disables displaying unexecuted functions. If a stack information file (.sni extension) output from the optimizing linkage editor does not exist, unexecuted functions are not displayed even if this check box is not checked.

The **[Include Data of Child Function(s)]** check box sets whether or not to display information for a child function called in the function as profile data.

5.70 Profile-Tree Window



The screenshot shows a window titled "Profile-Tree" with a table of function calls. The table has six columns: Function, Address, Size, Stack Size, Times, and Cycle. The rows are: -Application, -main, +_rand, _change, and _sort. The -main row is highlighted.

Function	Address	Size	Stack Size	Times	Cycle
-Application					
-main	H'00000000	H'000000AA	H'0000003A	1	98
+_rand	H'0000028E	H'00000000	H'00000000	1	181
_change	H'000001E6	H'000000A8	H'0000003A	0	0
_sort	H'000000AA	H'0000013C	H'0000001A	0	0

Figure 5.98 Profile-Tree Window

This window displays the relation of function calls in a tree structure. Displayed contents are the address, size, stack size, number of function calls, and profile data. The stack size, number of function calls, and profile data are values when the function is called.

Displayed profile data differ according to the target CPU as follows:

SH-1/SH-2/SH-2E Series, SH-DSP, SH-2DSP, and SH-DSP (SH7065):

Cycle (the number of execution cycles)

SH-3/SH-3E/SH-3DSP Series and SH-DSP with Cache:

Cycle (the number of execution cycles)

Cache miss (the number of cache misses)

SH-4 Series:

Cycle (the number of execution cycles)

ICache miss (the number of instruction cache misses)

OCache miss (the number of operand cache misses)

The number of execution cycles and cache misses are calculated by subtracting the total execution cycles or cache misses at a specific function call instruction execution from the total execution cycles or cache misses at a return instruction execution of a specific function.

Note: Displayed stack size does not represent the actual size. Use it as a reference value when the function is called. If there is no stack information file (.sni extension) output from the optimizing linkage editor, the stack size is not displayed. For details of the stack information file, refer to the manual of the optimizing linkage editor.

Double-clicking a function in the Function column expands or reduces the tree structure display. The expansion or reduction is also provided by the "+" or "-" key. Double-clicking the Address

column displays the source program or disassembled memory contents corresponding to the specific address.

Right-clicking on the mouse within the window displays a popup menu. Supported menu options are described in the following sections:

5.70.1 View Source

Displays the source program or disassembled memory contents for the address in the selected line.

5.70.2 View Profile-List

Displays the **Profile-List** window.

5.70.3 View Profile-Chart

Displays the **Profile-Chart** window focused on the function in the specified line.

5.70.4 Enable Profiler

Toggles acquisition profile data. When profile data acquisition is active, a check mark is shown to the left of the menu text. Profile data and performance analysis data cannot be acquired at a time. If the profile data acquisition is going to be enabled when the performance analysis data acquisition is active (when the “Enable Analysis” in the **Performance Analysis** window is checked), a warning message box is displayed.

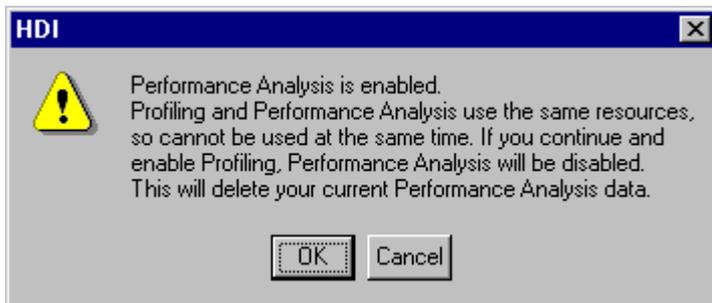


Figure 5.99 Warning Message Box Showing Profiler and Analysis Cannot Be Set at a Time

When [OK] is clicked, the performance analysis data acquisition is disabled and the profile data acquisition is enabled.

5.70.5 Find...

Displays the **Find Text** dialog box to find a character string in the Function column. Search is started by inputting a character string to be found in the edit box and clicking [**Find Next**] or pressing ENTER.

5.70.6 Find Data...

Displays the **Find Data** dialog box. When the cursor is in the Function column, this menu option is displayed in gray characters.

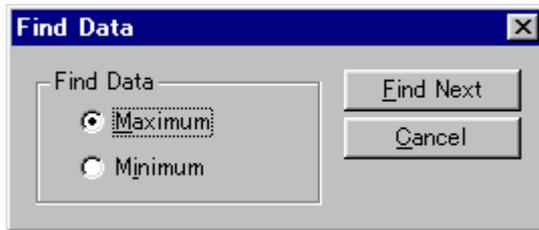


Figure 5-100 Find Data Dialog Box

By selecting the search type from the **Find Data** group and entering [**Find Next**] button or **ENTER** key, search is started. If the [**Find Next**] button or the ENTER key is input repeatedly, the second larger data (the second smaller data when the Minimum is specified) is searched for.

5.70.7 Clear Data

Clears the number of times functions are called and profile data. Data in the **Profile-Tree** window and the **Profile-Chart** window are also cleared.

5.70.8 Output Profile Information File...

Displays the **Save Profile Information File** dialog box. Profiling results are saved in a profile information file (.pro extension). The optimizing linkage editor optimizes user programs according to the profile information in this file. For details of the optimization using the profile information, refer to the manual of the optimizing linkage editor.

5.70.9 Output Text File...

Displays the **Save Text of Profile Data** dialog box. Displayed contents are saved in a text file.

5.70.10 Select Data...

Selects profile data types. The types of profile data differ according to the debugging platform. If this menu option is not supported by the debugging platform, it is displayed in gray characters.

5.70.11 Setting...

Displays the **Setting Profile-Tree** dialog box to set displayed contents.

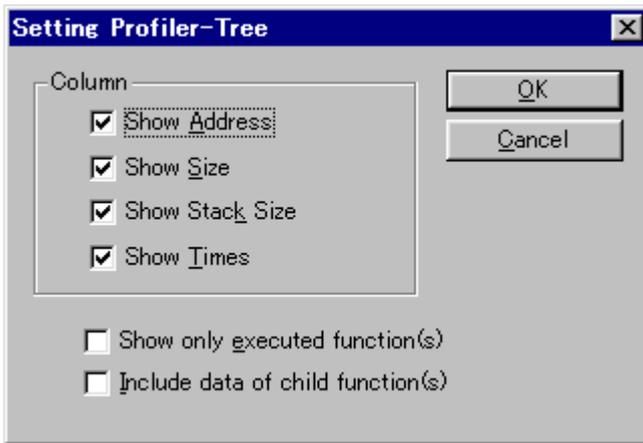


Figure 5.101 Setting Profile-Tree Dialog Box

[**Column**] group check boxes set to display or not to display a specific column.

Checking in the [**Show Only Executed Function(s)**] check box disables displaying unexecuted functions. If a stack information file (.sni extension) output from the optimizing linkage editor does not exist, unexecuted functions are not displayed even if this check box is not checked.

[**Include Data of Child Function(s)**] check box sets whether or not to display information for a child function called in the function as profile data.

5.71 Profile-Chart

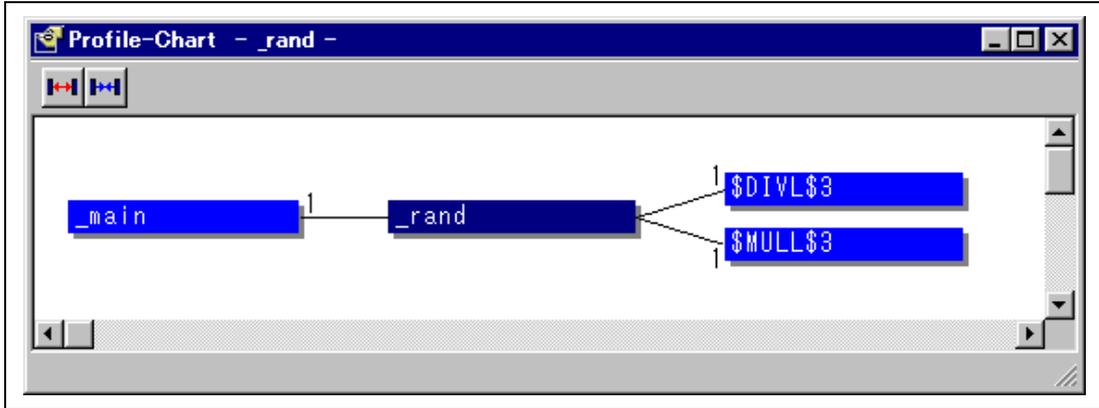


Figure 5-102 Profile-Chart Window

This window displays the relation of calls for a specific function. This window displays the calling relation for the function specified in the **Profile-List** window or **Profile-Tree** window. The specified function is displayed in the middle, the calling function on the left side, and the called function on the right side. Values beside the calling and called functions show the number of times the function has been called.

The **Profile-Chart** window includes the following tool buttons:

- Expands Size
- Reduces Size

Right-clicking on the mouse within the window displays a popup menu. Supported menu options are described in the section 5.71.3, View Source and in the subsequent sections.

5.71.1 Expands Size



Expands spaces between each function. The “+” key can also be used to expand spaces.

5.71.2 Reduces Size



Reduces spaces between each function. The “-” key can also be used to reduce spaces.

5.71.3 View Source

Displays the source program or disassembled memory contents for the address of the function on which the cursor is placed when the right side button of the mouse is clicked. If the cursor is not

placed on a function when the right side button is clicked, this menu option is displayed in gray characters.

5.71.4 View Profile-List

Displays the **Profile-List** window.

5.71.5 View Profile-Tree

Displays the **Profile-Tree** window.

5.71.6 View Profile-Chart

Displays the **Profile-Chart** window for the specific function on which the cursor is placed when the right side button of the mouse is clicked. If the cursor is not placed on a function when the right side button is clicked, this menu option is displayed in gray characters.

5.71.7 Enable Profiler

Toggles acquisition of profile data. When profile data acquisition is active, a check mark is shown to the left of the menu text. Profile data and performance analysis data cannot be acquired at a time. If the profile data acquisition is going to be enabled when the performance analysis data acquisition is active (when the “Enable Analysis” in the **Performance Analysis** window is checked), a warning message box is displayed.

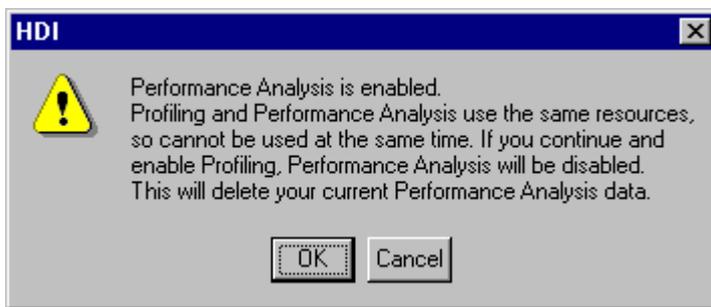


Figure 5.103 Warning Message Box Showing Profiler and Analysis Cannot Be Set at a Time

When [OK] is clicked, the performance analysis data acquisition is disabled and the profile data acquisition is enabled.

5.71.8 Clear Data

Clears the number of times functions are called and profile data. Data in the **List** window and the **Profile-Tree** window are also cleared.

5.71.9 Multiple View

If the **Profile-Chart** window is going to be opened when it has already been opened, selects whether another window is to be opened or the same window is to be used to display data. When a check mark is shown to the left side of the menu text, another window is opened.

5.71.10 Output Profile Information File...

Displays the **Save Profile Information File** dialog box. Profiling results are saved in a profile information file (.pro extension). The optimizing linkage editor optimizes user programs according to the profile information in this file. For details of the optimization using the profile information, refer to the manual of the optimizing linkage editor.

Section 6 Command Lines

Table 6.1 lists the commands.

Table 6.1 Simulator/Debugger Commands

Command Name	Abbreviation	Function
!	-	Comment
ANALYSIS	AN	Enables or disables performance analysis
ANALYSIS_RANGE	AR	Sets or displays performance analysis functions
ANALYSIS_RANGE_DELETE	AD	Deletes a performance analysis range
ASSEMBLE	AS	Assembles instructions into memory
ASSERT	-	Checks if an expression is true or false
BREAKPOINT	BP	Sets a breakpoint at an instruction address
BREAK_ACCESS	BA	Specifies a memory range access as a break condition
BREAK_CLEAR	BC	Deletes breakpoints
BREAK_DATA	BD	Specifies a memory data value as a break condition
BREAK_DISPLAY	BI	Displays a list of breakpoints
BREAK_ENABLE	BE	Enables or disables a breakpoint
BREAK_REGISTER	BR	Specifies a register data as a break condition
BREAK_SEQUENCE	BS	Sets sequential breakpoints
DISASSEMBLE	DA	Disassembles memory contents
ERASE	ER	Clears the Command Line window
EVALUATE	EV	Evaluates an expression
FILE_LOAD	FL	Loads an object (program) file
FILE_SAVE	FS	Saves memory to a file
FILE_VERIFY	FV	Verifies file contents against memory
GO	GO	Executes user program
GO_RESET	GR	Executes user program from reset
GO_TILL	GT	Executes user program until temporary breakpoint
HALT	HA	Halts user program
HELP	HE	Gets help for command line or help on a command
INITIALISE	IN	Initializes HDI

Table 6.1 Simulator/Debugger Commands (cont)

Command Name	Abbreviation	Function
LOG	LO	Controls command output logging
MAP_DISPLAY	MA	Displays memory mapping
MAP_SET	MS	Allocates a memory area
MEMORY_DISPLAY	MD	Displays memory contents
MEMORY_EDIT	ME	Modifies memory contents
MEMORY_FILL	MF	Fills a memory area
MEMORY_MOVE	MV	Moves a block of memory
MEMORY_TEST	MT	Tests a block of memory
QUIT	QU	Exits HDI
RADIX	RA	Sets default input radix
REGISTER_DISPLAY	RD	Displays CPU register values
REGISTER_SET	RS	Changes CPU register contents
RESET	RE	Resets CPU
SLEEP	-	Delays command execution
STEP	ST	Steps program (by instructions or source lines)
STEP_OUT	SP	Steps out of the current function
STEP_OVER	SO	Steps program, not stepping into functions
STEP_RATE	SR	Sets rate of stepping
SUBMIT	SU	Executes a command file
SYMBOL_ADD	SA	Defines a symbol
SYMBOL_CLEAR	SC	Deletes a symbol
SYMBOL_LOAD	SL	Loads a symbol information file
SYMBOL_SAVE	SS	Saves a symbol information file
SYMBOL_VIEW	SV	Displays symbols
TRACE	TR	Displays trace buffer contents
TRACE_ACQUISITION	TA	Enables or disables trace information acquisition

The following describes each command syntax.

!(COMMENT)

Abbreviation: none

Description:

Allows a comment to be entered, useful for documenting log files.

Syntax:

! <text>

Parameter	Type	Description
<text>	Text	Output text

Example:

! Start of test routine Outputs comment 'Start of test routine' into the **Command Line** window (and to the log file, if logging is active).

ANALYSIS

Abbreviation: AN

Description:

Enables/disables performance analysis. Counts are not automatically reset before running.

Syntax:

an [<state>]

Parameter	Type	Description
none		Displays the performance analysis state
<state>	Keyword	Enables/disables performance analysis
	enable	Enables performance analysis
	disable	Disables performance analysis
	reset	Resets performance analysis counts

Examples:

ANALYSIS Displays performance analysis state.

AN enable Enables performance analysis.

AN disable

Disables performance analysis.

AN reset

Resets performance analysis counts.

ANALYSIS_RANGE

Abbreviation: AR

Description:

Sets a function for which the performance analysis is provided, or displays a function for which the performance analysis is provided without parameters.

Syntax:

ar [<function name>]

Parameter	Type	Description
none		Displays all functions for which the performance analysis is provided
<function name>	String	Name of function for which the performance analysis is provided

Examples:

ANALYSIS_RANGE sort

Provides the performance analysis for the function sort.

AR

Displays the function for which the performance analysis is provided.

ANALYSIS_RANGE_DELETE

Abbreviation: AD

Description:

Deletes the specified function, or all functions if no parameters are specified (it does **not** ask for confirmation).

Syntax:

ad [<index>]

Parameter	Type	Description
none		Deletes all functions
<index>	Numeric	Index number of function to delete

Examples:

ANALYSIS_RANGE_DELETE 6 Deletes the function with index number 6.

AD Deletes all functions.

ASSEMBLE

Abbreviation: AS

Description:

Assembles mnemonics and writes them into memory. In assembly mode, '.' exits, '^' steps back a byte, the ENTER key steps forward a byte.

Syntax:

as <address>

Parameter	Type	Description
<address>	Numeric	Address at which to start assembling

Example:

AS H'1000 Starts assembling from H'1000.

ASSERT

Abbreviation: none

Description:

Checks if an expression is true or false. It can be used to terminate the batch file when the expression is false. If the expression is false, an error is returned. This command can be used to write test harnesses for subroutines.

Syntax:

assert <expression>

Parameter	Type	Description
<expression>	Expression	Expression to be checked

Example:

ASSERT #R0 == 0x100 Returns an error if R0 does not contain 0x100.

BREAKPOINT

Abbreviation: BP

Description:

Specifies a breakpoint at the address where the instruction is written.

Syntax:

bp <address> [<count>]

Parameter	Type	Description
<address>	Numeric	The address of a breakpoint
<count>	Numeric	The number of times the instruction at the specified address is to be fetched (optional, default = 1).

Examples:

BREAKPOINT 0 2 A break occurs when an attempt is made to execute the instruction at address H'0 for the second time.

BP C0 A break occurs when an attempt is made to execute the instruction at address H'C0.

BREAK_ACCESS

Abbreviation: BA

Description:

Specifies a memory range as a break condition

Syntax:

ba <start address> [<end address>] [<mode>]

Parameter	Type	Description
<start address>	Numeric	The start address of a breakpoint
<end address>	Numeric	The end address of a breakpoint (optional, default = <start address>)
<mode>	Keyword	Access type (optional, default = RW).
	R	A break occurs when the specified range is read.
	W	A break occurs when the specified range is written to.
	RW	A break occurs when the specified range is read or written to.

Examples:

`BREAK_ACCESS 0 1000 W` A break occurs when the specified range from address H'0 to address H'1000 is written to.

`BA FFFF` A break occurs when address H'FFFF is accessed.

Note: For the SH-3DSP series, specify values within the range H'A5000000 to H'A501FFFF (X and Y memory virtual addresses, corresponding to physical addresses H'05000000 to H'0501FFFF) as the start end addresses for X or Y memory accesses by the MOVX or MOVY instruction.

BREAK_CLEAR

Abbreviation: BC

Description:

Deletes breakpoints.

Syntax:

`bc <index>`

Parameter	Type	Description
<index>	Numeric	Index of the breakpoint to be canceled. If the index is omitted, all breakpoints are deleted.

Examples:

`BREAK_CLEAR 0` The first breakpoint is deleted.

`BC` All breakpoints are deleted.

BREAK_DATA

Abbreviation: BD

Description:

Specifies a memory data value as a break condition.

Syntax:

bd <address> <data> [<size>] [<option>]

Parameter	Type	Description
<address>	Numeric	The address where the break condition is checked.
<data>	Numeric	Access data
<size>	Keyword	Size (optional, default = L).
	B	Byte size
	W	Word size
	L	Longword size
	S	Single-precision floating-point size
	D	Double-precision floating-point size
<option>	Keyword	Match or mismatch of data. The default is EQ.
	EQ	A break occurs when the data matches the specified value.
	NE	A break occurs when the data does not match the specified value.

Examples:

- BREAK_DATA 0 100 L EQ A break occurs when H'100 is written to memory address H'0 in longword.
- BD C0 FF B NE A break occurs when a value other than H'FF is written to memory address H'C0 in byte.
- BD 4000 1000 A break occurs when H'1000 is written to memory address H'4000 in longword.

Note: For the SH-3DSP series, specify values within the range H'A5000000 to H'A501FFFF (X and Y memory virtual addresses, corresponding to physical addresses H'05000000 to H'0501FFFF) as the start end addresses for X or Y memory accesses by the MOVX or MOVY instruction.

BREAK_DISPLAY

Abbreviation: BI

Description:

Displays a list of breakpoints.

Syntax:

bi

Parameter	Type	Description
None		Displays a list of breakpoints

Examples:

BREAK_DISPLAY A list of breakpoints is displayed.

BI A list of breakpoints is displayed.

BREAK_ENABLE

Abbreviation: BE

Description:

Enables or disables a breakpoint.

Syntax:

be <flag> [<index>]

Parameter	Type	Description
<flag>	Keyword	Enabling or disabling of a breakpoint
	E	Enable
	D	Disable
<index>	Numeric	Index of the breakpoint to be canceled. If the index is omitted, all breakpoints are deleted.

Examples:

BREAK_ENABLE D 0 The first breakpoint is disabled.

BE E All breakpoints are enabled.

BREAK_REGISTER

Abbreviation: BR

Description:

Specifies a register data as a break condition

Syntax:

br <register name> [<data> <size>] [<option>]

Parameter	Type	Description
<register>	Character string	Register name.
<data>	Numeric	Access data.
<size>	Keyword	Access size. If no size is specified, the size of the specified register is assumed. Note that when data is specified, the size must not be omitted.
	B	Byte size
	W	Word size
	L	Longword size
	S	Single-precision floating-point size
	D	Double-precision floating-point size
<option>	Keyword	Match or mismatch of data. The default is EQ.
	EQ	A break occurs when the data matches the specified value.
	NE	A break occurs when the data does not match the specified value.

Examples:

BREAK_REGISTER R0 FFFF W EQ A break occurs when the low-order two bytes of the R0 register change to H'FFFF.

BR R10 A break occurs when the R10 register is written to.

BREAK_SEQUENCE

Abbreviation: BS

Description:

Sets sequential breakpoints

Syntax:

bs <address1> [<address2> [<address 3> [...]]]

Parameter	Type	Description
<address1> - <address8>	Numeric	Addresses of sequential breakpoints. Up to eight addresses can be specified.

Examples:

BREAK_SEQUENCE 1000 2000 A break occurs when addresses H'1000 and H'2000 are passed in this order.

BS 1000 A break occurs when address H'1000 is executed.

DISASSEMBLE

Abbreviation: DA

Description:

Disassembles memory contents to assembly-language code. The display of disassembled memory is fully symbolic.

Syntax:

da <address> [<length>]

Parameter	Type	Description
<address>	Numeric	Start address
<length>	Numeric	Number of instructions (optional, default = 16)

Examples:

DISASSEMBLE H'100 5 Disassembles 5 lines of code starting at H'100.

DA H'3E00 20 Disassembles 20 lines of code starting at H'3E00.

ERASE

Abbreviation: ER

Description:

Clears the **Command Line** window

Syntax:

fs <filename> <start> <end>

Parameter	Type	Description
<filename>	String	File name
<start>	Numeric	Start address
<end>	Numeric	End address

Examples:

FILE_SAVE TESTFILE H'0 H'2013 Saves address range H'0-H'2013 as Motorola S-Record file "TESTFILE.MOT".

FS D:\\USER\\ANOTHER.A22 H'4000 H'4FFF Saves address range H'4000-H'4FFF as S-Record format file "ANOTHER.A22".

FILE_VERIFY

Abbreviation: FV

Description:

Verifies file contents against memory contents. The file data must be in a Motorola S-Record format. The file extension default is **.MOT**.

Syntax:

fv <filename> [<offset>]

Parameter	Type	Description
<filename>	String	File name
<offset>	Numeric	Offset to be added to file address (optional, default = 0)

Examples:

FILE_VERIFY A:\\BINARY\\TEST.A22 Verifies S-Record file "TEST.A22" against memory.

FV ANOTHER 200 Verifies Motorola S-Record file "ANOTHER.MOT" against memory with an offset of H'200 bytes.

GO

Abbreviation: GO

Description:

Executes object code (the user program). While the user program is executing, the **Performance Analysis** window is updated.

Syntax:

go [<state>] [<address>]

Parameter	Type	Description
<state>	Keyword	Specifies whether or not to continue command processing during user program execution (optional, default = wait)
	wait	Causes command processing to wait until user program stops
	continue	Continues command processing during execution
<address>	Numeric	Start address for PC (optional, default = PC value)

Wait is the default and this causes command processing to wait until user program stops executing.

Continue allows you to continue to enter commands (but they may not work depending on the debugging platform).

Examples:

GO Executes the user program from the current PC value. Command processing cannot be continued.

GO CONTINUE H'1000 Executes the user program from H'1000. Command processing can be continued.

GO_RESET

Abbreviation: GR

Description:

Executes the user program starting at the address specified in the reset vector.

While the user program is executing, the **Performance Analysis** window is updated.

Wait is the default and this causes command processing to wait until user program stops executing

Continue allows you to continue to enter commands (but they may not work depending on the debugging platform)

Example:

GO_TILL H'1000 Continues execution until the PC reaches address H'1000.

HALT

Abbreviation: HA

Description:

Halts the user program. This command can be used after the GO command if the GO command uses continue for option.

Syntax:

ha

Parameter	Type	Description
none		Halts the user program

Example:

HA Halts the user program.

HELP

Abbreviation: HE

Description:

Opens a window displaying the help file.

For context sensitive help, the F1 key should be pressed. Help on a particular command can be displayed by entering HELP or HE followed by the command name.

Syntax:

he [<command>]

Parameter	Type	Description
none		Displays the contents of the help
<command>	String	Displays the help for the specified command

Examples:

HE	Displays the contents of the help.
HE GO	Displays help for the GO command.

INITIALISE

Abbreviation: IN

Description:

Initializes HDI, user system, all breakpoints, and memory mapping. It also initializes debugging platform, as if you had reselected the target DLL.

Syntax:

in

Parameter	Type	Description
none		Initializes HDI

Example:

IN	Initializes HDI.
----	------------------

LOG

Abbreviation: LO

Description:

Controls logging of command output to file. If no parameters are specified, logging status is displayed. If an existing file is specified, you will be warned; if you answer 'No', data will be overwritten to the existing file, otherwise the file will be added. Logging is only supported for the command line interface.

Syntax:

lo [<state>|<filename>]

Parameter	Type	Description
none		Displays logging status
<state>	Keyword	Starts or suspends logging
	+	Starts logging
	-	Suspends logging
<filename>	Numeric	Specifies the logging output file

Examples:

LOG TEST Stores the logging in file TEST.

LO - Suspends logging.

LOG + Resumes logging.

LOG Displays logging status

MAP_DISPLAY

Abbreviation: MA

Description:

Displays memory mapping.

Syntax:

ma

Parameter	Type	Description
none		Displays the current memory mapping

Example:

MA Displays the current memory mapping.

MAP_SET

Abbreviation: MS

Description:

Allocates a memory area.

Syntax:

ms <start address> [<end address>] [<mode>]

Parameter	Type	Description
<start address>	Numeric	Specified start address
<end address>	Numeric	Specified end address
<mode>	Keyword	Access type (optional, default = RW)
	R	Read only
	W	Write only
	RW	Displays the current memory mapping

Examples:

MAP_SET 0000 3FFF RW A read/write-enabled area is allocated to addresses H'0000 to H'3FFF.

MS 5000 A read/write-enabled area is allocated to address H'5000.

MEMORY_DISPLAY**Abbreviation: MD****Description:**

Displays memory contents.

Syntax:

md <address> [<length>] [<mode>]

Parameter	Type	Description
<address>	Numeric	Start address
<length>	Numeric	Length (optional, default = H'100 bytes)
<mode>	Keyword	Display format (optional, default = byte)
	byte	Displays in byte units
	word	Displays in word units (2 bytes)
	long	Displays in longword units (4 bytes)
	ascii	Displays in ASCII codes
	single	Displays in single-precision floating-point format
	double	Displays in double-precision floating-point format

Examples:

MEMORY_DISPLAY H'C000 H'100 WORD Displays H'100 bytes of memory starting at H'C000 in word units

MEMORY_DISPLAY H'1000 H'FF Displays H'FF bytes of memory starting at H'1000 in byte units

MEMORY_EDIT

Abbreviation: ME

Description:

Allows memory contents to be modified. When editing memory the current location may be modified in a similar way to that described in the **ASSEMBLE** command description.

When editing, '.' exits edit mode, '^' goes back a unit, and blank line goes forward without modification.

Syntax:

me <address> [<mode>] [<state>]

Parameter	Type	Description
<address>	Numeric	Address to edit
<mode>	Keyword	Format (optional, default = byte)
	byte	Edits in byte units
	word	Edits in word units
	long	Edits in longword units
	ascii	Edits in ASCII codes
	single	Edits in the single-precision floating-point format
	double	Edits in the double-precision floating-point format
<state>	Keyword	Verify flag (optional, default = V)
	V	Verify
	N	No verify

Example:

ME H'1000 WORD Modifies memory contents in word units starting from H'1000 (with verification)

MEMORY_FILL**Abbreviation: MF****Description:**

Modifies the contents in the specified memory area to the specified data value.

Syntax:

mf <start> <end> <data> [<mode>] [<state>]

Parameter	Type	Description
<start>	Numeric	Start address
<end>	Numeric	End address
<data>	Numeric	Data value
<mode>	Keyword	Data size (optional, default = byte)
	byte	Byte
	word	Word
	long	Longword
	single	Single-precision floating-point
	double	Double-precision floating-point
<state>	Keyword	Verify flag (optional, default = V)
	V	Verify
	N	No verify

Examples:

MEMORY_FILL H'C000 H'C0FF H'55AA WORD Modifies memory contents in the range from H'C000 to H'C0FF to word data H'55AA.

MF H'5000 H'7FFF H'21 Modifies memory contents in the range from H'5000 to H'7FFF to data H'21.

MEMORY_MOVE

Abbreviation: MV

Description:

Moves data in the specified memory area.

Syntax:

mv <start> <end> <dest> [<state>]

Parameter	Type	Description
<start>	Numeric	Source start address
<end>	Numeric	Source end address (including this address)
<dest>	Numeric	Destination start address
<state>	Keyword	Verify flag (optional, default = V)
	V	Verify
	N	No verify

Examples:

MEMORY_MOVE H'1000 H'1FFF H'2000 Moves memory contents in the area from H'1000 to H'1FFF into H'2000.

MV H'FB80 H'FF7F H'3000 Moves memory contents in the area from H'FB80 to H'FF7F into H'3000.

MEMORY_TEST

Abbreviation: MT

Description:

Performs read, write, and verification testing in the specified address range. At this time, the original contents are destroyed. The test will access the memory according to the map settings.

This simulator/debugger does not support the MEMORY_TEST command.

Syntax:

mt <start> <end>

Parameter	Type	Description
<start>	Numeric	Start address
<end>	Numeric	End address (including this address)

Examples:

MEMORY_TEST H'8000 H'BFFF Tests from H'8000 to H'BFFF.

MT H'4000 H'5000 Tests from H'4000 to H'5000.

QUIT

Abbreviation: QU

Description:

Exits HDI. Closes a log file if it is open.

Syntax:

qu

Parameter	Type	Description
none		Exits HDI

Example:

QU Exits HDI.

RADIX

Abbreviation: RA

Description:

Sets default input radix. If no parameters are specified, the current radix is displayed. Radix can be changed by using B', H', D', or O' before numeric data.

Syntax:

ra [<mode>]

Parameter	Type	Description
none		Displays current radix
<mode>	Keyword	Sets radix to specified type
	H	Sets radix to hexadecimal
	D	Sets radix to decimal
	O	Sets radix to octal
	B	Sets radix to binary

Examples:

- RADIX Displays the current radix.
- RA H Sets the radix to hexadecimal.

REGISTER_DISPLAY

Abbreviation: RD

Description:

Displays CPU register contents.

Syntax:

rd

Parameter	Type	Description
none		Displays all register contents

Example:

- RD Displays all register contents

REGISTER_SET

Abbreviation: RS

Description:

Changes the contents of a register.

Syntax:

rs <register> <value> <mode>

Parameter	Type	Description
<register>	Keyword	Register name
<value>	Numeric	Register value
<mode>	Keyword	Data size (optional, default = corresponding register size)
	byte	Byte
	word	Word
	long	Longword
	single	Single-precision floating-point
	double	Double-precision floating-point

Examples:

RS PC _StartUp Sets the program counter to the address defined by the symbol _StartUp

RS R0 H'1234 WORD Sets word data H'1234 to R0.

RESET

Abbreviation: RE

Description:

Resets the microprocessor. All register values are set to the initial values of the device. Memory mapping and breakpoints are not initialized.

Syntax:

re

Parameter	Type	Description
none		Resets the microprocessor

Example:

RE Resets the microprocessor.

SLEEP

Abbreviation: none

Description:

Delays command execution for a specified period.

Syntax:

sleep <milliseconds>

Parameter	Type	Description
< milliseconds >	Numeric	Delayed time (ms)

Default radix (it is not always decimal) is used, if you do not specify D'.

Example:

SLEEP D'9000 Delays 9 seconds.

STEP

Abbreviation: ST

Description:

Single step (in source line or instruction units) execution. Performs a specified number of instructions, from current PC. Default is stepping by lines if source debugging is available. Count default is 1.

Syntax:

st [<mode>] [<count>]

Parameter	Type	Description
<mode>	Keyword	Type of single step (optional)
	instruction	Steps by assembly instruction
	line	Steps by source code line
<count>	Numeric	Number of steps (optional, default = 1)

Example:

STEP 9 Steps code for 9 steps.

STEP_OUT

Abbreviation: SP

Description:

Steps the program out of the current function. (i.e., a step up). This works for both assembly-language and source level debugging.

Syntax:

sp

Parameter	Type	Description
none		Steps the program out of the current function

Example:

SP Steps the program out of the current function.

STEP_OVER

Abbreviation: SO

Description:

Performs a specified number of instructions from current PC.

This command differs from STEP in that it does not perform single step operation in subroutines or interrupt routines. These are executed at full speed.

Syntax:

so [<mode>] [<count>]

Parameter	Type	Description
<mode>	Keyword	Type of stepping (optional)
	instruction	Steps by assembly instruction
	line	Step by source code line
<count>	Numeric	Number of steps (optional, default = 1)

Example:

SO Steps over 1-step code.

STEP_RATE

Abbreviation: SR

Description:

Controls the speed of stepping in the STEP and STEP_OVER commands. A rate of 6 causes the fastest stepping. A value of 1 is the slowest.

Syntax:

sr <rate>

Parameter	Type	Description
none		Displays the step rate
<rate>	Numeric	Step rate 1 to 6 (6 = fastest)

Examples:

- SR Displays the current step rate.
- SR 6 Specifies the fastest step rate.

SUBMIT

Abbreviation: SU

Description:

Executes a file of emulator commands. This command can be used even in a command file to be processed. Any error aborts the file. The **[stop]** button terminates the process.

Syntax:

su <filename>

Parameter	Type	Description
<filename>	String	File name

Examples:

- SUBMIT COMMAND.HDC Processes the file COMMAND.HDC.
- SU A:SETUP.TXT Processes the file SETUP.TXT on drive A:.

SYMBOL_ADD

Abbreviation: SA

Description:

Adds a symbol, or changes an existing one.

Syntax:

sa <symbol> <value>

Parameter	Type	Description
<symbol>	String	Symbol name
<value>	Numeric	Value

Examples:

SYMBOL_ADD start H'1000 Defines the symbol start at H'1000.

SA END_OF_TABLE 1000 Uses current default radix and defines END_OF_TABLE at H'1000 .

SYMBOL_CLEAR

Abbreviation: SC

Description:

Deletes a symbol. If no parameters are specified, deletes all symbols (after confirmation).

Syntax:

sc [<symbol>]

Parameter	Type	Description
none		Deletes all symbols
<symbol>	String	Symbol name

Examples:

SYMBOL_CLEAR Deletes all symbols (after confirmation).

SC start Deletes the symbol 'start'.

SYMBOL_LOAD

Abbreviation: SL

Description:

Loads symbols from file. File must be in XLINK Pentica-b format (i.e. 'XXXXXH name'). The symbols are added to the existing symbol table.

Syntax:

sl <filename>

Parameter	Type	Description
<filename>	String	File name

Examples:

SYMBOL_LOAD TEST.SYM	Loads the file TEST.SYM.
SL MY_CODE.SYM	Loads the file MY_CODE.SYM.

SYMBOL_SAVE

Abbreviation: SS

Description:

Saves symbols to a file in XLINK Pentica-b format. The symbol file extension default is **.SYM**. If the file name already exists, then a prompt to overwrite the file is displayed.

Syntax:

ss <filename>

Parameter	Type	Description
<filename>	String	File name

Examples:

SYMBOL_SAVE TEST	Saves symbol table to TEST.SYM.
SS MY_CODE.SYM	Saves the symbol table to MY_CODE.SYM.

SYMBOL_VIEW

Abbreviation: SV

Description:

Displays all defined symbols, or those containing the case sensitive string pattern.

Syntax:

sv [<pattern>]

Parameter	Type	Description
none		Displays all symbols
<pattern>	String	Displays the symbols including the specified string pattern

Examples:

- SYMBOL_VIEW BUFFER Displays all symbols containing the word BUFFER.
- SV Displays all the symbols.

TRACE

Abbreviation: TR

Description:

Displays the trace buffer contents. The last (most recently executed) cycle in the buffer is 0, and older cycles have negative values.

Syntax:

tr [<start rec> [<count>]]

Parameter	Type	Description
<start rec>	Numeric	Offset (optional, default = most recent cycle - 9)
<count>	Numeric	Count (optional, default = 10)

Example:

- TR 0 5 Displays five lines of trace buffer contents starting from the top of the buffer.

TRACE_ACQUISITION

Abbreviation: TA

Description:

Enables or disables trace information acquisition

Syntax:

ta <mode>

Parameter	Type	Description
<mode>	Keyword	Enabling or disabling trace information acquisition.
	E	Trace information acquisition is enabled.
	D	Trace information acquisition is disabled.

Examples:

TRACE_ACQU ISITION E Trace information acquisition is enabled.

TA D Trace information acquisition is disabled.

Section 7 Messages

7.1 Information Messages

The simulator/debugger outputs information messages as listed in table 7.1 to notify users of execution status.

Table 7.1 Information Messages

Message	Contents
Break Access	The break access condition was satisfied and execution has stopped.
Break Data	The break data condition was satisfied and execution has stopped.
Break Register	The break register condition was satisfied and execution has stopped.
Break Sequence	The break sequence condition was satisfied and execution has stopped.
PC Breakpoint	The breakpoint condition was satisfied and execution has stopped.
Sleep	Execution has been stopped by the SLEEP instruction.
Step Normal End	The step execution succeeded.
Stop	Execution has been stopped by the [Stop] button.
Trace Buffer Full	Since the Break mode was selected by Trace buffer full handling in the Trace Acquisition dialog box and the trace buffer became full, execution was terminated.

7.2 Error Messages

The simulator/debugger outputs error messages to notify users of the errors of user programs or operation. Table 7.2 lists the error messages.

Table 7.2 Error Messages

Message	Contents
Address Error	One of the following states occurred: <ul style="list-style-type: none">• A PC value was an odd number.• An instruction was read from the internal I/O area.• Word data was accessed to an address other than a multiple of 2.• Longword data was accessed to an address other than a multiple of 4.• The VBR or SP was a value other than a multiple of 4.• An error occurred in the exception processing of an address error. Correct the user program to prevent the error from occurring.
Exception Error	An error occurred during exception processing. Correct the user program to prevent the error from occurring.
FPU Disable	An attempt was made to execute an FPU instruction while the FPU is disabled (SR.FD = 1). Correct the user program to prevent the error from occurring.
FPU Error	One of the following states occurred during floating-point operation: <ul style="list-style-type: none">• An FPU error occurred.• An invalid operation occurred.• A division by zero occurred.• An overflow occurred.• An underflow occurred.• An inaccurate operation occurred. Correct the user program to prevent the error from occurring.
General Invalid Instruction	Either of the following states occurred: <ul style="list-style-type: none">• A code other than an instruction was executed.• An error occurred in the exception processing of a reserved instruction exception. Correct the user program to prevent the error from occurring.
Illegal CCR2 Set	The CCR2 value is illegal. Check the setting.
Illegal Combination BSC Register	An attempt was made to access the area for which the BSC register setting is invalid. Correct the user program to prevent the error from occurring.

Table 7.2 Error Messages (cont)

Message	Contents
Illegal DSP Operation	Either of the following states occurred: <ul style="list-style-type: none">• A shift of more than 32 bits was executed with the PSHA instruction.• A shift of more than 16 bits was executed with the PSHL instruction. Correct the user program to prevent the error from occurring.
Illegal LRU Set	LRU value of the cache is invalid. Check the setting.
Illegal Operation	Either of the following states occurred: <ul style="list-style-type: none">• A division by zero occurred during DIV1 instruction execution.• Zero was written to by the SETRC instruction. Correct the user program to prevent the error from occurring.
Illegal PR bit	An attempt was made to execute an FPU instruction while the PR bit value of the FPSCR is illegal. Correct the user program to prevent the error from occurring.
Initial Page Write	Initial page write occurred during simulation. Take necessary procedures such as updating the TLB contents.
Instruction TLB Illegal LRU	An LRU value in the instruction TLB is illegal. Check the setting.
Instruction TLB Miss	An instruction TLB miss occurred during memory access. Take necessary procedures such as updating the TLB contents.
Instruction TLB Protection Violation	An instruction TLB protection exception occurred during memory access. Take necessary procedures such as updating the TLB contents.
Invalid DSP Instruction Code	An invalid instruction code was detected in the DSP parallel instruction. Correct the user program to prevent the error from occurring.
Invalid Slot Instruction	Either of the following states occurred: <ul style="list-style-type: none">• An instruction that changes a PC value (a branch instruction) immediately after a delayed branch instruction was executed.• An error occurred during the exception processing of an invalid slot instruction. Correct the user program to prevent the error from occurring.

Table 7.2 Error Messages (cont)

Message	Contents
Memory Access Error	<p>One of the following states occurred:</p> <ul style="list-style-type: none"> • A memory area that had not been allocated was accessed. • Data was written to a memory area having the write protect attribute. • Data was read from a memory area having the read disable attribute. • A memory area in which memory does not exist was accessed. <p>Allocate memory, change the memory attribute, or correct the user program to prevent the memory from being accessed.</p>
Multiple Exception	Multiple exceptions occurred. Correct the user program to prevent the error from occurring.
Slot FPU Disable	An attempt was made to execute an FPU instruction in a delay slot while the FPU is disabled (SR.FD = 1). Correct the user program so that no error occurs.
System Call Error	System call error occurred. Modify the incorrect contents of registers R0, R1, and parameter block.
TLB Invalid	TLB invalid exception occurred during simulation or during command execution. Take necessary procedures such as updating the TLB contents.
TLB Miss	TLB miss occurred during simulation or during command execution. Take necessary procedures such as updating the TLB contents.
TLB Multiple Hit	Multiple TLB entries were hit when a virtual address was accessed during simulation or command execution. TLB is not correctly set. Modify TLB contents and user program (handler routine).
TLB Protection Violation	Illegal TLB protection exception occurred during simulation.
Unified TLB Miss	A unified TLB miss occurred during memory access. Take necessary procedures such as updating the Unified TLB (UTLB) contents.
Unified TLB Multiple Hit	Multiple unified TLB entries were hit when a virtual address was accessed. TLB is not correctly set. Modify TLB contents and user program (handler routine).
Unified TLB Protection Violation	A unified TLB protection exception occurred during memory access. Take necessary procedures such as updating the Unified TLB (UTLB) contents.

Section 8 Looking at Your Program

This section describes how to look at your program as source code and assembly language mnemonics. HDI's facilities for dealing with code and symbol information are explained and you will be shown how to look at text files in the user interface.

8.1 Compiling for Debugging

In order to be able to debug your program at C/C++ source level, your C/C++ program must be compiled and linked with the debug option enabled.

Note: Make sure you have the debug option enabled on your compiler and linker, when you generate an object file for debugging.

If your debug object file does not contain any debugging information, then you can still load it into the debugging platform, but you will only be able to debug at assembly-language level.

8.2 Viewing the Code

8.2.1 Viewing Source Code

To look at your program's source, choose the [View->Source...] menu option; use the **Ctrl+K** accelerator; or click on the Source Window toolbar button .

Select your source file and click [Open], HDI opens a **Source** window:

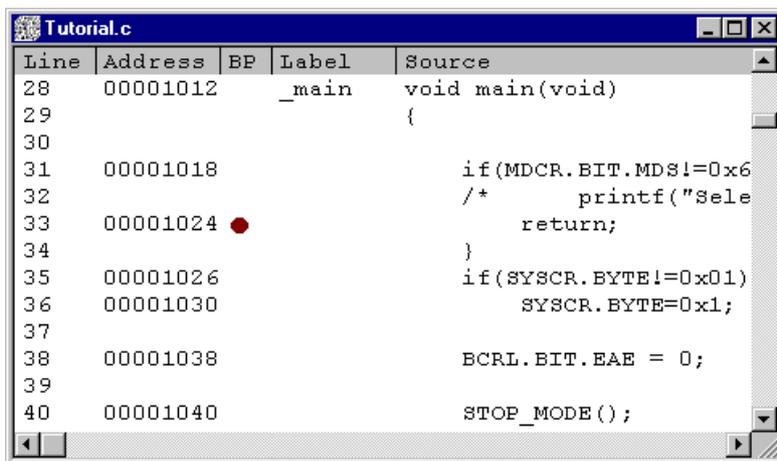


Figure 8.1 Source Window

The **Source** window is divided into two areas; the header bar area and the main window area, and split vertically into five columns; Line, Address, BP (breakpoint), Label, and Source. The respective width of each column can be adjusted by dragging the dividing line between each column title in the header bar. The cursor will change to \leftrightarrow and a vertical line will be displayed where the dividing line of the columns will be. Release the mouse button when you are satisfied with the column width and the display will be updated with the new column width.

8.2.2 Viewing Assembly-Language Code

If you have a source file open, right-click to open the popup menu and select **Go to Disassembly** to open a **Disassembly** window at the same address as the current **Source** window.

If you do not have a source file, but wish to view code at assembly-language level, either choose the **[View->Disassembly...]** menu option; use the **Ctrl+D** accelerator; or click on the

Disassembly Window toolbar button . This will open a **Set Address** dialog box in which you can address to start disassembling.

The **Disassembly** window shows Address, BP (breakpoint), Code - showing the machine code values, Label and Assembler - showing the disassembled mnemonics (with labels when available). Additionally the final column contains any source line starting at that address, thus providing mixed mode display.

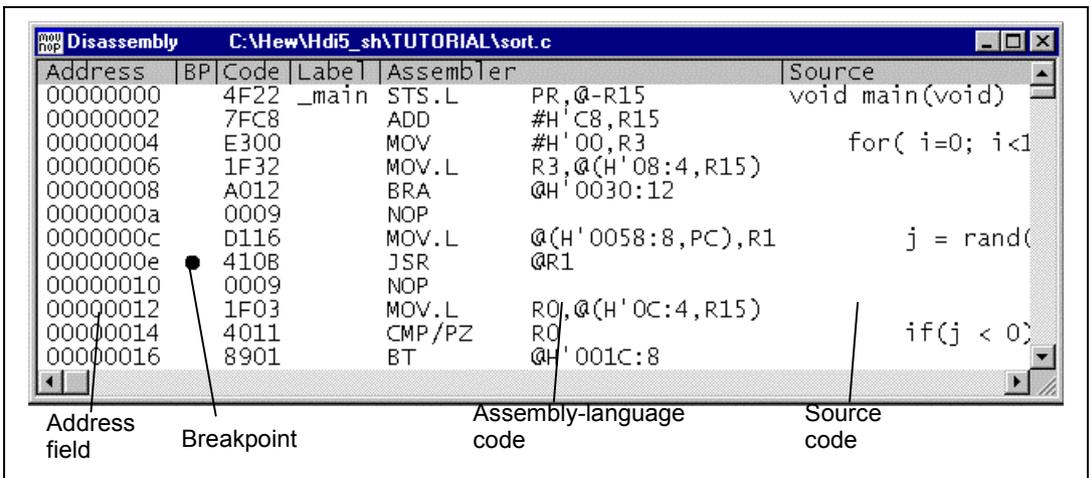


Figure 8.2 Disassembly Window

8.2.3 Modifying Assembly-Language Code

You can modify the assembly-language code by double-clicking on the instruction that you wish to change. The **Assembler** dialog box will open:

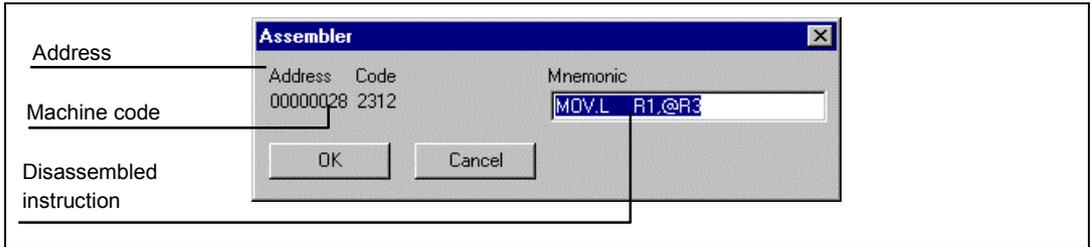


Figure 8.3 Assembler Dialog Box

The address, machine code and disassembled instruction are displayed. Type the new instruction or edit the old instruction in the Mnemonic field. Pressing **ENTER** will assemble the instruction into memory and move on to the next instruction. Clicking [**OK**] will assemble the instruction into memory and close the dialog box. Clicking [**Cancel**] or pressing **ESC** will close the dialog box.

Note: The assembly-language display is disassembled from the actual machine code in the debugging platform's memory. If the memory contents are changed the display will show the corresponding new assembly-language code, but will not match the text shown in the source display.

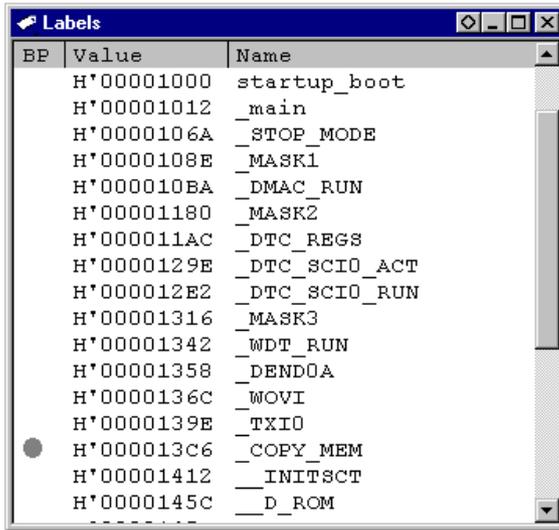
8.3 Looking at Labels

The *debug object file* also contains symbolic information. This is a table of text names that represent an address in the program and is referred to as labels in HDI. You will see symbols in the Label field on the line of the corresponding address, and in the Assembler field as part of an instruction's operand.

- Notes**
1. An instruction's operand is replaced with a label name if the operand and label value match. If two or more labels have the same value, then the label that comes first alphabetically will be displayed.
 2. Wherever you can enter an address or value in an HDI edit control you can use a label instead.

8.3.1 Listing Labels

To see a list of all the labels defined in the current session open the **Labels** window by choosing the **[View->Labels]** menu option.



BP	Value	Name
	H*00001000	startup_boot
	H*00001012	_main
	H*0000106A	_STOP_MODE
	H*0000108E	_MASK1
	H*000010BA	_DMAC_RUN
	H*00001180	_MASK2
	H*000011AC	_DTC_REGS
	H*0000129E	_DTC_SCIO_ACT
	H*000012E2	_DTC_SCIO_RUN
	H*00001316	_MASK3
	H*00001342	_WDT_RUN
	H*00001358	_DEND0A
	H*0000136C	_WOVI
	H*0000139E	_TXIO
●	H*000013C6	_COPY_MEM
	H*00001412	_INIT3CT
	H*0000145C	_D_ROM

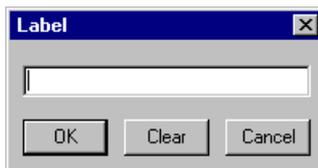
Figure 8.4 Labels Window

You can view symbols sorted either alphabetically (by ASCII code) or by address value by clicking on the respective column heading.

You can quickly set a software break at an address by double-clicking (or right-clicking and selecting Break on the BP popup menu) in the BP column.

8.3.2 Adding a Label from a Source or Disassembly Window

You can quickly add a label from a **Source** or **Disassembly** window, by double-clicking in the Label column at the address for which you want to assign the Label. The **Label** dialog box opens for you to enter the text.



Label

OK Clear Cancel

Figure 8.5 Label Dialog Box

Enter the label name text and click **[OK]**, so that the label is added to the label list with the address value contained in the Address column of the corresponding line, and the **Source** window display is updated to show the label. The **[Clear]** button can be used to remove the label.

This method can also be used for quickly modifying the text of existing labels. When you double-click on the label in the Label column, the text is copied into the edit box of the **Label** dialog box. You can then edit it and the modified version is saved in the label list. The **Source** window display is updated to show the new label.

Note: To use added or modified labels again in later sessions, save them in a file. For details, see section 5.6.11, Save As....

8.4 Looking at a Specific Address

When you are looking at your program in a **Source** window, you may want to look at another area of your program's code. Rather than scrolling through a lot of code in the program, you can go directly to a specific address. Double-click in the Address column; the **Set Address** dialog box opens:

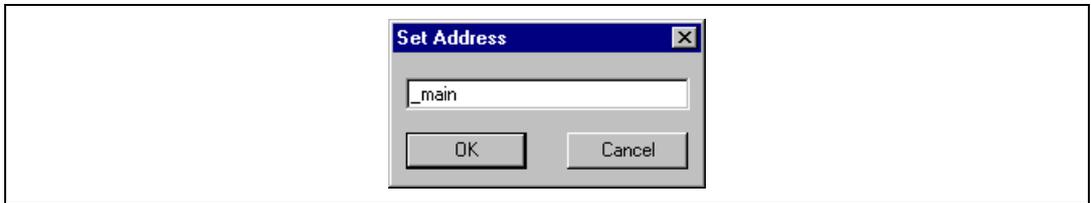


Figure 8.6 Set Address Dialog Box

Enter the address or symbol name in the edit box and either click on **[OK]** or press **ENTER**. If the code at that address is in the same source file, the **Source** window updates to show the code at the new address. When an overloaded function or a class name is entered, the **Select Function** dialog box opens for you to select a function. For details, refer to section 14, Selecting Functions.

If the new address is in a source file that is already being viewed in a **Source** window, that window is brought to the front and updated to show the code at the new address.

If the new address is in another source file, a new **Source** window opens to show the code at that address. By default the new window shows source if it is available. If no source is available for the new address, then a **Disassembly** window shows assembly-language code.

8.4.1 Looking at the Current Program Counter Address

Wherever you can enter an address or value into HDI, you can also enter an expression (see section 2.2, Data Entry). If you enter a register name prefixed by the “#” character, the contents of that register will be used as the value in the expression. Therefore if you open the **Set Address** dialog box and enter the expression “#PC”, the **Source** or **Disassembly** window display will go to the current PC address. You can also display from an offset of the current PC by entering an expression with the PC register plus an offset, e.g., “#PC+0x100”.

8.5 Finding Text

You can search for a particular text string in the **Source** window using the find option. To do this, choose the [**Find...**] menu option from the popup menu, or use the **F3** accelerator key.

The **Find** dialog box is displayed:

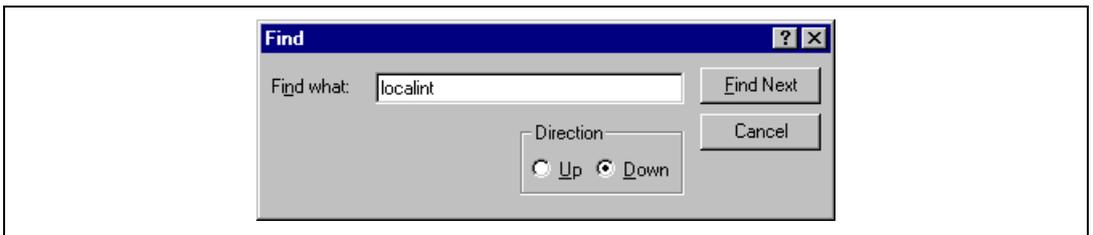


Figure 8.7 Find Dialog Box

Enter the text that you wish to find and click [**Find Next**] or press **ENTER**. The **Source** window will display the text (if found) highlighted. To find the next occurrence of the text, click [**Find Next**] or press **ENTER** again. To close the **Find** dialog box, click [**Cancel**] or press **ESC**.

Section 9 Working with Memory

This section describes how to look at areas of memory in the CPU's address space. It will show you how to look at an area of memory in different formats, fill, move and test a block of memory, and save, load and verify an area of memory with a disk file.

9.1 Looking at an Area of Memory

To look at an area of memory, choose the **[View->Memory...]** menu option; using the **Ctrl+M** accelerator; or clicking the Memory Window toolbar button  to open a **Memory** window. This will open an **Open Memory Window** dialog box:

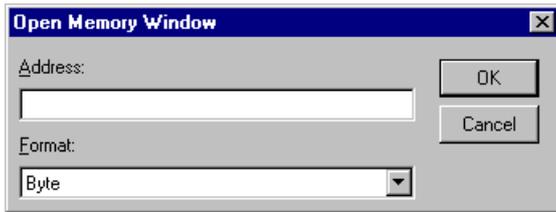


Figure 9.1 Open Memory Window Dialog Box

Type in the start address or equivalent symbol for the window display in the Address field and select the required display format from the Format list. Click **[OK]** or press **ENTER**, and the dialog box closes and a **Memory** window opens:

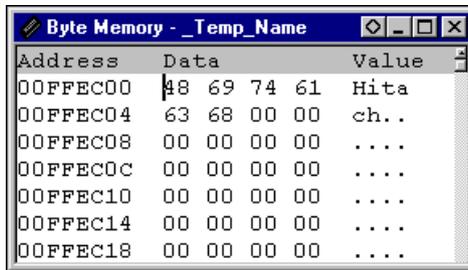


Figure 9.2 Memory Window (Bytes)

There are two display columns excluding the address display column:

1. **Data** - The data read from the debugging platform. Where supported it is read from physical memory at the displayed width. Editing is supported.
2. **Value** - Data displayed in an alternative format. Editing is not supported.

If you want to change the display format from the one you selected when you opened the window, do it from the popup menu.

9.1.1 Displaying Memory as ASCII

To display and edit memory as ASCII characters, choose the **[ASCII]** menu option from the popup menu and the display will be updated to show the area of memory as ASCII characters.

9.1.2 Displaying Memory as Bytes

To display and edit memory as bytes, choose the **[Byte]** menu option from the popup menu and the display will be updated to show the area of memory as individual bytes as shown in figure 9.2.

9.1.3 Displaying Memory as Words

To display and edit memory as words, choose the **[Word]** menu option from the popup menu and the display will be updated to show the area of memory as 16-bit words.

9.1.4 Displaying Memory as Longwords

To display and edit memory as longwords, choose the **[Long]** menu option from the popup menu and the display will be updated to show the area of memory as 32-bit longwords.

9.1.5 Displaying Memory as Single-Precision Floating Point

To display and edit memory as single-precision floating-point data, choose the **[Single float]** menu option from the popup menu and the display will be updated to show the area of memory as single-precision floating-point data.

9.1.6 Displaying Memory as Double-Precision Floating Point

To display and edit memory as double-precision floating-point data, choose the **[Double float]** menu option from the popup menu and the display will be updated to show the area of memory as double-precision floating-point data.

9.1.7 Looking at a Different Area of Memory

If you want to change the area of memory that is displayed in the **Memory** window, use the scroll bars. To quickly look at a new address you can use the **Set Address** dialog box. This can be opened either by choosing the **[Set Address...]** menu option from the popup menu or by double-clicking in the Address column.

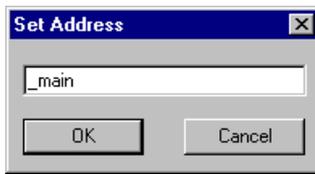


Figure 9.3 Set Address Dialog Box

Enter the new address value, and click **[OK]** or press **ENTER**. The dialog box closes and the **Memory** window display is updated with the data at the new address. When an overloaded function or a class name is entered, the **Select Function** dialog box opens for you to select a function. For details, refer to section 14, Selecting Functions.

9.2 Modifying Memory Contents

There are two ways that you can change the contents of memory at an address:

1. Quick edit method - allows you to enter values by typing directly into the window, but is limited to ASCII (when displaying ASCII format) or hexadecimal values only (when displaying all other formats).
2. Full edit method - uses a dialog box to enter values as floating point or evaluated expressions.

9.2.1 Quick Edit

The quick way to change the contents of memory is to select the digit that you wish to change, by clicking or dragging on it. You will see the selected digit is highlighted. Type the new value for the digit; it must be in the range 0-9, a-f (when displaying not ASCII format) or the new value for ASCII; it must be ASCII (when displaying ASCII format) . The new value is written into the digit and the cursor moves on to the next digit in memory.

9.2.2 Full Edit

The full way to change the contents of memory is accessed via the **Edit** dialog box. Move the cursor on the memory unit (depending on your **Memory** window display choice) that you wish to change. Either double-click on the memory unit, or press **ENTER**. The **Edit** dialog box opens:



Figure 9.4 Edit Dialog Box

Like any other data entry field in HDI, you can enter a formatted number or C/C++ expression (see section 2.2, Data Entry). When you have entered the new number or expression, click the [OK] button or press **ENTER**, the dialog box closes and the new value is written into memory.

9.2.3 Selecting a Memory Range

If the memory address range is in the **Memory** window, you can select the range by clicking on the first memory unit (depending on your **Memory** window display choice) and dragging the mouse to the last unit. The selected range is highlighted.

9.3 Finding a Value in Memory

To find a value in memory you must open a **Memory** window, then choose the [Search] menu option from the popup menu. Alternatively, with a **Memory** window in focus, just press **F3**.

This will open the **Search Memory** dialog box:

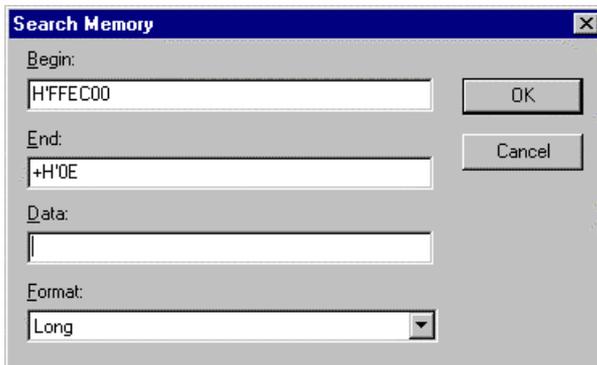


Figure 9.5 Search Memory Dialog Box

Enter the start and end addresses of the range in which to search (if an area of memory was selected in the **Memory** window then the Begin and End address values will be filled in

automatically) and the data value to search for. The end address can also be prefixed by a '+' which will use the entered value as a range.

Select the search format and click **[OK]** or press **ENTER**. The dialog box closes and HDI searches the range for the specified data. If the data is found, it will be highlighted in the **Memory** window. If the data cannot be found, the caret position in the **Memory** window remains unchanged and a message informing you that the data could not be found is displayed on the message box.

9.4 Filling an Area of Memory with a Value

You can set the contents of a range of memory addresses to a value using the memory fill feature.

9.4.1 Filling a Range

To fill a range of memory with the same value, choose the **[Fill...]** menu option on a **Memory** window's popup menu, or **[Memory->Fill...]** menu option. The **Fill Memory** dialog box opens:

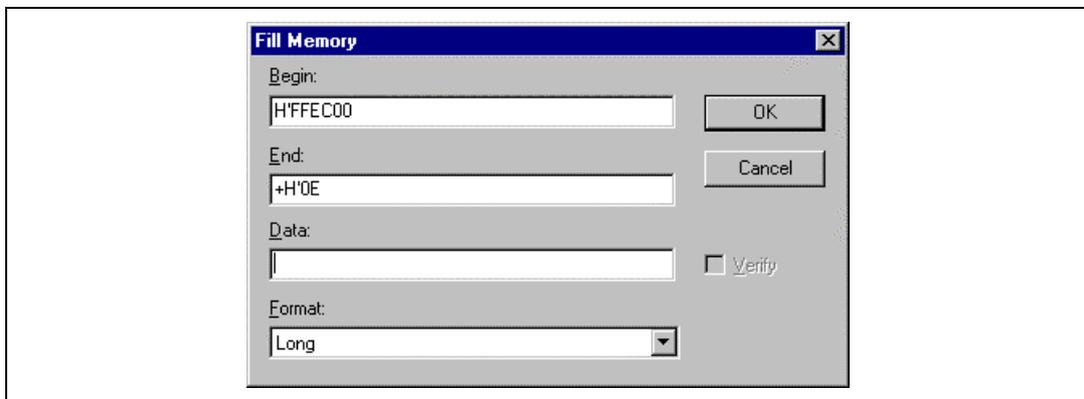


Figure 9.6 Fill Memory Dialog Box

If an address range has been selected in the **Memory** window, the specified start and end addresses will be displayed. Select the format from the Format drop list and enter the data value in the Data field. Click the **[OK]** button or press **ENTER**, the dialog box closes and the new value are written into the memory range.

9.5 Copying an Area of Memory

You can copy an area of memory using the memory copy feature. Select a memory range (see section 9.2.3, Selecting a Memory Range), choose the **[Copy...]** menu option from the popup menu. The **Copy Memory** dialog box opens:

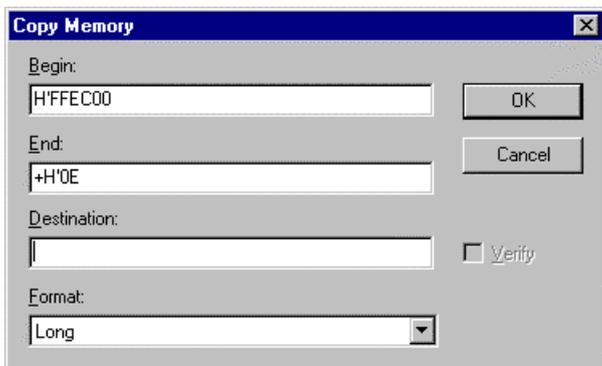


Figure 9.7 Copy Memory Dialog Box

The source start and end address specified in the **Memory** window will be displayed in the **Begin** and **End** fields. Enter the destination start address in the **Destination** field and click the **[OK]** button or press **ENTER**, the dialog box closes and the memory block will be copied to the new address.

9.6 Saving an Area of Memory

You can save an area of memory in the address space to a disk file using the save memory feature. Open the **Save Memory As** dialog box by choosing the **[Memory->Save...]** menu option:

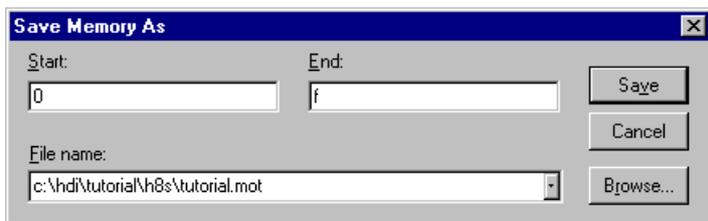


Figure 9.8 Save Memory As Dialog Box

Enter the start and end addresses of the memory block that you wish to save and a file name. The File name drop-list contains the previous four file names used for saving memory, or a standard **Save As** dialog box can be launched by clicking the **[Browse...]** button. Click the **[Save]** button or press **ENTER**, so that the dialog box closes and the memory block will be saved to the disk as a Motorola S-Record format file. When the file save is completed, a confirmation message box may be displayed (this can be switched off in the Confirmations tab on the **HDI Options** dialog box).

9.7 Loading an Area of Memory

To load an S-Record file to an area of memory without removing the current debugging information by using the load memory feature. Open the **Load Memory** dialog box by choosing the **[Memory->Load...]** menu option:

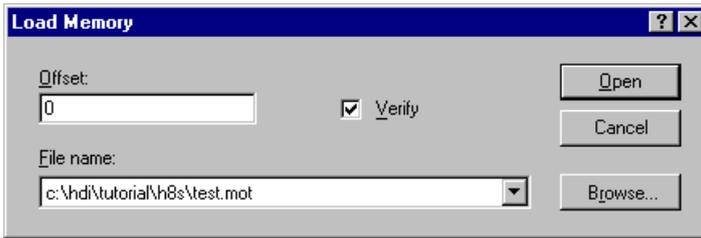


Figure 9.9 Load Memory Dialog Box

You can offset the loading address from the address specified in the S-Record by entering a value (positive or negative) in the Offset field. Click the **[Open]** button or press **ENTER**, so that the dialog box closes and the data loads into memory. When the file load is completed, a confirmation message box may be displayed (this can be switched off in the Confirmations tab on the **HDI Options** dialog box).

9.8 Verifying an Area of Memory

You can compare an area of memory against a previously saved block of memory using the memory verify feature. Open the **Verify S-Record File with Memory** dialog box by choosing the **[Memory->Verify...]** menu option:

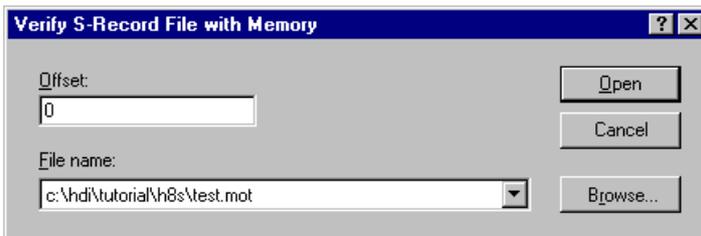


Figure 9.10 Verify S-Record File with Memory Dialog Box

You can offset the verification address from the address specified in the S-Record by entering a value (positive or negative) in the Offset field. Click the **[Open]** button or press **ENTER** so that the dialog box closes and the file and the memory contents are verified. When the file verification is completed a confirmation message box may be displayed (this can be switched off in the Confirmations tab on the **HDI Options** dialog box).

Section 10 Executing Your Program

This section describes how you can execute your program. You can either run your program continuously or step single or multiple instructions at a time.

10.1 Running from Reset

To reset your user system and run your program from the reset vector address, choose the [Run->Reset Go] menu option, or click the Reset Go toolbar button .

The program will run until it hits a breakpoint or a break condition is satisfied. You can stop the program manually at any time by choosing the [Run->Halt] menu option, or by clicking the Halt toolbar button .

Note: The program will start running from whatever address is stored in the reset vector location. Therefore it is important to make sure that this location contains the address of your startup code.

10.2 Continuously Running Your Program

When your program is stopped and the debugger is in break mode, the HDI will highlight the line in the **Source** and **Disassembly** windows that correspond to the CPU's current program counter (PC) address value. This will be the next instruction to be executed if you perform a step or continue running.

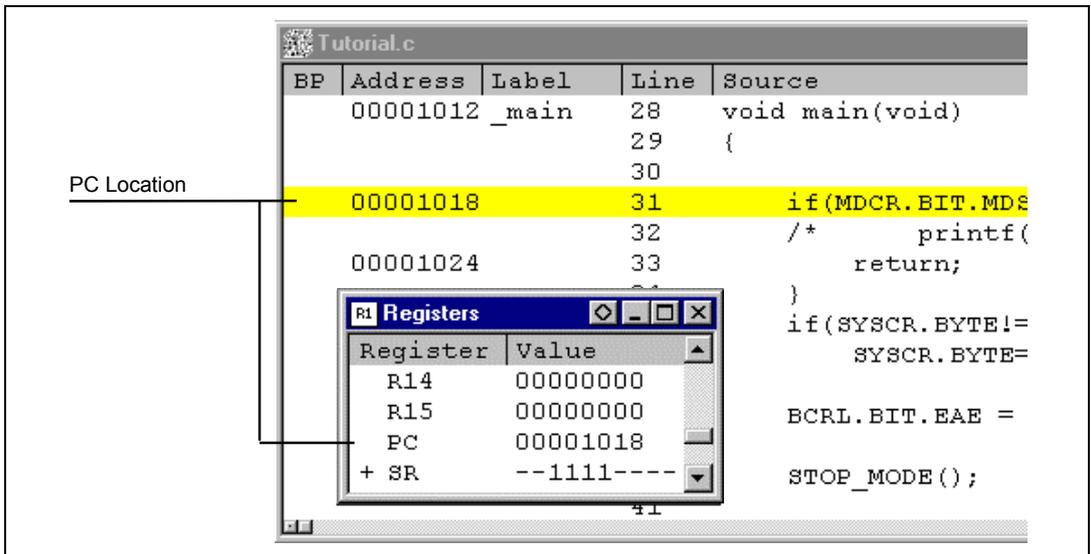


Figure 10.1 Highlighted Line Corresponding to PC Address

To continue running from the current PC address, click the Go toolbar button , or choose the **[Run->Go]** menu option.

10.3 Running to the Cursor

The function for executing only a part of the user program is provided by the Go To Cursor feature to execute to a specific address.

Using Go To Cursor

1. Make sure that a **Source** or **Disassembly** window is open showing the address at which you wish to stop.
2. Position the text cursor on the address at which you wish to stop by either clicking in the Address field or using the cursor keys.
3. Choose the **[Go To Cursor]** menu option from the popup menu.

The debugging platform will run your program from the current PC value until it reaches the address indicated by the cursor's position.

- Notes**
1. **If your program never executes the code at this address, the program will not stop. If this happens, program execution can be stopped by pressing ESC, choosing the [Run->Halt] menu option, or clicking on the 'Halt' toolbar button .**
 2. **The Go To Cursor feature requires a temporary breakpoint - if you have already used all those available then the feature will not work, and the menu option will be disabled.**

10.4 Running to Several Points

When you want to perform something like the Go To Cursor operation but the destination is outside the **Source** window, or want to stop at several addresses, you can use HDI's temporary breakpoint feature (see section 11.5, Temporary Breakpoints).

10.5 Single Step

When you are debugging your code, it is very useful to be able to step a single line or instruction at a time and examine the effect of that instruction on the system. In the **Source** window, a step operation will step a single source line. In the **Disassembly** window, a step operation will step a single assembly-language instruction. If the instruction calls another function or subroutine, you have the option to either step into or step over the function. If the instruction does not perform a call, then either option will cause the debugger to execute the instruction and stop at the next instruction.

10.5.1 Stepping Into a Function

If you choose to step into the function, the debugger will execute the call and stop at the first line or instruction of the function. To step into the function either click the Step In toolbar button , or choose the [Run->Step In] menu option.

10.5.2 Stepping Over a Function Call

If you choose to step over the function, the debugger will execute the call and all of the code in the function (and any function calls that that function may make) and stop at the next line or instruction of the calling function. To step over the function either click the Step Over toolbar button , or choose the [Run->Step Over] menu option.

10.6 Stepping Out of a Function

During debugging, there are occasions when you may have entered a function, finished stepping through the instructions that you want to examine, and would like to return to the calling function without stepping through all the remaining code in the function. Or alternatively (and perhaps more usefully) you may have stepped into a function by accident, when you meant to step over it and so want to return to the calling function without stepping all the way through the current function. You can do this with the Step Out feature.

To step out of the current function either click the Step Out toolbar button , or choose the [Run->Step Out] menu option.

10.7 Multiple Steps

Sometimes you may find it useful to step several instructions at a time. You can do this by using the **Step Program** dialog box. The dialog box also provides an automated step with a selectable intervals between steps. Open it by choosing the **[Run-> Step...]** menu option.

The **Step Program** dialog box is displayed:



Figure 10.2 Step Program Dialog Box

Enter the number of steps in the Steps field, choose whether you want to step over function calls by the Step Over Calls check box, and choose whether to make one line of the source program correspond to one step by the Source Level Step check box. If you are using the feature for automated stepping, choose the step rate from the list in the Rate field. Click **[OK]** or press **ENTER** to start stepping.

Section 11 Stopping Your Program

This section describes how you can halt execution of your program. This section describes how to do this directly by using the halt command and by setting breakpoints at specific locations in your code.

11.1 Halting Execution

When your program is running, the Halt toolbar button is enabled  (a red STOP sign), and when the program has stopped it is disabled  (the STOP sign is grayed out). To stop the program click on the Halt toolbar button, press **ESC**, or choose the **[Run->Halt]** menu option.

Your program's execution is halted, with the message "Break = Stop" displayed on the status bar. HDI will then update any open windows.

The last break cause can also be viewed in the **Platform** pane of the **System Status** window.

11.2 Standard Breakpoints (PC Breakpoints)

When you are trying to debug your program, you will want to be able to stop the program running when it reaches a specific point or points in your code. You can do this by setting a PC breakpoint on the line or instruction at which to want the execution to stop. The following instructions will show you how to quickly set and clear simple PC breakpoints. More complex breakpoint operation can be done via the **Breakpoints** window, which is discussed later.

➤ To set a program (PC) breakpoint

1. Make sure that the **Source** window is open at the place you want to set a program (PC) breakpoint.
2. Double-click in the BP column, or press **F9**, at the line showing the address at which you want the program to stop.
3. You will see a circle and the word 'Break' appear in the column to indicate that a program (PC) breakpoint has been set.

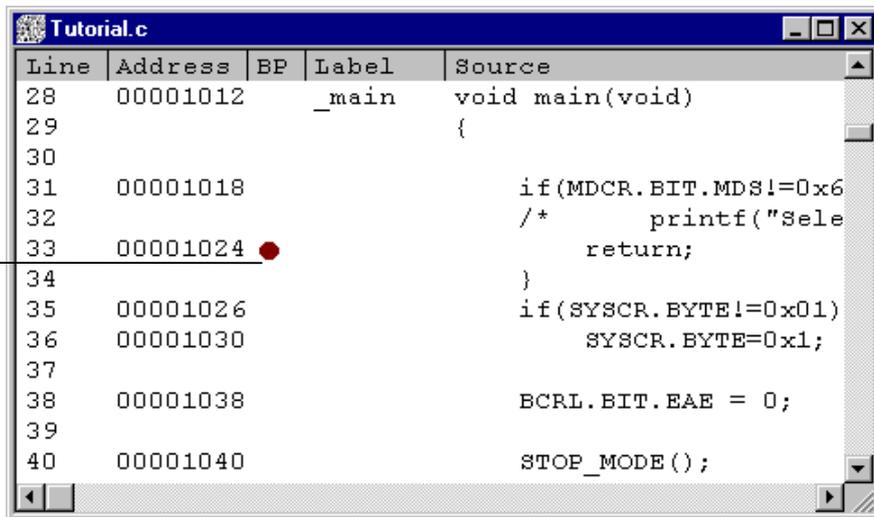


Figure 11.1 Setting a Program Breakpoint

Now when you run your program and it reaches the address at which you set the program (PC) breakpoint, execution halts with the message "Break = PC Breakpoint" displayed on the status bar, and the **Source** window display is updated with the program (PC) breakpoint line highlighted.

Note: The line or instruction at which you set a program (PC) breakpoint is not actually executed; the program stops just before it is about to execute it. If you choose to Go or Step after stopping at the program (PC) breakpoint, then the highlighted line will be the next instruction to be executed.

11.3 Breakpoints Window

The **Breakpoints** window allows you to access complex breakpoints (if your debugging platform supports them) and gives you more control over setting or clearing and enabling or disabling breakpoints. To open the **Breakpoints** window choose the [View->Breakpoints] menu option or click the Breakpoint toolbar button , if visible.

The **Breakpoints** window opens.

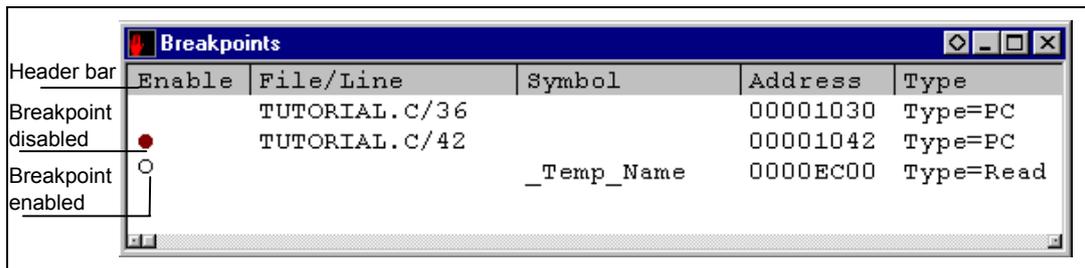


Figure 11.2 Breakpoints Window

The window displays a list of the breakpoints set in the system. The breakpoint list is divided horizontally into five columns; Enable, File/Line, Symbol, Address, and Type. The respective widths of each of the columns can be adjusted by clicking and dragging on the dividing line between each column title in the header bar. The cursor will change to $\leftarrow\rightarrow$ and a vertical line will be displayed at the dividing line of the columns. Release the mouse button when you are satisfied with the column width and the display will be updated with the new column width.

11.3.1 Adding a Breakpoint

You can add a new breakpoint in the **Breakpoints** window by choosing the **[Add...]** menu option from the popup menu.

The **Set Break** dialog box will open in which you can enter the type and parameters of the new breakpoint.

11.3.2 Modifying a Breakpoint

To edit an existing breakpoint in the **Breakpoints** window, select the breakpoint in the list by double-clicking, or by clicking on the line corresponding to it and choose **[Edit...]** menu option from the popup menu.

The **Set Break** dialog box will open in which you can change the type and parameters of the selected breakpoint. When a break sequence is selected, the **Break Sequence** dialog box will open.

11.3.3 Deleting a Breakpoint

To delete an existing breakpoint in the **Breakpoints** window, select the breakpoint in the list by clicking on the line corresponding to it and choose the **[Delete]** menu option from the popup menu.

The breakpoint is deleted and the window is updated.

11.3.4 Deleting All Breakpoints

To delete all of the breakpoints listed in the **Breakpoints** window choose the **[Delete All]** menu option from the popup menu.

All breakpoints are deleted and the window is cleared.

11.4 Disabling Breakpoints

During the course of a debugging session you may find that you tend to focus on particular areas of code for a period of time and then look at other areas, but want to return to the previous ones afterwards. When concentrating on these areas you will want to set breakpoints to stop your program execution at useful points. If you have set these breakpoints and wish to move on to another area of investigation, but know that you will want to return to the current area later, it is frustrating to have to delete all the breakpoints you have set only to have to set them all again when you return. Fortunately, HDI eases this problem by allowing you to disable breakpoints, while still leaving them in the breakpoint list.

11.4.1 Disabling a Breakpoint

To disable an individual breakpoint, select the breakpoint in the list by clicking on the line corresponding to it and choose the **[Disable]** menu option from the popup menu.

Alternatively, double-click in the Enable column of the breakpoint you need to disable.

The symbol in the Enable column is cleared to show that the breakpoint is disabled.

11.4.2 Enabling a Breakpoint

When you want to re-enable a breakpoint in the **Breakpoints** window list, select the breakpoint in the list by clicking on the line corresponding to it and choose the **[Enable]** menu option from the popup menu.

Alternatively, double-click in the Enable column of the breakpoint you need to enable.

The symbol in the Enable column is set to show that the breakpoint is enabled.

11.5 Temporary Breakpoints

There are times when you may want to start running your program and want it to stop if it hits one or more addresses, but do not want to set permanent breakpoints at these addresses. For example you may want to perform something like the Go To Cursor operation, but the destination may be outside the **Source** window or you may want to stop at several addresses. To

do this you can use HDI's temporary breakpoint feature to run as it supports up to ten temporary breakpoints that are cleared when you break. Temporary breakpoints are set in the **Run Program** dialog box, which is opened by choosing the **[Run-> Run...]** menu option.

The **Run Program** dialog box opens:

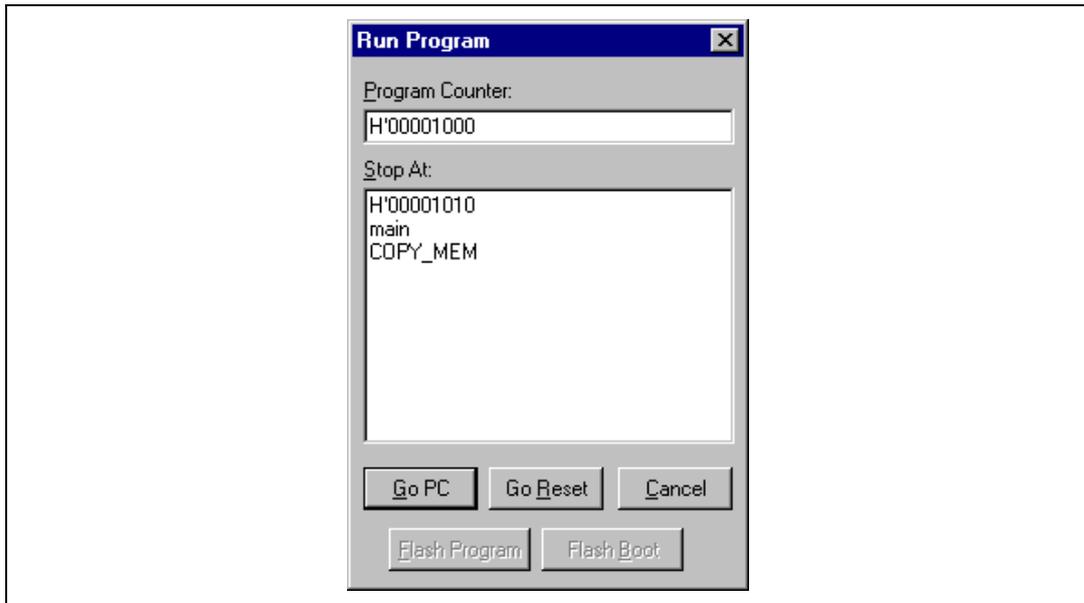


Figure 11.3 Run Program Dialog Box

Enter the symbols or address values for the points at which you want the program to stop (up to ten points) in the Stop At field. When an overloaded function or a class name is entered, the **Select Function** dialog box opens for you to select a function. For details, refer to section 14, Selecting Functions.

Click the **[Go PC]** button to start running from the current program counter address, as displayed in the Program Counter field. Click the **[Go Reset]** button to reset the CPU and start running from the reset vector address.

When the program halts the temporary breakpoints that you specified are cleared from the current breakpoint list. However, when the dialog box is opened again, the list is retained in the Stop At field and will be set again if you click the **[Go PC]** or **[Go Reset]** buttons.

Section 12 Looking at Variables

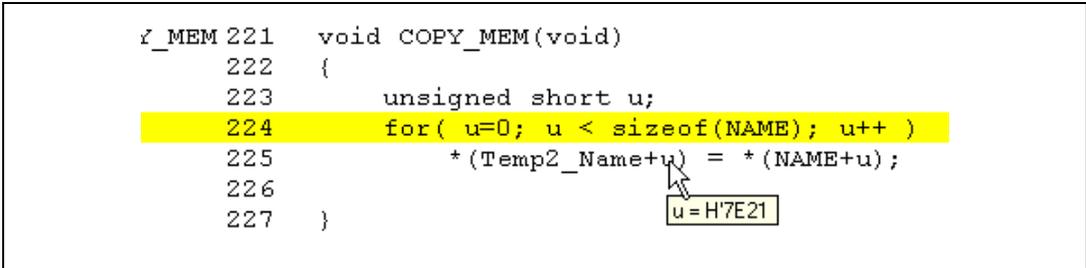
This section describes how to look at the variables and data objects that your program uses. It shows you how to view variables, set up watch items and look at the contents of the CPU's general, FPU, DSP and on-chip peripheral registers.

12.1 Tooltip Watch

The quickest way to look at a variable in your program is to use the Tooltip Watch feature.

➡ To use Tooltip Watch:

1. Open the **Source** window showing the variable that you want to examine.
2. Rest the mouse cursor over the variable name that you want to examine; a tooltip will appear near the variable containing basic watch information for that variable.



```

x_MEM 221 void COPY_MEM(void)
      222 {
      223     unsigned short u;
      224     for( u=0; u < sizeof(NAME); u++ )
      225         *(Temp2_Name+u) = *(NAME+u);
      226
      227 }

```

A tooltip box is shown over the variable 'u' in the for loop, containing the text 'u = H'7E21'. The line containing the for loop is highlighted in yellow.

Figure 12.1 Tooltip Watch

12.2 Instant Watch

To look at the variable in more detail, use the Instant Watch feature.

➡ To use Instant Watch:

1. Open the **Source** window showing the variable that you want to examine.
2. Click on the variable. You should see a cursor on the variable.
3. Choose the **[Instant Watch]** menu option from the popup menu.

The **Instant Watch** dialog box opens:

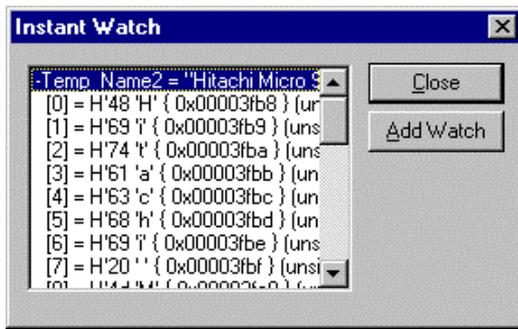


Figure 12.2 Instant Watch Dialog Box

You can add this variable to the list of watch items in the **Watch** window by clicking on the **[Add Watch]** button.

12.3 Using Watch Items

When you are debugging your program you may find it useful to be able to look at variables of interest and see their values at different times during the program execution. HDI allows you to open **Watch** windows, which contain a list of variables and their values. To open a **Watch** window choose the **[View->Watch]** menu option; or click on the Watch Window toolbar button  if it is visible. A **Watch** window opens. Initially the contents of the window will be blank.

12.3.1 Adding a Watch

There are two ways to add watch items to the **Watch** window; the quick method accessed from the **Source** window, and the full method using the **Add Watch** dialog box in the **Watch** window.

Quick Method

The quickest way to add a variable to the **Watch** window is to use the Add Watch feature.

☛ To use Add Watch from a **Source** Window:

1. Open the **Source** window showing the variable that you want to examine.
2. Click on the variable. You should see a cursor on the variable.
3. Choose the **[Add Watch...]** menu option from the popup menu.

The variable is added as a watch item and the **Watch** window is updated.

Full Method

The full method uses a dialog box that allows you to enter more complex watch expressions, for example arrays, structures or pointers.

➡ To use Add Watch from a **Watch** Window:

1. Open the **Watch** window.
2. Choose the [**Add Watch...**] menu option from the popup menu.

The **Add Watch** dialog box opens:



Figure 12.3 Add Watch Dialog Box

Enter the name of the variable that you wish to watch and click [**OK**]. The variable is added to the **Watch** window.

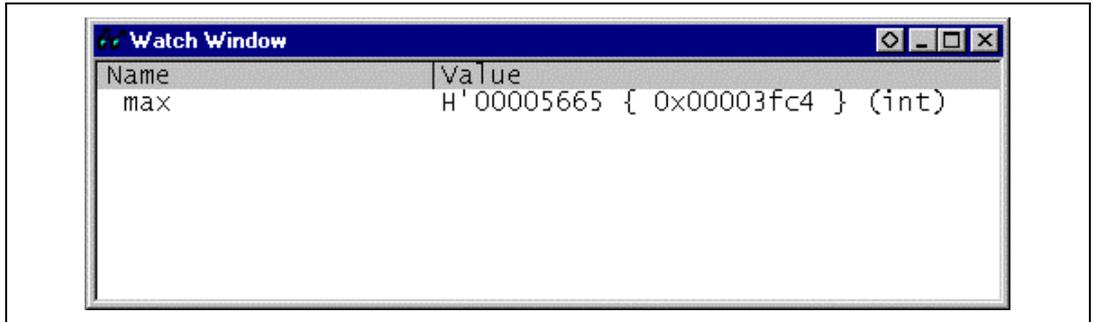


Figure 12.4 Watch Window

12.3.2 Expanding a Watch

If a watch item is a pointer, array, or structure, then you will see a plus sign (+) expansion indicator to the left of its name. This means that you can expand the watch item. To expand a watch item, double-click on it. The item expands to show the elements (in the case of structures and arrays) or data value (in the case of pointers) indented by one tab character, and the plus sign

changes to a minus sign (-). If the elements of the watch item also contain pointers, structures, or arrays, then they will also have expansion indicators next to them.

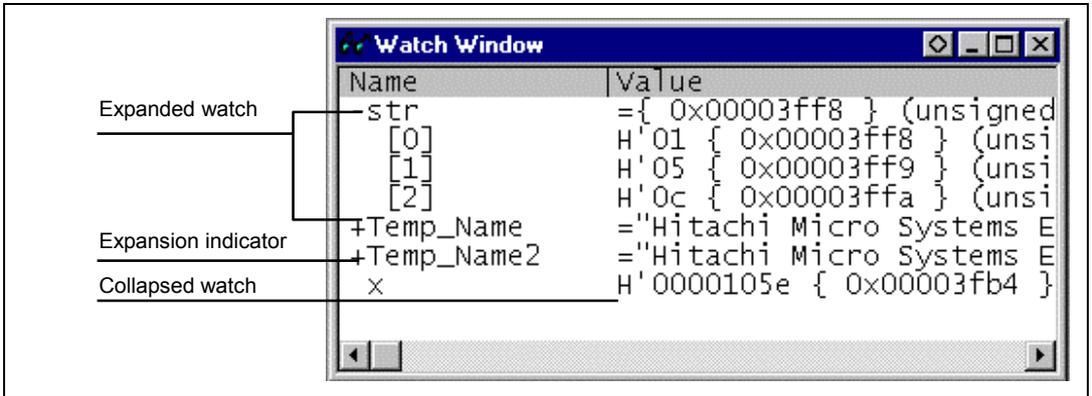


Figure 12.5 Expanding a Watch

To collapse an expanded watch item, double-click on the item again. The item's elements will collapse back to the single item and the minus sign changes back to a plus sign.

12.3.3 Modifying Radix for Watch Item Display

To change the radix of watch item, select the corresponding item by clicking it, and click the right mouse button on the item. Then a popup menu will be displayed. Choose the **[Radix]** menu option from the popup menu. Then choose the radix in which you wish the selected watch item to be displayed. The value will be updated immediately.

12.3.4 Changing a Watch Item's Value

You may wish to change the value of a watch variable, e.g. for testing purposes or if the value is incorrect due to a bug in your program. To change a watch item's value use the Edit Value function.

➤ Editing a watch item's value:

1. Select the item to edit by clicking on it, you will see a blinking cursor on the item.
2. Choose the **[Edit Value]** menu option from the popup menu.

The **Edit Value** dialog box opens:

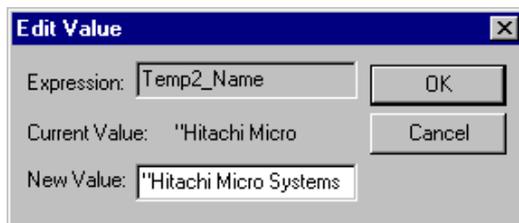


Figure 12.6 Edit Value Dialog Box

Enter the new value or expression in the New Value field and click **[OK]**. The **Watch** window is updated to show the new value.

12.3.5 Deleting a Watch

To delete a watch item, select it and choose the **[Delete]** menu option from the popup menu. The item is deleted and the **Watch** window updated.

Note: Watch items that you have set in the Watch window can be saved in a session file. See section 15, Configuring the User Interface.

12.4 Looking at Local Variables

To look at local variables, open the **Locals** window by choosing the **[View->Locals]** menu option.

The **Locals** window opens:

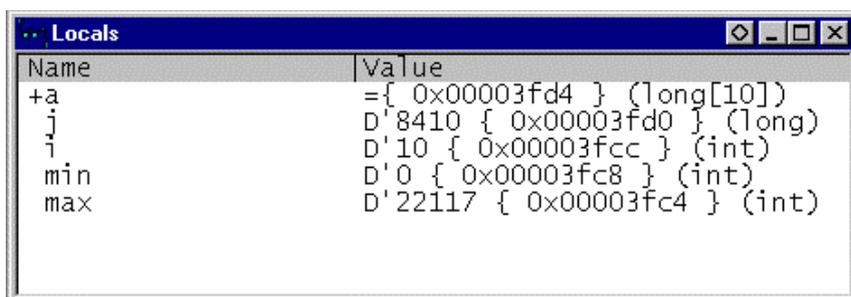


Figure 12.7 Locals Window

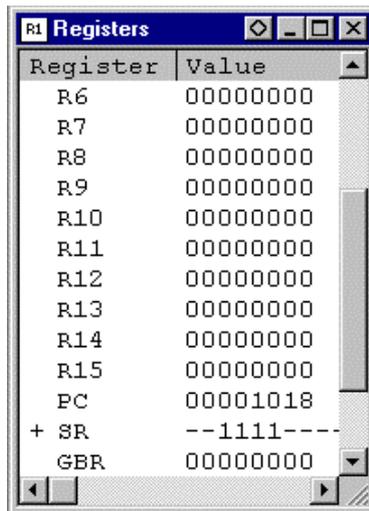
As you debug your program the **Locals** window will be updated, following a step or break from run, to show the current local variables and their values. If a local variable is not initialized when

defined, then the value in the **Locals** window will be undefined until a value is assigned to the local variable.

The local variable values and the radix for local variable display can be modified in the same manner as in the **Watch** window.

12.5 Looking at Registers

If you are debugging at assembly-language level, using the **Source** window in assembly language or mixed display, then you will probably find it useful to see the contents of the CPU's general, FPU and DSP registers. You can do this using the **Registers** window.



Register	Value
R6	00000000
R7	00000000
R8	00000000
R9	00000000
R10	00000000
R11	00000000
R12	00000000
R13	00000000
R14	00000000
R15	00000000
PC	00001018
+ SR	--1111---
GBR	00000000

Figure 12.8 Registers Window

To open a **Registers** window choose the [View->Registers] menu option or click the CPU Registers toolbar button . A **Registers** window opens showing all of the CPU's general, FPU and DSP registers and their values, displayed in hexadecimal.

12.5.1 Expanding a Bit Register

If a register is used to control or display status using flags at the bit level, then you will see a plus sign (+) expansion indicator to the left of its name; this means that you can expand it. To do this, double-click on the plus sign to show the flags indented by one tab character, and the plus sign changes to a minus sign (-). If the flags have sub-groups, for example register masks, they will also have expansion indicators next to them.

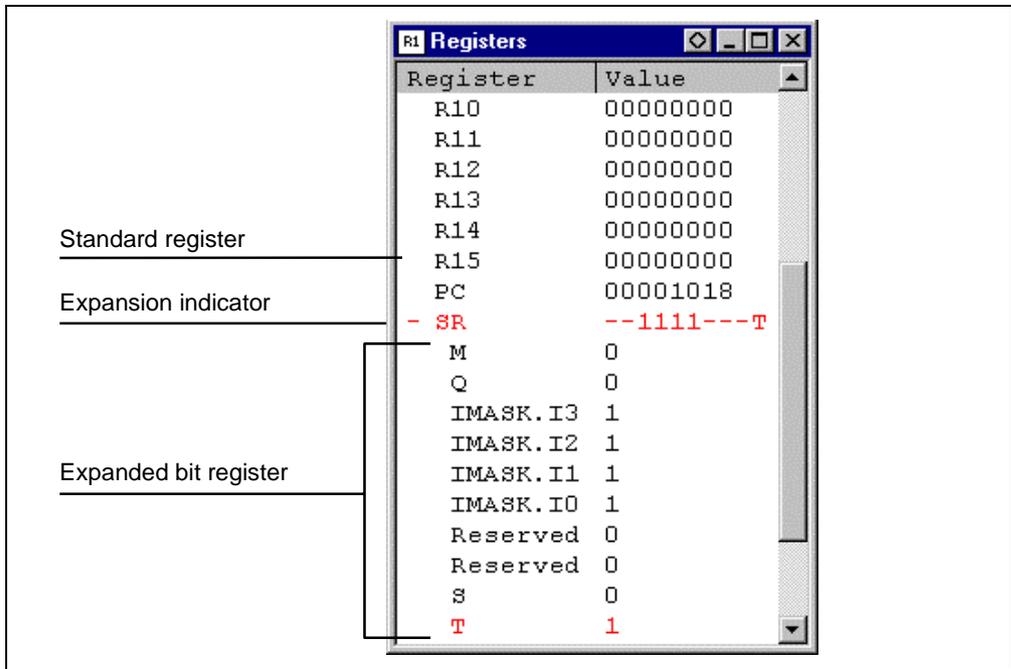


Figure 12.9 Expanding a Bit Register

To collapse an expanded bit register, double-click on the minus sign. The registers collapse back to the single item and the minus sign changes back to a plus sign.

12.5.2 Modifying Register Contents

There are two ways that you can change a register's contents. The quick edit method that allows you to enter values by typing directly into the window, but is limited to hexadecimal values only. The full edit method that requires you to enter values via a dialog box, but allows you to enter values in any base and use complex expressions.

Quick Edit

The quick way to change a register's contents is to select the digit that you wish to change, by clicking or dragging on it. You will see the selected digit is highlighted. Type the new value for the digit; it must be in the range 0-9 or a-f. The new value is written into the digit and the cursor moves to the next digit in the register. When you enter a value into the least significant digit of the register, the cursor moves on to the most significant digit of the next register. If the digit of the register display indicates a bit e.g. in the CPU condition code register (CCR) then you can press **SPACE** to toggle the bit's value.

Full Edit

The full way to change a register's contents is accessed via a **Register** dialog box. Open the **Register** dialog box in one of three ways:

1. Double-click the register you want to change.
2. Select the register you want to change, and press **ENTER**.
3. Select the register you want to change, and choose the **[Edit...]** menu option from the popup menu.

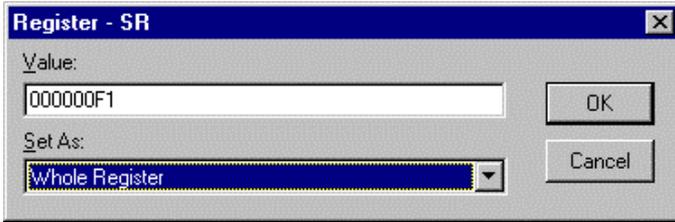


Figure 12.10 Register Dialog Box

As in any other data entry field in HDI, you can enter a formatted number or C/C++ expression (see section 2.2, Data Entry).

You can choose whether to modify the whole register contents (High Word, Low Word, etc), a masked area, floating or flag bits by selecting an option from the drop list box (the contents of this list depend on the CPU model and selected register).

When you have entered the new number or expression, click the **[OK]** button or press **ENTER**. The dialog box closes and the new value is written into the register.

12.5.3 Using Register Contents

It can be useful to be able to use the value contained in a CPU register when you are entering a value elsewhere in HDI, for example when displaying a specified address in the **Source** or **Memory** window. You can do this by specifying the register name prefixed by the “#” character, e.g.: #R1, #PC, #R6L, or #ER3.

Section 13 Overlay Function

Programs making use of the overlay function can be debugged. This section explains the settings for using the overlay function.

13.1 Displaying Section Group

When the overlay function is used, that is, when several section groups are assigned to the same address range, the address ranges and section groups are displayed in the **Overlay** dialog box.

Open the **Overlay** dialog box by choosing the [Setup->Overlay] menu option.

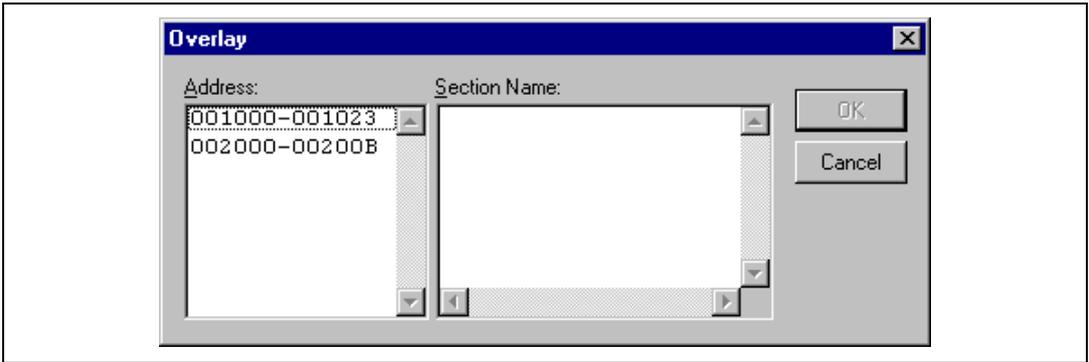


Figure 13.1 Overlay Dialog Box (at Opening)

This dialog box has two areas: the Address list box and the Section Name list box.

The Address list box displays the address ranges used by the overlay function. Click to choose one of the address ranges in the Address list box.

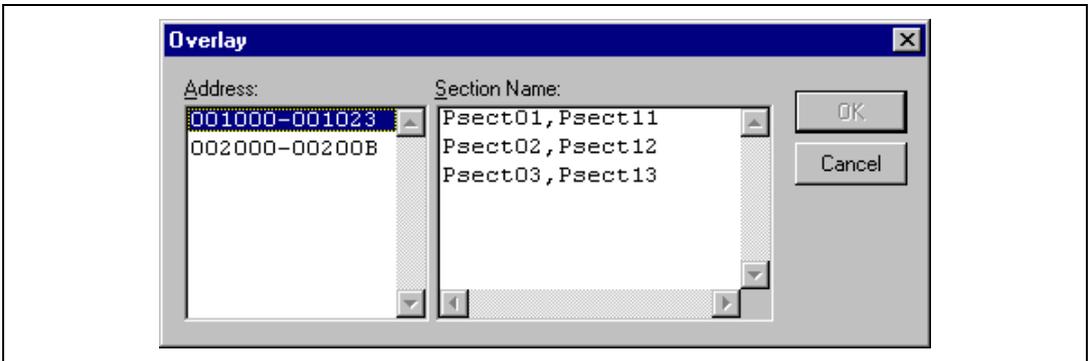


Figure 13.2 Overlay Dialog Box (Address Range Selected)

The Section Name list box displays the section groups assigned to the selected address range.

13.2 Setting Section Group

When using the overlay function, the highest-priority section group must be selected in the **Overlay** dialog box; otherwise HDI will operate incorrectly.

First click one of the address ranges displayed in the Address list box. The section groups assigned to the selected address range will then be displayed in the Section Name list box.

Click to select the section group with the highest-priority among the displayed section groups.

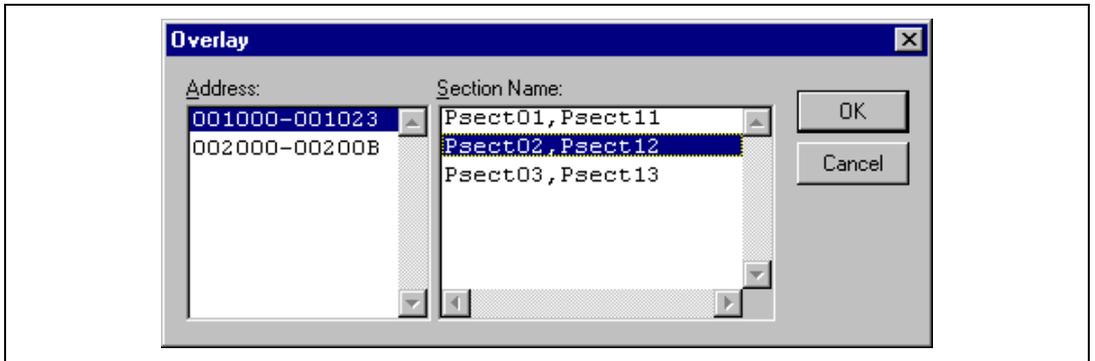


Figure 13.3 Overlay Dialog Box (Highest-Priority Section Group Selected)

After selecting a section group, clicking the **[OK]** button stores the priority setting and closes the dialog box. Clicking the **[Cancel]** button closes the dialog box without storing the priority setting.

Note: Within the address range used by the overlay function, the debugging information for the section specified in the Overlay dialog box is referred to. Therefore, the same section of the currently loaded user program must be selected in the Overlay dialog box.

Section 14 Selecting Functions

When selecting overloaded functions or member functions that can be used in C++ programs, follow the description in this section.

14.1 Displaying Functions

Use the **Select Function** dialog box to display overloaded functions and member functions.

A function can be selected in the following cases.

- When setting a breakpoint
- When specifying a function in the **Run Program** dialog box
- In the **Set Address** dialog box for opening the **Source** window
- In the **Set Address** dialog box for opening the **Memory** window
- When adding or modifying a symbol
- When specifying a function for performance analysis

When overloaded functions have the same specified function name, or when a class name including a member function is specified, the **Select Function** dialog box opens.

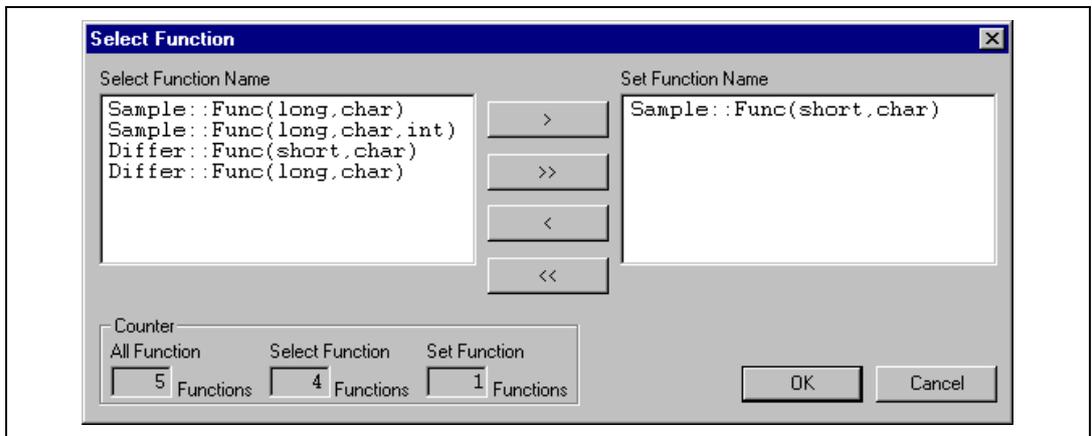


Figure 14.1 Select Function Dialog Box

This dialog box has three areas.

- Select Function Name list box
Displays the overloaded functions or member functions and their detailed information.
- Set Function Name list box
Displays the function to be set and their detailed information.

- Counter group edit box

- All Function Displays the number of functions with the same name or member functions.
- Select Function Displays the number of functions displayed in the Select Function Name list box.
- Set Function Displays the number of functions displayed in the Set Function Name list box.

14.2 Specifying Functions

Select overloaded functions or member functions in the **Select Function** dialog box. Generally, one function can be selected at one time; only for setting breakpoints, setting the function in the **Run Program** dialog box, or setting the function of the performance analysis, more than one function can be selected.

14.2.1 Selecting a Function

Click the function you wish to select in the Select Function Name list box, and click the [>] button. You will see the selected function in the Set Function Name list box. To select all functions in the Select Function Name list box, click the [>>] button.

14.2.2 Deleting a Function

Click the function you wish to delete from the Set Function Name list box, and click the [<] button. To delete all functions in the Set Function Name list box, click the [<<] button.

14.2.3 Setting a Function

Click the [OK] button to set the functions displayed in the Set Function Name list box. The functions are set and the **Select Function** dialog box closes.

Clicking the [Cancel] button closes the dialog box without setting the functions.

Section 15 Configuring the User Interface

When we designed the user interface for HDI we tried to make all the frequently used operations quickly accessible and have related operations grouped in a logical order. However, when you are in the middle of a heavy debugging session you may find it more useful to have a different arrangement of the user interface items or you may just have a personal preference for the way you want it arranged. We realize this and so HDI allows you to customize the user interface so that you can be satisfied with the tool that you are using for debugging your program. This section describes how you can arrange the user interface windows, customize various aspects of the display and save the configuration.

15.1 Arranging Windows

15.1.1 Minimizing Windows

If you have temporarily finished using an open window but want to be able to look at it in its current state later, you can reduce it to an icon. This is called *minimizing* the window. To minimize a window, either click on the minimize button of the window, or choose the [ -> **Minimize**] window menu option.

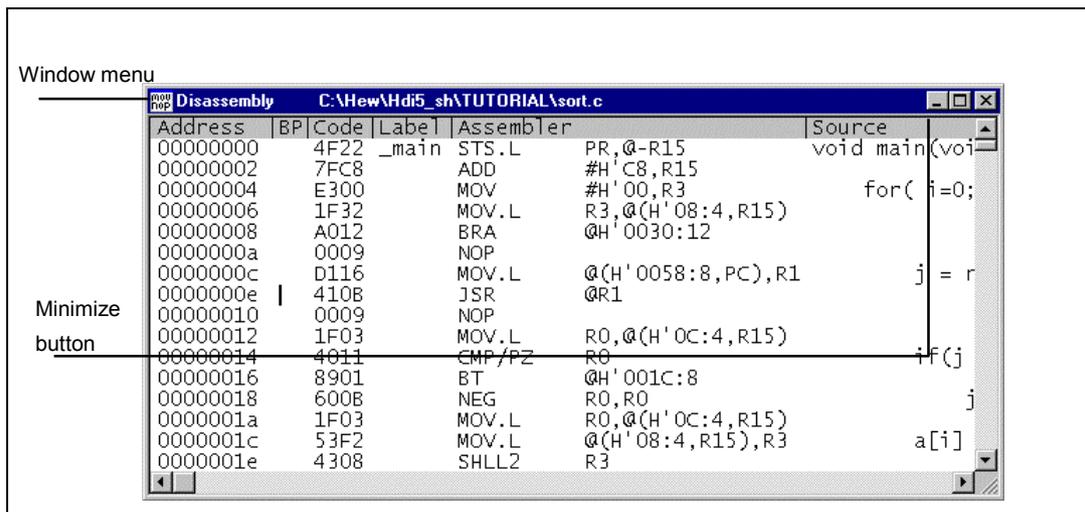


Figure 15.1 Minimizing a Window

The window is minimized to an icon at the bottom left of the HDI application window; for the above **Disassembly** window example, the icon is:



Figure 15.2 Disassembly Window Icon

Note: You may not be able to see the icon if you have a window open over the bottom of the screen.

To restore the icon back to a window, either double-click on the icon, or choose the **[Restore]** menu option from the window menu.

15.1.2 Arranging Icons

Although the icons will be put at the bottom left of the HDI application window by default when you minimize a window, you can move them anywhere you like in the application window by simply clicking and dragging them to a new position. When you restore the icon to a window, the window will be at the same position that it was in when you minimized it. Similarly, when you minimize it again, the icon will be placed at the last position that you moved it to.

When you have many minimized windows as icons, the display can look rather messy. To tidy up the icons, choose the **[Window->Arrange Icons]** menu option.

The icons will be arranged in order from the bottom left of the application window:

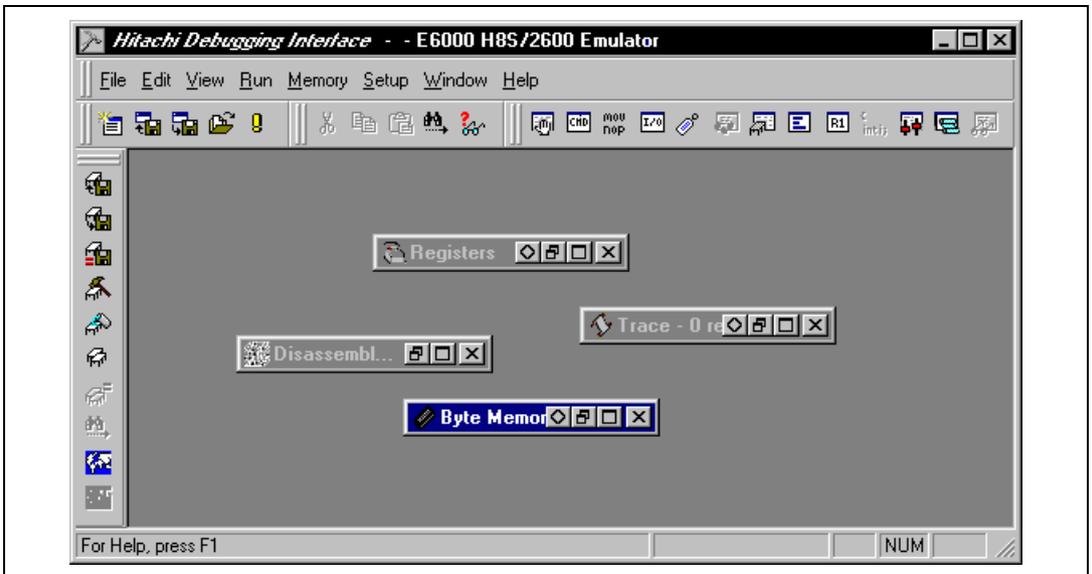


Figure 15.3 Icons Before Arrangement

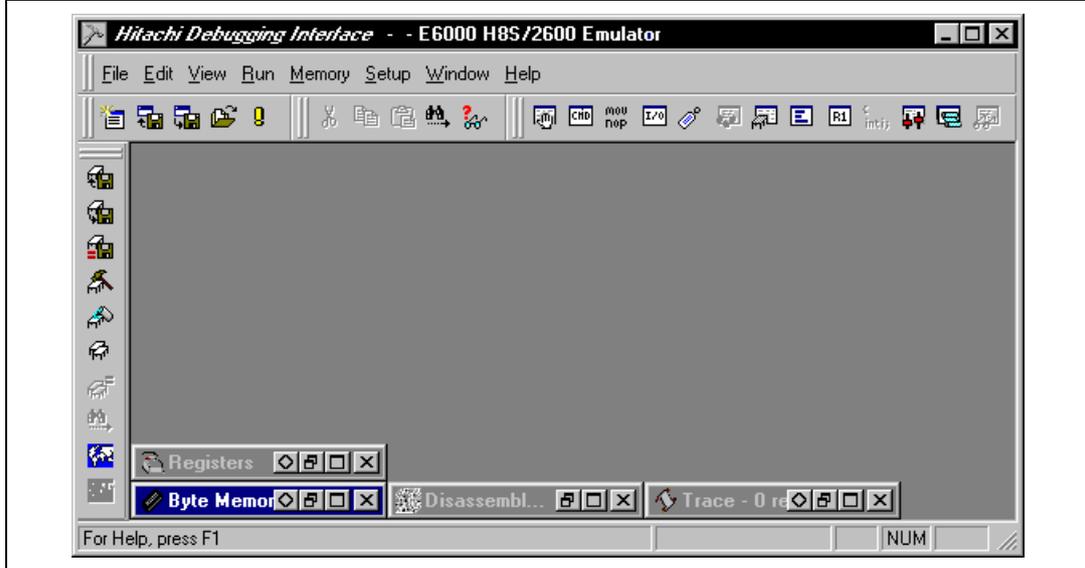


Figure 15.4 Icons After Arrangement

15.1.3 Tiling Windows

After some heavy debugging you may find that you have many windows open on the screen. You can arrange all the windows in a tile format with none of them overlapping each other using the Tile function by choosing the [**Window->Tile**] menu option.

All currently open windows are arranged in a tile format. Windows that are minimized to icons are not affected.

15.1.4 Cascading Windows

Open windows can also be arranged in a cascading format with only their left and top border visible under the window in front of them by choosing the [**Window->Cascade**] menu option. All currently open windows are arranged in a cascading format. Windows that are minimized to icons are not affected.

15.2 Locating Currently Open Windows

When you have many windows open in the HDI application window it is quite easy to lose one of them behind the others. There are two methods that you can use to find the lost window:

15.2.1 Locating the Next Window

To bring the next window in the window list to the front of the display, choose **[Next]** from the window menu, or press **CTRL+F6**. Repeating this operation will cycle selection of all windows (open and minimized).

15.2.2 Locating a Specific Window

To select a specific window, choose from the list of windows (open and minimized) at the bottom of the **[Window]** menu. The currently selected window has a check mark next to it in the window list. In the following example, the **Disassembly** window is the currently selected window:

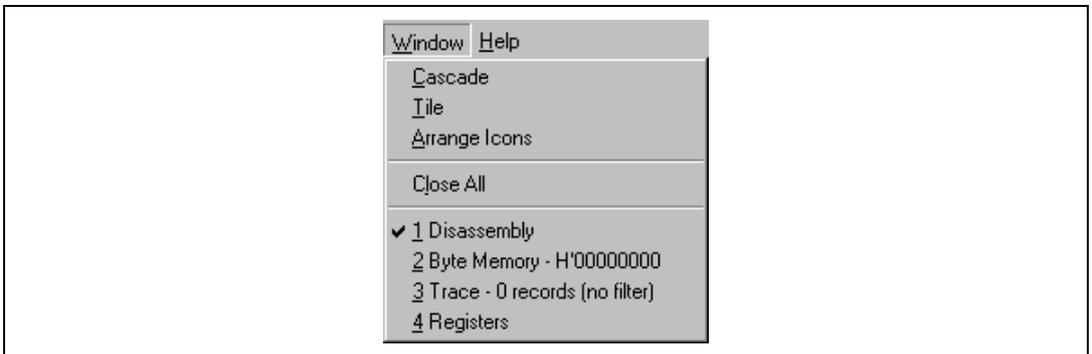


Figure 15.5 Selecting a Window

The window that you select will be brought to the front of the display. If it is minimized the icon is restored to a window.

15.3 Enabling/Disabling the Status Bar

You can select whether or not the status bar is displayed at the bottom of the HDI application window; by default it will be displayed. To disable display of the status bar, choose the **[Setup->Status Bar]** menu option.

The status bar will be disabled and removed from the HDI application window display. To re-enable the Status bar display, choose the **[Setup->Status Bar]** menu option again. The Status bar will be enabled and added to the HDI application window display.

15.4 Customizing the Toolbar

To control the selection and arrangement of buttons displayed on the toolbar, choose the [**Setup->Customize->Toolbar**] menu option.

The **Customize** dialog box opens and contains two panes. The first pane 'Toolbars' is used to set the overall appearance of the toolbars, while the second pane 'Commands' is used to set the individual buttons in each toolbar.

15.4.1 Overall Appearance

Select the Toolbars pane to set the overall appearance of the toolbars:

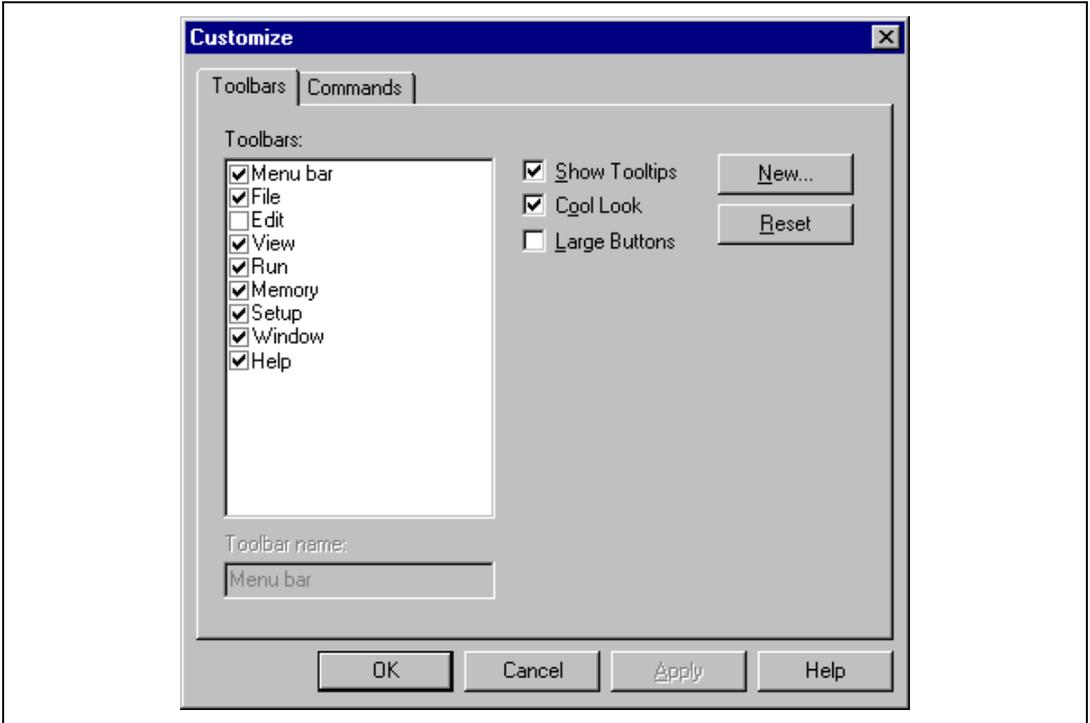


Figure 15.6 Customize Toolbar (Toolbars) Dialog Box

The toolbars are listed in a multi-selection list box. To individually switch off a toolbar, clear the check box next to the name (this name is displayed in a mini-title bar when the toolbar is not attached to the border of the main frame window).

Note: The menu bar cannot be switched off.

If you need to conserve desktop area (for example, when using a portable) then clear the 'Cool Look' check box to revert to the classic Windows® 3.1 style menu and toolbars.

It is possible to add user-defined toolbars - click on the [New...] button and enter a name for your toolbar. This can be edited later in the Toolbar Name edit box (feature only available for user defined toolbars). The new toolbar, in this case called 'My Toolbar', will appear floating at the top-left of the main frame but will have no buttons. To add buttons, you will now have to customize your toolbar.

15.4.2 Customizing Individual Toolbars

Customizing individual toolbars requires a mouse or other pointing device. The feature is not available if only the keyboard is available. This is because the toolbars only operate with a mouse, so customizing them would be unnecessary unless you have a mouse.

Select the Commands pane to set the individual buttons in each toolbar:

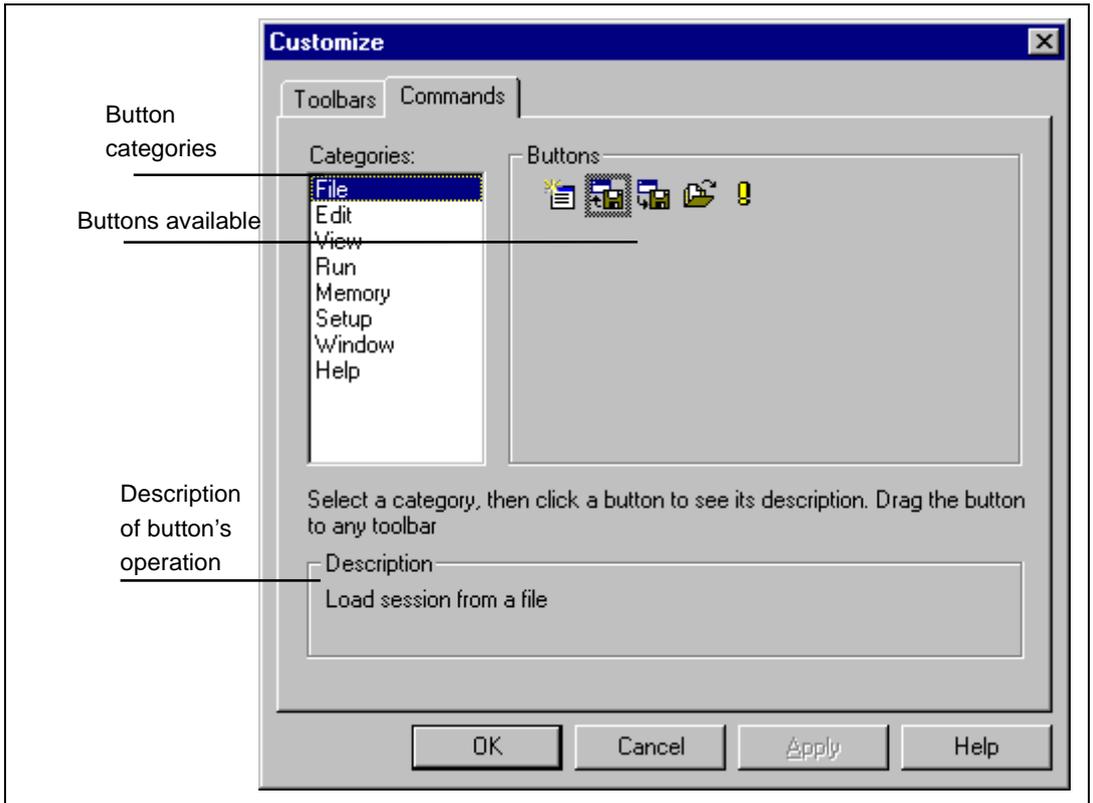


Figure 15.7 Customize Toolbar (Commands) Dialog Box

15.4.3 Button Categories

At the top left of the dialog box is a list of button categories. For each category a list of buttons within that category will be displayed to the right. Click on a button operation option in the list to view a description of the button's operation in the Description field.

15.4.4 Adding a Button to a Toolbar

➡ To add a button to a toolbar:

1. Select the button category from the button category list.
2. Select the button item from the operation list.
3. Drag the button from the dialog box to the toolbar location you wish to add the new button. Then the button is inserted into the tool bar.

15.4.5 Positioning a Button in a Toolbar

➡ To move a button position in a toolbar:

1. Select the button in a toolbar.
2. Drag the button to the new position in the toolbar or another toolbar.

Note: Holding down the Ctrl key while dragging will copy the button.

15.4.6 Removing a Button from a Toolbar

➡ To remove a button in a toolbar:

1. Select the button in a toolbar.
2. Drag the button out of the toolbar (anywhere into the main frame).

15.5 Customizing the Fonts

You can customize the display font for text style windows (e.g. **Source** and **Memory** windows), or change the default font that is used when a new window is opened.

To change the display font, choose the [**Setup->Customize->Font**] menu option. This will launch the **Font** dialog box:

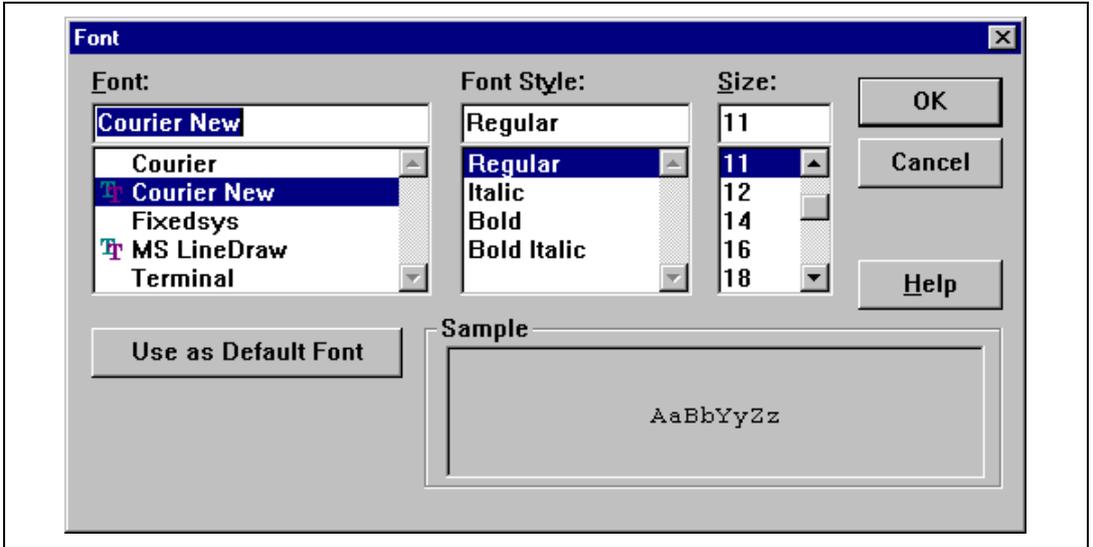


Figure 15.8 Font Dialog Box

The dialog box is based on the standard Windows® font selection dialog box, except that only fixed width fonts are listed in the Font list box. By pressing the [Use as Default Font] button, the font to be used when a new window is opened can be specified.

15.6 Customizing the File Filters

You can customize the file filters displayed in the **Open** dialog box.

To change the filters, choose the [**Setup->Customize->File Filter**] menu option. This will launch the **Customize File Filter** dialog box:

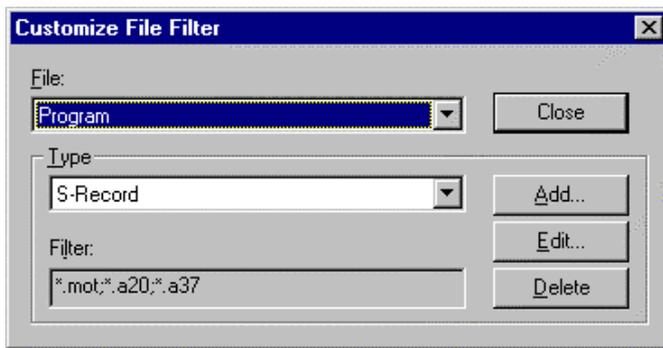


Figure 15.9 Customize File Filter Dialog Box

Note: Changes are made immediately when using this dialog box. There is no option to cancel changes made.

➡ To edit an existing filter:

1. Select the file group from the File drop list.
2. Select the file type name from the Type drop list.
3. Click the **[Edit...]** button to open the **Edit Filter** dialog box. The dialog title will display the file group that is being changed. The edit box on this dialog box is limited to accept only valid characters for filter type or extension.
4. Change the filter name and/or extension. If more than one extension is required, then separate each extension with a semi-colon. For example:

`*.mot;*.a20;*.a37`

➡ To enter a new filter:

1. Select the file group from the File drop list.
2. Click the **[Add...]** button to open the **Add Filter** dialog box. The dialog title will display the file group that is being changed. The edit box on this dialog box is limited to accept only valid characters for filters.
3. Enter a name for the filter type and the extensions you want to use for the filter.

Note: If the filter type entered matches an existing type, the filter for the existing type will be changed to the newly entered filter.

➡ To remove a filter:

1. Select the file group from the File drop list.
2. Select the file type name from the Type drop list.
3. The file type will be removed when the **[Delete]** button is clicked.

15.7 Saving a Session

If you have downloaded the user program into the debugging platform, have the corresponding source files displayed and a number of auxiliary windows open, then it can take some time to setup this information the next time the program is loaded. To help with this, HDI can save the current settings to a file.

If you are already using a named session, or want to create a session with the same name as the current object file, choose the **[File->Save Session]** menu option.

To save the current setting under a new name, choose the **[File->Save Session As...]** menu option. This will launch a common file dialog box prompting you for a file name. Up to three files are saved; an HDI session file (*.hds); a target session file (*.hdt); and a watch session file (*.hdw). The first includes the HDI interface settings, e.g. all the open windows and their positions. The second includes the settings specific to the debugging platform/user system, e.g. the name of the debugging platform and its configuration. The third is only created if a **Watch** window is open and it includes a list of the variables currently being watched.

The session name is then displayed as the second entry in HDI's title bar.



Figure 15.10 Session Name Display

Note: The session file does not include symbol or memory information. To use modified information again in later sessions, save the symbol and memory information in appropriate files. For details, see section 9.6, Saving an Area of Memory and section 5.6.11, Save As....

15.8 Loading a Session

To reload a saved session, choose the **[File->Load Session...]** menu option. This will launch a standard Windows® file dialog box prompting you for an HDI session file name (*.hds).

Any currently open windows will be closed, and the connection to the debugging platform initialized. If user program has been downloaded to the user system, then the status bar will

display the percentage done. When the download is completed, windows will be opened and updated to show the latest information from the user system.

15.9 Setting HDI Options

There are a number of settings available to help you to use the HDI interface. Choosing the [Setup->Options...] menu option will launch the **HDI Options** dialog box:

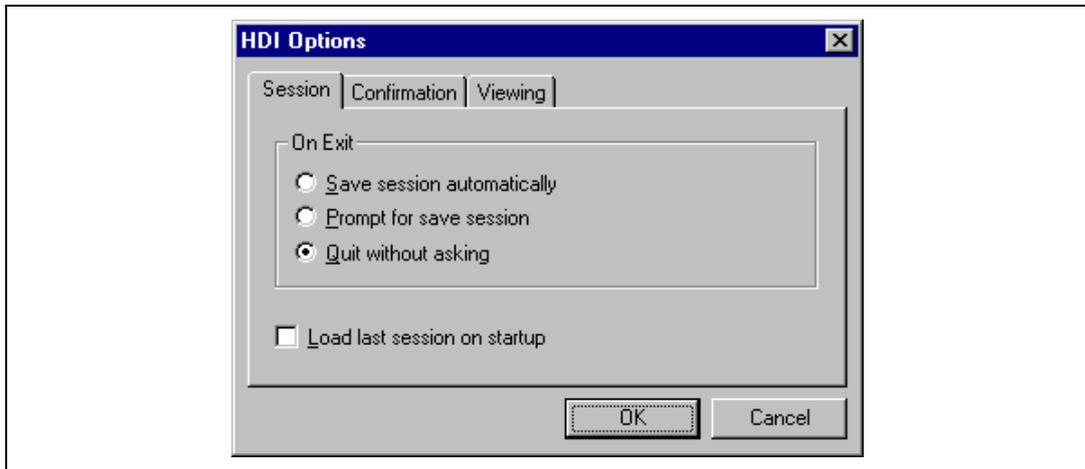


Figure 15.11 HDI Options (Session) Dialog Box

The 'On Exit' group of radio buttons automates saving the current session when the user program is shut down:

- **Save session automatically:** This will save the session information in the current session file. If there is no current session file then you will be prompted to enter an HDI session file name.
- **Prompt for save session:** This will always ask you if you want to save the current session when the program is shut down. If you select 'Yes', then the session information is saved in the current session file. If there is no current session file then you will be prompted to enter a session file name.
- **Quit without asking:** This shuts down the program and does not prompt you, nor save the current session information.

Check the 'Load last session on startup' check box if you want to automatically load the last saved session the next time the user program is started.

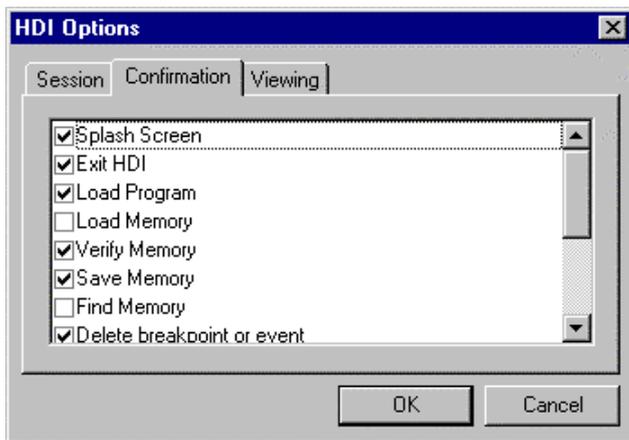


Figure 15.12 HDI Options (Confirmation) Dialog Box

Confirmation message boxes can be switched off or on by using the appropriate confirmation check box.

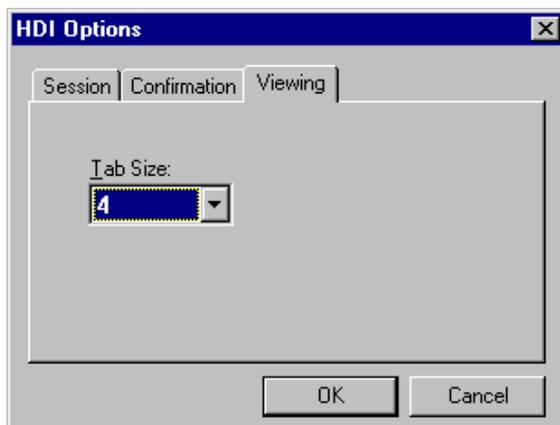


Figure 15.13 HDI Options (Viewing) Dialog Box

The 'Tab Size' list box can be used to set the number of spaces that a tab character will be expanded to within the views. Valid values are between 2 and 8. The best value will be the same as your normal editor.

15.10 Setting the Default Input Radix

HDI can accept input in several numerical bases. The default is hexadecimal (except Count fields which are always decimal), but you can also use one of the prefixes described in section 2.2.2,

Data Formats. To improve usability, you can select one of these formats as the default, i.e. you will not need to enter the corresponding prefix to use that radix.

To change the default radix, choose the [**Setup->Radix**] menu option. This will display a list of possible numbering systems with a check mark to the left of the current radix:

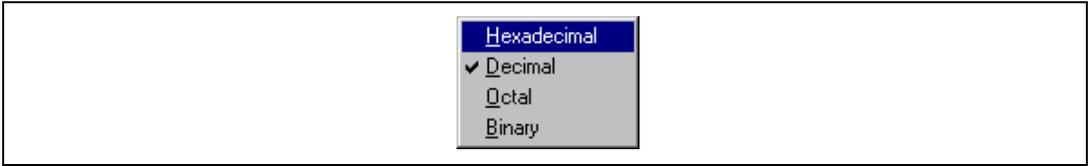


Figure 15.14 Setting Radix

Section 16 Co-verification Functions

This section describes co-verification using the Synopsys Eagle. For details of the Eagle or hardware simulator, refer to the applicable manuals for the product.

16.1 Features

The simulator/debugger can simulate and debug SuperH™ RISC engine microcomputers. It can perform co-verification for the SH-3DSP, SH-4, and SH-DSP (SH7065) series microcomputers. The co-verification function evaluates programs written in C/C++ language or assembly language at an early stage, before hardware development is completed.

Co-verification supports the following and enables efficient program testing and debugging.

- Interrupts such as NMI, IRQ, IRL, or Timer
- Bus width, WAIT, or IDLE
- A timer

16.2 Operating Environment

Co-verification can be executed in the following environment.

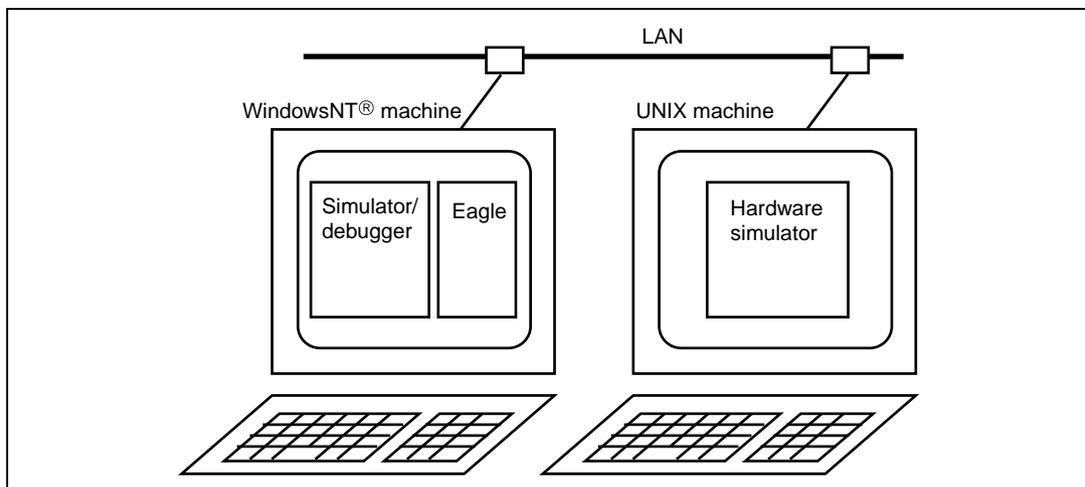


Figure 16.1 Operating Environment of Co-Verification

- Notes:**
1. Co-verification can only be performed on Windows NT® and cannot be performed on Windows® 95 or Windows® 98.
 2. Eagle can also run on UNIX. However, an environment to operate the remote shell must be implemented on Windows NT®.

16.3 Simulator/Debugger Functions

This section describes the simulator/debugger functions supported by co-verification.

16.3.1 Simulator/Debugger Memory Management

(1) Usable Memory Model

Co-verification uses the following memory models, which are set by Eagle.

- Memory models managed by Eagle (Direct Memory in Eagle)
- Memory models used by hardware simulator (Remote Memory in Eagle)
- Memory managed by simulator/debugger (Local Memory in Eagle)

For details, refer to the Eagle user's manual.

(2) Setting Memory Map

Set the memory map for the simulator/debugger even when using the memory models managed by Eagle or memory models used by the hardware simulator. The memory map can be set through the **System Configuration** dialog box. The memory will be used to calculate the number of memory access cycles during simulation. The following items should be set for the memory map.

- Memory type
- Start address and end address of the memory area
- Number of memory access cycles
- Memory data width

Co-verification invalidates the number of memory access cycles and memory data width set through the **System Configuration** dialog box. Therefore, validate these items through the bus state controller (BSC).

(3) Defining Memory Resources

Define memory resources to execute the memory models managed by Eagle and the memory models used by the hardware simulator. Memory resources can be defined through the **System Memory Resource Modify** dialog box.

16.3.2 Endian

The MD pin sets the endian for the SH-3DSP and SH-4. The HDL language sets high or low for the MD pin. The BSC sets the endian for the SH-DSP (SH7065); however, it cannot specify the

endian for each area. This means that the endian specified for area 0 becomes the endian for all areas.

Set the endian through the **System Configuration** dialog box. For details, refer to the simulator/debugger user's manual.

16.3.3 Bus State Controller (BSC)

The BSC sets the bus width, programmable waits, and idle cycle.

Only normal memory is supported for the memory type.

16.3.4 Interrupt Controller (INTC)

Co-verification enables interrupts such as NMI, IRQ, IRL, and timer.

16.4 Tutorial

This section describes the simulator/debugger co-verification operation.

16.4.1 Introduction

Before starting the HDI, set the Eagle and hardware simulator. For details, refer to the product manual.

This description notes uses Windows NT[®] version Eagle for tutorial.

16.4.2 Setting Eagle and Running HDI

Specify HDI.EXE in File to run field in the VSP Software Control Configuration of the **Eagle Console** window.

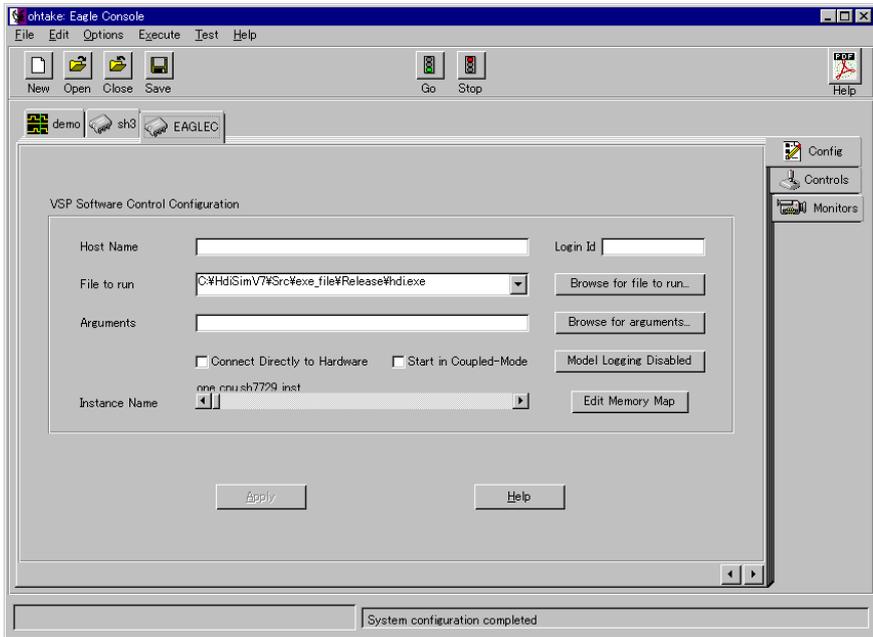


Figure 16.2 Eagle Console Display

16.4.3 Selecting the Target

Pressing the GO button in the **Eagle Console** window will run the hardware simulator. This will start the HDI. Then you will be prompted to choose a CPU.

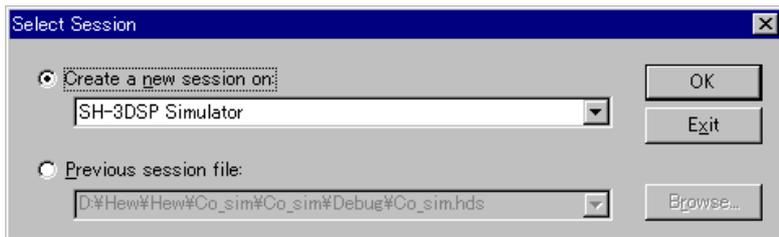


Figure 16.3 Select Session Dialog Box

Note: Co-verification can be performed for SH-3DSP and SH-4, SH-DSP (SH7065) only.
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16.4.4 Setting the Memory Map

After running the HDI, choose [**Configure Platform...**] from the [**Setup**] menu and open the **Eagle Console** window to set the memory map and endian.

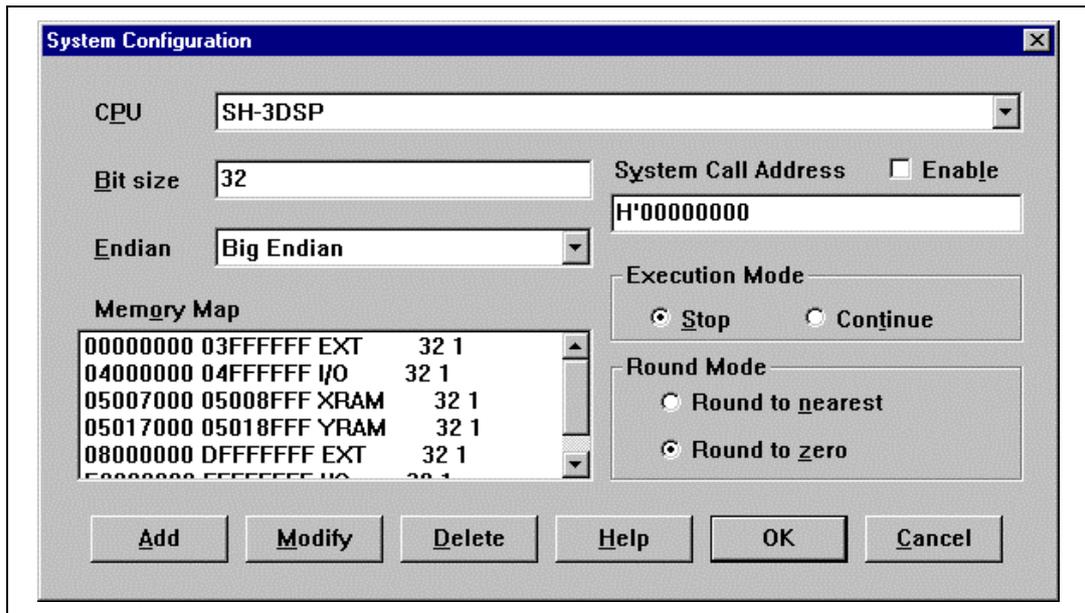


Figure 16.4 System Configuration Window

16.4.5 Mapping the Memory Resource

Define the memory map to access memory models.

Choose [**Configure Map...**] from the [**Memory**] menu to display the memory map.

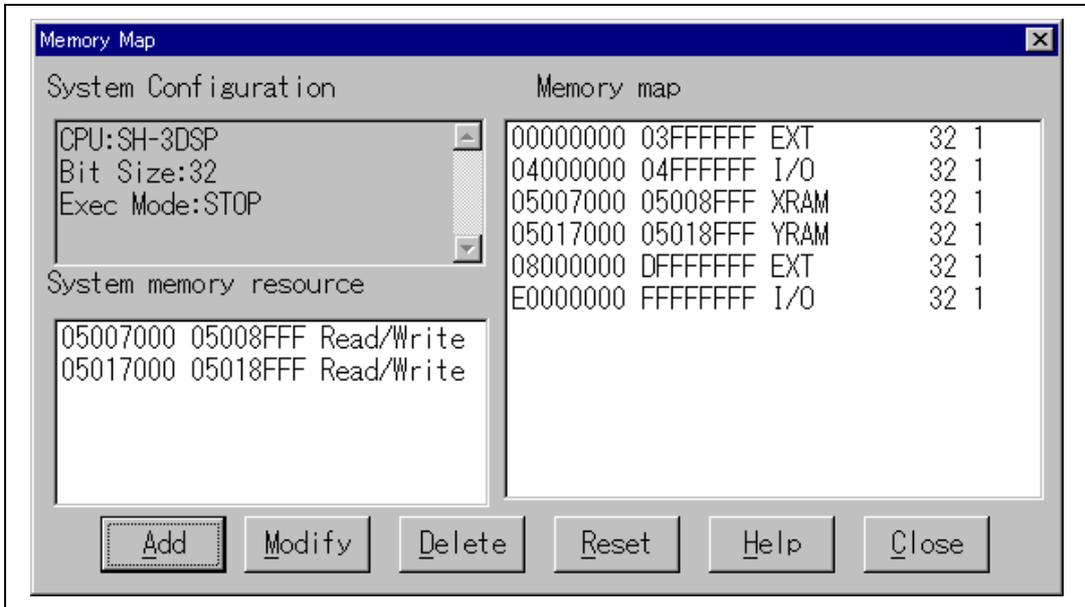


Figure 16.5 Memory Map Dialog Box

Clicking the **[Add]** button displays the **System Memory Resource Modify** dialog box.

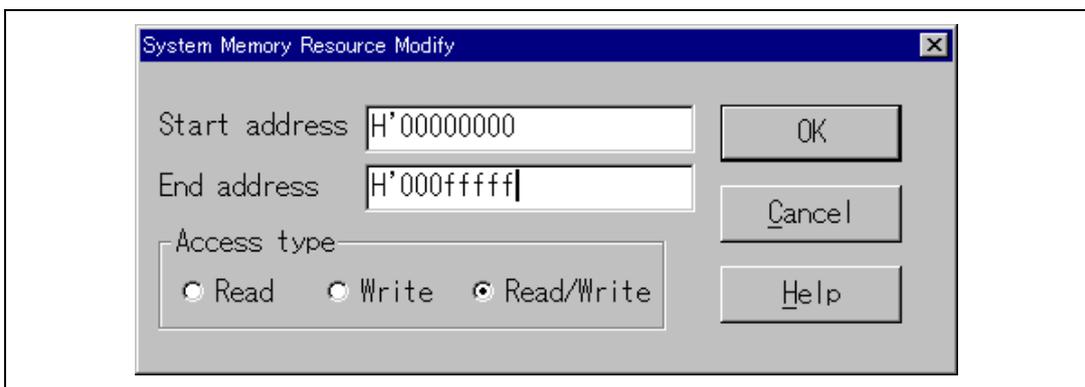


Figure 16.6 System Memory Resource Modify Dialog Box

In the **[Access type]** box, specify one of the following access types:

- Read: Only read enabled
- Write: Only write enabled
- Read/Write: Read and write enabled

Note: Set the memory map to access memory models.

16.4.6 Opening External Tools Window

Choose **[External Tools]** from the **[View]** menu to display the **External Tools** window.



Figure 16.7 External Tools Window

- Tool name: Eaglei of Synopsys Inc. is displayed.
- Attribute: Co-verification tool is displayed.
- Status: Terminate or Connect is displayed.

16.4.7 Opening Eagle Window

Clicking the **External Tools** window with the right mouse button displays the following popup menu.

- Connect: Connects to Eagle.
- Terminate: Disconnects Eagle.

Note: If Terminate is selected to disconnect Eagle, it cannot be reconnected.

Select Connect to connect to Eagle. The **Eaglei** window will then open.

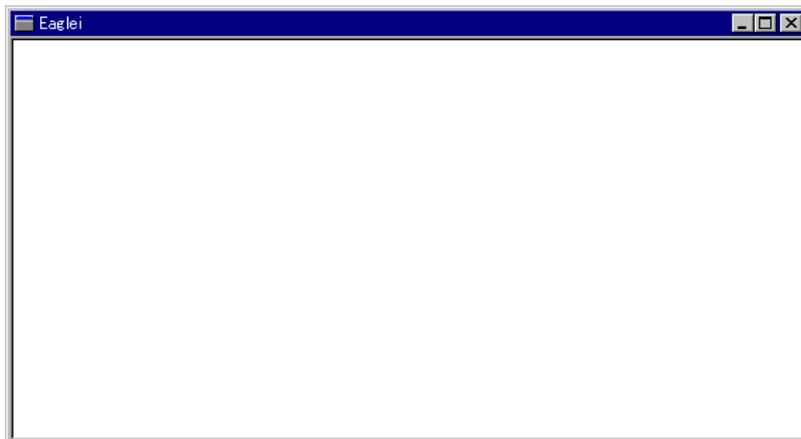


Figure 16.8 Eaglei Window

A message from Eagle is displayed on the **Eaglei** window.

Clicking the **Eagle** window with the right mouse button displays the following popup menu.

- Coupling: Toggles between the coupling mode and uncoupling mode in Eagle. A check mark is displayed when the coupling mode is selected.
- Update Map: Updates the Eagle map setting. Selecting the [**Update Map**] displays the dialog box for selecting the file to be displayed. Select the Eagle map setting file and open the dialog box. The simulator/debugger will load map information.

16.4.8 Downloading the Tutorial Program

There are three ways to download the tutorial program:

- Through the simulator/debugger, download the program by selecting [**Load Program**] from the [**File**] menu.
- Directly to memory. For details, refer to the Eagle user's manual.
- Through the hardware simulator. Set the initial value to the memory model using the HDL language function.

16.5 Notes on Co-Verification

When performing co-verification, keep the following in mind:

1. Keep the **External Tools** window and **Eaglei** window open when performing co-verification. Closing these windows automatically disconnects Eagle.
2. When referencing and modifying the memory contents by using the simulator/debugger, there are cases when the hardware simulator cycles are counted and not counted.
 - Hardware simulator cycles are counted in coupling mode, and when the memory model on the hardware simulator is accessed in the uncoupling mode.
 - Hardware simulator cycles are not counted in cases other than above.
3. When the Eagle's Local memory and Direct memory are used, the number of cycles displayed in the **Trace** window and **Status** window are incorrect. To refer to the correct number of cycles, use the Eagle's Remote memory.

Appendix A - System Modules

The following section describes the architecture of the HDI debugging system.

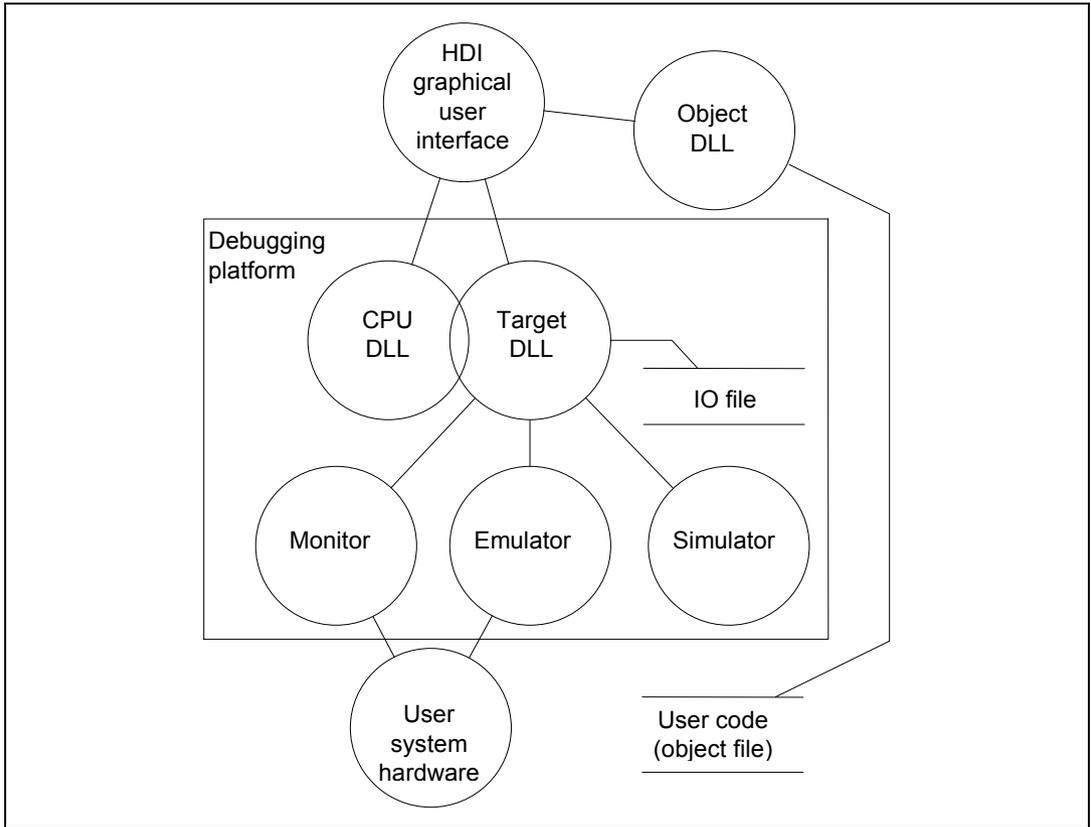


Figure A.1 HDI System Modules

In normal operation, the user program will be placed directly into the user system hardware (for example as an EPROM). HDI uses this information to provide a Windows[®]-based debugging system.

To decrease the learning curve when swapping between different debugging platforms and/or user system hardware, HDI provides a single unified interface (the GUI) and a family of target specific modules. Normally, the user will only interact with the standard GUI - once the appropriate target module has been selected, the rest of the system configures itself automatically by loading the appropriate modules.

Graphical User Interface

This is the main HDI.EXE program that runs under Windows®. It uses familiar Windows® operations, with menus and windows to give a user-friendly view into the debugging system. The GUI is the only contact between the user and the rest of the system; it processes commands and provides the required information about the user program. It also provides the interface between the module DLLs and the host file system, i.e., the PC.

Object DLL

When creating the user program, a compiler will generate an *absolute object file*. This file contains the actual machine code and data that the microcomputer processes to execute the functions making up the target application. In order to debug the user program as original source code, the compiler must provide more information to the debugger. For this reason, nearly all compilers have a debugging option that puts all the information necessary for debugging your source code into the absolute file, which is usually called a debug object file.

The object DLL extracts this information from the object file for display to the user. Since the format of data is compiler dependent, more than one object DLL may be present in the HDI directory - HDI will try each in turn until it finds one that can understand the object file's format.

CPU DLL

The CPU DLL module contains information specific to the target microcomputer. For example, it contains the number and types of registers available to the microcomputer. It also translates the raw machine code in the target into more familiar assembly-language mnemonics displayed in the **Source** window, and vice versa.

Target DLL

The target DLL informs HDI about the debugging platform's capabilities and selects the correct CPU DLL. Since some capabilities of the debugging platform cannot be generic (for example, target configuration), the target DLL also includes extensions to the standard GUI to provide the user with access to these capabilities.

For a detailed description of the features available using your target DLL, refer to the supplied debugging platform user's manual.

Appendix B - GUI Command Summary

Menu	Item	Accelerator	Toolbar Graphic
File	New Session...	Ctrl+N	
	Load Session...	Ctrl+O	
	Save Session	Ctrl+S	
	Save Session As...		
	Load Program...		
	Initialize		
	Exit	Alt+F4	
Edit	Cut	Ctrl+X	
	Copy	Ctrl+C	
	Paste	Ctrl+V	
	Find	F3	
	Evaluate		
View	Breakpoint	Ctrl+B	
	Command Line	Ctrl+L	
	Disassembly...	Ctrl+D	
	I/O Area	Ctrl+I	
	Labels	Ctrl+A	
	Locals	Ctrl+Shift+W	
	Memory...	Ctrl+M	
	Performance Analysis	Ctrl+P	
	Profile-List	Ctrl+P	
	Profile-Tree	Ctrl+F	
	Registers	Ctrl+R	
	Source...	Ctrl+K	

Menu	Item	Accelerator	Toolbar Graphic
View (cont)	Stat <u>u</u> s	Ctrl+U	
	<u>T</u> race	Ctrl+T	
	<u>W</u> atch	Ctrl+W	
Run	Reset <u>C</u> PU		
	<u>G</u> o	F5	
	Re <u>s</u> et Go	Shift+F5	
	Go To <u>C</u> ursor		
	Set <u>P</u> C To Cursor		
	<u>R</u> un...		
	Step <u>I</u> n	F8	
	Step <u>O</u> ver	F7	
	Step <u>O</u> ut		
	<u>S</u> tep...		
	<u>H</u> alt	Esc	
Memory	<u>R</u> efresh	F12	
	<u>L</u> oad...		
	<u>S</u> ave...		
	<u>V</u> erify...		
	<u>T</u> est...		
	F <u>i</u> ll...		
	<u>C</u> opy...		
	Com <u>p</u> are...		
	Search...		
	Configure <u>M</u> ap...		
	Configure <u>O</u> verlay...		

Menu	Item	Accelerator	Toolbar Graphic
Setup	Options...		
	Radix (Input) >		
	Hexadecimal		
	Decimal		
	Octal		
	Binary		
	Customize >		
Toolbar...			
Font...			
File Filter...			
Configure Platform...			
Window	Cascade		
	Tile		
	Arrange Icons		
	Close All		
Help	Index	F1	
	Using Help		
	Search for Help on		
	About HDI		

Appendix C - Symbol File Format

In order for HDI to be able to understand and decode the symbol file correctly, the file must be formatted in a specified manner:

1. The file must be a plain ASCII text file.
2. The file must start with the word “BEGIN”.
3. Each symbol must be on a separate line with the value first, in hexadecimal terminated by an “H”, followed by a space then the symbol text.
4. The file must end with the word “END”.

Example:

```
BEGIN
11FAH Symbol_name_1
11FCH Symbol_name_2
11FEH Symbol_name_3
1200H Symbol_name_4
END
```

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