NEC

User's Manual

ID78K0

Integrated Debugger

Guide (Windows™ based operation)

Target device
78K/0 series

Document No. U11649EJ1V2UM00 (1st edition)
Date Published March 1998 J CP(K)

M7A 96.10

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- Ordering information
- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
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Preface

Thank you for purchasing the ID78K0 integrated debugger.

Conventional debuggers are used by entering commands directly. The ID78K0 integrated debugger, on the other hand, runs under Windows to provide a friendly, easy-to-use GUI (Graphical User Interface). Its operation is mouse-based, and operation is possible without having to refer to the manual. Also, frequently used commands are represented as buttons, allowing their activation simply by clicking the button with the mouse.

«Purpose»

The purpose of this manual is to provide the user with a brief explanation of how to use the ID78K0 integrated debugger. This manual should be read together with the "ID78K0 Integrated Debugger User's Manual (Reference)." For a detailed explanation of each window, refer to the "ID78K0 Integrated Debugger User's Manual (Reference)."

«Files supplied with the integrated debugger»

Files used with the integrated debugger

File name	Explanation
ID78K0.EXE	Debugger main section. The debugger is started by executing this file.
ID78K0P.DLL	Contains the libraries used for link processing with Project Manager.
DB78K0.DLL	Contains libraries for file and symbol processing.
AS78K0.DLL	Contains libraries for assembly and disassembly.
EX78K0.DLL	Contains libraries for communication with the in-circuit emulator.
EX78K0.OM0	Downloaded into the in-circuit emulator when the debugger starts.
ID78K0.HLP	Help file.
EXPC.INI	Initial file. Used to specify a set point and an interrupt address for the PC interface board.

Sample programs

File name	Explanation
SAMPLE.C	Sample program written in C.
SUB.C	Sample program written in C. Contains the subroutines of SAMPLE.C.
SAMPLE.LNK	Load module file for sample programs SAMPLE.C and SUB.C. Compiled by μPD78014.

«Target device»

The device which is to be the target of debugging by the integrated debugger is called a target device. The table below lists target devices, their associated device files, microprograms, and the names of the CPUs which select the target devices.

Target device	CPU name	Device file
μPD78014	78014	D014.78K
μPD78044	78044	D044.78K
μPD78054	78054	D054.78K
μPD78064	78064	D064.78K

Note: For details of other devices, contact your NEC sales representative or authorized dealer.

«In-circuit emulator»

An in-circuit emulator and dedicated interface board are required to use the integrated debugger.

The table below lists the in-circuit emulator boards and interface boards that can be connected to host machines.

In-circuit emulator

Product name	Explanation
IE-78000-R-A	In-circuit emulator main board
IE-78xxx-R-EM(Note 1)	Product type dependent board

Note 1. For details, contact your NEC sales representative or authorized dealer.

Interface boards

Product name	Explanation
IE-70000-98-IF-A	Interface board for PC-9801 and 9821 Series (C bus)
IE-70000-98-IF-B	Interface board for PC-9801 and 9821 Series (C bus)
IE-70000-98N-IF(Note 2)	Interface board for 98NOTE (110-pin expansion bus)
IE-70000-PC-IF-B(Note 3)	Interface board for IBM-PC/AT Series (ISA bus)

Note 2. The IE-70000-98N-IF is corrected to the expansion bus (110-pin type) of 98NOTE.

Note 3. The IE-70000-PC-IF-A cannot be used.

«Host machine»

The integrated debugger runs under Windows. The table below lists the requirements for the machine to be used.

Item	Requirement
Host machine	PC-9801, 9821 or IBM-PC/AT Series
CPU	i80386 or above (i80486, 33 MHz or above recommended)
Main memory	4M bytes or more (8M bytes or more recommended)
OS	Windows 3.1 or Windows 95
Screen size	640 x 400 dots or larger (800 x 600 dots or larger recommended)

«Configuration»

- **Chapter 1 Overview**

  Explains general operations of the integrated debugger.

- **Chapter 2 Basic Operations**

  Explains the relationships between windows and other information by purpose.

- **Chapter 3 Advanced Use of ID78K0**

  Describes the terms used in the explanation of the integrated debugger.

«Conventions»

The following explains the conventions used throughout this manual.

[ ]	:	Indicates a key to be pressed.
+	:	Indicates keys which must be pressed at the same time.
“ ”	:	Indicates a character string.
‘ ’	:	Indicates a character.
[ ]	:	Indicates an optional parameter.
[GRPH] key	:	Representation of a key featured by the PC-9801 and 9821 Series.
		The [Alt] key of the IBM-PC/AT Series has the same function.

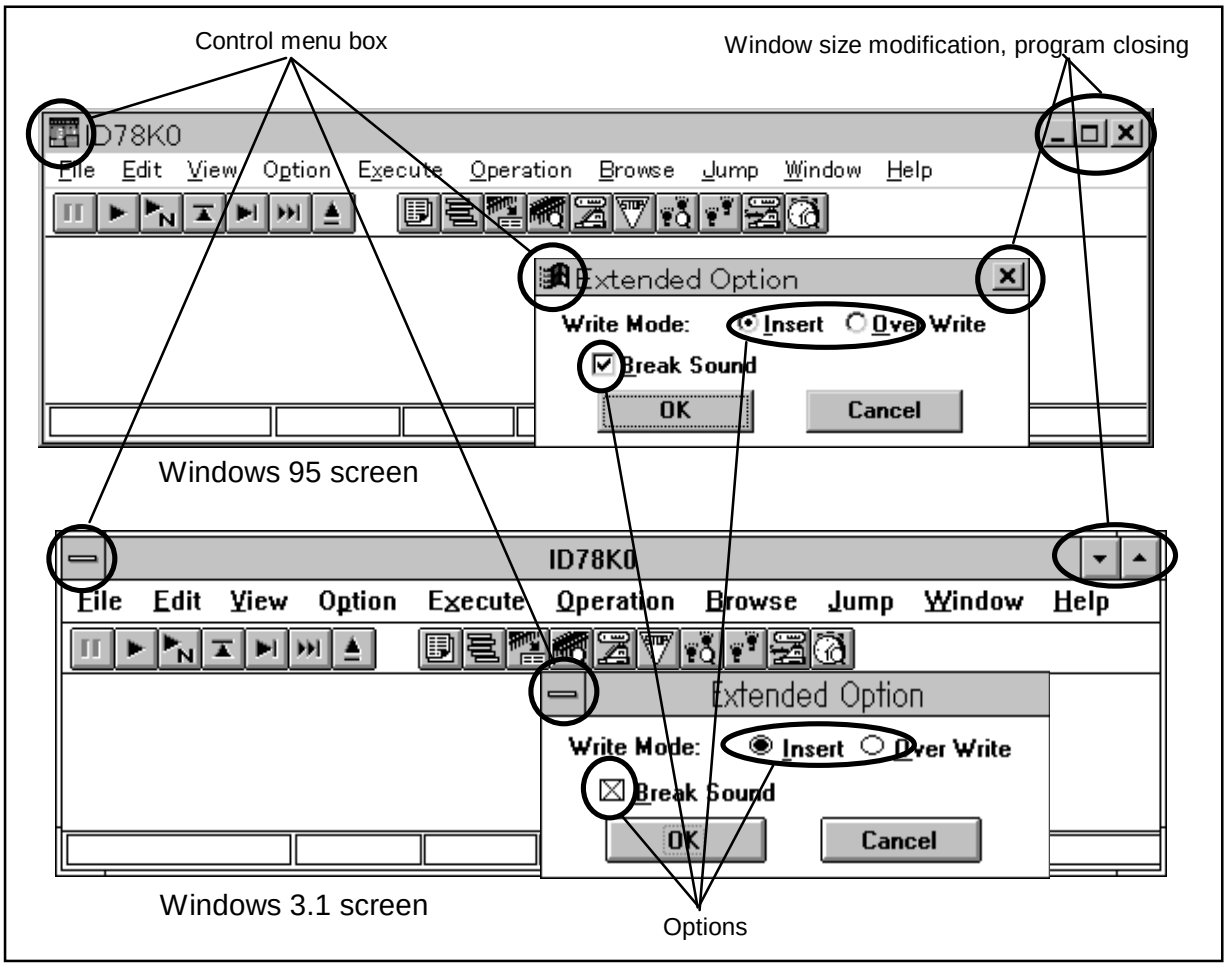
All representations of keys in this manual are for the PC-9801 and 9821 Series. When using an IBM-PC/AT Series computer as a host machine, see **Appendix B**.

«Screen»

The descriptions in this manual refer to Windows 95 screens unless specified otherwise.

The differences between Windows 3.1 screens and Windows 95 screens are as described below.

	Windows 3.1	Windows 95	Remarks
Control menu box			Displays the control menu. With Windows 95, an icon or the Windows logo is displayed.
Window size modification			Minimizes the window.
			Maximizes the window.
			Restores the window to its original size.
Close button	(None)		Closes the window.
Option			Multiple options can be selected.
			Only one of the multiple options can be selected.



«Cautions»

- To perform source debugging, add options for creating debug information whenever compiling, assembly, or linking is performed. Otherwise, source debugging may not be possible.

- When creating your own startup routine in C, add the symbols given below. Failing to do so may result in part of the step execution not being performed correctly.

Where to add	Symbol to be added
Start of startup routine	_@cstart
End of startup routine	_@cend

«Related Documents»

The documents (user's manuals) related to this manual are listed below:

Document name		Document number	
		Japanese	English
ID78K0 Integrated Debugger User's Manual, Reference		U11539J	U11539E
RA78K Series Assembler Package	Language	EEU-815	EEU-1399
	Operation	EEU-809	EEU-1404
RA78K Series Structured Assembler Preprocessor		EEU-817	EEU-1402
CC78K Series C Compiler	Language	EEU-655	EEU-1280
	Operation	EEU-656	EEU-1284
78K/0 Series User's Manual, Instructions		IEU-849	EEU-1372
μPD78014, 78014Y Sub-Series		U-10085JJ	EEU-1343

Note: The above documents may be revised without notice. Use the latest versions when designing an application system.

[MEMO]

Chapter 1 Overview

This chapter outlines the debugger.

1.1 Starting and Terminating the Debugger

This section explains how to start and terminate the debugger.

1.2 Making Maximum Use of the Main Window

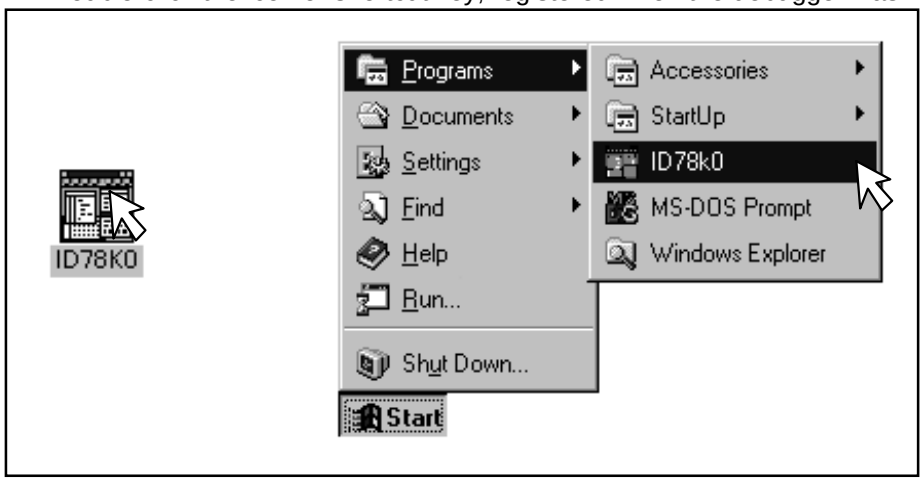
The main window appears when the debugger is started. The main window supports many functions. By making full use of these functions, the efficiency of debugging can be significantly enhanced.

1.1 Starting and Terminating the Debugger

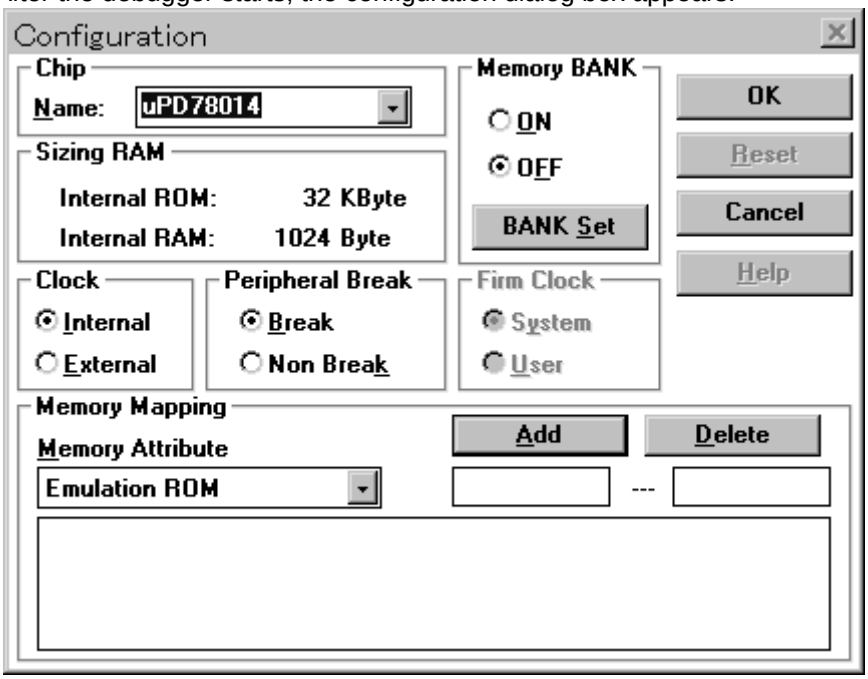
- The debugger can be started and terminated easily.
- To start the debugger, select the icon, shortcut key, or corresponding item in the start menu. These will have been registered when the software was installed.
- To terminate the debugger, select the corresponding item from the menu. When terminating the debugger, you may select saving of the debugging environment. Doing so allows the debugger to be used immediately the next time it is started.

1.1.1 Starting

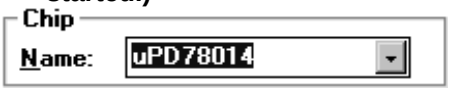
1. Start Windows.
2. Turn on the in-circuit emulator.
3. Turn on the target, if being used.
4. Double-click the icon or shortcut key, registered when the debugger was installed.



5. After the debugger starts, the configuration dialog box appears.



6. Select a debug target device.
   (Note that the debug target device can be selected only when the debugger is being started.)

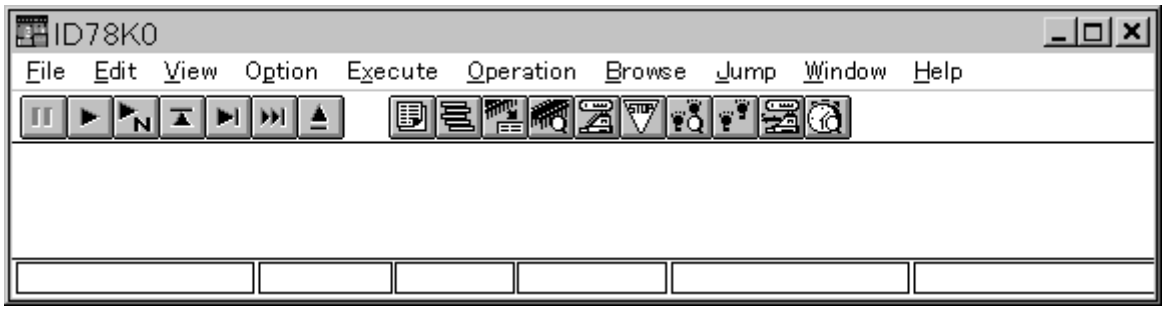


7. Set the clock source, memory mapping, and other required items.

8. Once all the necessary items have been set, click the 

button. This completes device initialization and causes the required data to be downloaded to the in-circuit emulator.

9. Once downloading has been completed, the main window of the debugger opens. The main window is used as the core window for debugging.

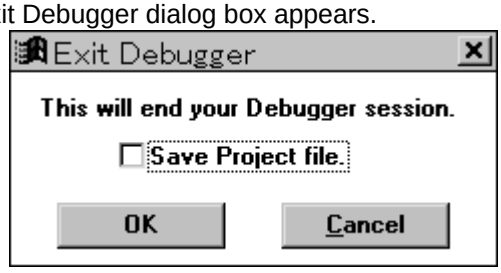


1.1.2 Terminating

1. Select File from the menu bar of the main window.

2. Select Exit from the File pull-down menu.

3. The Exit Debugger dialog box appears.



4. Click the 

button to terminate the debugger.

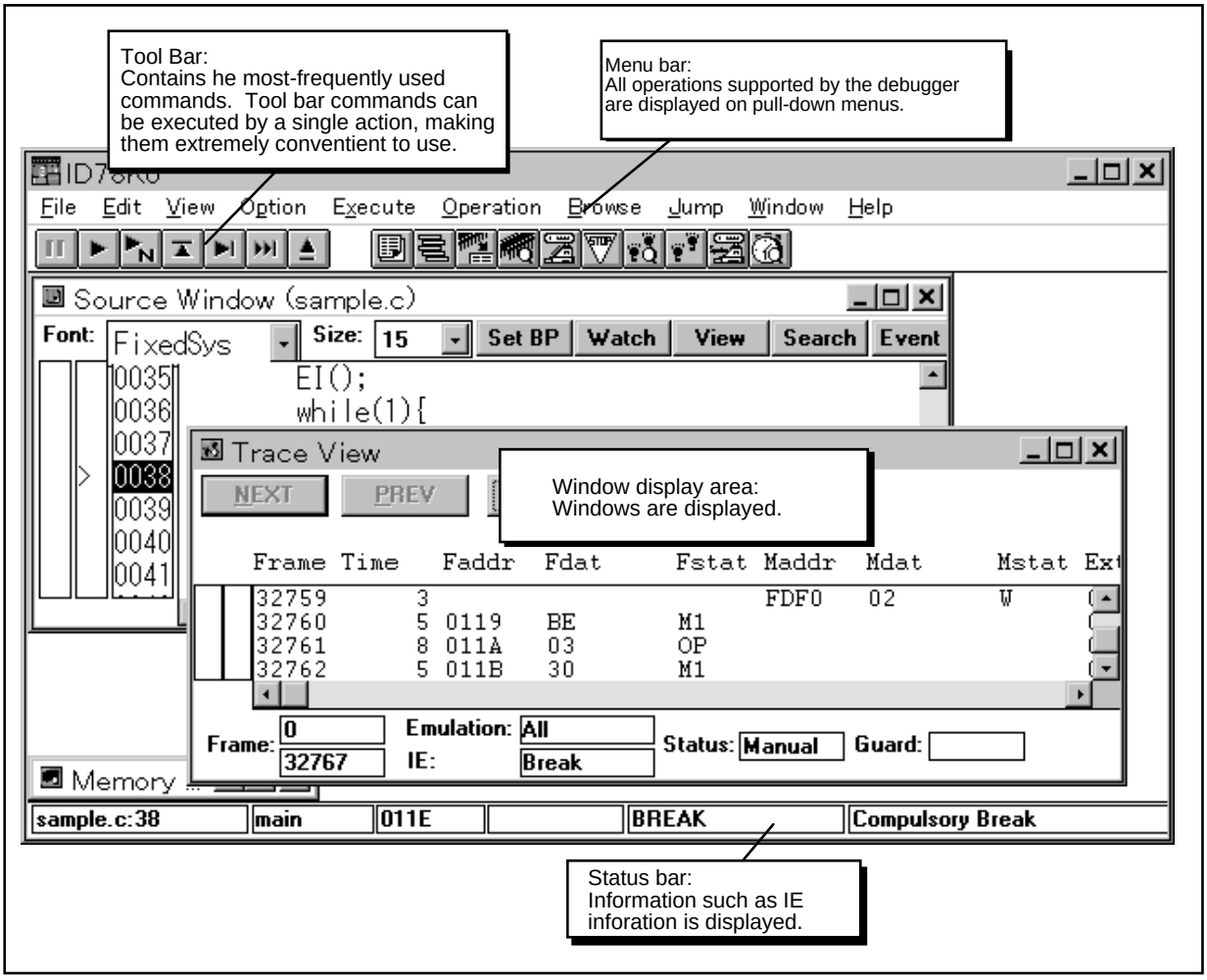
1.2 Making Maximum Use of the Main Window

- All debugger windows are based on the main window.
- The main window supports many functions, all of which are easy to use.

1.2.1 Main Window Functions

- The main window supports four major functions.
- Many debugger operations are performed from the main window. Remember the following four functions.

Function	Description
Menu bar	Contains all the functions supported by the debugger. To perform some operation with the debugger, first check the contents of the menu bar.
Tool bar	Contains the most-frequently used commands. While no target is connected, try clicking each of the buttons, and make a note of the graphic identifying each button.
Window display area	Windows are displayed in this area. These windows include, for example, the Source window and Assemble window, both of which are used whenever debugging is performed.
Status bar	The status of the in-circuit emulator (IE) is displayed in this area. The IE status and break cause are particularly important.



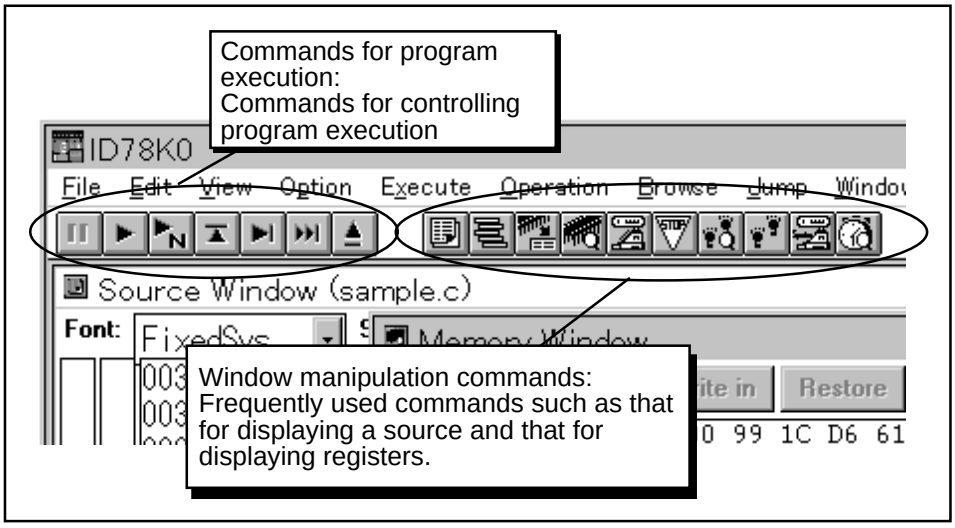
1.2.2 Making Maximum Use of Menus

- The menus contain all the functions supported by the debugger.
- Even when you are not familiar with the debugger's functions, briefly studying each of the pull-down menus will allow you to understand the range of functions available.
- The menus are outlined below.

Menu	Description
File	Contains file operation commands. This menu enables the switching of the source displayed in the Source window, the loading and saving of project files, and other file operations.
Edit	Provides commands for copying and pasting displayed data, as well as commands for memory editing.
View	Contains display commands. Using this menu, you can retrieve variables, enter the display start address, and display variables.
Option	Allows you to display and hide the tool bar, status bar, and buttons in each window, and to establish the debugger environment.
Execute	Contains execution commands. Also, trace mode setting is performed from this menu.
Operation	Allows you to perform window mode switching, and to specify connection to the trace window.
Browse	Contains the commands used to open each window. From this menu, you can display windows such as the event and coverage windows.
Jump	Allows you to jump to the source window, assemble window, and memory window.
Window	Allows you to specify how windows are to be displayed, the arrangement of icons, and also enables switching between windows.
Help	Displays help information.

1.2.3 One-Touch Tool Bar Operation

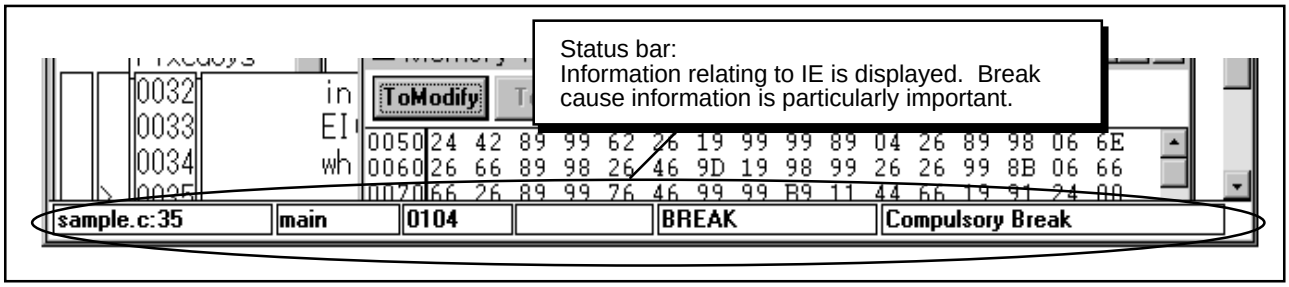
- The tool bar consists of buttons which correspond to frequently used commands. Commands are executed simply by clicking the corresponding button.
- The function of each button is identified by a suitably representative graphic.
- The commands assigned to the tool bar buttons can also be executed from the menu bar.



Display	Description
	Stops user program execution.
	Executes a user program. As soon as the break conditions are satisfied, the user program terminates.
	Executes a user program. Even when break conditions are satisfied, the user program does not terminate.
	Executes the program in real time, until execution returns to the calling function.
	Executes the program, step by step. Every time this button is clicked, one step of the program is executed. For source level debugging, one step corresponds to one line. For instruction level debugging, one step corresponds to one instruction.
	Performs Next step execution of the program. Every time this button is clicked, one step of the program is executed, by means of Next step execution. For source level debugging, one step corresponds to one line. For instruction level debugging, one step corresponds to one instruction.
	Initializes the debugger or emulation CPU. Opens the Reset Debugger dialog box.
	Displays the source text. Opens the Source window.
	Displays the stack contents. Opens the Stack window.
	Displays a disassembled program. Opens the Assemble window.
	Displays the contents of memory. Opens the Memory window.
	Displays the register contents. Opens the Register window.
	Registers and sets break events. Opens the Break dialog box.
	Displays trace results. Opens the Trace View window.
	Registers and sets trace events. Opens the Trace dialog box.
	Displays the SFR contents. Opens the SFR window.
	Displays timer measurement results. Opens the Timer window.

1.2.4 Using Information Provided by the Status Bar

- The status bar displays important data including, for example, the status of the IE and the cause of a break.
- If a break occurs at a point where no break has been set, or if no source appears when a break occurs, for example, check this area first.



1. **Source file name:** Displays the source file name and source line number corresponding to the indicated PC value. If no file information is available, "---" is displayed.
2. **Function name:** Displays the function name corresponding to the indicated PC value. If no function information is available, "---" is displayed.
3. **PC value:** Displays the current PC value.
4. **CPU status:** Displays the status of the CPU (μPD780xx: target device).

CPU status	Description
TARGET	The target is on.
HOLD	Bus hold mode
STANDBY	Halt or stop mode
LUTCHUP	Latch-up has been detected. Turn off the target and in-circuit emulator immediately.

5. **IE status:** Displays the operation status of the in-circuit emulator.

IE status	Description
RUN	Real-time execution in progress
STEP	Step-by-step execution in progress
BREAK	Break status
TRACE	Tracing in progress
TIMER	Timer measurement in progress

6. **Break cause:** Displays the reason for a break. The table below lists possible break causes.

Cause	Description
Compulsory Break	Normal break (manual break)
Temporally Break	Normal break (break caused by internal processing)
Event Break	Break triggered by an event
Out Of Range Break	Break caused by procedure step termination
Trace Full Break	Break caused by trace full state
Non Map Break	Access to a non-mapped area was attempted.
SFR Illegal	Illegal access to an SFR was attempted.
Stack Overflow	Break caused by stack overflow
Write Protect	An attempt was made to write to a write-protected area.

Chapter 2 Basic Operations

This chapter explains the basic operations of the ID78K0.
Each section clarifies how windows are related to each other.

2.1 Establishing the Environment

Explains how to establish a debugging environment.

2.2 Source Level Debugging

Explains the use of the Source window to debug a source program.

2.3 Instruction Level Debugging

Explains the use of the Assemble window to perform assembler level debugging.

2.4 Manipulating Memory

Explains the use of the Memory window to perform modification, initialization, and other operations on memory.

2.5 Manipulating Registers

Explains the functions of the Register window, used to manipulate general-purpose registers, and those of the SFR window, used to manipulate SFRs.

2.6 Creating Events

Events are very useful for debugging. Events can be used for program and trace control. This section explains how to set an event.

2.7 Manipulating Symbols (Variables)

The debugger supports the input of symbols as data. This section explains how to enter symbols and display variables.

2.8 Using the Tracer Effectively

The IE-78000-R-A contains 32K frames of trace memory. The tracer is used to trace data, making it very useful for detecting program problems. This section explains the use of the tracer.

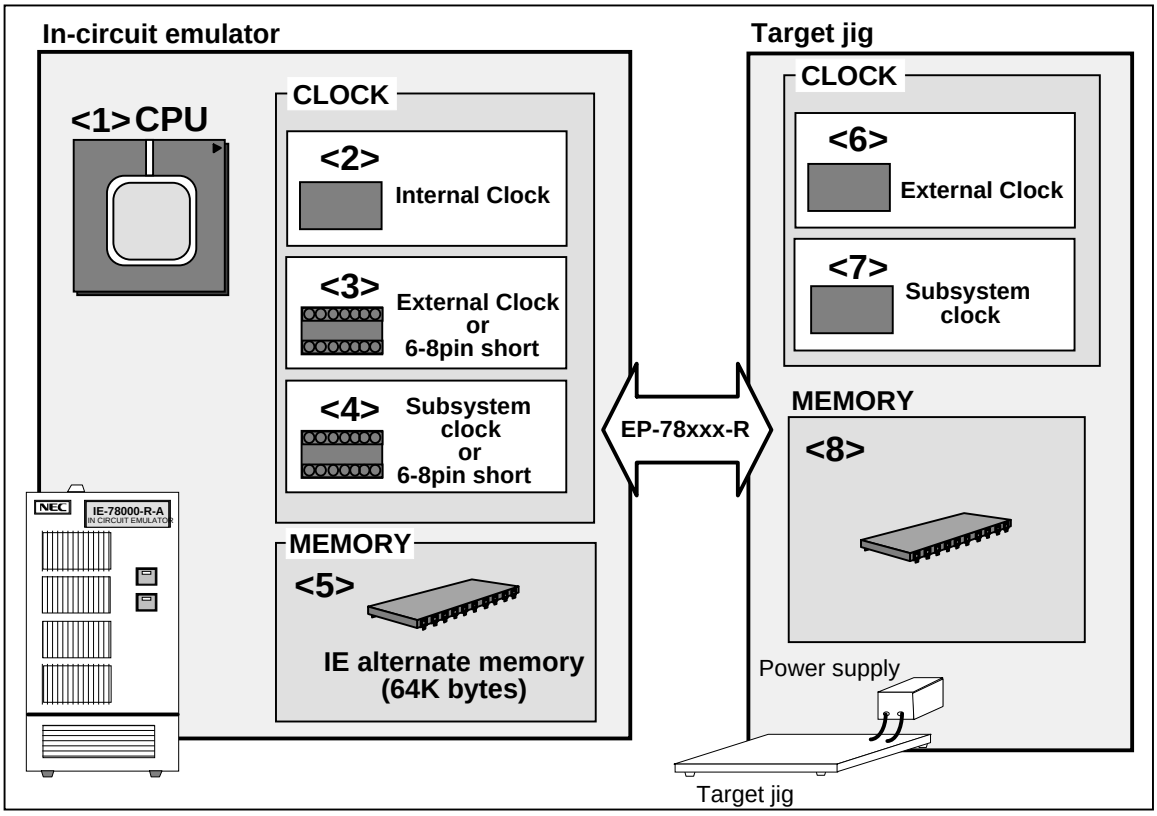
2.9 Measuring the Execution Time

Explains the time required to execute a program from beginning to end, and time tags written in the tracer.

2.1 Establishing the Environment

- Establishing an environment allows the debugger to recognize the configuration of a target system. Establishing a debugging environment enables the maximum utilization of the debugger functions.
- The environment must be established whenever the debugger is started.
- Once an environment has been established, it can be saved to a file, subsequently eliminating the need to newly establish the environment. When the debugger is next started, the environment can be established simply by loading the file (project file).
- For the ID78K0 operating environment, set the following items:

Item	Setting window	Location in environment setup diagram	Remarks
Device	Configuration dialog box	**<1>**CPU	Can be set only when the debugger is being started
CPU clock		**<2> <3> <4> <6> <7>** CLOCK	
Peripheral equipment operation		**<1>** CPU	
Memory bank switching	Configuration dialog box Bank Set dialog box	**<1>** CPU **<8>** MEMORY	
Alternate operation clock	Configuration dialog box	**<1>** CPU	
Memory mapping	Configuration dialog box	**<5> <8>** MEMORY	Can be set at any time
Mask option	Mask Option dialog box	**<1>** CPU	



Establishing an Environment

2.1.1 Selecting a Device

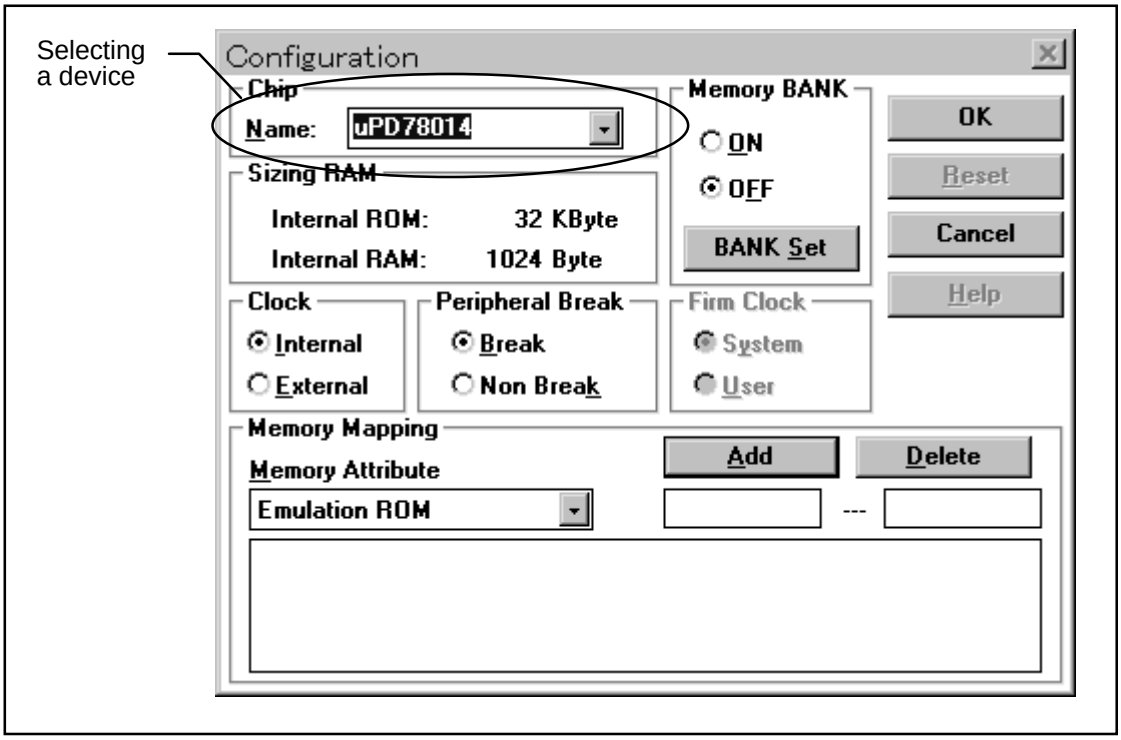
- A device can be selected in the Configuration dialog box that appears when the debugger is started. Note that once the debugger has started, this selection cannot be changed.

Setting in the Configuration dialog box:

1. Start the debugger.
2. Select a device in the Configuration dialog box that appears when the debugger is started.

When the main window has already been opened:

1. Terminate, then restart, the debugger.



2.1.2 Selecting a CPU Clock

- A CPU clock is selected in the Configuration dialog box that appears when the debugger is started. Note that once the debugger has started, the CPU clock cannot be changed.

Setting in the Configuration dialog box:

1. Start the debugger.
2. Change the CPU clock in the Configuration dialog box that appears when the debugger is started.

When the main window has already been opened:

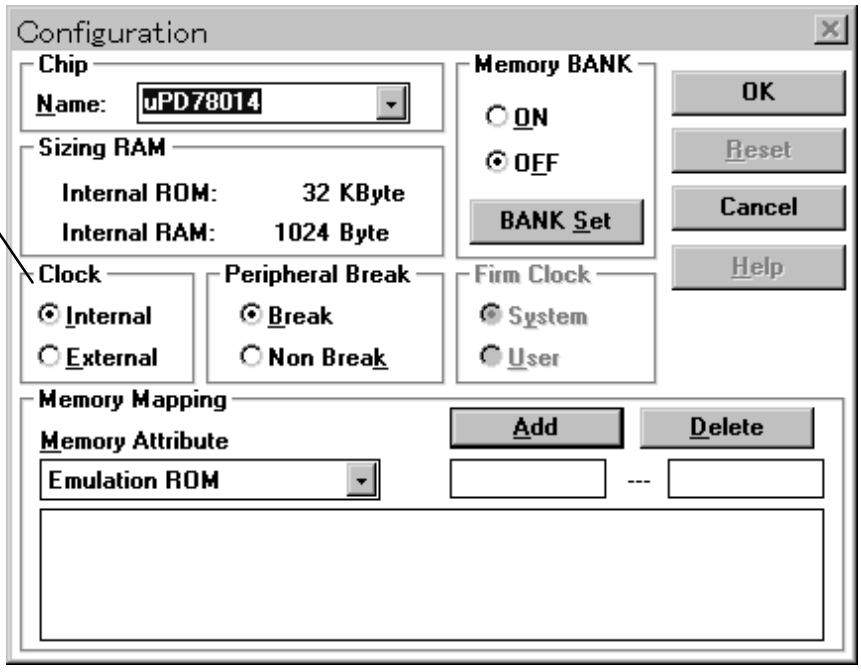
1. Terminate, then restart, the debugger.

- When "Internal" is selected as the CPU clock, the clock provided by the in-circuit emulator is used as the CPU clock. This clock frequency is determined by the connected emulation board (EM board).

Emulation board(Note)	CPU clock frequency when "Internal" is selected
IE-78014-R-EM	8.38 MHz
IE-78014-R-EM-A	
IE-780208-R-EM	4.19 MHz
IE-78044-R-EM	
IE-78064-R-EM	5.0 MHz
IE-78078-R-EM	
IE-78098-R-EM	6.0 MHz

Note For emulation boards not listed here, refer to the manual provided with the board.

To use the clock provided by the target, select "External."



2.1.3 Mapping

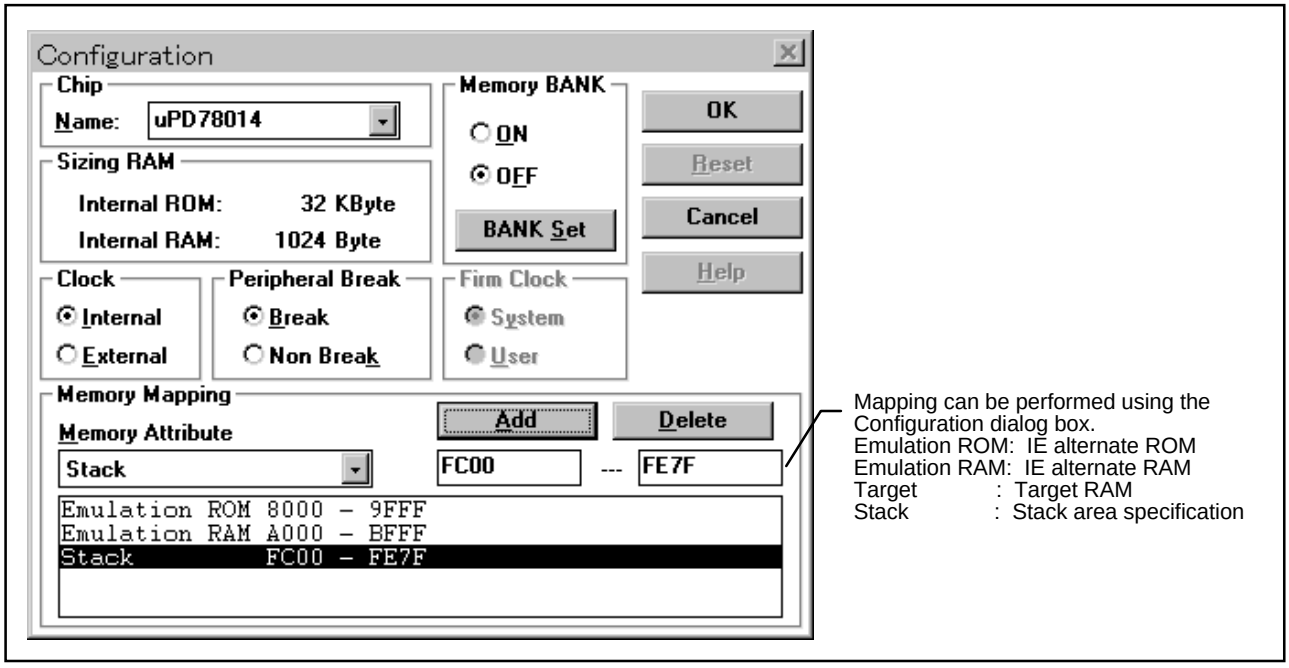
- When external ROM/RAM is used in addition to internal ROM and internal RAM (including SFRs and registers), the area to be mapped must be set.

To add an area to be mapped:

1. Open the Configuration dialog box. This dialog box appears when the debugger is started. It can also be displayed by selecting Option -> Configuration... from the menu bar.
2. Set the Memory Attribute area, then click the Add button.

To delete a mapped area:

1. Open the Configuration dialog box. This dialog box appears when the debugger is started. It can also be displayed by selecting Option -> Configuration... from the menu bar.
2. Select the mapped area to be deleted, then click the Delete button.



2.1.4 Specifying a Stack Area

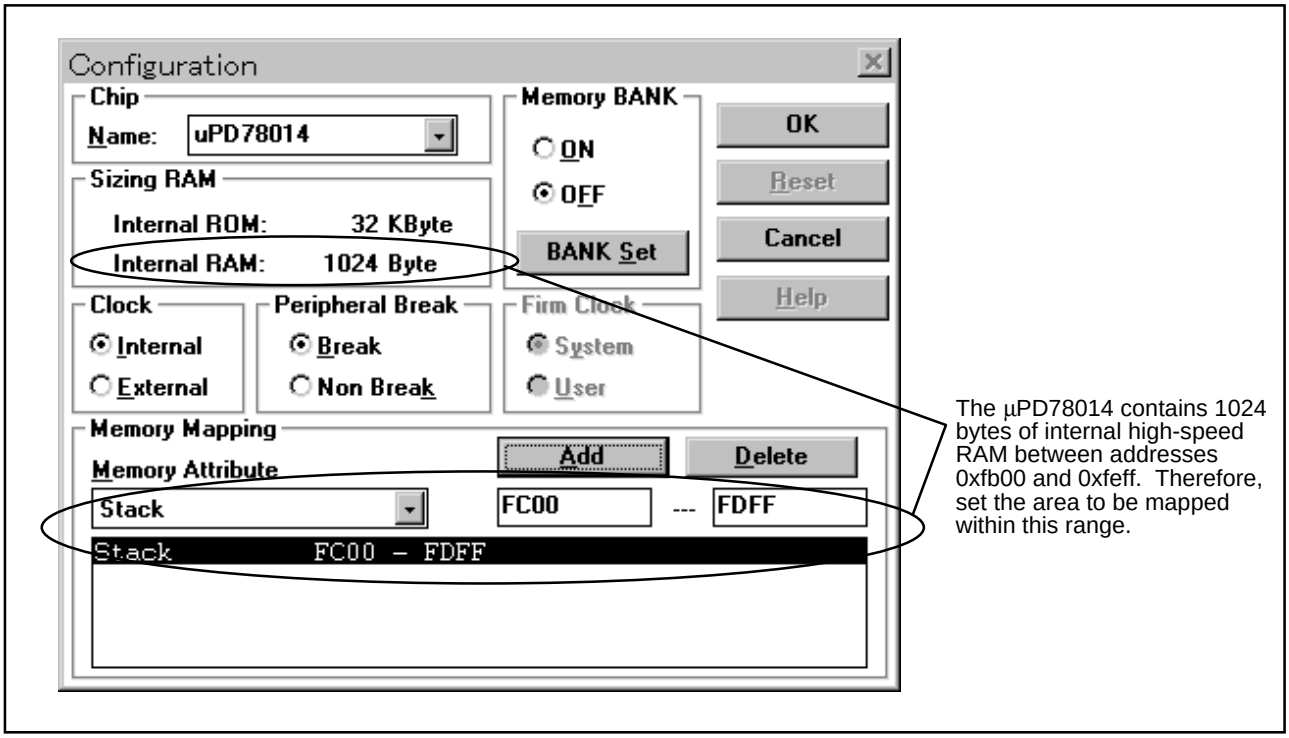
- To monitor stack operation, specify a stack area.
- When a stack area has been specified, any stack operation (CALL, RET, PUSH, POP) performed outside the set area is detected as being an illegal access.
- An area in internal high-speed RAM can be specified as the stack area.
- When no stack area is specified, the entire internal high-speed RAM area is used as the stack area.

To specify a stack area:

1. Open the Configuration dialog box. This dialog box appears when the debugger is started. It can also be displayed by selecting Option -> Configuration... from the menu bar.
2. Set the Memory Attribute area, then click the Add button.

To cancel the stack area specification:

1. Open the Configuration dialog box. This dialog box appears when the debugger is started. It can also be displayed by selecting Option -> Configuration... from the menu bar.
2. Select the mapped stack area to be deleted, then click the Delete button.

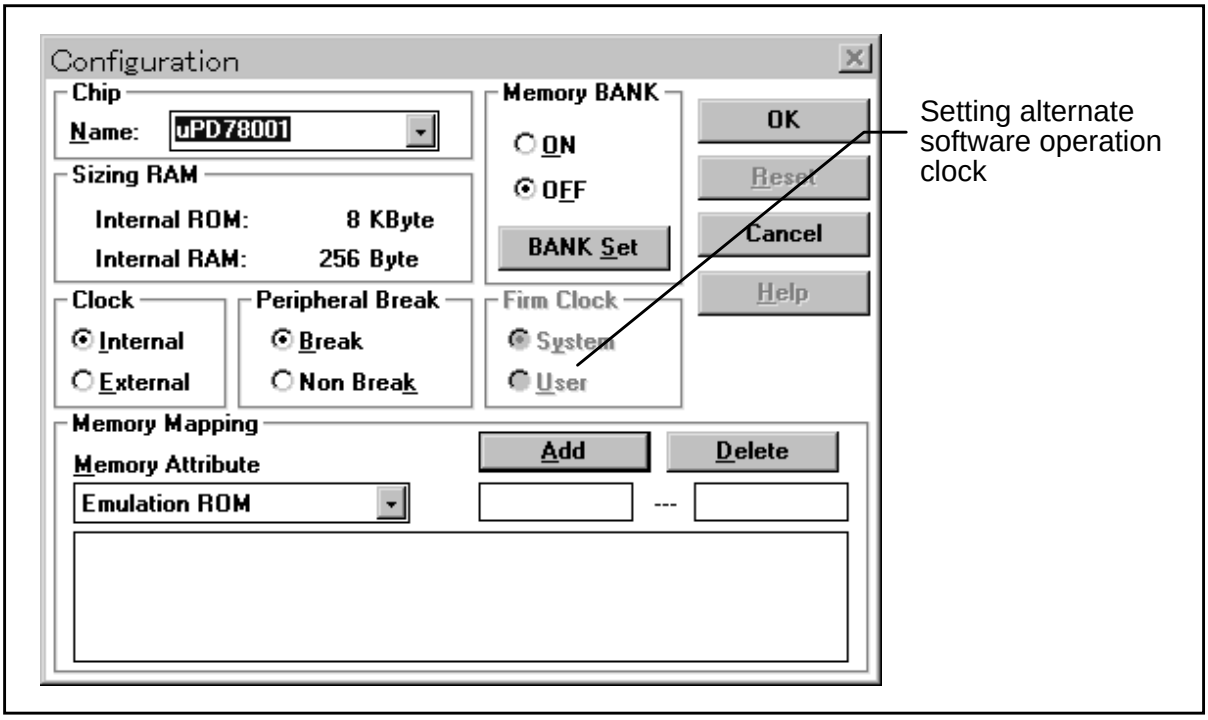


2.1.5 Setting the Alternate Software Operation Clock

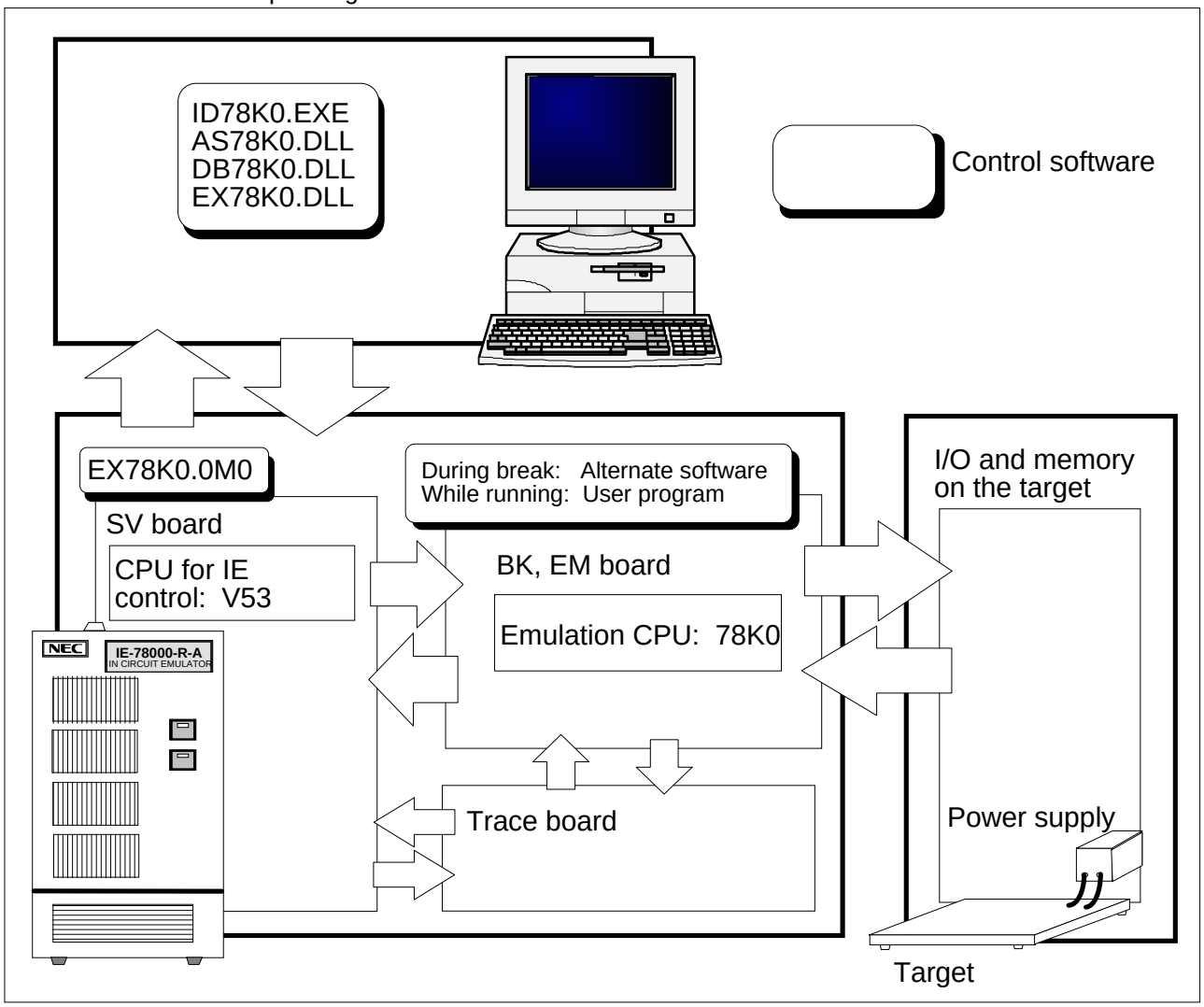
- The alternate software is control software that runs on the 78K0 device. It controls the resources (register values, SFRs, and memory) of the target while the in-circuit emulator is in break mode.
- The alternate software accesses the target resources directly.
- The operation of the alternate software uses the same clock as the user program. If, therefore, the user program uses a low-speed clock while the in-circuit emulator is in break mode, the alternate software will also operate slowly, thus lowering the overall speed of debugger operation. To avoid this, specify the use of the alternate software operation clock.

To set the operation clock:

1. Open the Configuration dialog box. This dialog box appears when the debugger is started. It can also be displayed by selecting Option -> Configuration... from the menu bar.
2. Select the operation clock in the alternate software operation clock selection area.



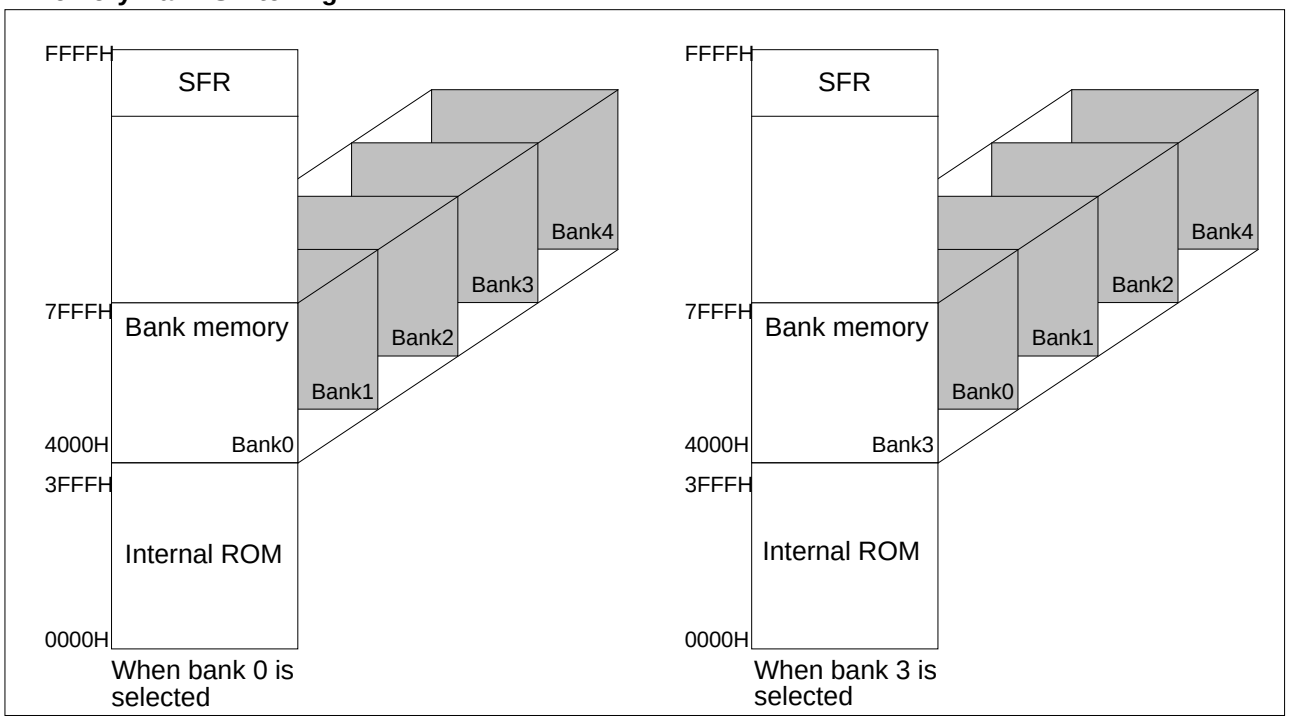
The alternate software operating environment is illustrated below.



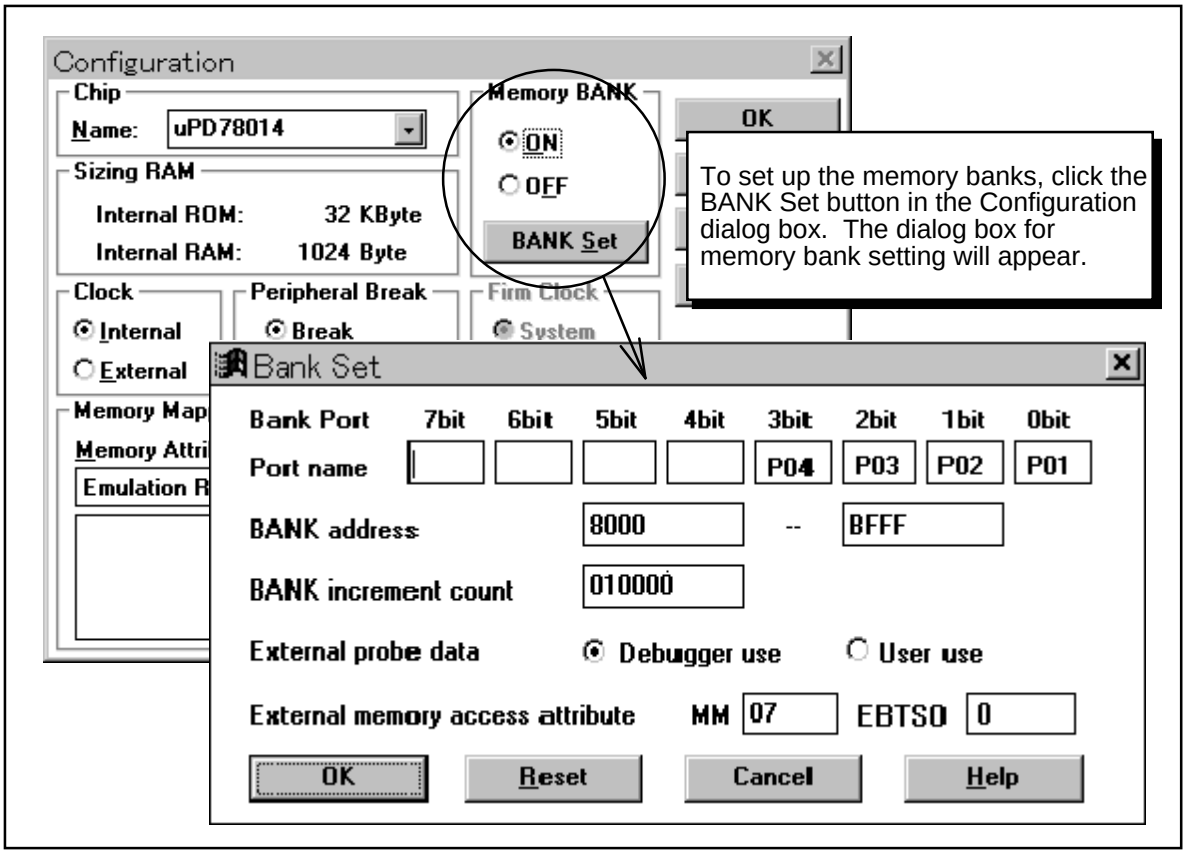
2.1.6 Setting Memory Banks

- The 78K0 series has an address space consisting of up to 64K bytes between addresses 0 and 0xffff.
- A program of 64K bytes or more can be run by switching part or all of the program area between addresses 0 and 0xffff.
- The structure of the memory banks is shown below.
  In the following figure, the 16K-byte space between addresses 4000h and 7fffh is used for the memory banks. Five banks, 0 to 4, are used. When bank 0 is selected, data in bank 0 can be accessed at addresses 4000h to 7fffh, a linear space existing between address 0h and 7fffh. When bank 0 is selected, the spaces corresponding to banks 1 to 4 cannot be accessed. When bank 3 is selected, the data in bank 3 can be accessed between addresses 4000h and 7fffh. The other banks cannot be accessed.

Memory Bank Switching



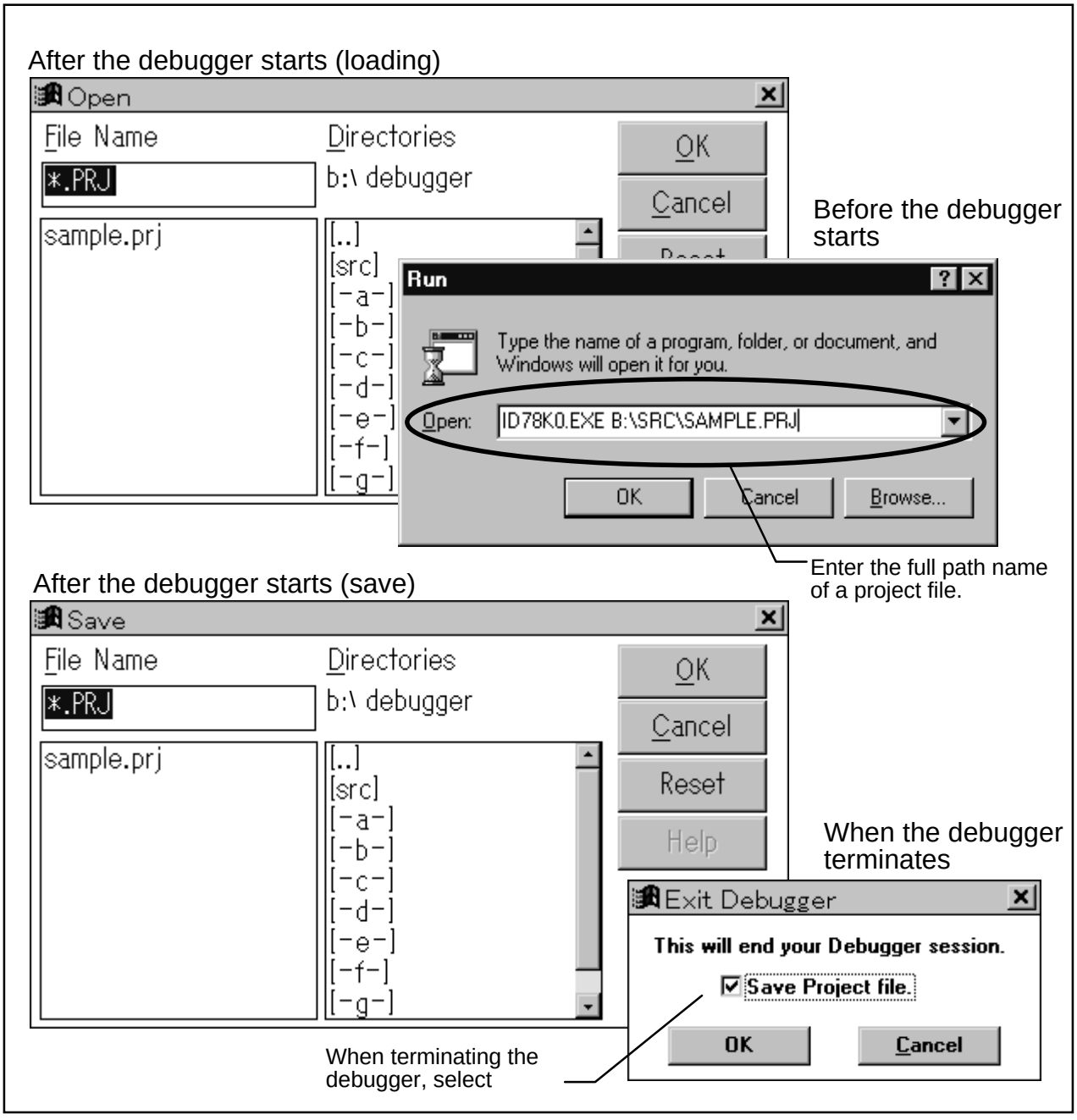
- To switch between memory banks, program the generation of the upper address by using, for example, ports.
- So that the debugger can control the memory banks effectively, set the ports and other data to be used for bank switching when establishing the environment.



2.1.7 Loading/Saving the Debugging Environment

- Saving the debugging environment into a project file enables subsequent debugging to be performed in exactly the same environment.

Debugging environment		Method
Load	At start	Specify a project file to be read, using its full path name, as a start option.
	After start	Load a project file by using the Project file load dialog box.
Save	After start	Save a project file using the Project file save dialog box.
	At exit	Select "Save Project File" in the Exit Debugger dialog box, then terminate the debugger.



Data to be loaded/saved

Window	Data
Configuration dialog box	All items
Bank Set dialog box	All items
Main window	Setting information
Load Module dialog box	File information downloaded
Extended Option dialog box	Setting information
Mask Option dialog box	Setting information
Source Path dialog box	Source path information
Source window	Window display information, font information
Assemble window	Window display information, display start address
Memory window	Window display information, display start address
Stack window	Window display information
SFR window	Window display information
Local Variable window	Window display information
Trace View window	Window display information
Show Trace dialog box	Setting information
Snap Trace dialog box	Setting information
Event Manager	Window display information, all event information
Event Link dialog box	Window display information
Break dialog box	Window display information
Trace dialog box	Window display information
Snap-Shot dialog box	Window display information
Event Set dialog box	Window display information
Register window	Window display information, displayed bank
Variable window	Window display information, displayed variable information
Coverage window	Window display information

2.2 Source Level Debugging

- ID78K0 can set breakpoints and display variables for a source.
- Many source level operations are supported, thus greatly enhancing debugging efficiency.
- Source level debugging can be performed by loading a file containing source information.
- Source level debugging is particularly effective for debugging programs written in C or structured assembly language.

2.2.1 Notes on Compilation, Assembly, and Linking

- When source level debugging is performed, the file to be loaded must contain source debugging information.
- Source debugging information is included in the object by specifying the option for adding debugging information at assembly or compile time.
- The following shows how to set options at compilation, assembly, and linking:

Type of source to be debugged		Required action
C program	Without in-line assembly description	Specify the -G option at compile time.
	With in-line assembly description	1. At compile time, specify the -a option to output an assembly source file. 2. Assemble the source generated in 1, above, without specifying any debug options (-GA, -NGA).
Structured assembly language program		1. Specify the -GS option at structured assembly. 2. Assemble the source generated in 1, above, without specifying any debug options (-GA, -NGA).
Assembly language program		Specify the -GA option at assembly.

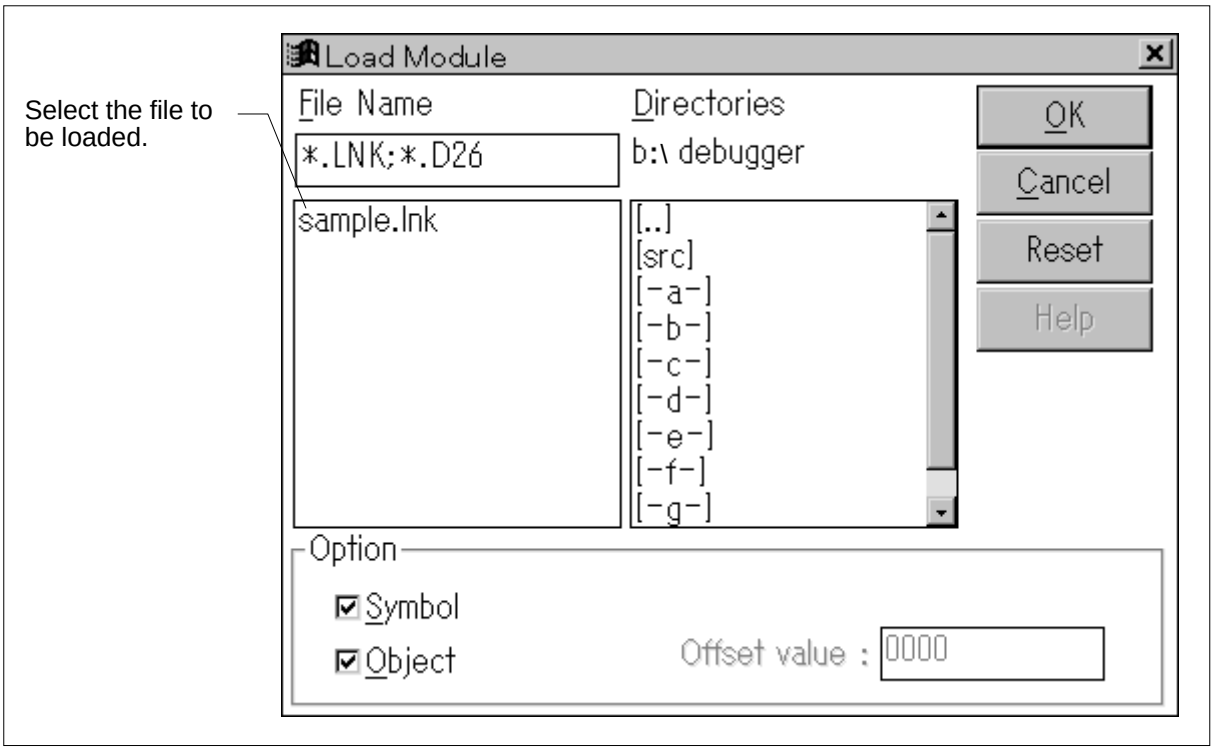
Link	Specify the -G option at linking.

2.2.2 Downloading a Program

- Load module files and hexadecimal files can be downloaded.
- When a downloaded file contains source debugging information, source level debugging can be performed.

To perform downloading:

1. Select File -> Download... from the menu bar to open the Load Module dialog box.
2. Load the desired file.



2.2.3 Displaying a Source

- After a load module file containing source debugging information has been downloaded, the source can be displayed.
- If the source file is stored in a directory other than that containing load module file, or if the source file is stored in more than one directory, source path information must be provided to the debugger.

To display a source:

1. Select Browse -> Source Text... from the menu bar or click the  button to open the Source window.

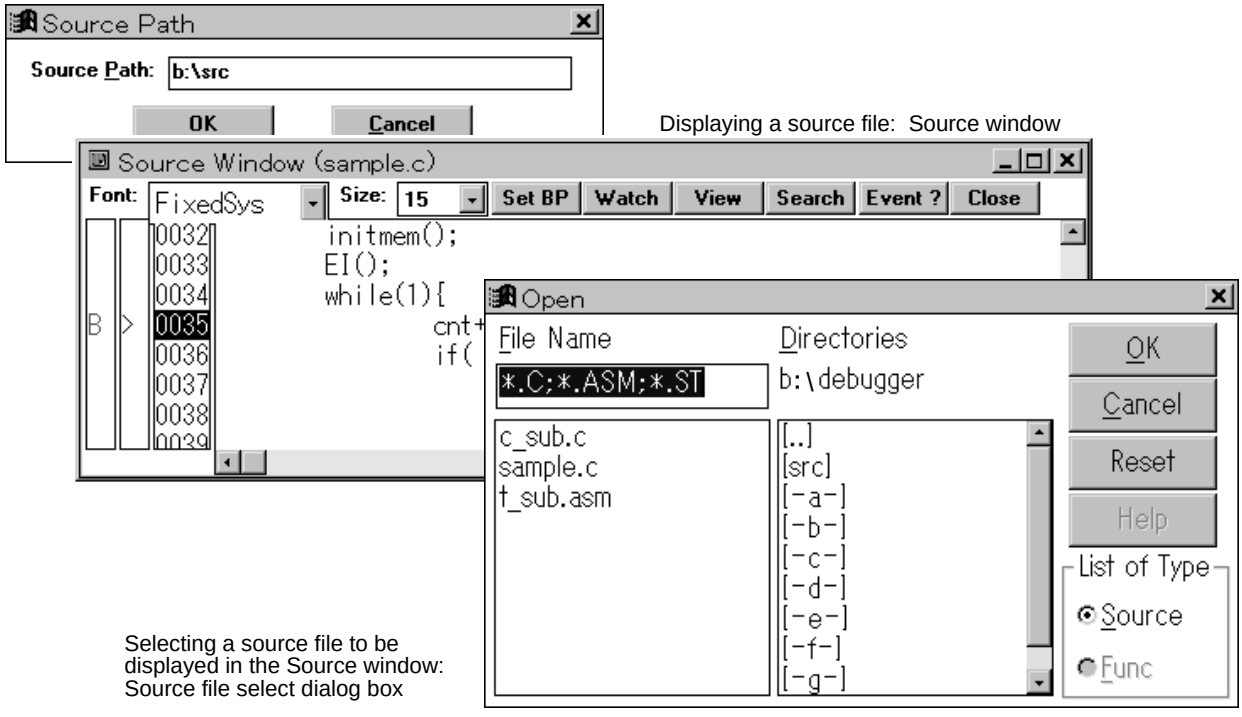
To change the source file displayed in the Source window:

1. Activate the Source window.
2. Select File -> Open... from the menu bar to open the Source file select dialog box.

When a source file is stored in another directory or in more than one directory:

1. Select Option -> Source Path... from the menu bar to open the Source Path dialog box.

Specifying a directory containing a source file: Source Path dialog box

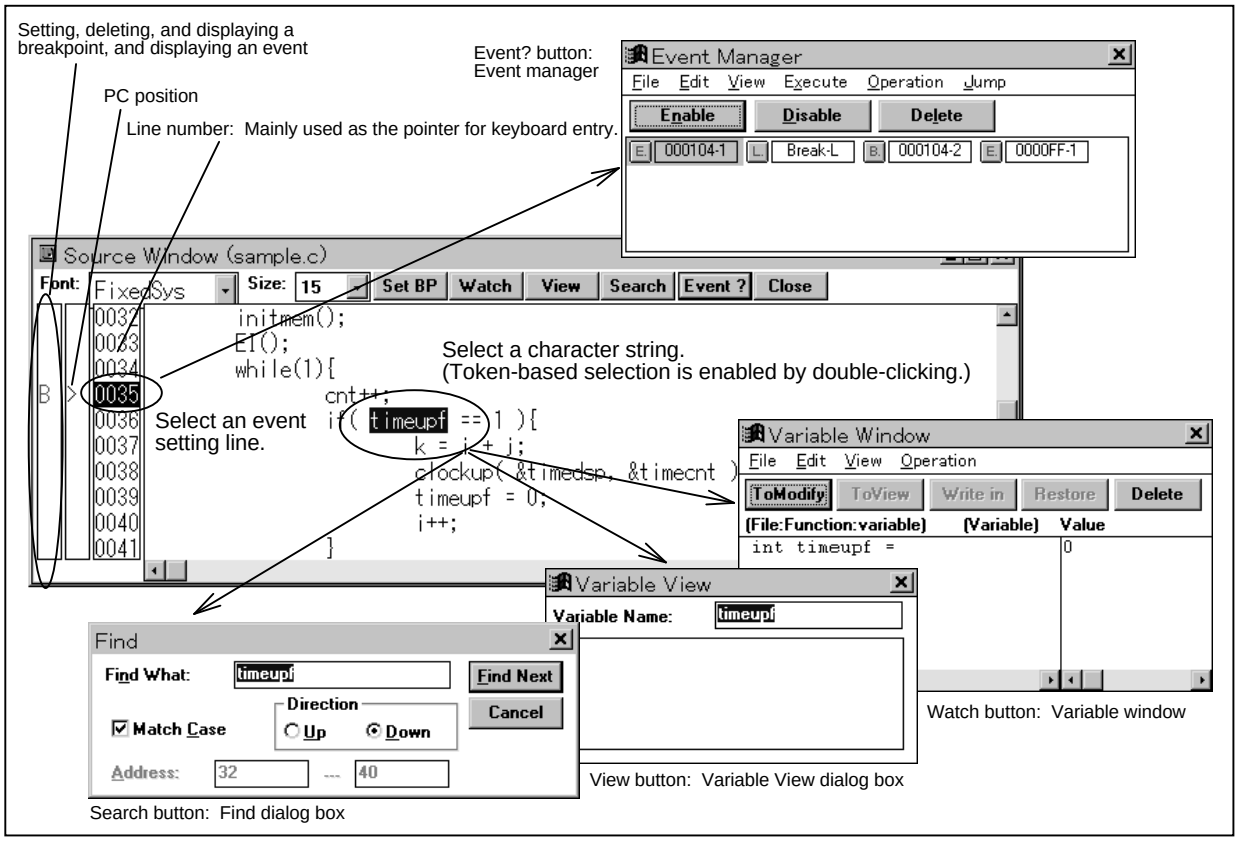


Selecting a source file to be displayed in the Source window: Source file select dialog box

2.2.4 Functions Supported by the Source Window

- The Source window Supports a wide range of functions, such as the setting of breakpoints and the addition of variables to be displayed.
- The supported functions are listed below:

Function	Procedure	
	Using the mouse	**From the keyboard**
Setting/deleting a breakpoint	Click the point mark area.	1. Select a line number (with the mouse). 2. Select Execute -> Set BP from the menu bar. (CTRL+B)
Setting PC	---	1. Select a line number (with the mouse). 2. Select Execute -> Set PC from the menu bar. (CTRL+E)
Displaying a variable	1. Select a variable. 2. Click the Watch button then the View button.	1. Select a variable (with the mouse). 2. Select View -> Watch Variable... or View Variable... from the menu bar.
Retrieving a character string	1. Select a variable. 2. Click the Search button.	1. Select a variable (with the mouse). 2. Select View -> Search... from the menu bar.
Checking an event	1. Select an event line. 2. Click the Event ? button.	1. Select an event line (with the mouse). 2. Select View -> Event? from the menu bar.

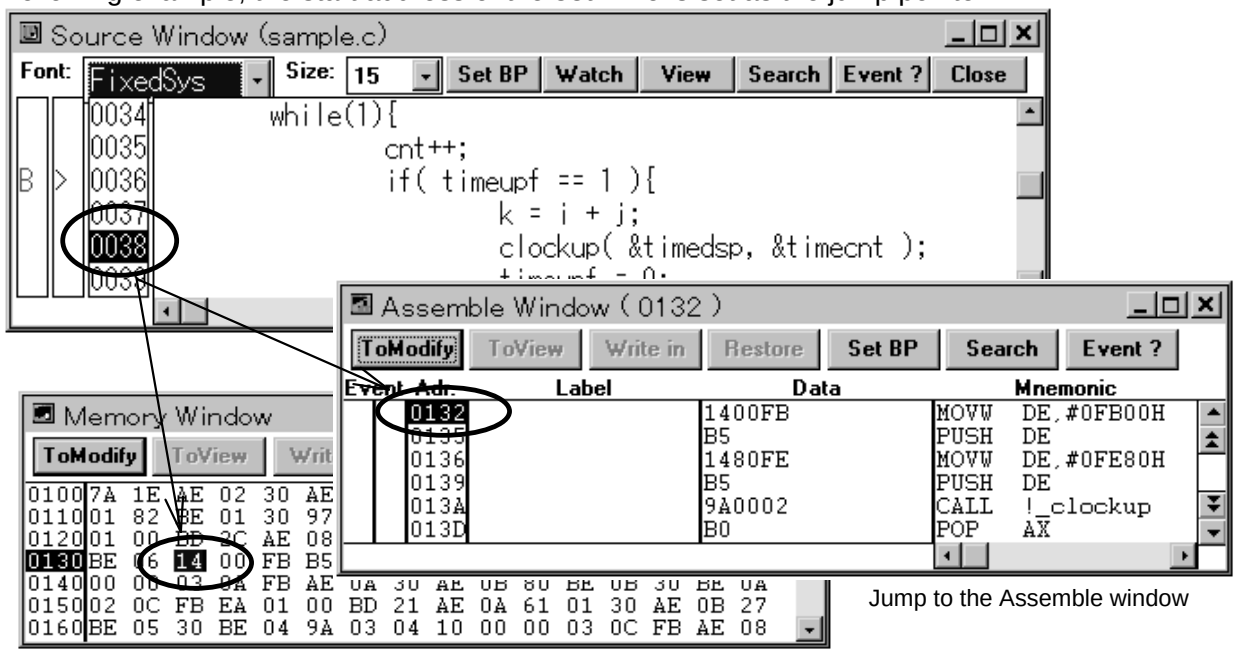


2.2.5 Jump from the Source Window

- Jump from the Source window to the Assemble window and Memory window is supported.
- Using the jump function, it is easy to check the source text assemble results.
- Select a source line number as the jump destination. Then, the start address of the selected source line is set as the jump pointer.

Jump destination	Procedure
Assemble window	1. Select a source line number. 2. Select Jump -> Assemble... from the menu bar.
Memory window	1. Select a source line number. 2. Select Jump -> Memory... from the menu bar.

The jump destination is the address of the source line, displayed in reverse video: In the following example, the start address of the 38th line is set as the jump pointer.



Jump to the Assemble window

Jump to the Memory window

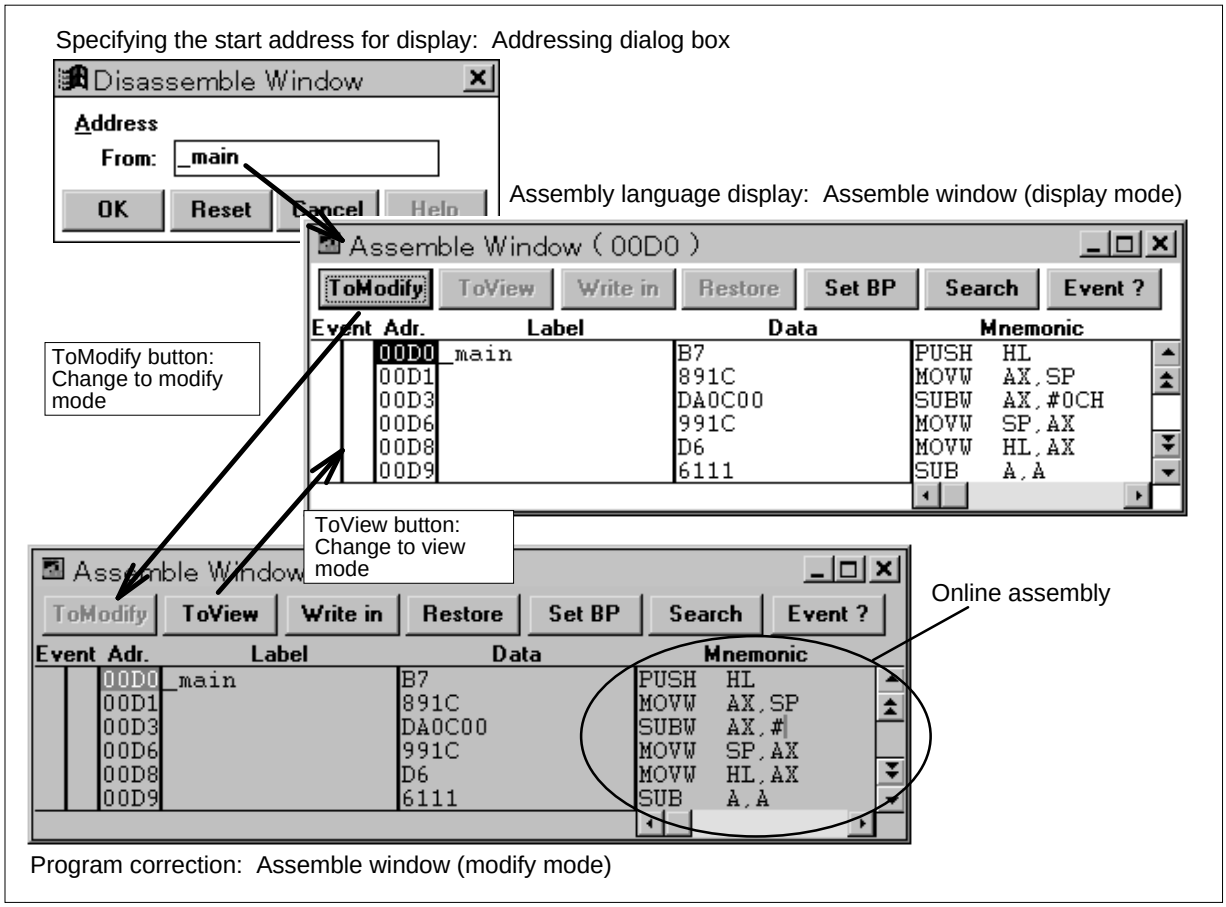
2.3 Instruction Level Debugging

- The contents of memory can be displayed, modified, and retrieved in assembly language.
- Instruction level debugging supports a higher level of precision than source level debugging.
- Assembly language code can be displayed in the Assemble window and Trace View window. This section mainly explains the operations supported by the Assemble window.

2.3.1 Assembly Language Display and Online Assembly

- The Assemble window allows you to view assembly language code and perform online assembly.
- With the online assemble function, patching can be performed. Simple bugs can be corrected and confirmed immediately.

Assemble		Procedure
Display	To select a displayed address	Open the Addressing dialog box in either of the following two ways: 1. Select Browse -> Assemble... from the menu bar. 2. Click the button.
	To display instructions starting from an address selected in another window (such as the Source, Memory, or Register window)	1. Select an address to be used as the display pointer. 2. Select Jump -> Assemble... from the menu bar.
Modification		1. Open the Assemble window. 2. Click the ToModify button to enter modify mode. 3. Position the cursor to the mnemonic display/modification area, then correct the program. 4. After completing the correction of the program, click the, Write in button to rewrite the program. 5. Click the ToView button to enter view mode.



2.3.2 Saving and Referencing Displayed Assembly Language Code

- The displayed assembly language code can be saved to a file. The saved file can subsequently be referenced.
- The file is saved in text format, such that any commercially available editor can be used to view its contents.

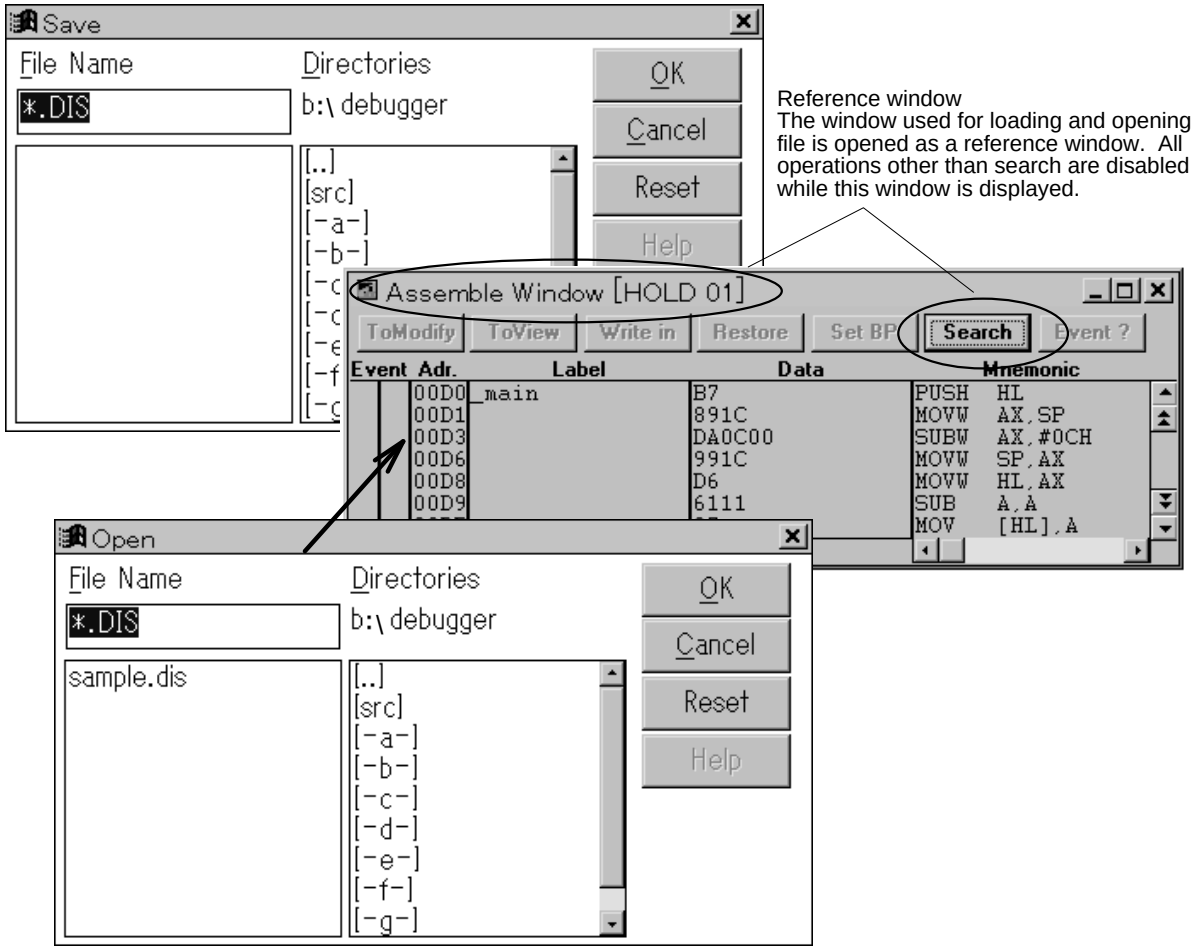
To save displayed assembly language code to a file:

1. Activate the Assemble window.
2. Select File -> Save As... from the menu bar.
3. Save the displayed assembly language code using the View file save dialog box.

To open and reference the saved file:

1. Activate the Assemble window.
2. Select File -> Open... from the menu bar.
3. Load the file to be referenced using the View file load dialog box.

Saving the display contents to a file: View file save dialog box

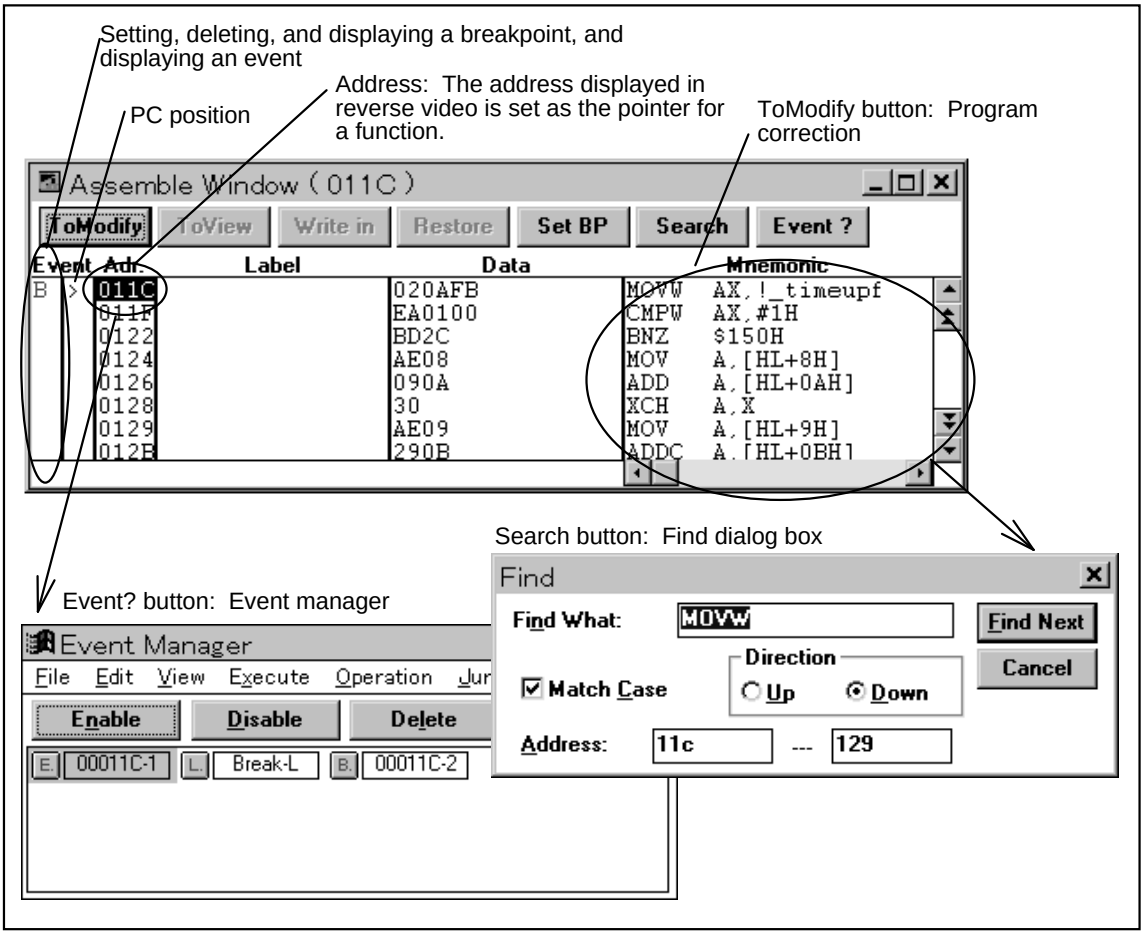


Displaying the contents saved to a file: View file load dialog box

2.3.3 Functions Supported by the Assemble Window

- The Assemble window supports many functions such as the setting of breakpoints and PC setting.
- The supported functions are listed below:

Function	Procedure	
	Using the mouse	**Using the keyboard**
Setting/deleting a breakpoint	Click the point mark area.	1. Select an address (with the mouse). 2. Select Execute -> Set BP from the menu bar. (CTRL+B)
Setting PC	---	1. Select an address (with the mouse). 2. Select Execute -> Set PC from the menu bar. (CTRL+E)
Retrieving a character string	1. Select a character string. 2. Click the Search button.	1. Select a character string (with the mouse). 2. Select View -> Search... from the menu bar.
Checking an event	1. Select the address at which an event is set. 2. Click the Event ? button.	1. Select the address at which an event is set (with the mouse). 2. Select View -> Event? from the menu bar.

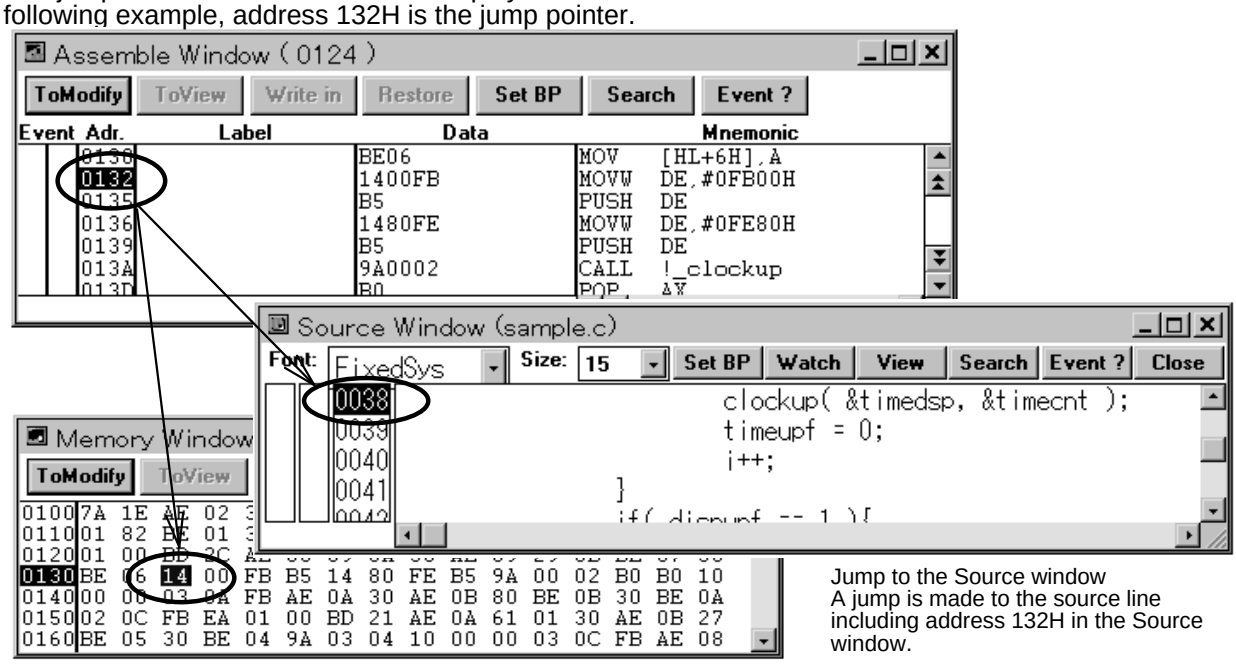


2.3.4 Jump from the Assemble Window

- Jump from a line in the Assemble window to the corresponding source line or memory address is supported.
- Select an address as the jump destination. Then, the selected address is set as the jump pointer.
- When the jump destination is the Source window, a jump is made to a source line including the jump pointer.

Jump destination	Procedure
Source window	1. Select an address. 2. Select Jump -> Source Text... from the menu bar.
Memory window	1. Select an address. 2. Select Jump -> Memory... from the menu bar.

The jump destination is the address displayed in reverse video: In the following example, address 132H is the jump pointer.



Jump to the Source window
A jump is made to the source line including address 132H in the Source window.

Jump to the Memory window

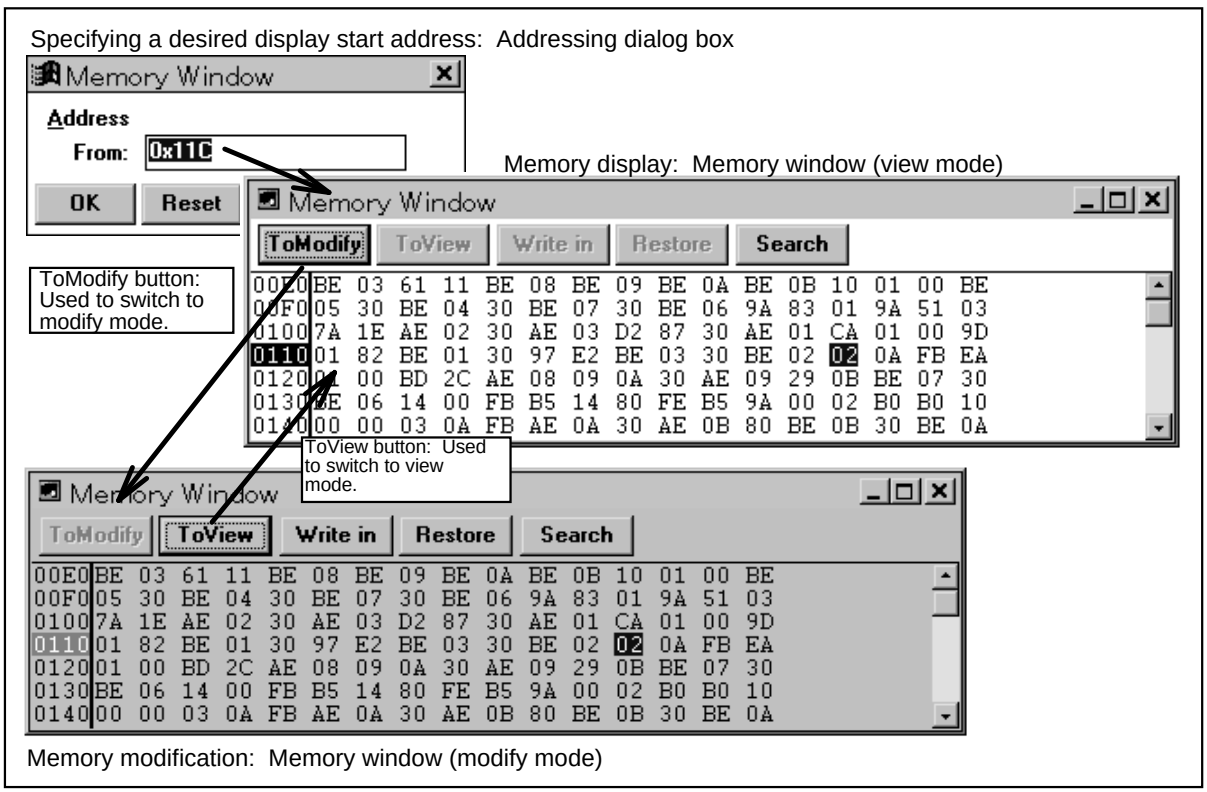
2.4 Manipulating Memory

- The user can display, modify, and search for memory data.
- The user can display and modify memory data in ASCII format.

2.4.1 Displaying and Modifying Memory Data

- The user can display and modify memory data in the Memory window.

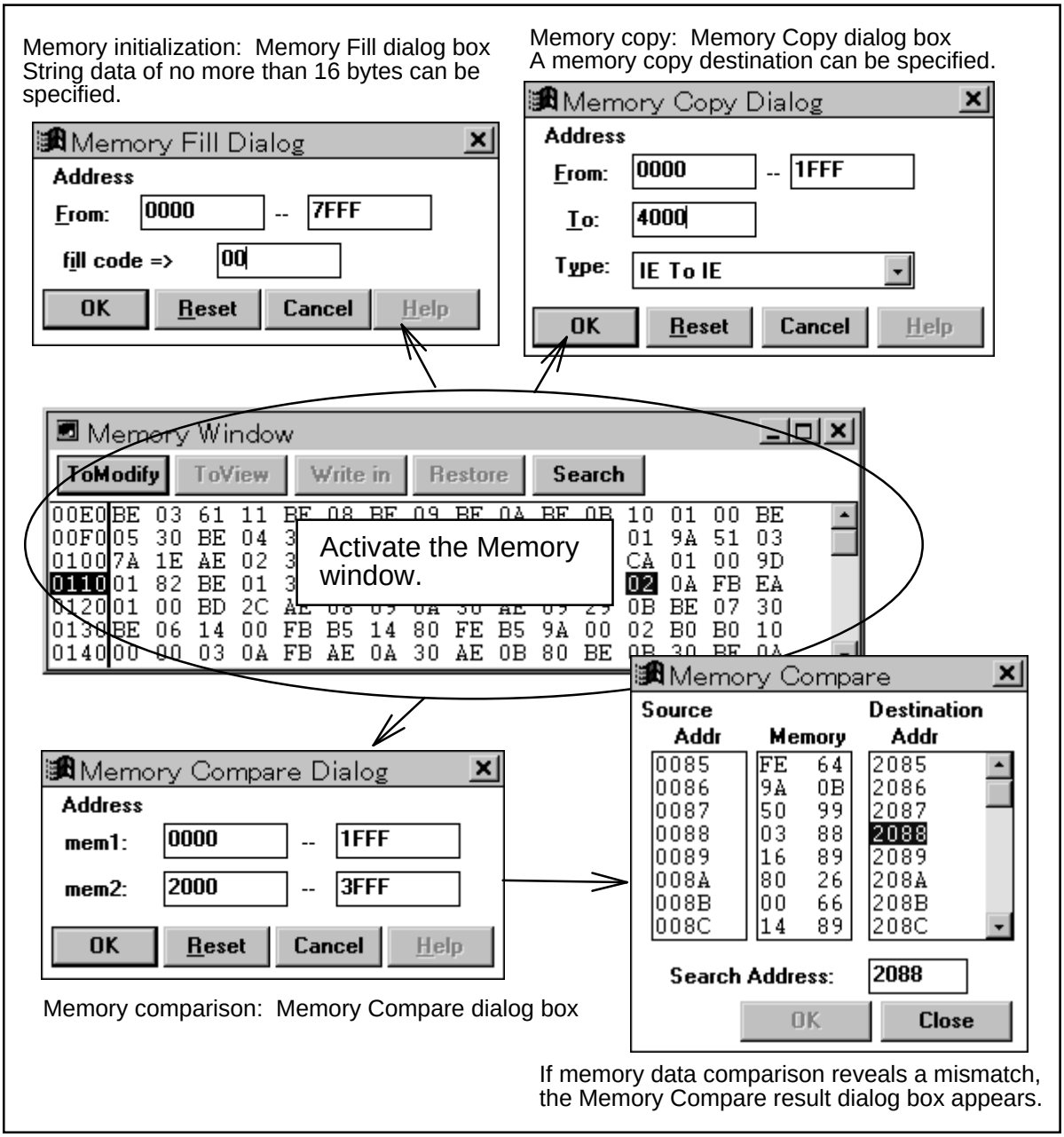
Memory		Procedure
Display	**When a display address is to be selected**	The Addressing dialog box can be opened by means of either of the following two procedures: 1. Select Browse -> Memory... from the menu bar. 2. Select the button.
	When memory data is to be displayed starting from an address selected in another window (such as the Source window, Assemble window, or Register window)	1. Select an address to act as a display pointer. 2. Select Jump -> Memory... from the menu bar, or press CTRL + M.
Modification		1. Open the Memory window. 2. Switch to modify mode by clicking the ToModify button. 3. Position the cursor to the desired memory display/modification area, then modify the data. 4. After entering the new data, execute the modification by clicking the Write in button. 5. Switch to view mode by clicking the ToView button.



2.4.2 Basic Memory Data Operations

- Basic memory data operations are enabled by activating the Memory window.
- The basic operations include initialization, copy, and comparison.

To initialize memory:
Select Edit -> Memory -> Memory Fill... from the menu bar.
To copy memory data:
Select Edit -> Memory -> Memory Copy... from the menu bar.
To compare memory data:
Select Edit -> Memory -> Memory Compare... from the menu bar.



2.4.3 Saving and Referencing Displayed Memory Data

- Displayed memory data can be saved to a file. A file containing saved memory data can be referenced.
- Memory data is saved in text format, allowing an editor to be used to reference saved memory data.

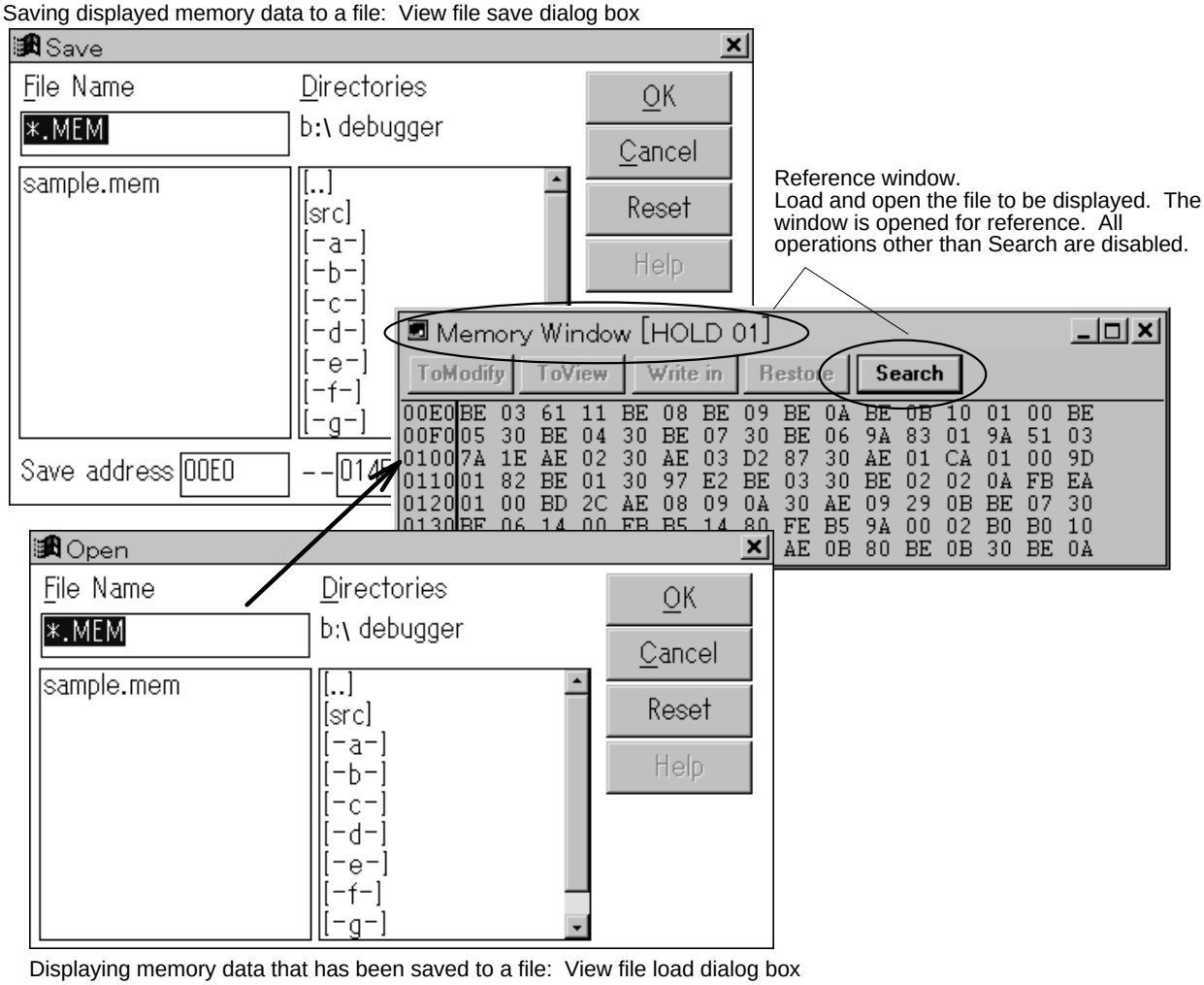
To save displayed memory data to a file:

1. Activate the Memory window.
2. Select File -> Save As... from the menu bar.
3. Save the displayed memory data by using the View file save dialog box.

To open and reference a file containing saved memory data:

1. Activate the Memory window.
2. Select File -> Open... from the menu bar.
3. Load the file to be referenced by using the View file load dialog box.

Saving displayed memory data to a file: View file save dialog box

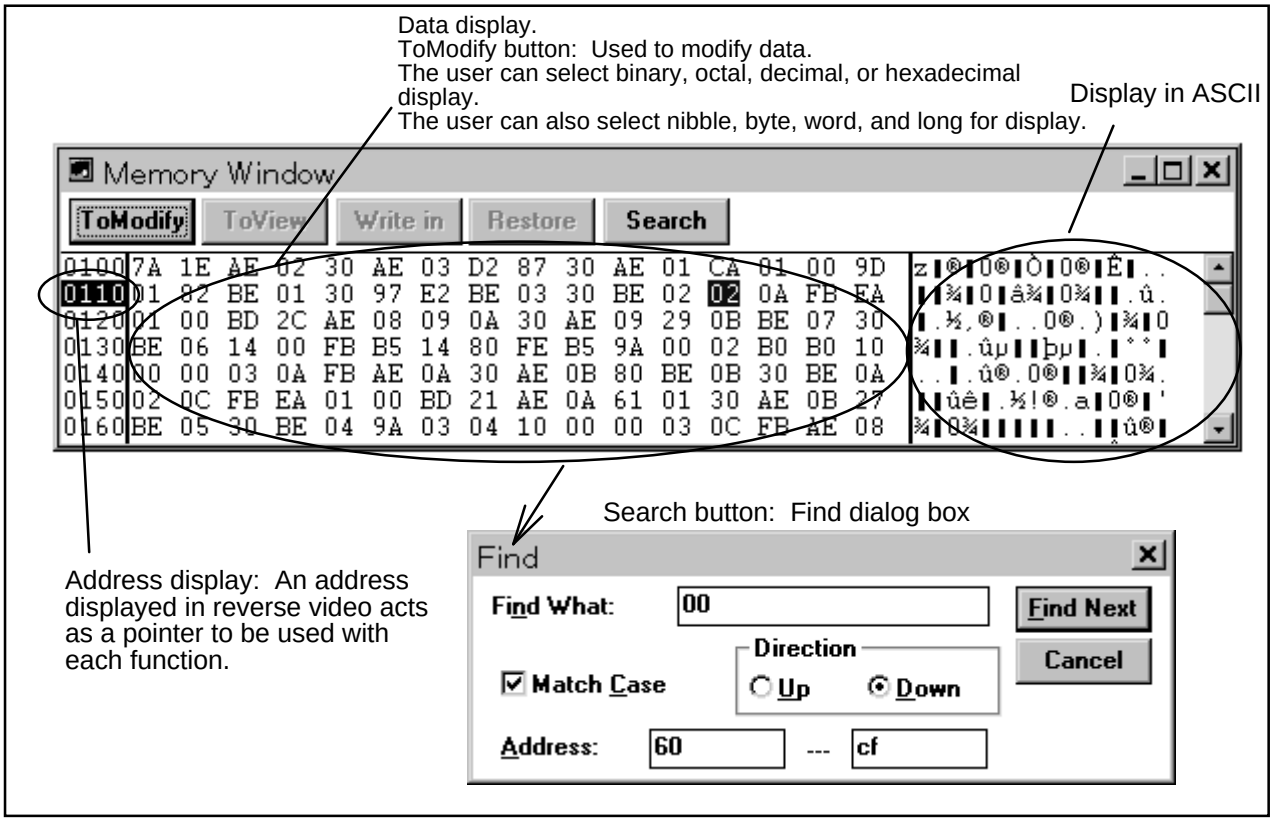


Displaying memory data that has been saved to a file: View file load dialog box

2.4.4 Functions Available in the Memory Window

- The Memory window allows the user to perform a range of functions including modification in ASCII format, and data search.
- The available functions are listed below.

Function	Procedure
Character string search	1. Select a character string. 2. Click the Search button, or select View -> Search... from the menu bar.
ASCII character display selection	Select View -> Memory -> Ascii from the menu bar.
Type display selection	Select View -> Memory -> Nibble, Byte, Word, or Long from the menu bar.
Number system display selection	Select View -> Bin, Oct, Dec, or Hex from the menu bar.

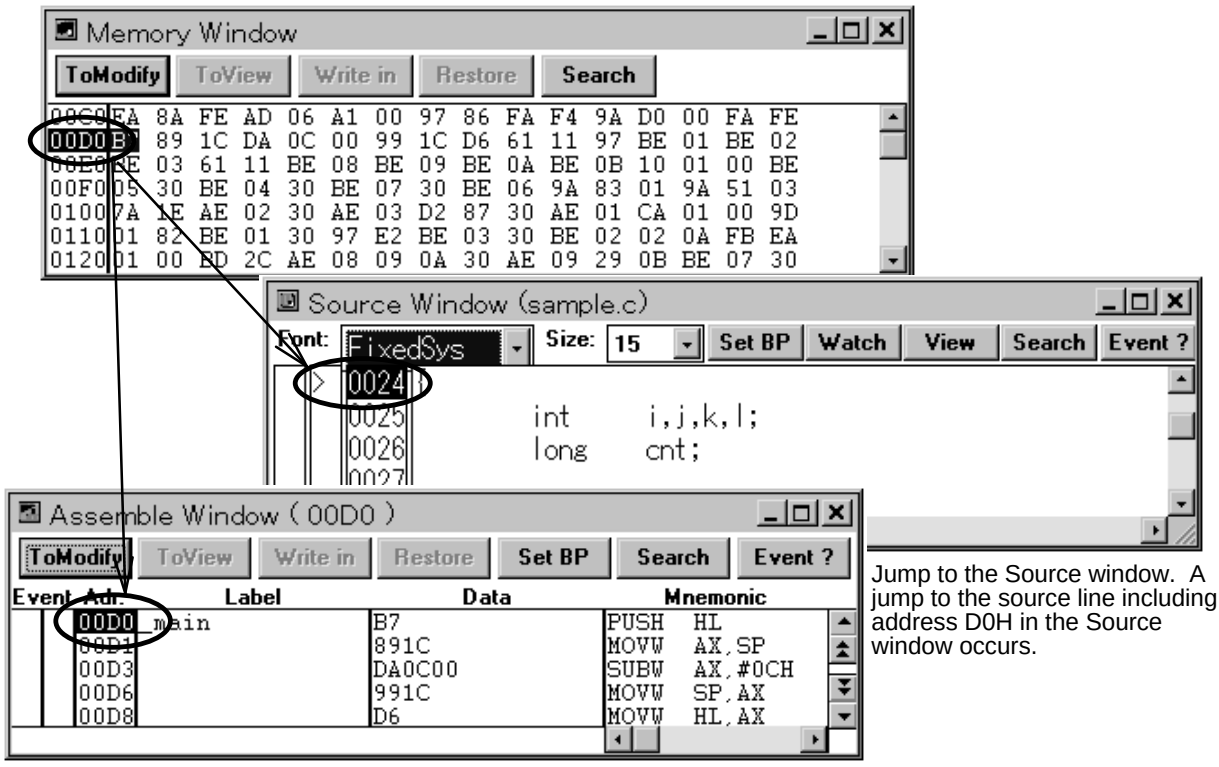


2.4.5 Jumping from the Memory Window

- This function enables a jump to the source line or disassembly start address corresponding to an address in the Memory window.
- A jump destination can be specified by selecting a desired address. The selected address serves as a jump pointer.
- When a jump is made to the Source window, a jump to the source line including the jump pointer occurs.

Jump destination	Procedure
Source window	1. Select an address. 2. Select Jump -> SourceText... from the menu bar.
Assemble window	1. Select an address. 2. Select Jump -> Assemble... from the menu bar.

A jump is made to the address displayed in reverse video.
In this case, address D0H is the jump pointer.



Jump to the Source window. A jump to the source line including address D0H in the Source window occurs.

Jump to the Assemble window

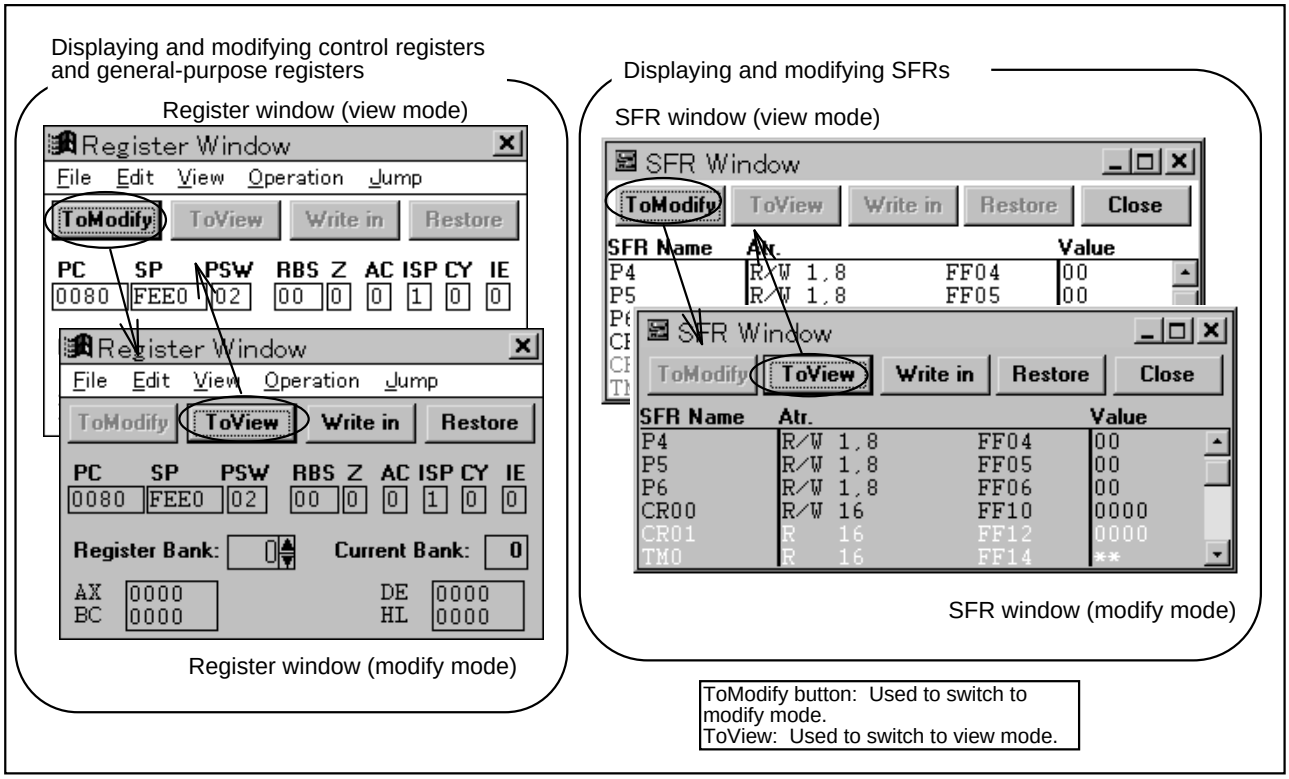
2.5 Manipulating Registers

- Registers are classified into three major types: control registers, general-purpose registers, and special function registers (SFRs).
- The control registers and general-purpose registers can be displayed and modified in the Register window. The SFRs can be displayed and modified in the SFR window.

2.5.1 Displaying and Modifying Registers

- The user can display and modify control registers, general-purpose registers, and SFRs.
- The user can manipulate control registers and general-purpose registers in the Register window, and manipulate SFRs in the SFR window.

Memory		Procedure
Display	**Control registers and general-purpose registers (Register window)**	Select Browse -> Register... from the menu bar, or click the  button.
	SFRs (SFR window)	Select Browse -> Sfr... from the menu bar, or click the  button.
Modification (common to the Register window and SFR window)		1. Open a desired window. 2. Switch to modify mode by clicking the ToModify button. 3. Position the cursor to a desired register, then modify the data. 4. After making the modification, execute the modification by clicking the Write in button. 5. Switch to view mode by clicking the ToView button.



2.5.2 Saving and Referencing Displayed Register Data

- Displayed register data can be saved to a file. A file containing saved register data can be referenced.
- Register data is saved in text format, allowing an editor to be used to reference saved register data.

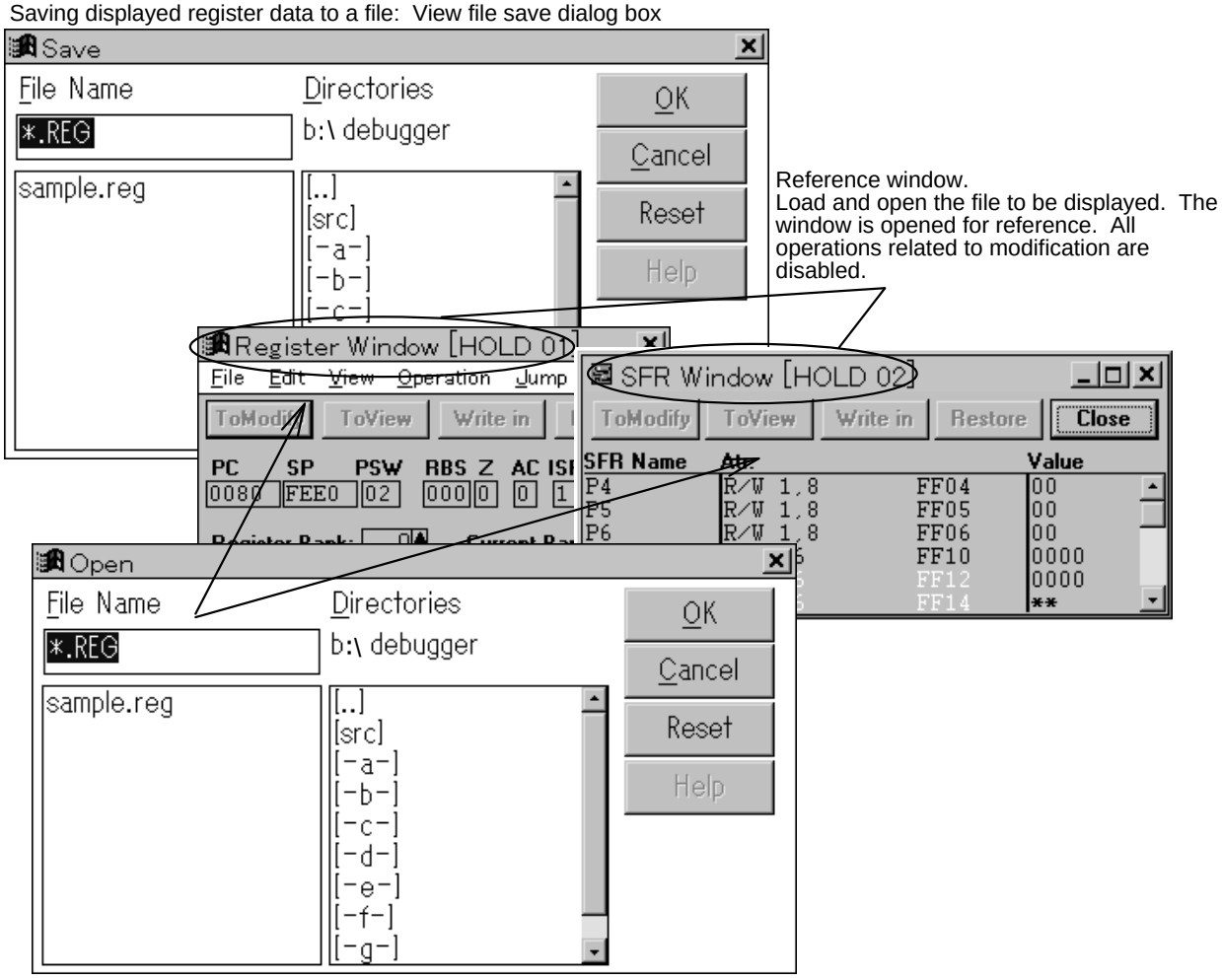
To save displayed register data to a file:

1. Activate a desired window.
2. When the Register window has been selected, select File -> Open/save Condition -> Save File as... from the menu bar.
   When the SFR window has been selected, select File -> Save As... from the menu bar.
3. Save the displayed register data by using the View file save dialog box.

To open and reference a file containing saved register data:

1. Activate a desired window.
2. When the Register window has been selected, select File -> Open/save Condition -> Open Condition... from the menu bar.
   When the SFR window has been selected, select File -> Open... from the menu bar.
3. Load the file to be referenced by using the View file load dialog box.

Saving displayed register data to a file: View file save dialog box



Reference window.
Load and open the file to be displayed. The window is opened for reference. All operations related to modification are disabled.

Displaying register data that has been saved to a file: View file load dialog box

2.5.3 Functions Available in the Register Window

- The Register window allows the user to choose between the function name display option and absolute name display option, choose between the register display option and pair register display option, and so forth.
- The available functions are listed below.

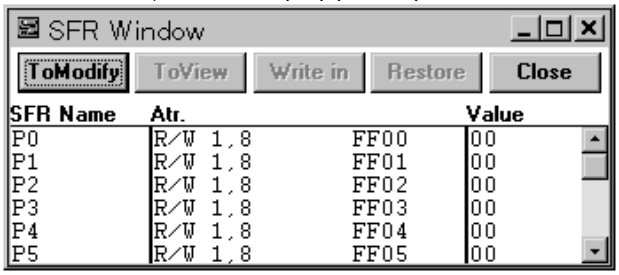
Function		Procedure
Display switching	**Absolute name display/function name display**	Absolute name: Select View -> Absolute Name from the menu bar. Function name: Select View -> Function Name from the menu bar.
	Register display/pair register display	Register display: Select View -> Register from the menu bar. Pair register display: Select View -> Register Pair from the menu bar.
Number system display selection		Select View -> Bin, Oct, Dec, or Hex from the menu bar.

2.5.4 Functions Available in the SFR Window

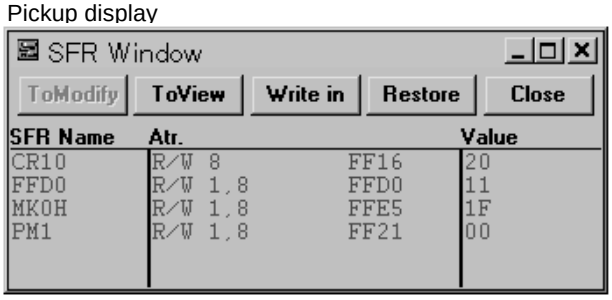
- The SFR window allows the user to select the display order, specify whether attribute data is to be displayed, and so forth.
- The available functions are listed below.

Function	Procedure
Display order selection	The user can choose either address order or alphabetic order as the display order: Select View -> Sfr -> Address Sort from the menu bar.
Attribute display selection	Select View -> Sfr -> Attribute -> Show or Hide from the menu bar.
Pickup display selection	Only those SFRs that have been modified but not yet written to a target in modify mode are displayed. Select View -> Sfr -> Pick Up from the menu bar.

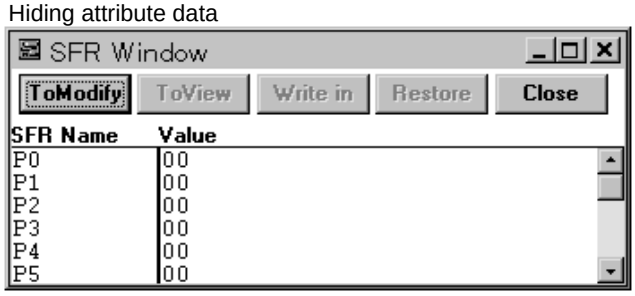
Address order, attribute display (default)



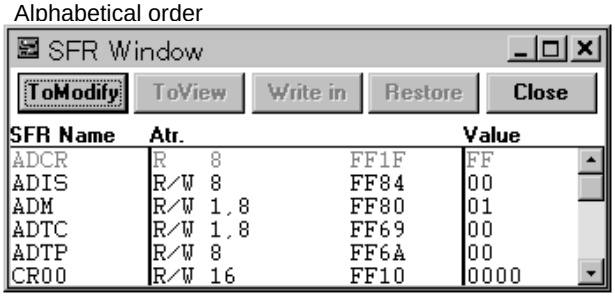
Pickup display



Hiding attribute data



Alphabetical order

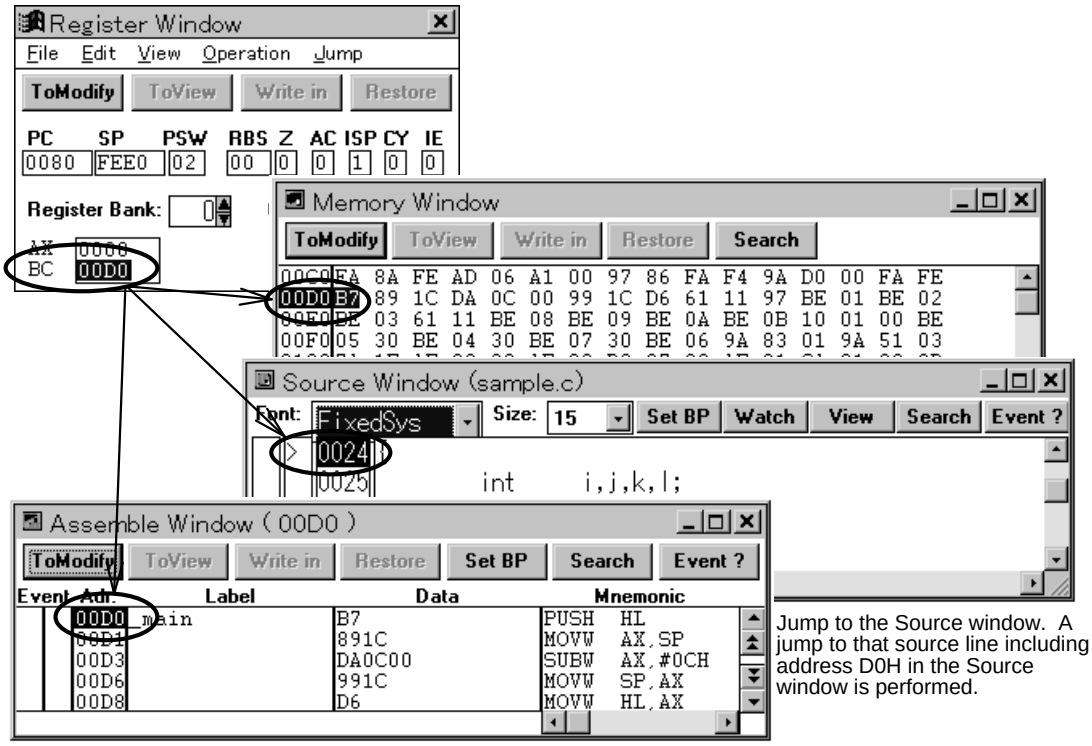


2.5.5 Jumping from the Register Window

- This function enables a jump to the source line, disassembly start address, or memory address corresponding to a register value in the Register window.
- A jump destination can be specified by selecting a desired register. The value of a selected register acts as a jump pointer.
- When a jump is made to the Source window, a jump to that source line including the jump pointer is performed.

Jump destination	Procedure
Source window	1. Select a register 2. Select Jump -> SourceText... from the menu bar.
Assemble window	1. Select a register. 2. Select Jump -> Assemble... from the menu bar.
Memory window	1. Select a register. 2. Select Jump -> Memory... from the menu bar.

A jump is made to the value of the selected register. In this case, address D0H, held in the BC register, is the jump pointrer.



Jump to the Source window. A jump to that source line including address D0H in the Source window is performed.

Jump to the Assemble window

2.6 Creating Events

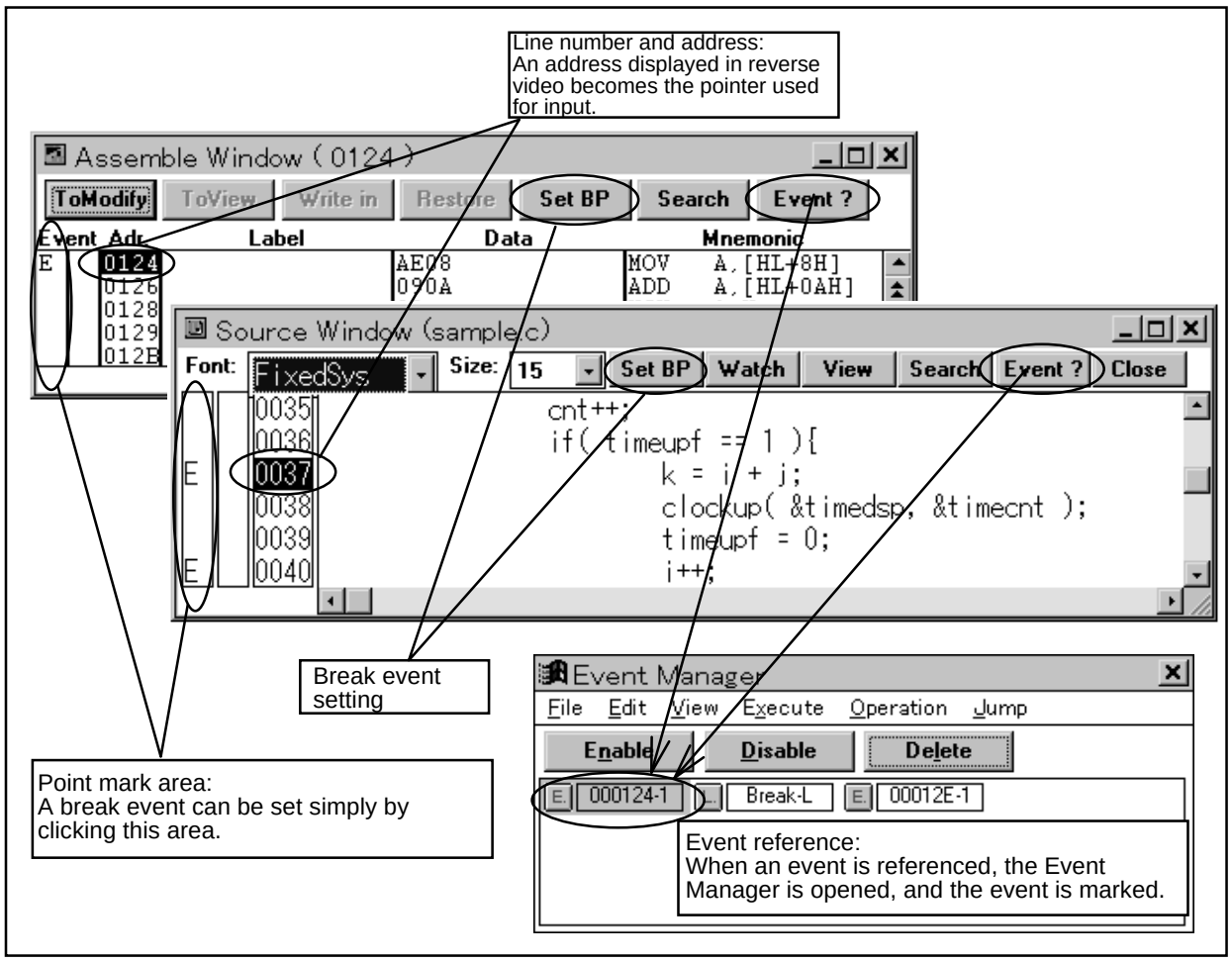
- An event, set beforehand in a program, specifies that an operation is to be performed when a specified condition is satisfied.
- Two types of conditions are used. One is an execution event, which is set for a program execution address. The other is an access event, which is set for memory data accessed by a programmed instruction.
- Four types of events are used to perform operations. These include break events for terminating the program or analyzer, and qualified events, section events, and snapshot events which are used to control the tracer.
- The event-related windows are listed below.

Operation		Window
Event management		Event Manager
Event condition creation	**Event condition**	Event Set dialog box
	Event link condition	Event Link dialog box
Event setting	**Break condition**	Break dialog box
	Trace condition	Trace dialog box
	Snapshot condition	Snap-Shot dialog box
	External sense clip condition	External Sense Clip dialog box

2.6.1 Setting and Referencing Events in the Source Window and Assemble Window

- In the Source window and Assemble window, break events can be set, and events can be referenced.
- If a break event is set in the Source window or Assemble window, a parallel-linked event link condition, named Break-L, is automatically created.
- All set break events become execution events (with the status set to Run).

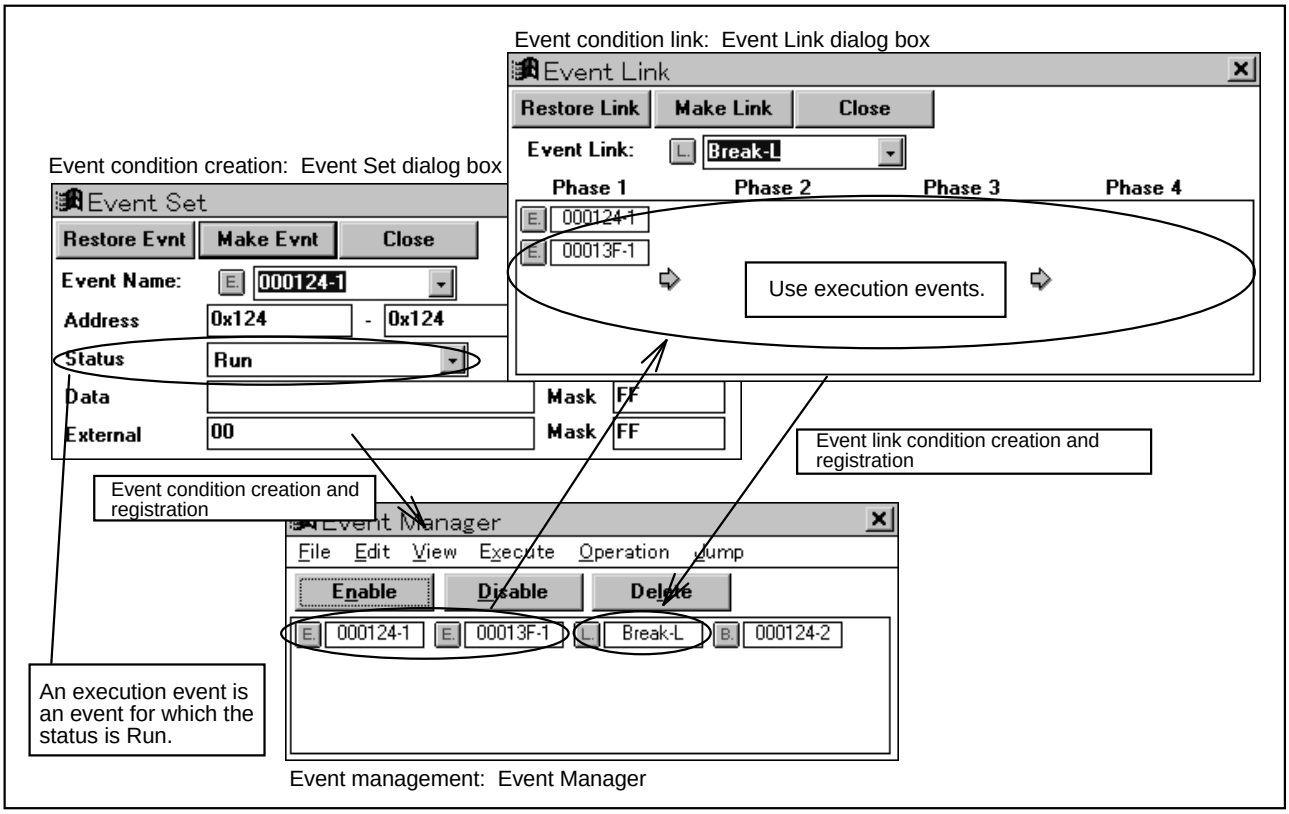
Function	Procedure
Break event setting	Use any of the five methods described below. 1. Click the point mark area. 2. Double-click a line number or address. 3. Select a line number or address, then click the Set BP button. 4. Select a line number or address, then select Execute -> Set BP from the menu bar. 5. Select a line number or address, then press CTRL+B.
Event condition reference	Use either of the two methods described below. Select an address or line number indicated by E in the point mark area, then perform either of the following operations: 1. Click the Event ? button. 2. Select View -> Event? from the menu bar.



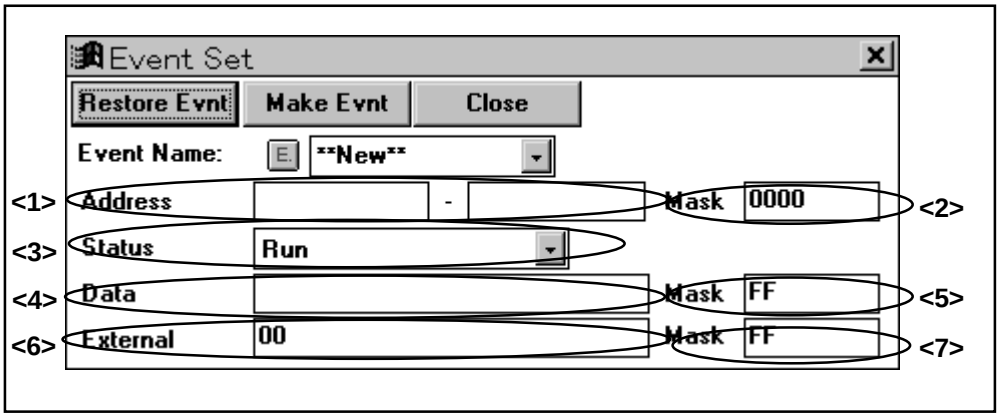
2.6.2 Creating Event Conditions

- Event conditions are divided into two main types: execution events for detecting an execution address, and access events for detecting access data.
- When an execution event is used, it can be combined with an event condition.

Function	Procedure
Event condition creation	The Event Set dialog box is used. Select Browse -> Event -> EventSet... from the menu bar.
Event link condition creation	1. Create an execution event in the Event Set dialog box. 2. Open the Event Manager by selecting Browse -> Event -> EventManager... from the menu bar. 3. Open the Event Link dialog box by selecting Browse -> Event -> EventLinkSet... from the menu bar. 4. Create an event link condition by dragging & dropping the execution event created in 1., above.



- Examples of event condition setting are given below.
  When the Event Set dialog box is opened, the default screen, shown below, initially appears. Modify the screen settings as required.

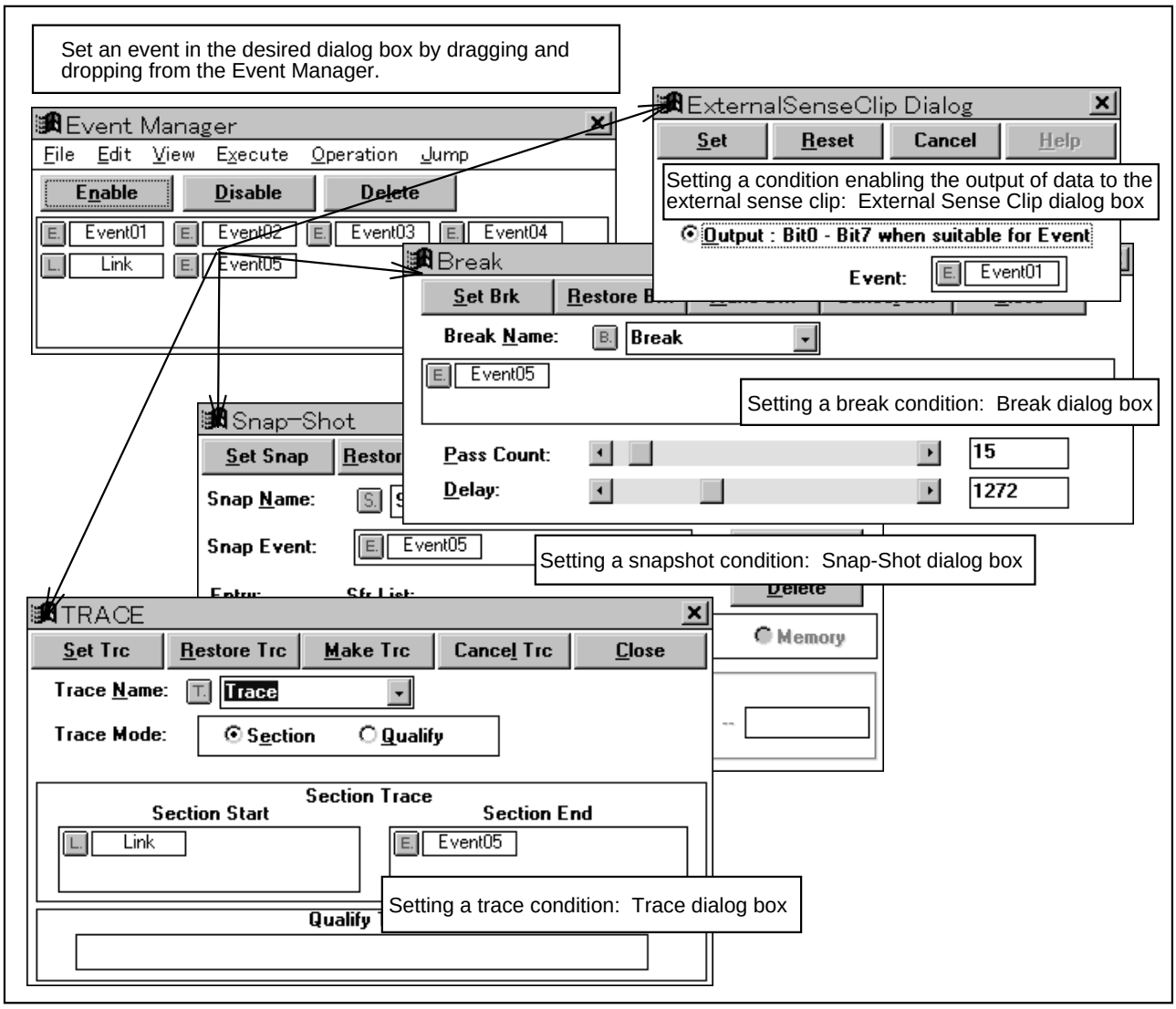


Condition	Setting	Remarks
When a program at address 0x100 is executed	**<1>**0x100 **<2>**0 **<3>**Run	The defaults are used for **<4>**, **<5>**, **<6>**, and **<7>**.
When memory access to address 0xfe00 is performed	**<1>**0xfe00 **<2>**0 **<3>**Data R/W **<4>**0x00 **<5>**ff	The defaults are used for **<6>** and **<7>**.
When memory access is performed for addresses 0xfe00 to 0xfe7f	**<1>**0xfe00-0xfe7f **<2>**0 **<3>**Data R/W **<4>**0 **<5>**ff	The defaults are used for **<6>** and **<7>**. An event occurs when any address in the range is accessed.
When memory is read (with no address condition set)	**<1>**0 **<2>**ffff **<3>**Data Read **<4>**0 **<5>**ff	The defaults are used for **<6>** and **<7>**.
If bit 0 is 1 when writing to address 0xfb01 is performed	**<1>**0xfb01 **<2>**0 **<3>**Data Write **<4>**1 **<5>**fe	The defaults are used for **<6>** and **<7>**. For mask specification, set those bits to be monitored to 0, and set the other bits to 1.
When 0x10 is written to address 0xfb01	**<1>**0xfb01 **<2>**0 **<3>**Data Write **<4>**0x10 **<5>**0	The defaults are used for **<6>** and **<7>**.
When an event is to be set at the start of function sub(), coded in C	**<1>**_sub **<2>**0 **<3>**Run	The defaults are used for **<4>**, **<5>**, **<6>**, and **<7>**.
When the value of variable cnt, registered in C, becomes 0x46	**<1>**_cnt **<2>**0 **<3>**Data R/W **<4>**0x46 **<5>**0	The defaults are used for **<6>** and **<7>**.
When an event is to be set with the START function of the assembler	**<1>**START **<2>**0 **<3>**Run	The defaults are used for **<4>**, **<5>**, **<6>**, and **<7>**.
When the value of assembler variable DATA becomes 35H	**<1>**DATA **<2>**0 **<3>**Data R/W **<4>**35H **<5>**0	The defaults are used for **<6>** and **<7>**.

2.6.3 Setting Events

Event conditions registered in the Event Set dialog box or Event Link dialog box can be used as break conditions and trace conditions.

Condition	Procedure
When used as a break condition	Select Browse -> BreakSet... from the menu bar.
When used as a trace condition	Select Browse -> Trace -> TraceSet... from the menu bar.
When used as a snapshot condition	Select Browse -> Trace -> SnapShotTraceSet... from the menu bar.
When used as an external sense clip condition	Select Execute -> ExtSenseClip... from the menu bar.



2.6.4 Saving and Restoring Event Conditions

- Event conditions can be saved to a file. Saved event conditions can be referenced.
- Event conditions are saved in text format, allowing an editor to be used to reference saved event conditions.

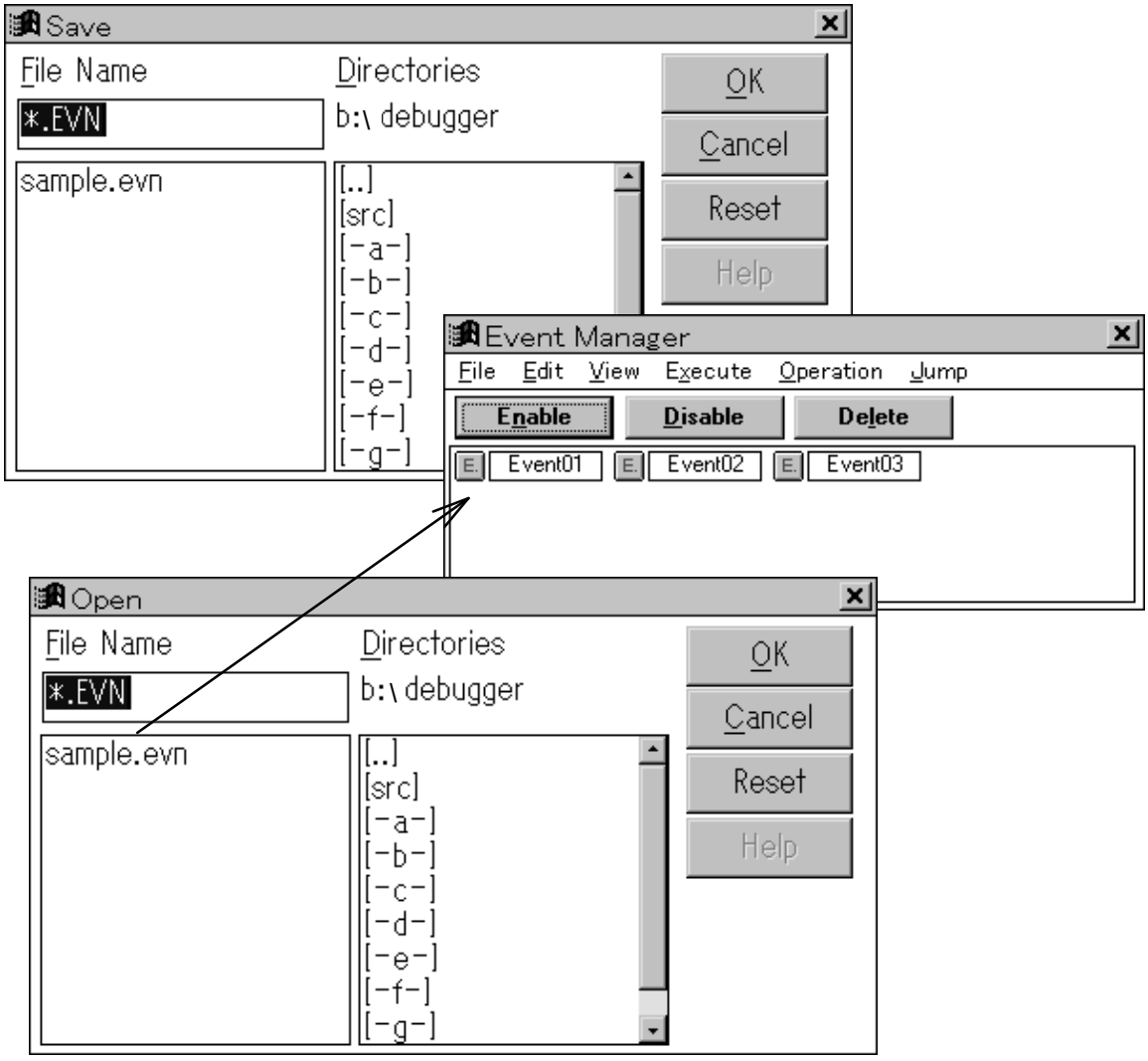
To save an event condition to a file:

1. Activate the Event Manager.
2. Select File -> Open/save Condition -> Save File as... from the menu bar of the Event Manager.
3. Save the event condition by using the View file save dialog box.

To restore a saved event condition:

1. Activate the Event Manager.
2. Select File -> Open/save Condition -> Open Condition... from the menu bar of the Event Manager.
3. Load the file containing the event condition to be restored with the View file load dialog box.

Saving an event condition to a file: View file save dialog box

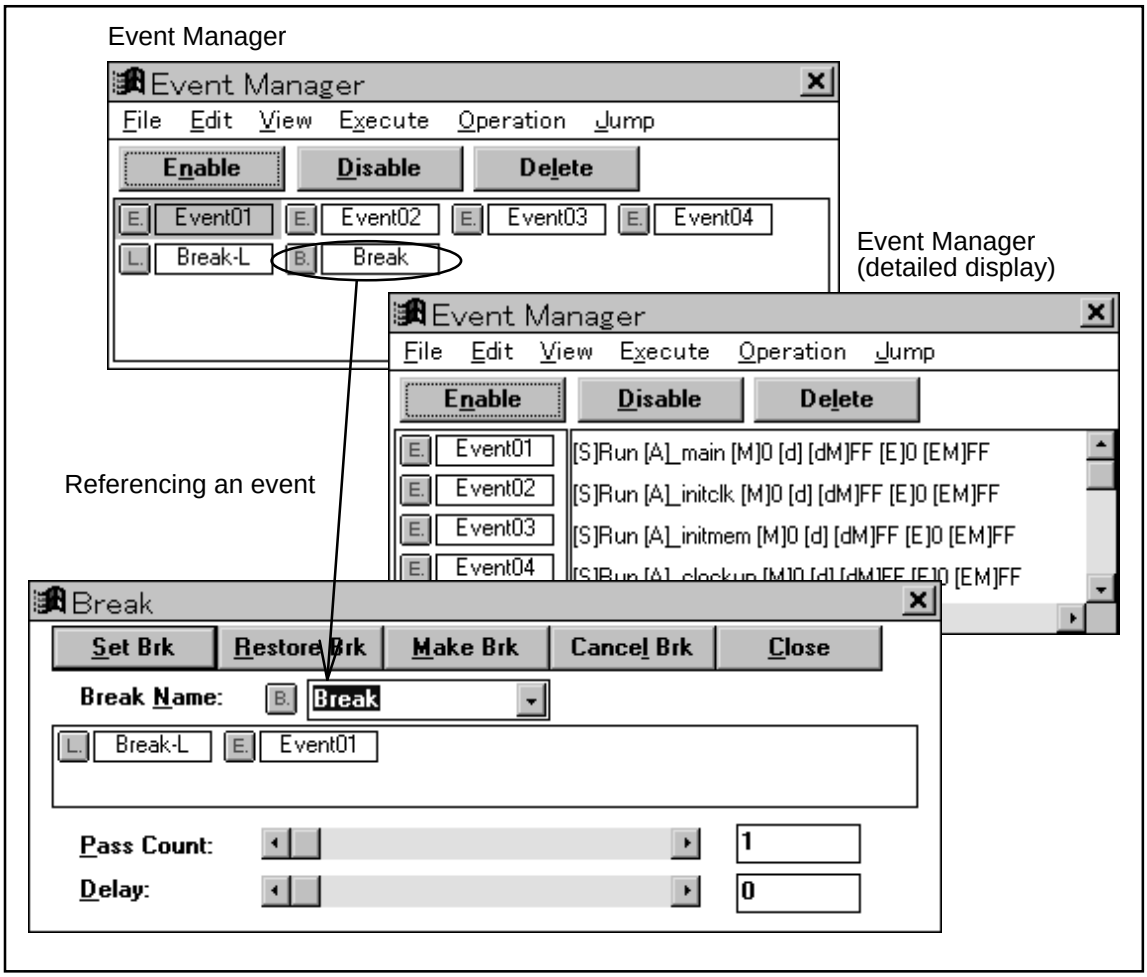


Restoring an event condition saved to a file: View file load dialog box

2.6.5 Functions Available in the Event Manager

- The Event Manager allows the user to use a variety of functions such as enabling/disabling an event, deleting an event, and referencing an event.
- The available functions are listed below.

Function	Procedure
Enabling/disabling an event	Select an event to be enabled or disabled, then perform the following: To enable the event: Click the Enable button. To disable the event: Click the Disable button.
Deleting an event	1. Select the event to be deleted. 2. Click the Delete button.
Detailed event condition display	Select View -> Detail from the menu bar of the Event Manager.
Changing the order of display	The order of display can be changed using the menu bar of the Event Manager. To enable display in event name order: Select View -> Name. To enable display in type order: Select View -> Kind.
Referencing/modifying an event condition	1. Select the event to be referenced or modified. 2. Select an option from Operation in the menu bar of the Event Manager.

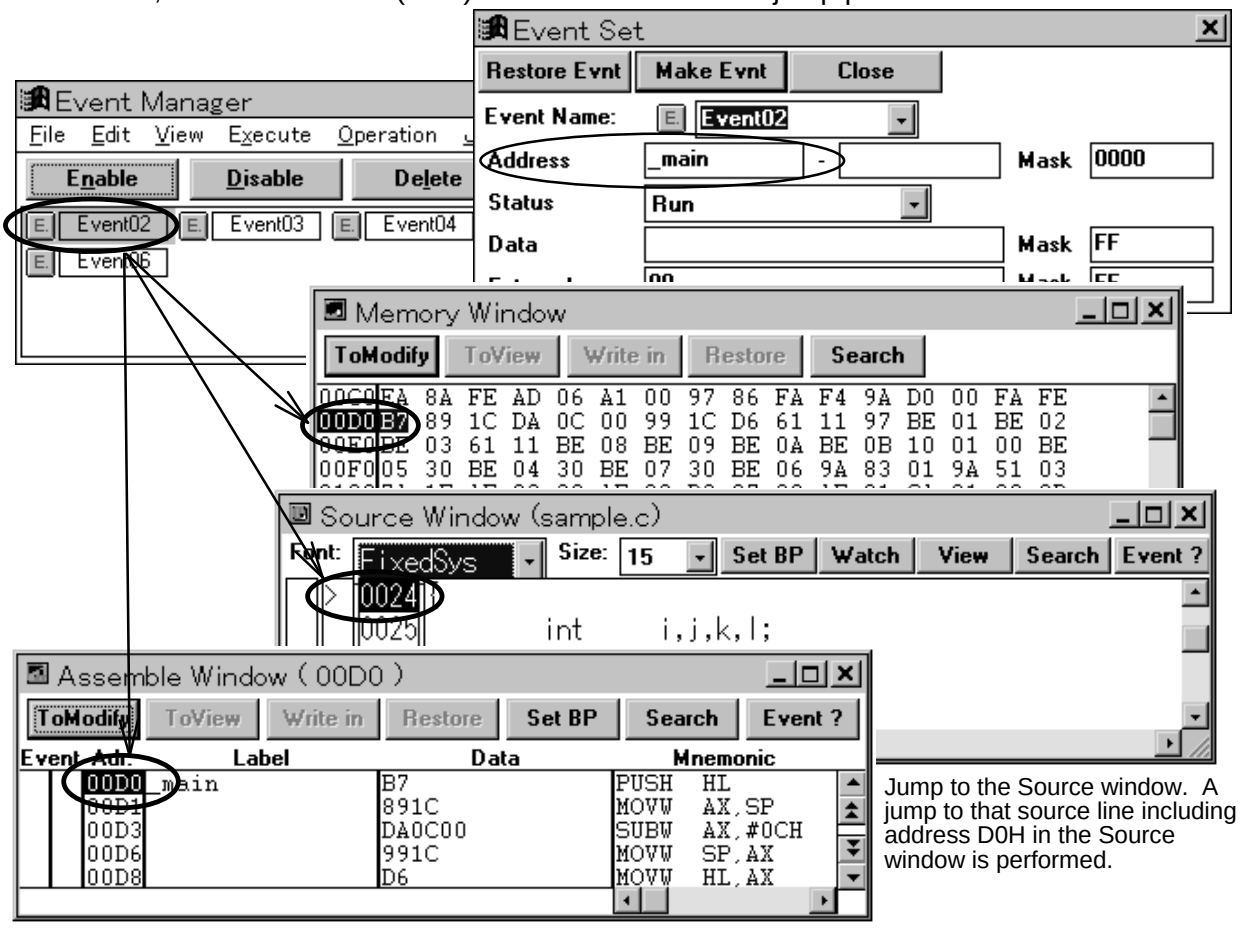


2.6.6 Jumping to an Event Setting Address

- This function enables a jump to the source line, disassembly start address, or memory address corresponding to the address of an event condition in the Event Manager.
- A jump destination can be specified by selecting an event condition. The start address of a selected event condition acts as a jump pointer.
- When a jump is made to the Source window, a jump to that source line including the jump pointer is performed.

Jump destination	Procedure
Source window	1. Select an event condition. 2. Select Jump -> SourceText... from the menu bar.
Assemble window	1. Select an event condition. 2. Select Jump -> Assemble... from the menu bar.
Memory window	1. Select an event condition. 2. Select Jump -> Memory... from the menu bar.

A jump is made to the address of the selected event, Event02.
In this case, the start address (D0H) of function main is the jump pointer.



Jump to the Source window. A jump to that source line including address D0H in the Source window is performed.

Jump to the Assemble window

2.7 Manipulating Symbols (Variables)

- The user can display and modify the values of variables.
- Before an operation such as symbol debugging can be performed, a load module file including debug information must be loaded.
- The user can enter symbols in the address and data input fields of each window.
- To enter symbols, observe the input formats indicated below.

Type of symbol	Input format
Variable defined in C	_fnc file**#**_fnc
Variable defined in assembler language	fnc file#fnc
Source line number	file**:**no
SFR	sfrneme

fnc: Function name or variable name sfrname: SFR name file: File name
no: Line number

1. When specifying a variable defined in C, prefix the variable with an underbar (_).
2. Use a sharp (#) as the separator between a file name and variable name.
3. Use a colon (:) as the separator between a file name and line number.

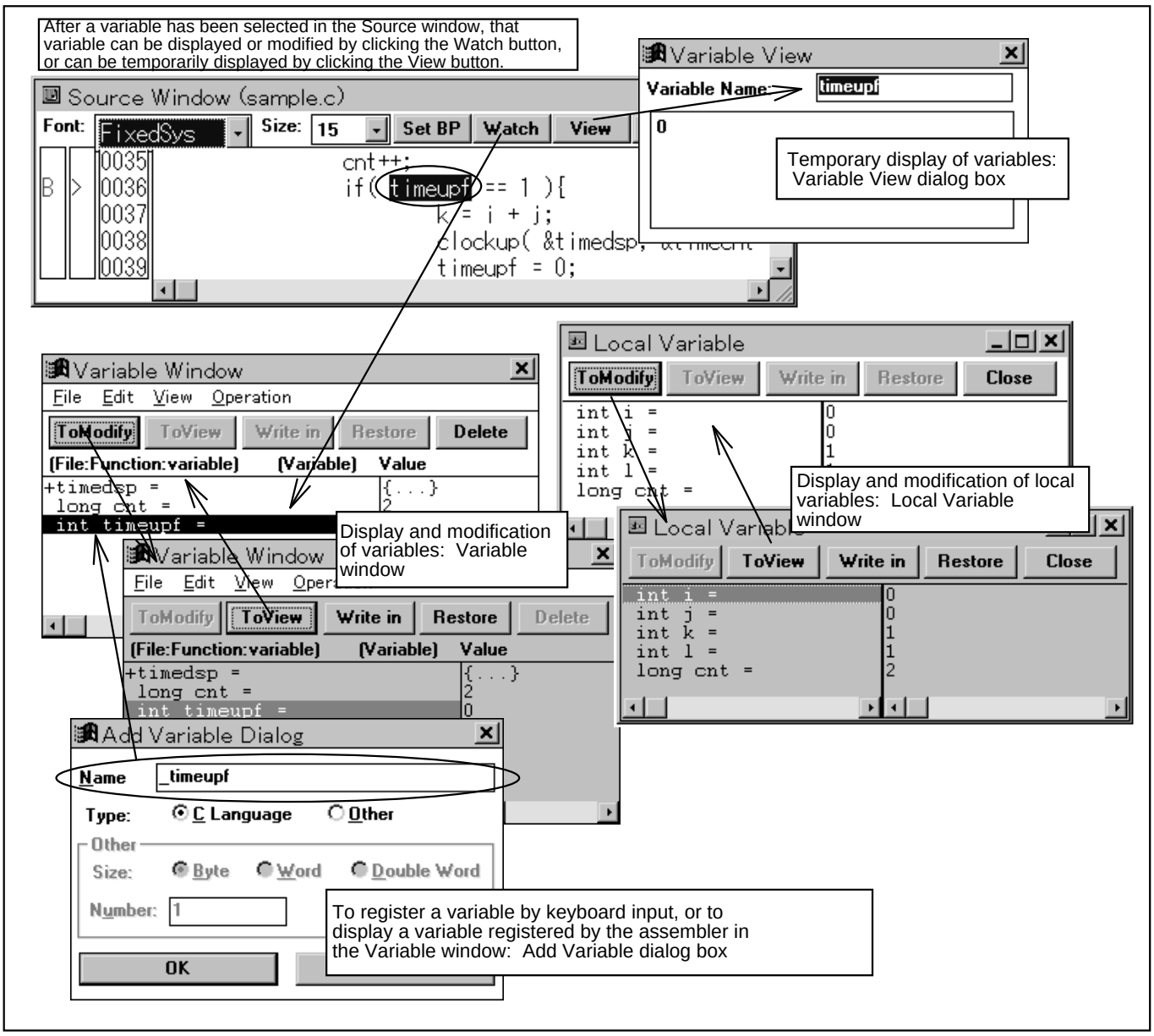
- The windows related to symbol operations are listed below.

Operation	Window
Display of variables	Variable window
Registration of displayed variables	Add Variable dialog box
Temporary display of variables	Variable View dialog box
Display of local variables	Local Variable window

2.7.1 Displaying and Modifying Variables

- The user can display and modify the values of variables in the Variable window, Variable View dialog box, and Local Variable window.

Variable		Procedure
Display	**Display at all times**	Display the variables in the Variable window. Select View -> Watch Variable... from the menu bar.
	Temporary display	1. Select a source variable displayed in the Source window. 2. Select View -> View Variable... from the menu bar, or click the [View] button in the Source window.
	Display of local variables	Select Browse -> Local Variable... from the menu bar.
Modification	**Variable modification** **Local variable modification**	Use the Variable window to modify a variable. Use the Local Variable window to modify a local variable. Both windows are modified as follows: 1. Open the desired window. 2. Switch to modify mode by clicking the [ToModify] button. 3. Position the cursor to the variable to be modified, then modify the data. 4. After entering the new data, execute the modification by clicking the [Write in] button. Switch to view mode by clicking the [ToView] button.
Registration		The Variable window allows the user to register a displayed variable. To register a variable in the Source window: 1. Select a source variable displayed in the Source window. 2. Select View -> Watch Variable... from the menu bar, or click the [Watch] button in the Source window. To register a variable in the Add Variable dialog box for variable registration: 1. Select View -> Add Variable... from the menu bar. 2. Register the variable in the Add Variable dialog box.
Deletion		The user can delete any variable displayed and registered in the Variable window. 1. Select the variable to be deleted. 2. Select Operation -> Delete from the menu bar.


After a variable has been selected in the Source window, that variable can be displayed or modified by clicking the Watch button, or can be temporarily displayed by clicking the View button.
Source Window (sample.c)
Font: FixedSys
Size: 15
Set BP
Watch
View
cnt++;
if(timeupf == 1){
k = i + j;
clockup(&timedsp,
timeupf = 0;
Variable View
Variable Name:
timeupf
0
Temporary display of variables: Variable View dialog box
Variable Window
File Edit View Operation
ToModify
ToView
Write in
Restore
Delete
(File:Function:variable)
(Variable)
Value
+timedsp =
long cnt =
int timeupf =
{...}
2
Display and modification of variables: Variable window
Local Variable
ToModify
ToView
Write in
Restore
Close
int i =
int j =
int k =
int l =
long cnt =
0
0
1
1
2
Display and modification of local variables: Local Variable window
Add Variable Dialog
Name
_timeupf
Type:
C Language
Other
Other
Size:
Byte
Word
Double Word
Number:
1
OK
To register a variable by keyboard input, or to display a variable registered by the assembler in the Variable window: Add Variable dialog box

2.7.2 Saving and Referencing Symbol Data

- Displayed symbol data can be saved to a file. A file containing saved symbol data can be referenced.
- Symbol data is saved in text format, allowing an editor to be used to reference saved symbol data.

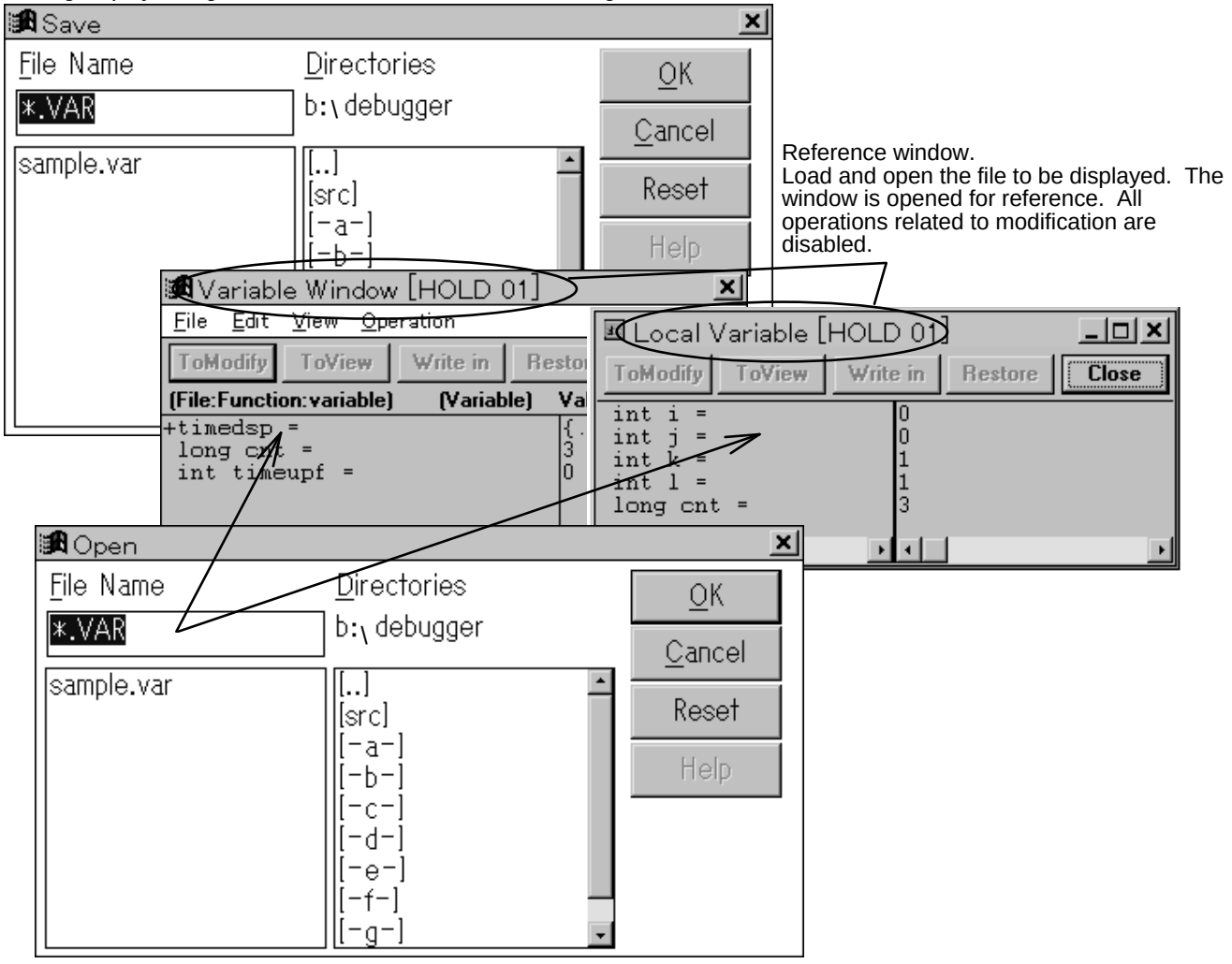
To save displayed symbol data to a file:

1. Activate the desired window.
2. When the Variable window has been selected, select File -> Open/save Condition -> Save File as... from the menu bar.
   When the Local Variable window has been selected, select File -> Save As... from the menu bar.
3. Save displayed symbol data by using the View file save dialog box.

To open and reference a file containing saved symbol data:

1. Activate the desired window.
2. When the Variable window has been selected, select File -> Open/save Condition -> Open Condition... from the menu bar.
   When the Local Variable window has been selected, select File -> Open... from the menu bar.
3. Load the file to be referenced by using the View file load dialog box.

Saving displayed register data to a file: View file save dialog box

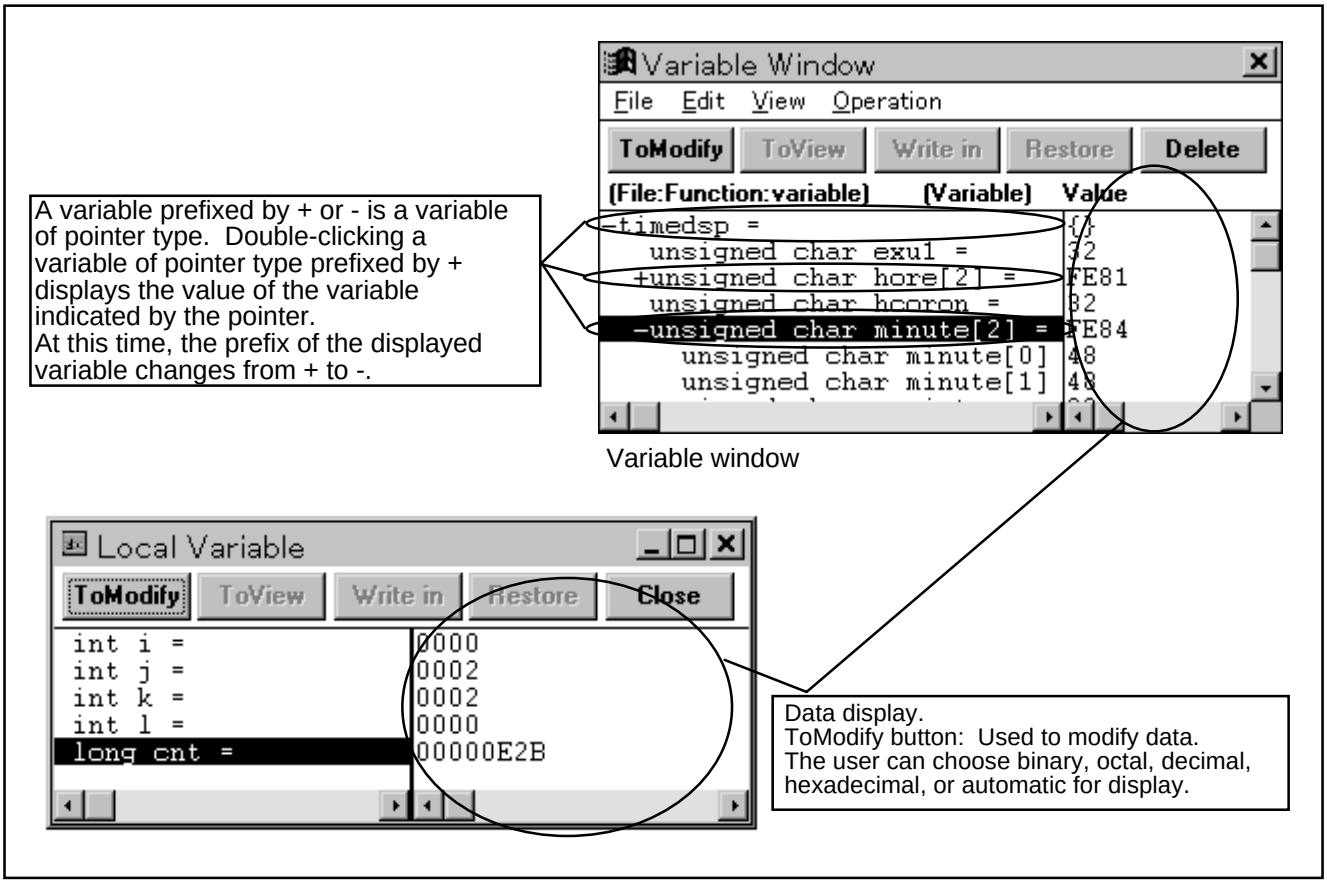


Displaying symbol data that has been saved to a file: View file load dialog box

2.7.3 Functions Available in the Variable Window and Local Variable Window

- The Variable window and Local Variable window give the user access to a variety of functions, such as the ability to modify the data number system.
- The available functions are listed below.

Function	Procedure
Display of variables of pointer type	A variable of pointer type is prefixed by + or -. **Variable prefixed by +:** The value of the variable indicated by the pointer is displayed by double-clicking. At this time, the prefix of the displayed variable changes to -. **Variable prefixed by -:** The display of the value of the variable indicated by the pointer is stopped by double-clicking. At this time, the prefix of the displayed variable changes to +.
Number system display selection	Select View -> Bin, Oct, Dec, Hex, or Proper from the menu bar.



2.8 Using the Tracer Effectively

- The tracer records device operations in trace memory.
- The IE-78000-R-A has 32K frames of trace memory.
- Trace memory has a ring buffer structure.
- For combined events, four trace methods are supported:

Trace cycle	Trace mode		Remarks
Machine cycle trace	**Total trace**		Port trace operation is possible.
Event cycle trace	**Total trace**		Trace operation is performed only when the device performs a read, write, or fetch operation.
	Conditio-nal trace	**Sectional trace**	The start and end of trace operation can be specified using an event condition.
		Qualified trace	Trace operation is performed only when an event condition match is detected.

- The trace-related windows are listed below.

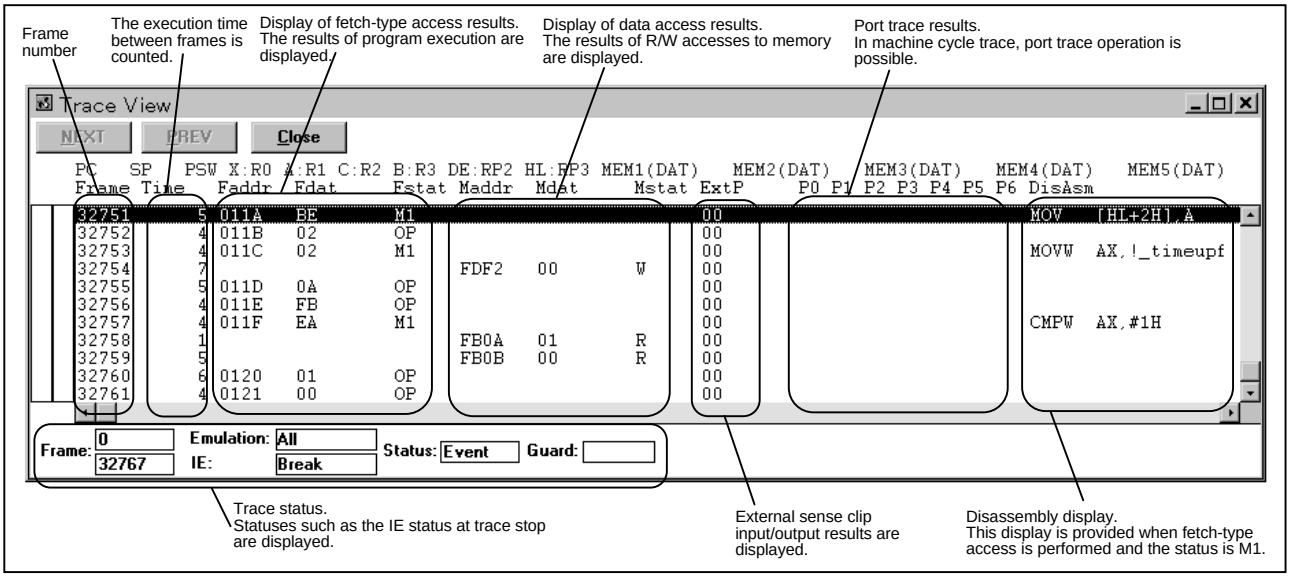
Operation		Window
Trace result display		Trace View window
Display item selection	**Trace display**	Show Trace dialog box
	Snapshot display	Snap Trace dialog box
Trace condition setting		Trace dialog box
Snapshot condition setting		Snap-Shot dialog box
Trace result search		Trace pick-up dialog box

2.8.1 Displaying Trace Results

- Trace results can be displayed in the Trace View window.

To display trace results:

Select Browse -> Trace -> TraceView... from the menu bar, or click the  button.



Item	Description
Frame	Displays trace frame numbers. Valid range: 0 ≤ Trace frame number ≤ 32,767
Time	Displays the number of clock pulses taken by the target chip between the start of execution of the immediately preceding trace address and the start of execution of the current trace address. For the clock signal, the CPU clock is not used. Instead, the 10-MHz clock signal of the in-circuit emulator is used. Measurement range: 1 ≤ Time tag ≤ 0xffffff
Address **Data** **Statu**	Displays program fetch results. This field displays the following information depending on the fetch status displayed in the Status field: M1 : Fetch of the first byte of an instruction OP : Operation code fetch IF : Invalid fetch
Address **Data** **Statu**	Displays data access results. This field displays the following information depending on the access status display in the Status field: VECT : Vector read R : Data read W : Data write
ExtP	Displays the input level of the external sense clips when trace has been performed.
DisAsm	Displays the results of disassembly. This information is displayed only when the fetch status is **M1**.

2.8.2 Saving and Referencing Trace Results

- Trace results can be saved to a file. A file containing saved trace results can be referenced.
- Trace results are saved in text format, allowing an editor to be used to reference saved trace results.

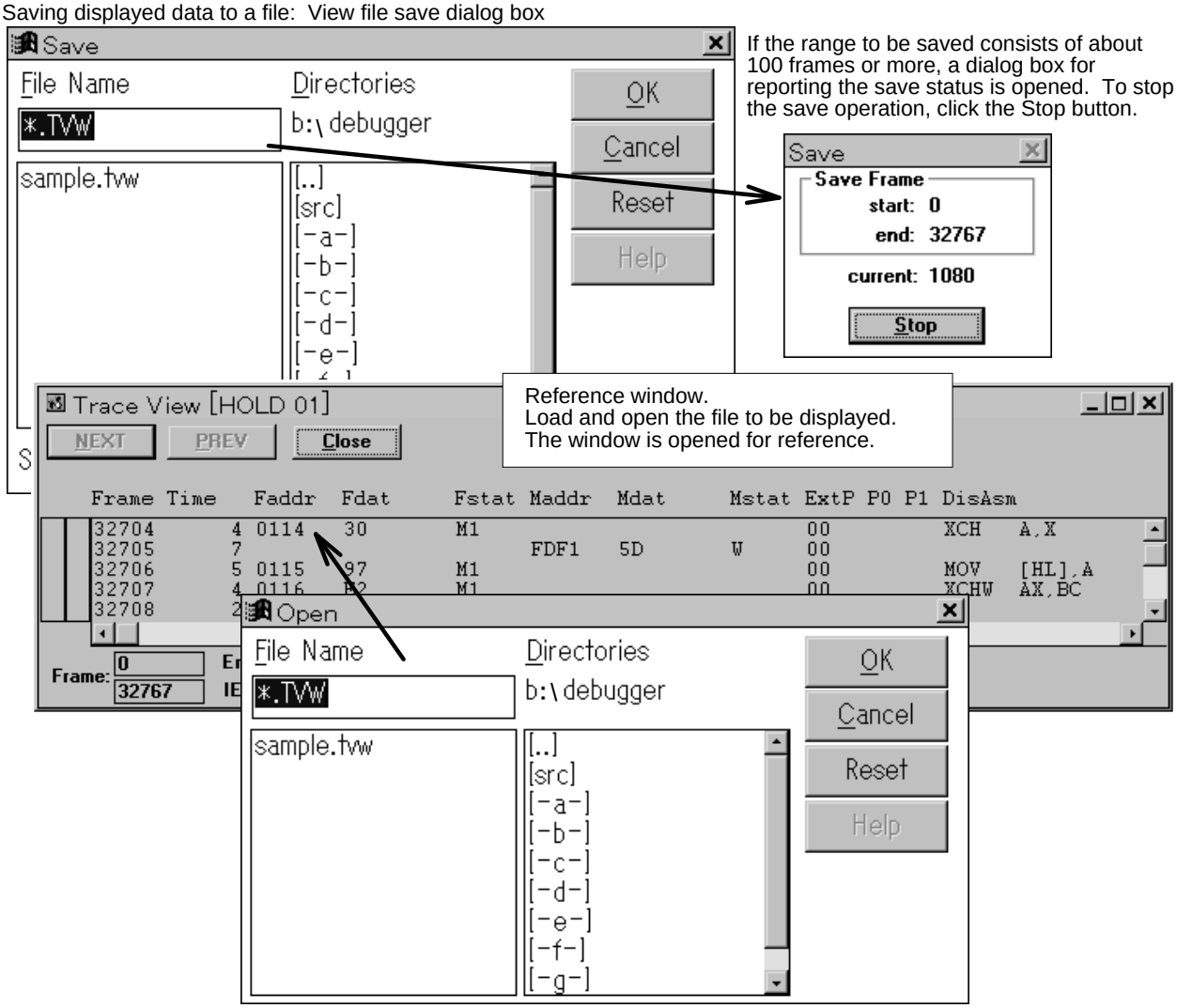
To save trace results to a file:

1. Activate the Trace View window.
2. Select File -> Save As... from the menu bar.
3. Save trace results with the View file save dialog box.

To open and reference a file containing saved trace results:

1. Activate the Trace View window.
2. Select File -> Open... from the menu bar.
3. Load the file to be referenced by using the View file load dialog box.

Saving displayed data to a file: View file save dialog box



Displaying data saved to a file: View file load dialog box

2.8.3 Effective Trace Memory Usage 1 (Trace Mode Setting)

- Trace memory can be used effectively by setting a trace condition and trace mode.
- Three major trace modes are supported:

Trace mode	Description
Total trace	All accesses are traced. The user can choose between machine cycle trace and event cycle trace.
Sectional trace	A section from one event to another is traced. This mode is useful, for example, for tracing one particular function.
Qualified trace	Only an event condition match point is traced. This mode is useful, for example, for tracing particular memory accesses.

- Each trace mode is described below.
  1. The data for each of the following modes indicates the results of executing test program 1 from address 80H to address 8EH.
  2. Test program 1 initializes, to zero, the four bytes of memory from address 0FE00H to address 0FE03H.

Test program 1: Clearing RAM

```
Addr Data     Mnemonic
0080 61D0     SEL     RB0          Selects register bank 0.
0082 16FFFC   MOVW    HL,#0FCFFH   Sets the initialization start address, minus 1.
0085 A100     MOV     A,#0H        Sets initialization data.
0087 A304     MOV     B,#4H        Sets the number of bytes to be initialized.
0089 BB       MOV     [HL+B],A     Initializes memory.
008A 8BFD     DBNZ    B,$89H       Determines termination.
008C 00       NOP
008D 00       NOP
008E FAFE     BR      $8EH
```

1. Results of total trace (event cycle trace)

- ♦ The results of total trace are indicated below.
- ♦ All accesses are traced, so that all program operations can be identified.
- ♦ Program fetch operations, and data read and write operations are traced.

```
frame Faddr  Fdat Fstat  Maddr Mdat Mstat  DisAsm
32738 0080   61   M1                      SEL   RB0
32739 0081   D0   OP
32740 0082   16   M1                      MOVW  HL,#0FCFFH
32741 0083   FF   OP
32742 0084   FC   OP
32743 0085   A1   M1                      MOV   A,#0H
32744 0086   00   OP
32745 0087   A3   M1                      MOV   B,#4H
32746 0088   04   OP
32747 0089   BB   M1                      MOV   [HL+B],A
32748 008A   8B   M1                      DBNZ  B,$89H
32749                 FD03   00    W
32750 008B   FD   OP
32751 0089   BB   M1                      MOV   [HL+B],A
32752 008A   8B   M1                      DBNZ  B,$89H
32753                 FD02   00    W
32754 008B   FD   OP
32755 0089   BB   M1                      MOV   [HL+B],A
32756 008A   8B   M1                      DBNZ  B,$89H
32757                 FD01   00    W
32758 008B   FD   OP
32759 0089   BB   M1                      MOV   [HL+B],A
32760 008A   8B   M1                      DBNZ  B,$89H
32761                 FD00   00    W
32762 008B   FD   OP
32763 008C   00   M1                      NOP
32764 008D   00   M1                      NOP
32765 008E   FA   M1                      BR    $8EH
32766 008F   FE   OP
```

- ♦ Total trace mode is set as follows:

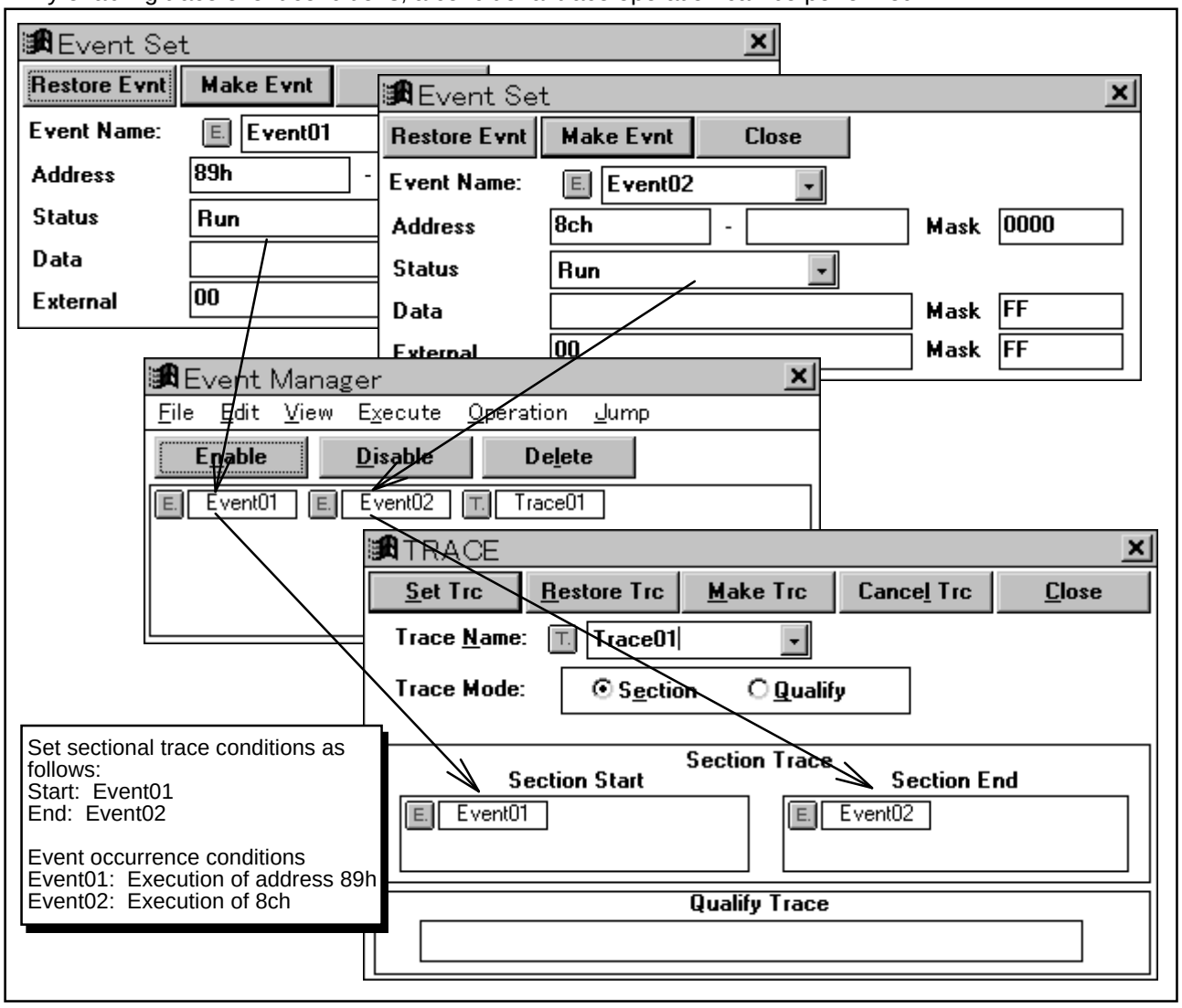
1. Disable all trace event conditions.
2. Select a trace cycle.
   Select Execute -> Trace -> Machine All. Trace or Event All. Trace from the menu bar.

2. Results of sectional trace

- The results of sectional trace from address 89H to address 8CH are shown below.
- The range to be traced can be specified, such that trace memory is used effectively.

```
frame Faddr  Fdat Fstat Maddr  Mdat Mstat  DisAsm
32750 0089    BB   M1                      MOV   [HL+B],A
32751 008A    8B   M1                      DBNZ  B,$89H
32752                   FD03   00    W
32753 008B    FD   OP
32754 0089    BB   M1                      MOV   [HL+B],A
32755 008A    8B   M1                      DBNZ  B,$89H
32756                   FD02   00    W
32757 008B    FD   OP
32758 0089    BB   M1                      MOV   [HL+B],A
32759 008A    8B   M1                      DBNZ  B,$89H
32760                   FD01   00    W
32761 008B    FD   OP
32762 0089    BB   M1                      MOV   [HL+B],A
32763 008A    8B   M1                      DBNZ  B,$89H
32764                   FD00   00    W
32765 008B    FD   OP
32766 008C    00   M1                      NOP
```

- Sectional trace mode and the event conditions can be set as shown below.
- By enabling trace event conditions, a conditional trace operation can be performed.

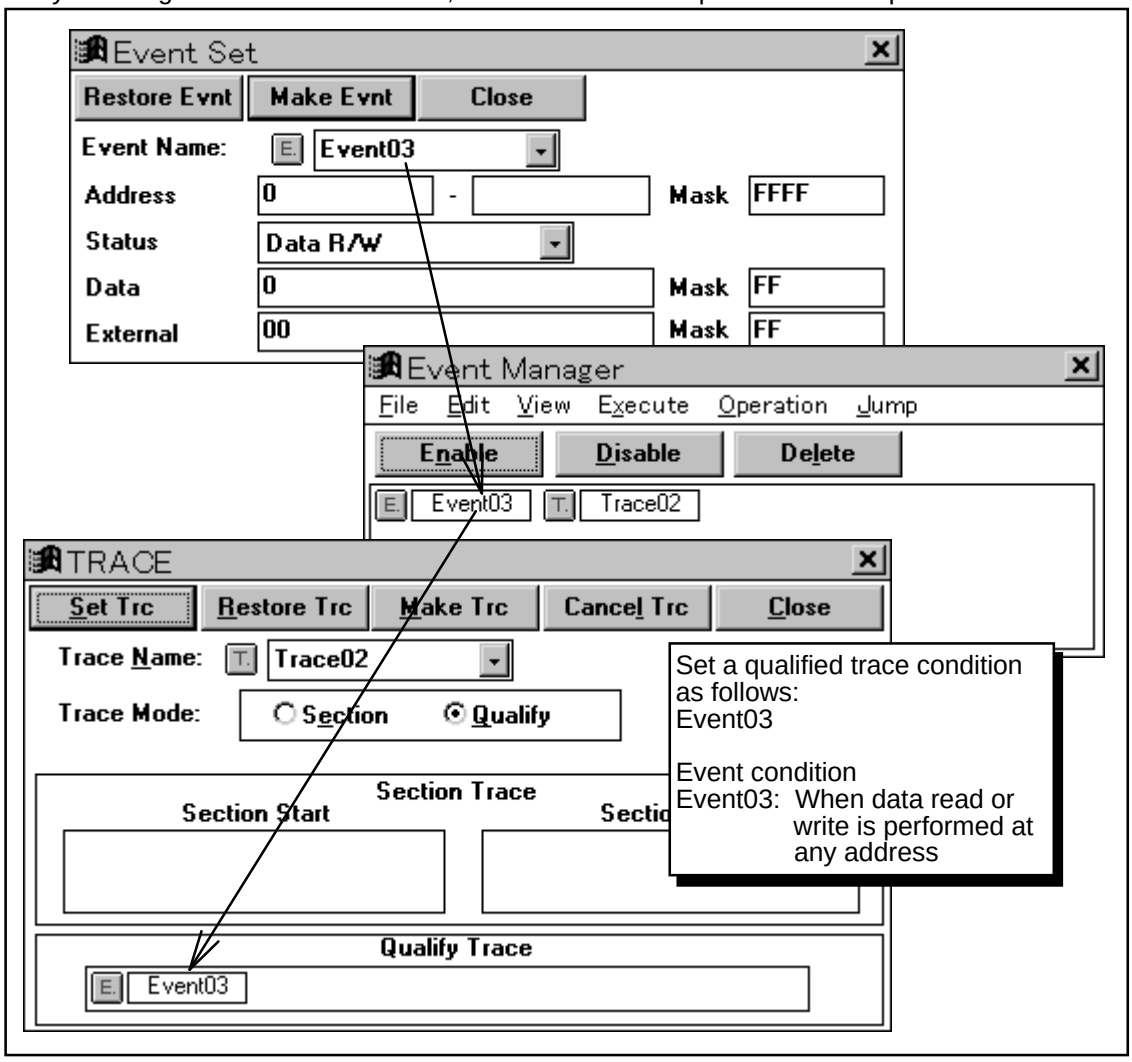


3. Results of qualified trace

- The results of qualified trace, for data read and write operations only, are indicated below.
- Only those points that are to be traced are traced, allowing large amounts of data to be traced. Note, however, that since trace is performed only when an event condition match is detected, the context is difficult to grasp.

```
frame Faddr  Fdat Fstat Maddr  Mdat Mstat  DisAsm
32763                  FD03   00    W
32764                  FD02   00    W
32765                  FD01   00    W
32766                  FD00   00    W
```

- Qualified trace mode and an event condition can be set as shown below.
- By enabling a trace event condition, a conditional trace operation can be performed.



2.8.4 Effective Trace Memory Usage 2 (Trace Full Break, Snapshot Trace)

- Trace full break
  1. Trace memory has a ring buffer structure. This means that, once the trace memory is filled with trace data, the existing trace data is overwritten by the new data, starting from the oldest data.
  2. To preserve the trace results, trace operation can be stopped once the trace memory is full.

Trace full break setting:
Select Execute -> Trace Full Break from the menu bar.

- Snapshot trace
  1. Trace memory is used to store the execution history. In addition to the execution history, other data can be stored by specifying a snapshot event.
  2. The snapshot trace function writes specified data into trace memory when a condition is satisfied. The following data can be written:

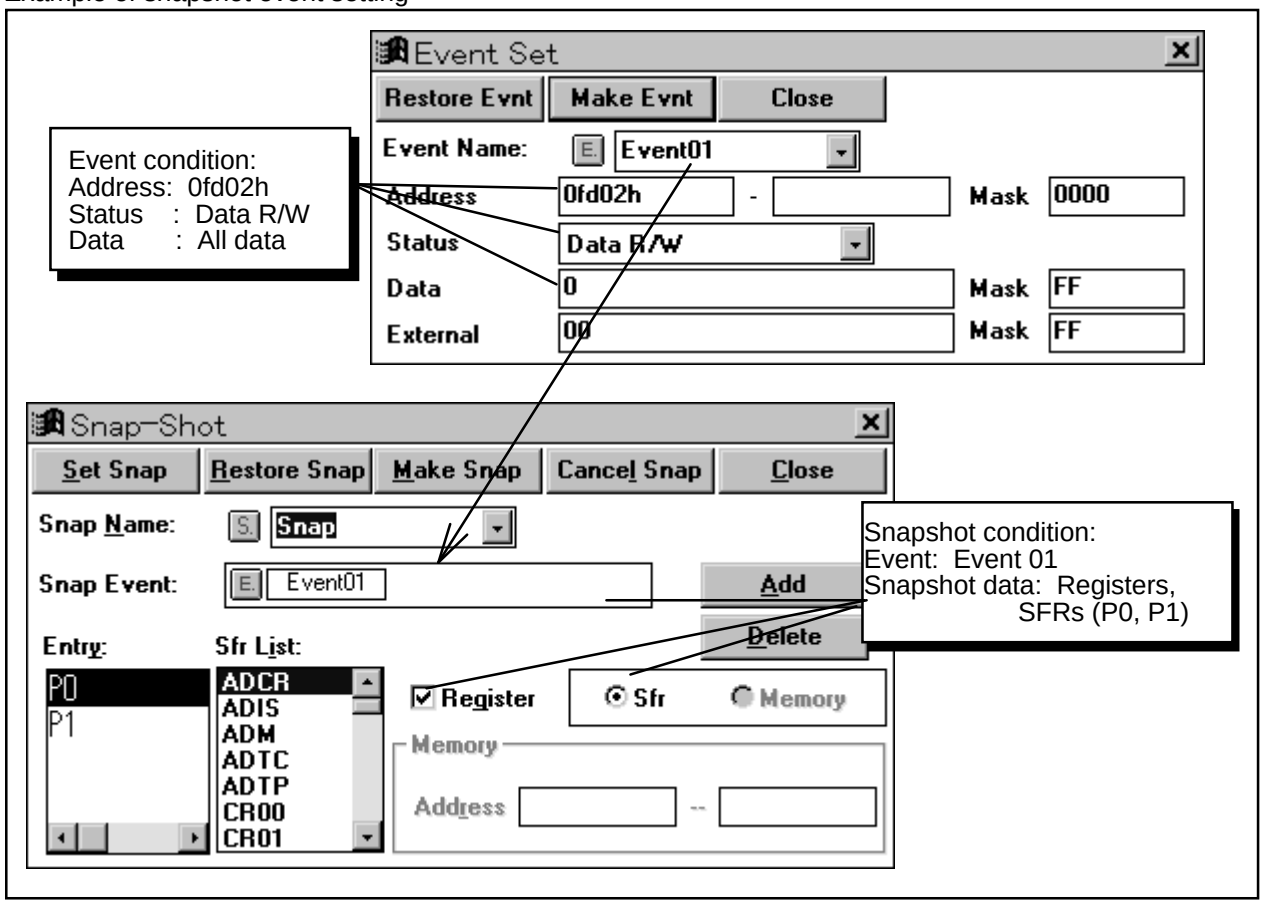
Data		Description
Register		All registers of the current bank (PC, SP, PSW, AX, BC, DE, HL)
Data	**SFR**	Up to five points in SFRs or memory can be traced.
	Memory	

  3. Before data is written into trace memory, the execution of the user program is stopped.
  4. For the program below, the method of writing the register and SFRs (P0, P1) when address 0fd02h is accessed is shown.

Test program 1: Clearing RAM

Addr Data	Mnemonic		
0080 61D0	SEL	RB0	Selects register bank 0.
0082 16FFFC	MOVW	HL,#0FCFFH	Sets an initialization start address, minus 1.
0085 A100	MOV	A,#0H	Sets initialization data.
0087 A304	MOV	B,#4H	Sets the number of bytes to be initialized.
0089 BB	MOV	[HL+B],A	Initializes memory.
008A 8BFD	DBNZ	B,$89H	Determines termination.
008C 00	NOP		
008D 00	NOP		
008E FAFE	BR	$8EH	

Example of snapshot event setting



Trace data

```
PC   SP   PSW X:R0 A:R1 C:R2 B:R3 DE:RP2 HL:RP3 MEM1(DAT)   MEM2(DAT)
frame Faddr  Fdat Fstat Maddr  Mdat Mstat  DisAsm
32742 0089   BB   M1                     MOV   [HL+B],A
32743 008A   8B   M1                     DBNZ  B,$89H
32744                FD03   00   W
32745 008B   FD   OP
32746 0089   BB   M1                     MOV   [HL+B],A
32747 008A   8B   M1                     DBNZ  B,$89H
32748                FD02   00   W
32749 008B   FD   OP
0089 FEE0 02  00   00   00   02   0000   FCFF   P0(00)     P1(00)
32755 0089   BB   M1                     MOV   [HL+B],A
32756 008A   8B   M1                     DBNZ  B,$89H
32757                FD01   00   W
32758 008B   FD   OP
32759 0089   BB   M1                     MOV   [HL+B],A
32760 008A   8B   M1                     DBNZ  B,$89H
32761                FD00   00   W
32762 008B   FD   OP
```

- In frame 32748, a match with event condition Event01 was detected, causing snapshot event Snap to occur.
- Between frame 32749 and frame 32755, the debugger stopped once to write snapshot data into the tracer.

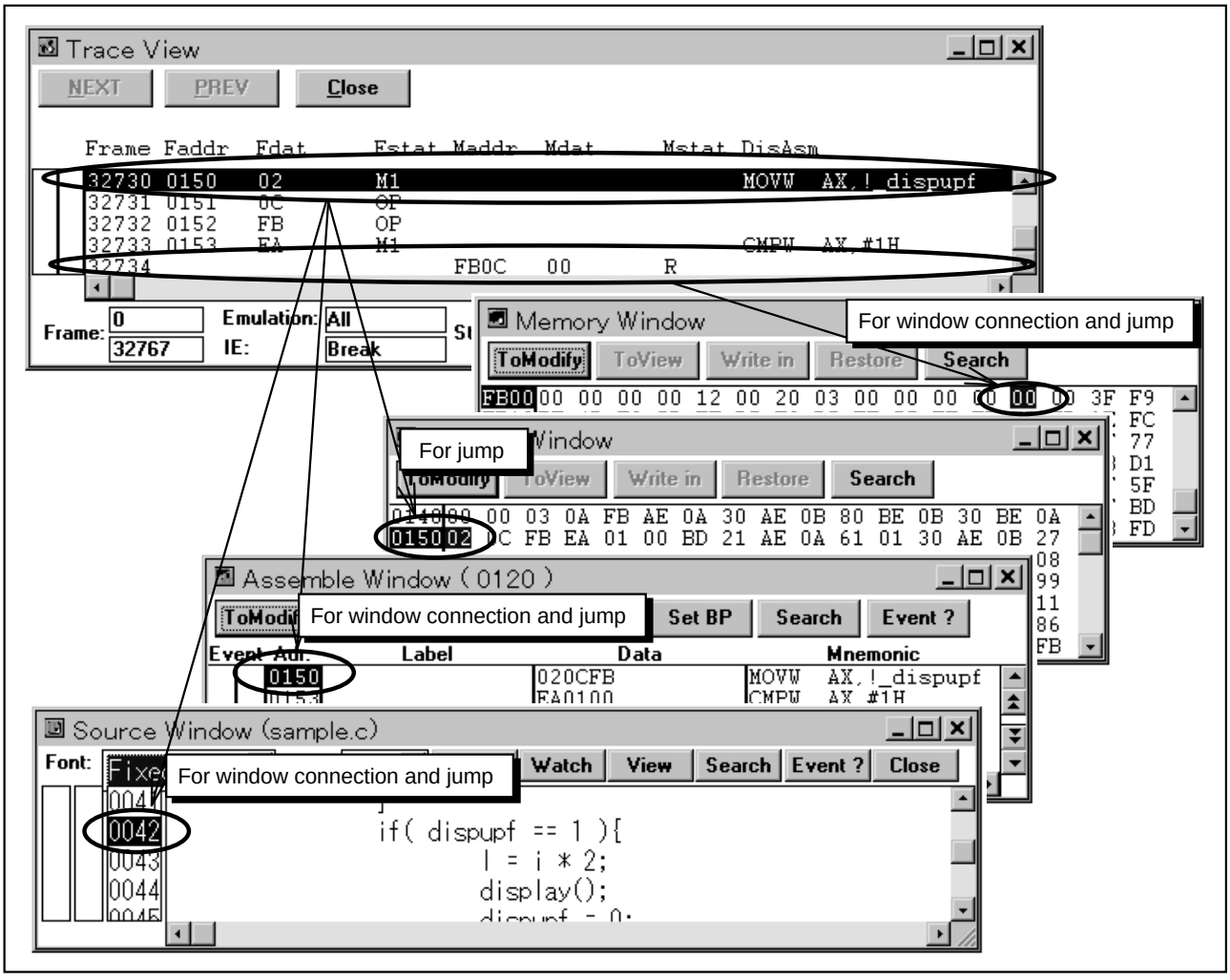
2.8.5 Inter-Window Connection Functions (Window Connection Function, Jump Function)

- Window connection function: This function displays trace results in each window. When the user positions the cursor to the Trace View window, each of the windows (Source window, Assemble window, and Memory window) can be manipulated interactively, thus allowing trace operation in each window.
- Jump function: A jump can be made to a position in the Source window, Assemble window, and Memory window corresponding to the address value of a frame line specified in the Trace View window.
- When the window connection function is used, the Trace View window remains active. When the jump function is used, however, the jump destination window becomes the active window.

Function		Operation
Window connection function	**Connection to the Source window**	Activate the Trace View window. Select Window Connect -> SourceText from the menu bar.
	Connection to the Assemble window	Activate the Trace View window. Select Window Connect -> Assemble from the menu bar.
	Connection to the Memory window	Activate the Trace View window. Select Window Connect -> Memory from the menu bar.
Jump function	**Jump to the Source window**	Select a frame in the Trace View window. Select Jump -> SourceText... from the menu bar, or press CTRL+U.
	Jump to the Assemble window	Select a frame in the Trace View window. Select Jump -> Assemble... from the menu bar, or press CTRL+A.
	Jump to the Memory window	Select a frame in the Trace View window. Select Jump -> Memory... from the menu bar, or press CTRL+M.

- With the window connection function and jump function, connection is made to the data in each window as follows:

Function	Window connection	Jump function
Source window	Fetch address	Fetch address
Assemble window		
Memory window	Data read address and data write address	Fetch address, data read address, and data write address



2.9 Measuring the Execution Time

- The IE-78000-R-A has two timers. One timer measures the time from the start of execution to the end of trace operation. The other timer measures the time from the start of the previous trace operation to the start of the current trace operation.
- The specifications of the two timers are as follows:

Timer	Maximum measurement time	Minimum measurement time
For execution time measurement	Approx. 14 minutes and 18 seconds	Approx. 500 nanoseconds
For trace interval measurement (time tag)	Approx. 1.677 seconds	Approx. 100 nanoseconds

2.9.1 Measuring Program Execution Time

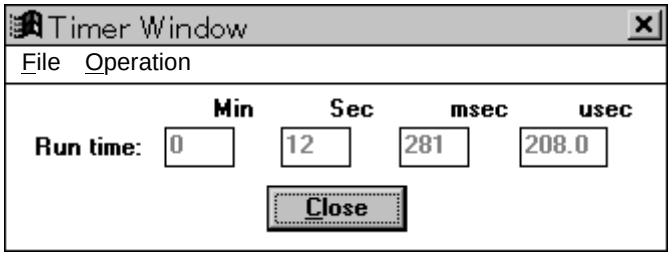
- The time from the start of program execution to the end of program execution is displayed in the Timer window.
- The measurement time depends on the execution mode, as indicated below.

Execution mode	Measurement section
Step execution	Last instruction
Real-time execution	From the start of execution to a break
Non-break real-time execution	From the start of execution to termination of the tracer

- The Timer window can be opened as follows:

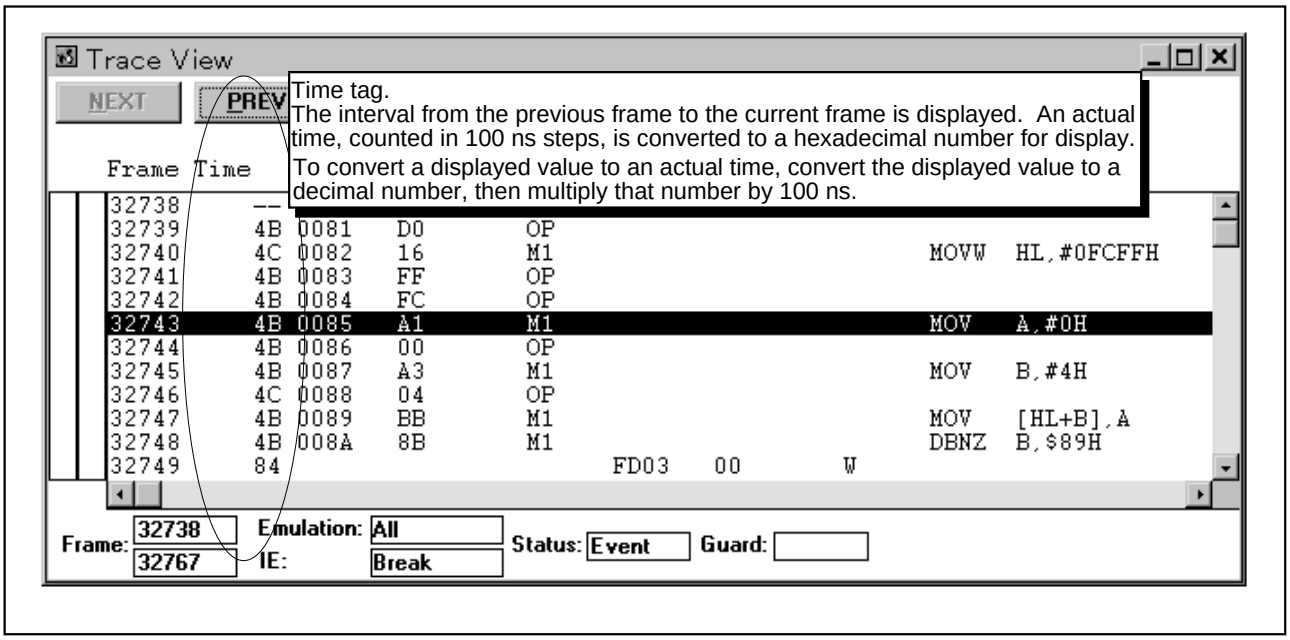
Execution time display:

Select Browse -> Timer... from the menu bar, or press the  button.



2.9.2 Time Measurement Using the Tracer

- For measurement of a short section, regularly executed processing, and so forth, the time tag is useful.
- When compared with the execution times displayed in the Timer window, shorter times are obtained with the time tag. However, the time tag stores multiple data items in trace memory, so that information such as time distribution data can be checked using a separate tool.
- With the time tag, the time from the start of the previous trace operation to the start of the current trace operation is measured. This measurement is conducted not only while the program is being executed but also while the program is stopped. This means that the time tag data for the first program execution frame is meaningless.



Chapter 3 Advanced Use of ID78K0

This chapter describes several advanced uses of the ID78K0. Note that these uses are usually not essential to normal operation.

3.1 Verifying the Validity of Evaluation

Evaluation is essential to the development of a program. If the evaluation of a particularly important item is omitted for some reason, bugs may remain in a program that is offered for retail sale. This section describes the use of the coverage functions to verify the validity of evaluation.

3.2 Using External Sense Clips

The in-circuit emulator status or the contents of memory can be output in real time, by using external sense clips together with event conditions. This section describes the use of the external sense clips.

3.3 Measuring Time by Setting Conditions

Basically, the Timer window of the ID78K0 supports only the measurement of the time that elapses between the start and end of program execution. Shorter periods can, however, be measured by using the tracer in combination with events.

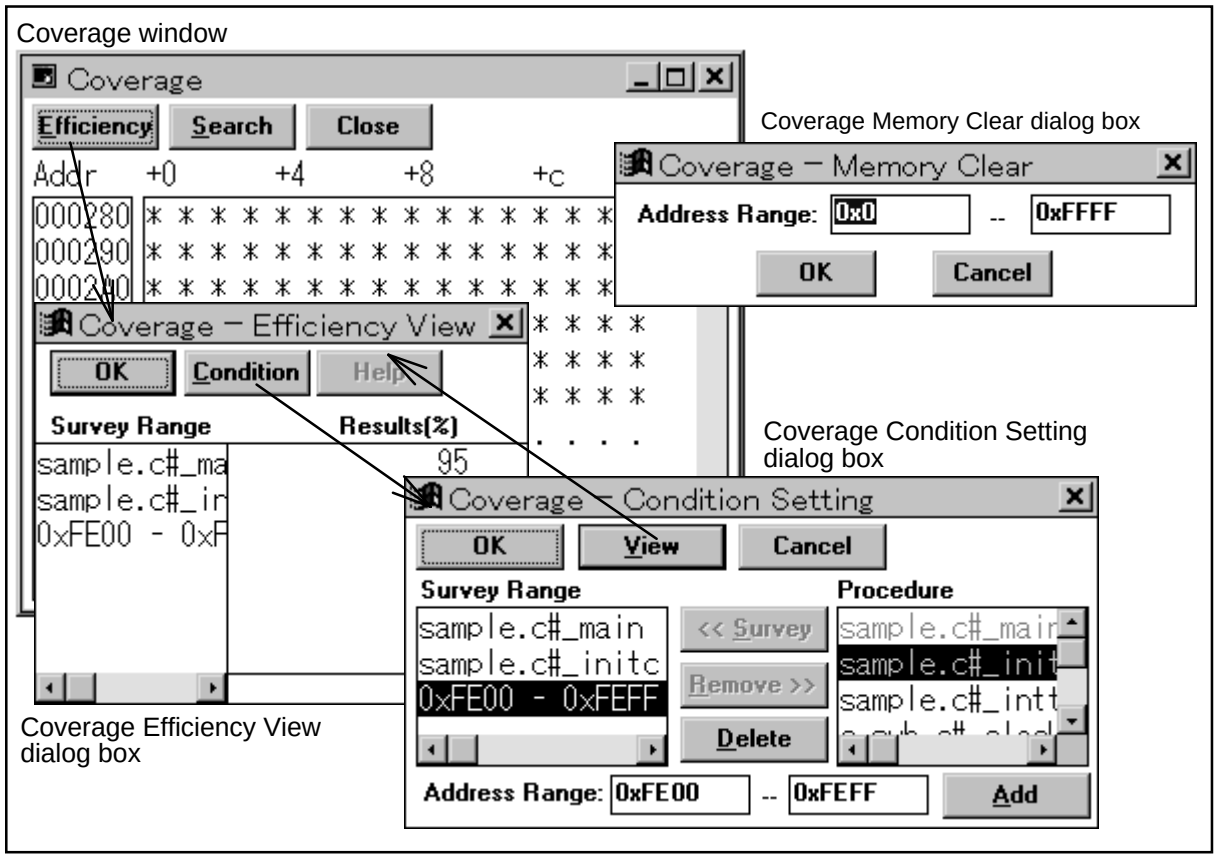
3.1 Verifying the Validity of Evaluation

- Evaluation is essential to the development of a program. If the evaluation of a particularly important item is omitted for some reason, bugs may remain in a program that is offered for retail sale.
- This section describes the use of the coverage functions to verify the validity of evaluation. Note, however, that the validity of evaluation cannot be completely verified based on only the results of coverage.

3.1.1 Coverage

- Coverage is a record of the flow of the execution of a program. While the tracer can trace program execution backwards, coverage merely indicates whether specified instructions within a program have actually been executed.
- The debugger supports coverage for the read, write, and fetch operations.
- The results of coverage can be displayed in the Coverage window.
- The following window and dialog boxes are used for coverage:

Window	Description
Coverage window	Displays the results of coverage.
Coverage Efficiency View dialog box	Displays the coverage results, as a percentage, for each function or specified address range.
Coverage Condition Setting dialog box	Used to add items to be displayed in the Coverage Efficiency View dialog box.
Coverage Memory Clear dialog box	Initializes the coverage memory.



3.1.2 Verifying the Validity of Evaluation Based on Coverage

- Ideally, all possible patterns of program execution should be evaluated. Due to time or other restrictions, however, evaluation may have to be restricted by, for example, sampling and combining several patterns. Evaluation based on sampled patterns must, however, be checked for validity.
- One method of verifying the validity of evaluation is the use of the coverage results to check whether all instructions have been executed.
- The above check can easily be performed by using the Coverage window and the memory map in the link list file (.MAP), output upon linkage of the program.

Verification based on coverage

1. Refer to the memory map in the link list file to identify any free spaces (* gap *) in the program.
2. Refer to the contents of the Coverage window to check whether all memory spaces other than the free spaces, identified in step 1, have been accessed (read, written, or fetched).
3. If any unaccessed space is revealed by step 2, check the program and review the evaluation items. If any free space in the program has been accessed, check that space by, for example, setting event conditions.

Example link list file

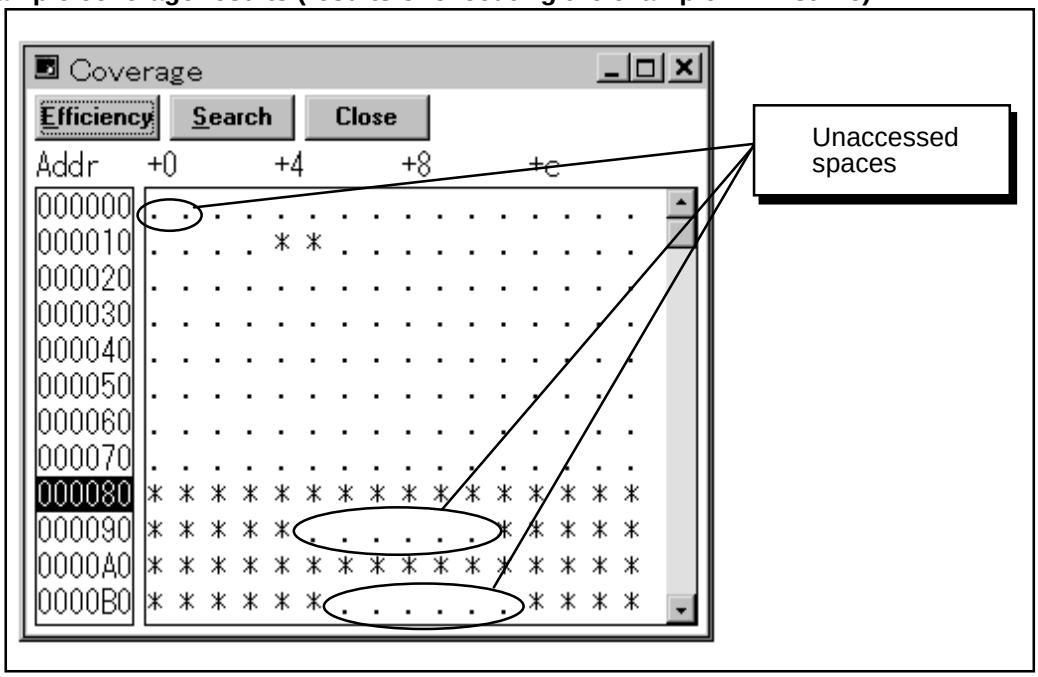
```
*** Memory map ***
  SPACE=REGULAR
  MEMORY=ROM
  BASE ADDRESS=0000H    SIZE=8000H
        OUTPUT   INPUT     INPUT     BASE      SIZE
        SEGMENT  SEGMENT   MODULE    ADDRESS
        @@VECT00                     0000H     0002H    CSEG AT
                 @@VECT00  @cstart   0000H     0002H
* gap *                               0002H     0012H
        @@VECT14                     0014H     0002H    CSEG  AT
                 @@VECT14  SAMPLE    0014H     0002H
* gap *                               0016H     002AH
        @@CALT                       0040H     0000H    CSEG  CALLT0
                 @@CALT    @cstart   0040H     0000H
                 @@CALT    SAMPLE    0040H     0000H
                 @@CALT    C_SUB     0040H     0000H
* gap *                               0040H     0040H

                      Intermediate lines omitted

        @@CNST                       0080H     0000H    CSEG  UNITP
                 @@CNST    @cstart   0080H     0000H
                 @@CNST    SAMPLE    0080H     0000H
                 @@CNST    C_SUB     0080H     0000H
        @@CODE                       0080H     02D1H    CSEG
                 @@CODE    @cstart   0080H     0050H
                 @@CODE    SAMPLE    00D0H     0130H
```

In this example, 0002H to 0013H, 0016H to 003FH, and 0040H to 007FH are free spaces.

Example coverage results (results of executing the example link list file)



In this example, the reset vector at addresses 0 and 1 has not been accessed. The operation performed upon a reset must, therefore, be evaluated.

3.1.3 Notes on Coverage Results

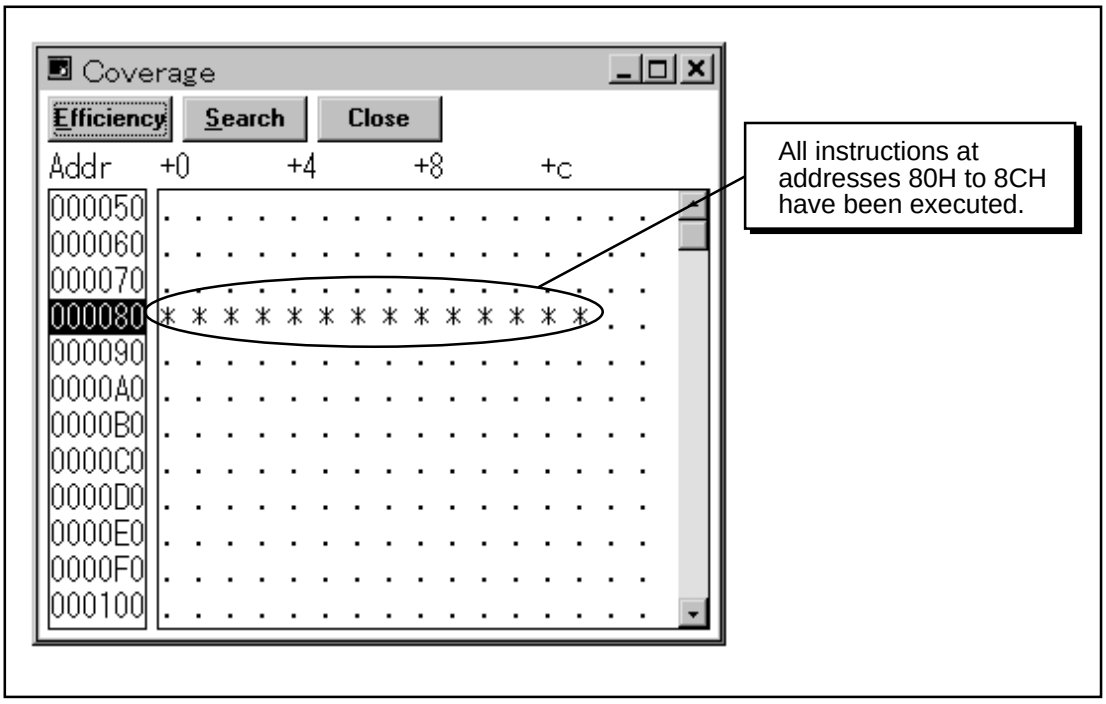
- When checking the coverage results, note the results of conditional branches.
- The IE-78000-R-A supports C0 coverage, which cannot be used to check how processing has branched at a conditional branch instruction.

Example of execution of a conditional branch instruction

1. When the following program is executed from address 80H to 8CH, a conditional branch instruction is executed at address 86H. Execution jumps to address 88H because the condition is false.

```
Addr  Data   Mnemonic
0080  A101   MOV  A,H          ;  Assume that the H register contains 1.
0082  A302   MOV  B,#2H
0084  4D01   CMP  A,#1H
0086  BD02   BNZ  $8AH
0088  610B   ADD  A,B
008A  A200   MOV  C,#0H
008C  00     NOP
```

2. The coverage results are as follows, indicating that all instructions have been executed.



3. Actually, however, the condition may be true, depending on the stored data, thus causing address 88H to be skipped. In such a case, the coverage results do not cover all evaluation items.

3.2 Using External Sense Clips

- External sense clips have various functions. They can be used to post notification of the in-circuit emulator status or output 1-byte RAM data in real-time.
- The use of external sense clips may enable essential processing which has not been possible conventionally.
- External sense clips No. 01 to 08 are provided. The debugger handles them as bits 0 to 7, respectively.

External sense clip number	Debugger handles as:
No.08	Bit 7
No.07	Bit 6
No.06	Bit 5
No.05	Bit 4
No.04	Bit 3
No.03	Bit 2
No.02	Bit 1
No.01	Bit 0

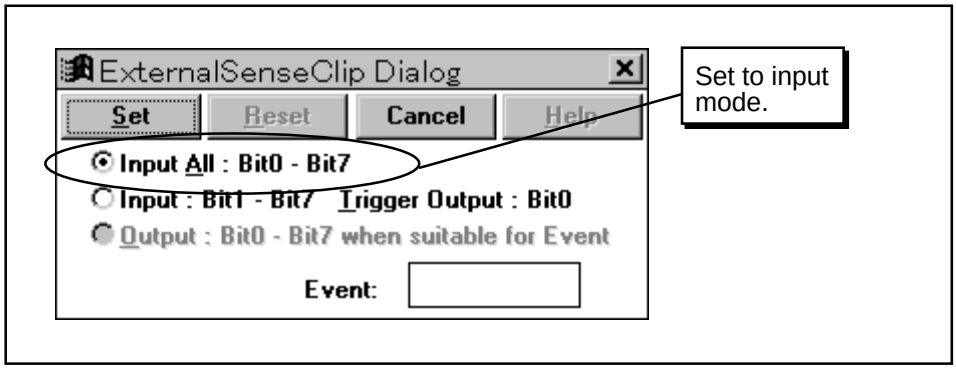
- When external sense clips are set to output mode, they must be pulled up using resistors. In such a case, a voltage exceeding +15 V cannot be applied to the sense clips.
- The tracer traces the potential difference between each external sense clip and GND, regardless of whether the sense clips are set to input or output mode. The HC4050B (used as an input buffer) determines whether the trace data for each external sense clip is 1 or 0.
- The trace data for external sense clips can be used for event conditions, thus enabling the setting of a wide range of event conditions.

3.2.1 Tracing External Data

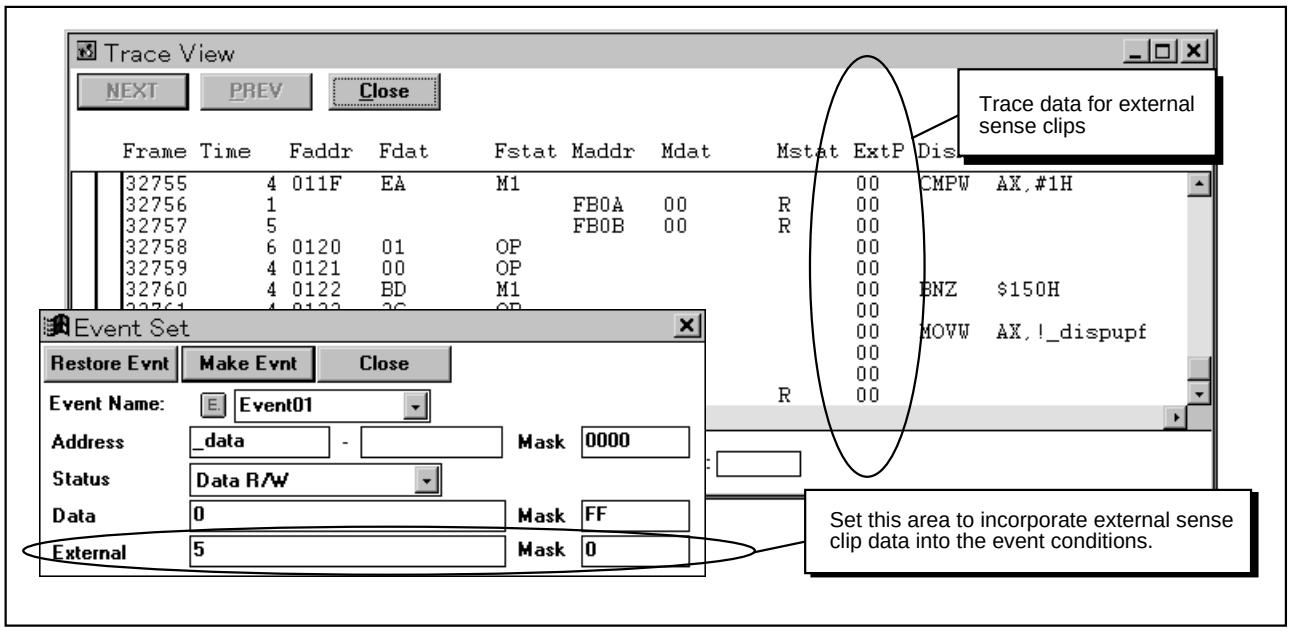
- To trace the state of each pin of the target device, set the external sense clips to input mode (default). Input data can be incorporated into event conditions, such that an event can be triggered by an external source.

Setting procedure

1. Set the external sense clips to input mode.

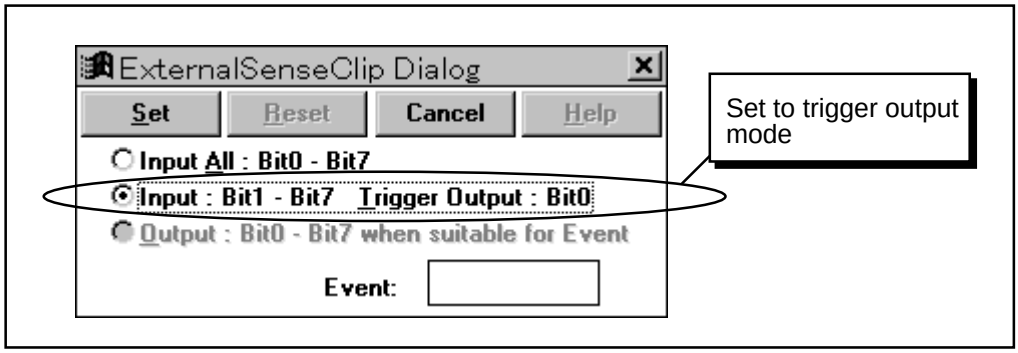


2. Connect external sense clips to the pins to be traced.
3. To set an event, set event conditions using the Event Set dialog box. The results of trace can be checked using the Trace View window.



3.2.2 Trigger Output

- To output the in-circuit emulator status or other data, set the external sense clips to trigger output mode.

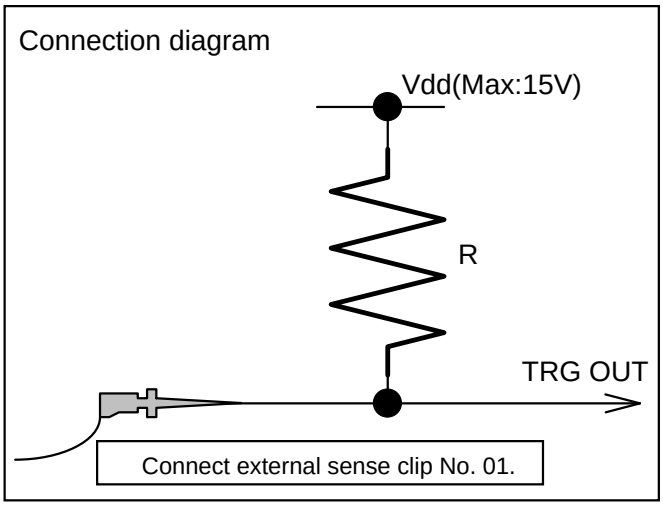


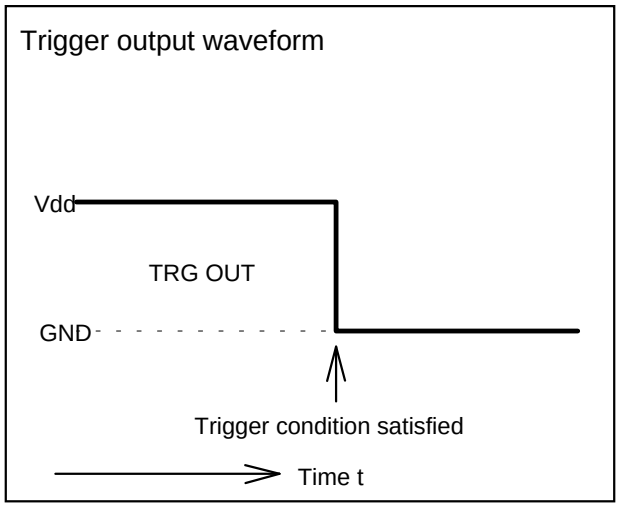
- Trigger output data is output under the following condition:

Trigger output condition
When the pass count becomes 0 upon the occurrence of a break event

Trigger data is not output upon the occurrence of a fail-safe or manual break.

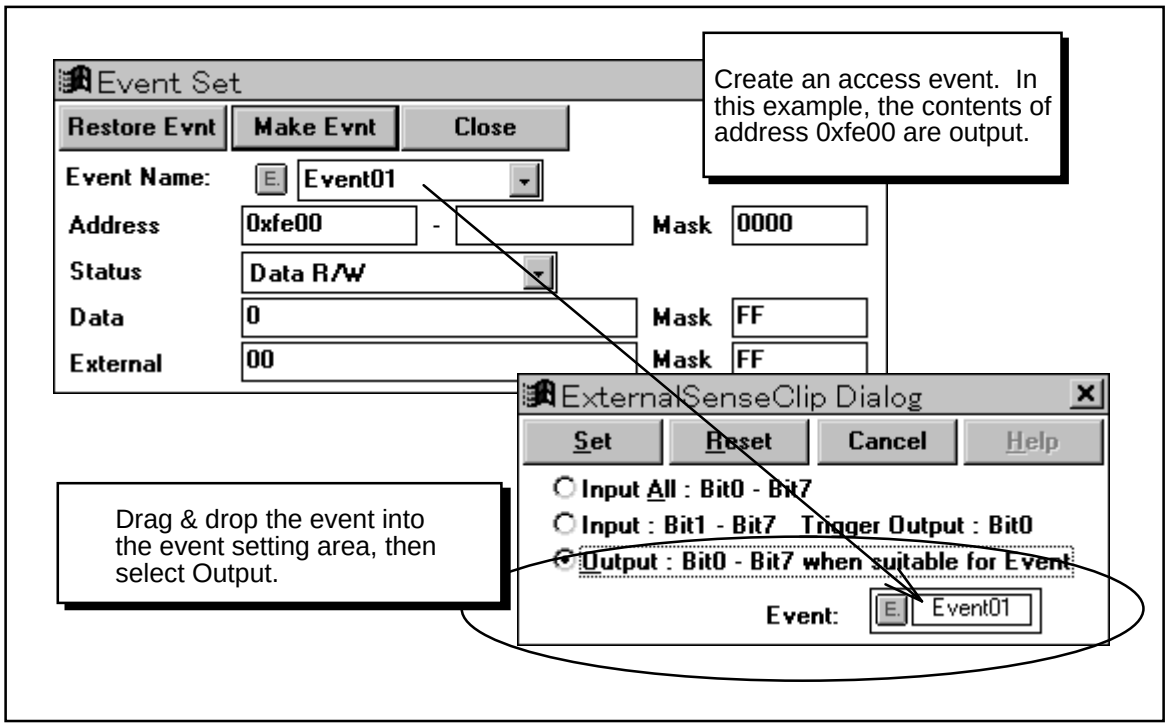
- Trigger output data is output from external sense clip No. 01.
- When external sense clips are set to output mode, they must be pulled up using resistors.



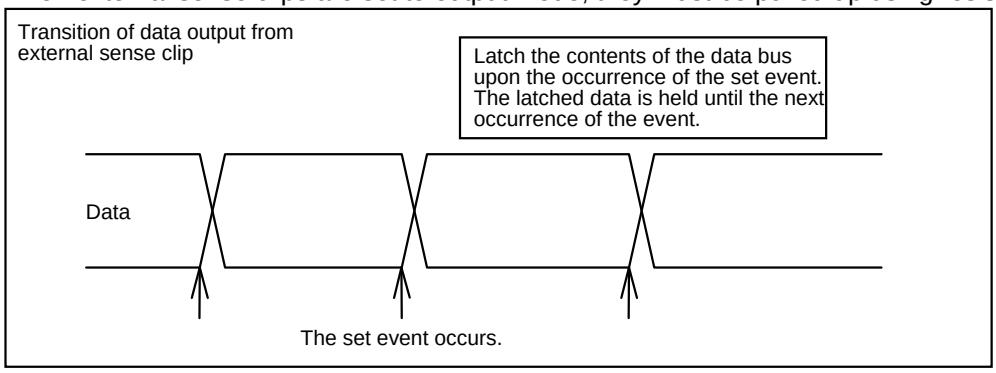


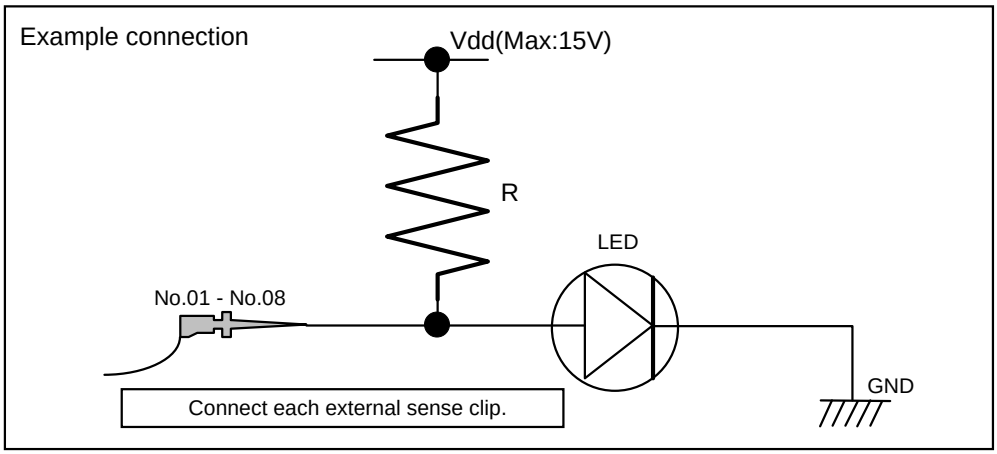
3.2.3 Real-Time RAM Output

- The IE-78000-R-A does not support real-time RAM sampling. Only 1-byte data in memory can be output in real-time, by using event conditions in combination with external sense clips and simple external jigs.



- Because data is being output in real time, it can also be used as a trigger source for other targets.
- When external sense clips are set to output mode, they must be pulled up using resistors.





3.2.4 Creating an Event by ANDing a Data Condition

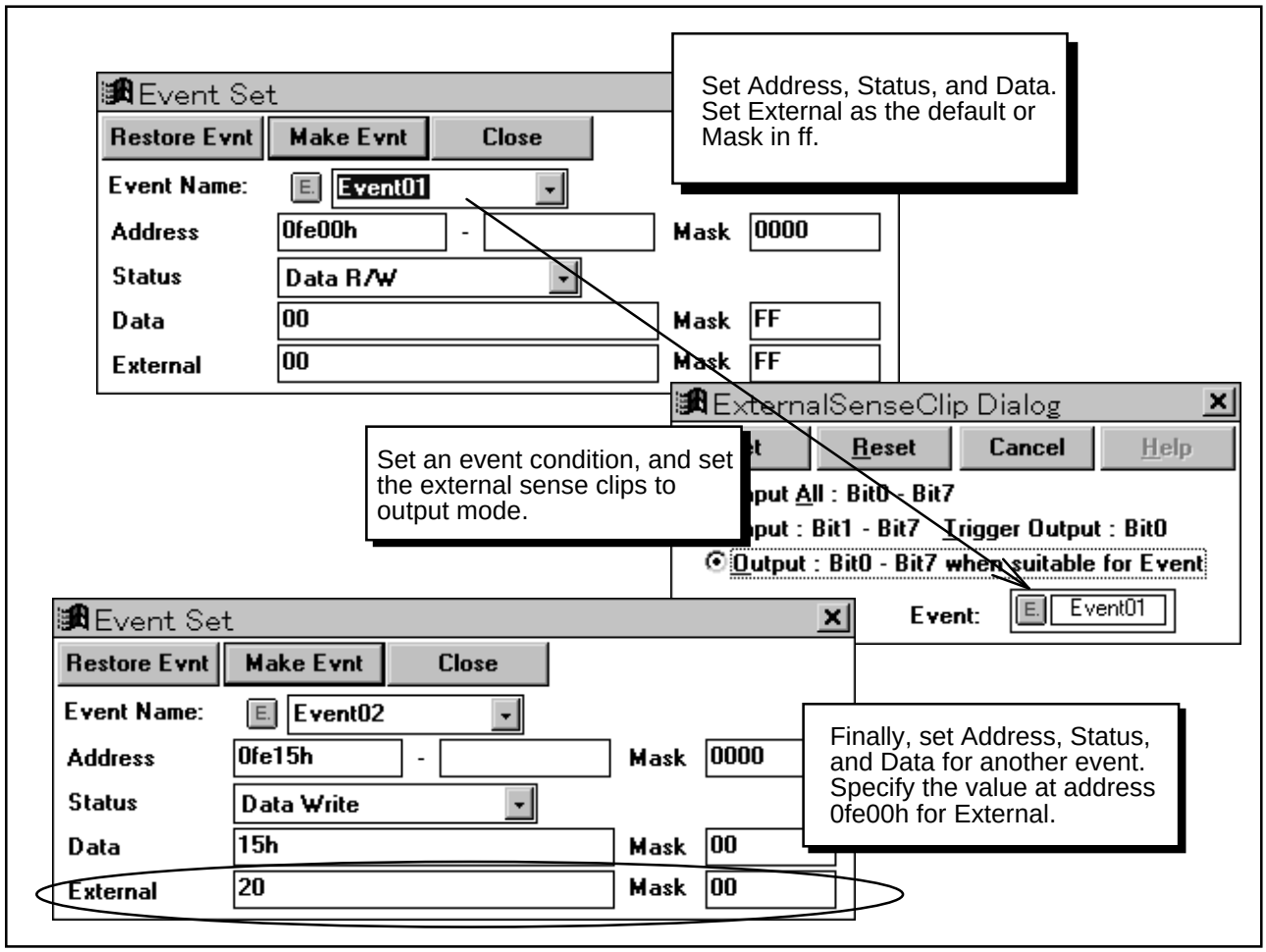
- Advanced events can be created by using external sense clips.
- An event condition can be created by ANDing a data condition, as follows:

Procedure for creating an event condition by ANDing a data condition

1. Create an event having a data condition.
2. Set the event created in step 1 as an output condition for the external sense clips.
3. Pull up the eight external sense clips using resistors.
4. Create an event having an address condition or execution condition.
5. Specify an external sense data condition for the event created in step 4, thus creating an event having a condition ANDing those specified in steps 1 and 4.

Example

Causing an event to occur when 15h is written into address 0fe12h, provided address 0fe00h contains 20h



In this example, one data condition is ANDed with another data condition. A data condition can also be ANDed with an execution condition. An event condition like that shown above can be set for various events, thus enabling the creation of advanced events. First try specifying "on."

3.3 Measuring Time by Setting Conditions

- The timer measurement function of the IE-78000-R-A does not support the setting of event conditions. The user may, however, require information such as the intervals that elapse between a function being called, or whether timer interrupts are generated correctly and on time.
- Time measurement using event conditions in combination with the tracer is described below.

Setting procedure

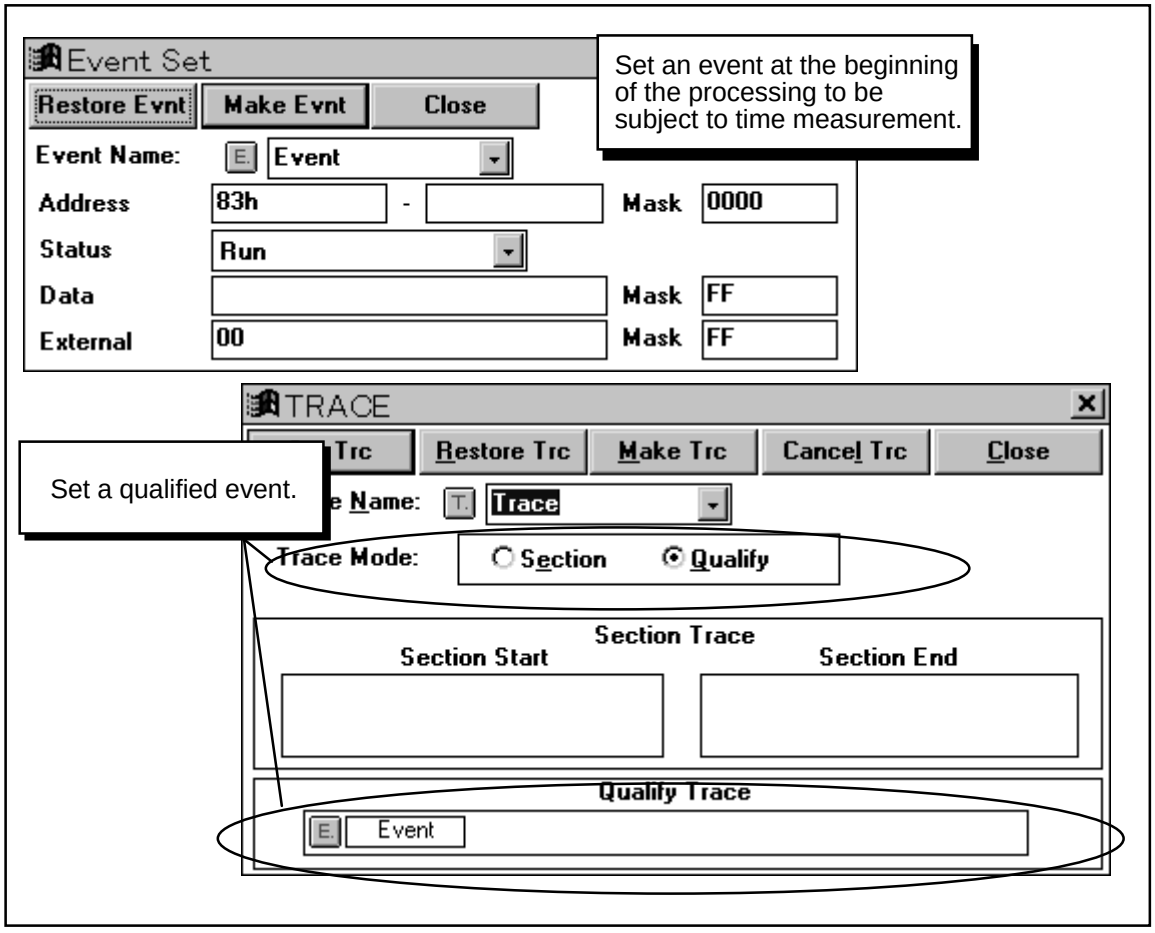
1. Set an event at the beginning of the function for which time will be measured. The following program is used as an example:

Example program to be subject to time measurement

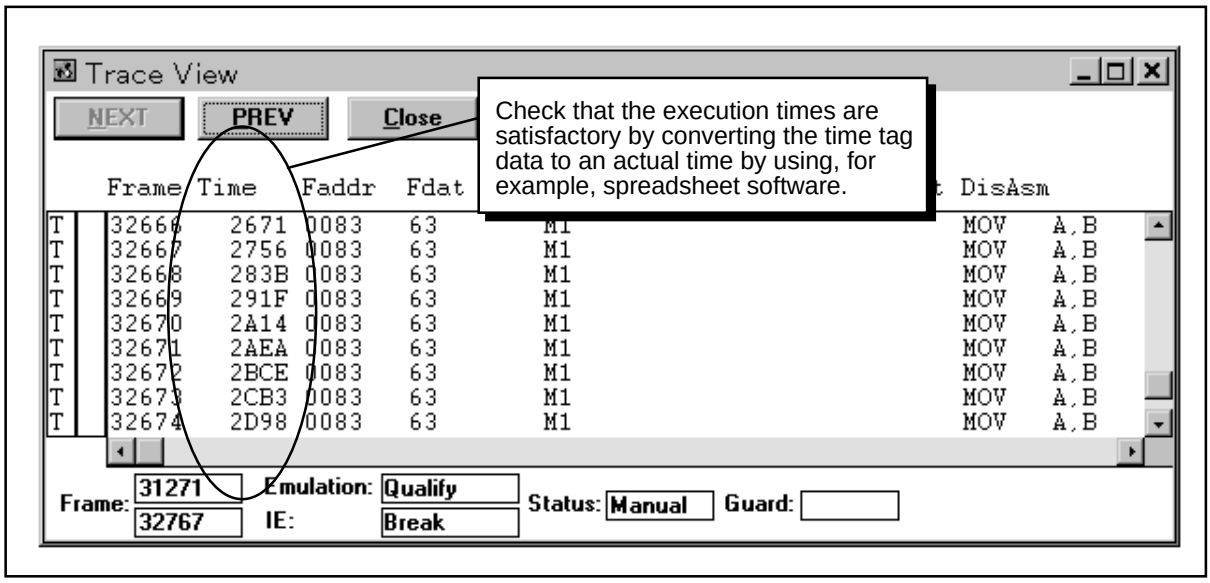
```
      Addr Data   Mnemonic
   >  0080 A300   MOV   B,#0H
      0082 43     INC   B
T     0083 63     MOV   A,B                ; Set an event.
      0084 8BFE   DBNZ  B,$84H
      0086 73     MOV   B,A
      0087 FAF9   BR    $82H
```

This program executes an infinite loop between addresses 82H and 87H. The intervals (µs) between the executions of the instruction at address 83H are measured.

2. Set event and trace conditions as follows:



3. After the event and trace conditions have been set, the execution of the program is traced as follows:



4. Save the trace results to a file. The execution times can be obtained by converting the time tag data to actual times by using, for example, spreadsheet software.

Conversion results

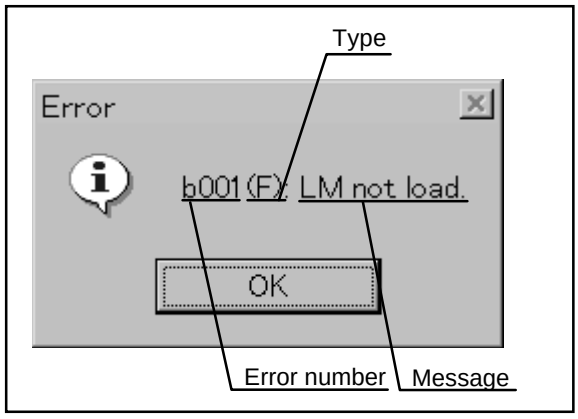
Frame number	Time tag data [hex]	Actual time [μs]
32666	0x2671	984.1
32667	0x2756	1007.0
32668	0x283B	1029.9
32669	0x291F	1052.7
32670	0x2A14	1077.2
32671	0x2AEA	1098.6
32672	0x2BCE	1121.4
32673	0x2CB3	1144.3
32674	0x2D98	1167.2

Time tag data is counted every 100 ns. To obtain an actual time, convert hexadecimal to decimal, then convert the radix.

Appendix A Error Messages

This appendix lists the error and warning messages output by ID78K0.

An error message consists of error number+type+message.



A type is represented by an alphabetic character. There are three types:

Type	Explanation
A	Abort error. Processing is interrupted and the debugger ends. If this error occurs, debugging cannot be continued.
F	Format (syntax) error. Processing is interrupted. The currently open windows and dialog boxes are closed.
W	Warning. Processing is interrupted. The currently open windows and dialog boxes remain as is.

A message contains the names of the file, variable, and device related to the error, as follows:

Representation in message	Explanation
xxx	Low-order three digits of device name
yyy	File name
zzz	Function name

Error messages (1/9)

Error No.	Type	Message	Explanation
---	--	Can't open this file. please make sure, now Active Window.	The project file format is incorrect, or the file content has collapsed. Loading the project file was discontinued.
---	--	Cannot find "character string".	The search character was not found. The search was discontinued. Alternatively, opening the specified file was discontinued because no data was in the file.
---	--	Event Name is not set.	There is no event name. Specify the name of the event when adding it.
---	--	Event number already exist.	It is impossible to add an event having the same number as an existing event. Change the number of the event to be added or of the existing event.
---	--	Not enough memory.	Because of insufficient memory, a window cannot be displayed, its content cannot be changed, or changes to it cannot be retained. Assign sufficient memory, and retry.
---	--	Other view mode window exist.	Two or more active windows of the same type cannot be opened simultaneously. An active window that was already open was closed.
---	--	Sorry, Too large view file.	The specified view file (.MEM, .TVW, or .DIS) contains more than 1000 lines. Its display was discontinued.
---	--	"event name" is already exist.	It is impossible to add an event having the same name as an existing event. Change the name of the event to be added or of the existing event.
0001	A	Communication open error	Communication with the in-circuit emulator (IE) is not possible.
0003	A	Hardware error	A hardware error is detected.
0004	A	Monitor time out	Data was not transferred to and from the monitor program. Clock pulses may not be being supplied to the target CPU or power may not be supplied. Check the above and restart the debugger.
0005	A	Not found monitor file	The monitor file is not found.
0006	A	Monitor file error	A monitor file error is detected.
0009	A	Communication failed	Communication with the IE failed.
000a	A	Verify error	A verify error is detected.
000e	A	User program Cannot run	The user program cannot be executed.
000f	A	Illegal receive data	An illegal response is received.
0012	A	Emulation-Board conflicts with Device-file	The EM board ID does not match the value in the device file.
0014	W	Target power off	The power of the target device is off.
0015	W	Program is running	The user program is running.
0016	W	Already break	The user program is already in the break status.
0017	W	Tracer is running	The tracer is running.

Error messages (2/9)

Error No.	Type	Message	Explanation
0018	W	Timer is running	Timer measurement is in progress.
001d	W	Measure is off	Timer measurement is not performed.
0020	W	Execution mode error	An execution mode error is detected.
0021	W	Mapping error	A mapping error is detected.
0022	W	Trace block not found	The specified trace block does not exist.
0023	W	There is no trace data	There is no trace data.
0024	W	Trace range over	The trace range has been exceeded.
0026	W	Bus hold mode	The bus hold mode is active.
0077	F	Search data not found	The search data does not exist.
0078	F	Measure overflow	The timer measurement result overflowed.
007a	F	Not specified coverage range	The coverage range has not been specified.
007e	W	Event No.3 is using	Event condition No. 3 is in use.
00c8	W	User program is stepping	The user program step is being executed.
01a1	A	Invalid EX78Kx.OM0	The executor file (EX78K0.OM0) was not read correctly. The executor file may not exist or may have been destroyed. Install the executor file again and restart the debugger.
01a3	A	Unconnected Emulation-board	The emulation board (IE-780xx-R-EM) is not correctly connected. Connect the IE-780xx-R-EM to the IE-78000-R-A correctly.
01a5	A	Unconnected I/O emulation-board	Emulation board 1 (IE-78xxx-R-EM1) is not correctly connected. Connect the IE-78xxx-R-EM1 to the IE-78000-R-A correctly.
01a6	A	Executor is running	The executor is running.
01a8	A	Invalid EXPC.INI	The initialize file (EXPC.INI) was not read correctly. The initialize file may not exist or may have been destroyed. Install the initialize file again and restart the debugger.
0600	A	Communication buffer error	The area for the buffer used for exchanging data with the IE was not reserved. End other MS-Windows applications, change the setting of the MS-Windows swap file, or install additional main memory in the host machine.
0f13	A	Send timed out	Data transmission to the IE failed. Possible causes include an invalid interface board setting and IE power off condition. Install the initialize file again, then restart the debugger.
0f14	A	Receive timed out	No response was received from the IE. The IE may be abnormal. Check the IE and restart the debugger.
0f15	A	Invalid D0xxx.78K	The device file (D0xxx.78K) cannot be read correctly. The device file may not be located in the specified directory or it may have been destroyed. Install the device file again, then restart the debugger.

Error messages (3/9)

Error No.	Type	Message	Explanation
1000	A	failure in initialization	An attempt to initialize the IE failed. Check whether the IE is abnormal.
1003	F	Illegal relocation address	It is impossible to relocate to a specified address.
1004	F	Illegal parameter	The parameter is illegal.
1006	F	Illegal address	The address is illegal.
1007	A	Not enough substitute memory	An attempt was made to map IE alternate memory in an area of 64K bytes or more.
100b	F	Program Is Running	A user program is running. This command cannot be executed.
100c	F	Different Bussize	An attempt was made to make duplicate specification in areas having different bus sizes.
100d	F	Total Maximum Over	An attempt was made to specify a bus larger than the maximum size (8).
100e	F	Enable Maximum Over	The bus size is larger than 8.
100f	W	Wrong Target Status(Power Off)	The target state is unstable.
10ff	A	Communication Error	It is impossible to communicate with the IE. Check whether the IE is abnormal.
2000	F	Illegal sfr name	The SFR name is illegal.
2002	F	User program is running	A user program is running. This command cannot be executed.
2003	F	Illegal SFR number	An attempt was made to access a nonexistent SFR.
2004	F	Illegal bit number	There is no bit SFR at the specified bit position.
2005	W	Redraw sfr name	The SFR has been disabled from redrawing.
2006	F	This SFR is hidden SFR	This SFR is not open to general use. It is impossible to display or change data for the SFR.
2007	F	Can’t Read/Write	An attempt was made to write to a write-protected SFR or read from a read-protected SFR.
2008	F	Too big number	The specified SFR was not found.
200a	F	Illegal Bit Pattern	An attempt was made to specify an illegal value for an SFR.
20ff	A	Communication Error	Communication with the IE is impossible. Check whether the IE is abnormal.
3000	F	Illegal address	The address is illegal.
3001	F	Different data	There is a memory content mismatch.
3002	F	Illegal source address	The specified source address range does not fall within the mapping range (during a memory search, comparison, or copy).
3003	F	Illegal destination address	The specified destination address range does not fall within the mapping range (during a memory search, comparison, or copy).
3004	F	Illegal address (source & destination)	The specified address range does not fall within the mapping range (during a memory search, comparison, or copy).
3005	F	Illegal parameter	The parameter is illegal.
3006	F	User program is running	A user program is running. This command cannot be executed.
3008	F	No Parameter	There is no parameter.

Error messages (4/9)

Error No.	Type	Message	Explanation
3009	F	Parameter Size Alignment Error	The parameter size is illegal. Change the parameter according to the memory access size.
300a	F	Memory Alignment Error	The address value is illegal. Change the address value according to the memory access size.
300b	F	Source Start Address Alignment Error	The source address is illegal. Change the source address according to the memory access size.
300c	F	Error, Destination Start Address Alignment Error	In the destination address range, a memory range with a conflicting access memory size was specified.
300d	F	End Address Alignment Error	The end address is illegal. Change the end address according to the memory access size.
300e	F	Different Access Size in This Area	In the address range, a memory range with a conflicting access memory size was specified.
300f	F	Different Access Size in Source Area	In the source address range, a memory range with a conflicting access memory size was specified.
3010	F	Different Access Size in Destination Area	In the destination address range, a memory range with a conflicting access memory size was specified.
3011	F	Different Access Size, Source & Destination	The access size conflicts between the source and destination address ranges.
30ff	A	Communication Error	Communication with the IE is impossible. Check whether the IE is abnormal.
4000	F	Number is referenced now	The specified event condition cannot be deleted.
4001	F	Illegal table number	The specified table number is illegal.
4002	F	Illegal start address	The start address is illegal.
4003	F	Illegal end address	The end address is illegal.
4004	F	Illegal status	The status is illegal.
4005	F	Illegal data	The data is illegal.
4006	F	Can’t action number	An attempt was made to use an event number that was already in use.
4007	F	Can’t empty number	An attempt was made to register more than 32,767 events of the same type.
4008	F	Table not found	The specified event has not been registered.
4009	F	Illegal data size	The data size is illegal.
400a	F	Illegal type mode	The mode is illegal.
400b	F	Illegal parameter	The parameter is illegal.
400c	F	Illegal type number	The type is illegal.
400d	F	Table overflow	An attempt was made to register more than 32,767 events of the same type.
400e	F	No entry event number	The specified event does not exist.
400f	F	Illegal Elink data	An event condition specified with a range condition or pass condition was used as an event link condition. Alternatively, only one event condition was specified.
4010	F	Function not found	The specified function was not found.
4011	A	No free memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.
4012	F	Timer not enabled	The timer is disabled. Enable it if timer measurement must be made.

Error messages (5/9)

Error No.	Type	Message	Explanation
4013	W	Data access size mismatch at the bus size	The access size in an event condition does not match the bus size for mapping.
4014	F	Can't use software break	At present, no software break can be used. Specify that a software break be usable, using the Extended Option dialog box.
4015	F	Not point-address	It is impossible to use, as an address condition, an event condition specifying a range.
4016	F	Not renew event condition.	This event condition is being used for another event. It is impossible to change the address range condition or pass count condition.
4017	F	Specified odd-address by word-access.	The data value was not detected in word data beginning at an odd address. Do not include that data value in the setting.
5000	A	Illegal type number	The type is illegal.
5002	A	Illegal file name	The device file cannot be opened.
5003	A	Cannot file seek	An attempt to seek the file failed.
5004	A	Cannot file close	An attempt to close the file failed.
5005	A	Illegal device format	The format of the device file is illegal.
5006	A	Cannot device initialize	An attempt to initialize the IE failed.
5007	A	Illegal device information	There is no device information.
5008	F	Cannot open device file	The specified device file cannot be opened.
5009	F	Cannot open EX78KX.OM0 file	The EX78K0.OM0 cannot be opened.
500a	F	No match device file of version	The version of the device file is illegal.
500b	W	Device has no relocatable iram.	The currently selected device does not support relocation in internal RAM.
6001	F	Illegal entry symbol name	The symbol name is illegal.
6002	F	Illegal parameter	The parameter is illegal.
6003	F	Illegal entry function name	The function name is illegal.
6004	F	Out of Buffer flow	Function display in the Stack window is incomplete. The maximum allowable line size is 512 characters.
6005	F	Illegal expression	The expression is illegal.
7001	F	User program is running	A user program is running. This command cannot be executed.
7002	F	User program is stopped	A user program is at a break. This command cannot be executed.
7003	F	Trace function is active	The tracer is running. This command cannot be executed.
7004	F	Trace memory is OFF	The tracer is off.
7005	F	No Return Address, Can't Execute	The return address of the current function was not found. Step execution based on the Return command is not carried out.
7010	W	Warning, No Source Line Information	Instruction-level step execution was carried out because there was no source information.
7012	A	Not enough memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.

Error messages (6/9)

Error No.	Type	Message	Explanation
70fe	A	Bus Hold Error	The bus is on hold. The user program cannot be executed.
70ff	A	Communication Error	Communication with the IE is impossible. Check whether the IE is abnormal.
7801	F	Step wait canceled	Step execution was discontinued. So, communication with the IE may become impossible.
7802	F	Step aborted	An illegal access break occurred during step execution. Check the user program.
7f00	F	Interrupted step	Step execution was forced to end.
7f02	F	Suspended step	Step execution was suspended.
7f03	A	Run/Step cancel failed. CPU resetted	An attempt to break the user program failed. The IE is unstable because the evaluation chip was reset. Make sure that the IE is normal, then restart it.
7f04	F	Illegal address	An attempt was made to execute in an non-mapped area.
8000	F	File not found	The file was not found.
8001	F	Illegal line number	The line number is illegal.
8002	F	Current data is not set	The current information has not been set.
8003	F	Ilegal address	The address is illegal.
9002	F	Illegal set value	The specified value cannot be set in a register. Specify a value that can be set.
a001	F	Illegal expression	The expression is illegal.
a002	F	Start address bigger than end address	The start address is greater than the end address (start address > end address). Check the addresses.
a003	F	Source path not found	The specified source path information is illegal. Specify the correct source path information.
a004	F	Expression is too big	The size of the expression is greater than 127 characters.
a005	A	Not enough memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.
a006	F	Illegal argument	The argument is illegal.
a008	F	Source path not set	The source path has not been specified.
a009	F	File not found	The file was not found.
a00a	F	File not open	The file cannot be opened.
a00b	A	File not close	An attempt to close the file failed.
a00c	A	File not read	An attempt to read the file failed. It is likely that the file has collapsed.
a00d	F	Not source file of LM	The specified source file has not been registered for the load module file. A file not registered for the load module file cannot be displayed in the Source window.
a00e	F	Illegal line number	The line number is illegal.
a00f	F	Illegal variable	The variable does not exist.
a010	A	Communication failed	Communication with the IE is impossible. Check whether the IE is abnormal.

Error messages (7/9)

Error No.	Type	Message	Explanation
a011	F	Can't access register	The register cannot be accessed. Check the IE.
a012	F	Can't access memory	The specified memory (variable) cannot be accessed. Check the IE or map setting.
b000	F	Command line error	The parameter is illegal.
b001	F	Task type not found	The load module file does not contain program information.
b002	F	File not found	The file was not found.
b003	F	Function not found	The specified function was not found.
b004	F	Illegal magic number	The magic number for the load module file is illegal.
b005	F	Symbol not found	The symbol was not found.
b008	F	Illegal value	The expression is illegal.
b009	A	Not enough memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.
b00a	F	Illegal symbol entry	There is an illegal symbol in the load module file. It is likely that there is a bug related to the programming language.
b00b	F	Current type noting	There is no debug information. Load the load module file.
b00c	F	Current file noting	There is no current source file. Alternatively the source file cannot be opened because the load module file has not been loaded.
b012	F	Line number too large	The line number is illegal.
b015	A	Read error	An attempt to read the file failed. It is likely that the file has collapsed.
b016	A	Open error	The file cannot be opened.
b017	A	Write error	An attempt to write to the file failed.
b019	A	Seek error	An attempt to seek the file failed.
b01a	A	Close error	An attempt to close the file failed.
b01d	F	Address not found	There is no source line that corresponds to the current PC value.
b01e	F	No line information(not compile with -g)	There is no source line information in the load module file. Attach the debug option, and carry out recompilation, assembly, and linkage.
b01f	F	Cannot find member	No member was found in the specified structure.
b020	F	Cannot find value	The specified enumeration constant is illegal.
b021	F	Striped LM	There is no symbol information in the load module file.
b022	F	Null statement line	The line number is illegal.
b026	F	Max dimension array over	A four-dimensional or greater-scale array cannot be displayed.
b027	F	End of file	The file is not complete.
b029	F	Illegal address	The address is illegal.
b02a	A	Communication failed	Communication with the IE is impossible. Check whether the IE is abnormal.
b02b	F	No stack frame point	Stack tracing is impossible with the current PC value.

Error messages (8/9)

Error No.	Type	Message	Explanation
b02c	F	Max block overflow	The maximum number of blocks in one function is exceeded. The function cannot be displayed. (The maximum number of blocks per function is 256.)
b02d	F	Illegal argument	The argument is illegal.
c001	F	Cannot open file	The file cannot be opened.
c002	A	Cannot close file	An attempt to close the file failed.
c003	A	Cannot read file	An attempt to read the file failed. It is likely that the file has collapsed.
c004	A	Cannot seek file	An attempt to seek the file failed.
c005	F	Illegal file type	The format of the file is illegal. This file cannot be handled.
c006	F	Illegal magic number	The magic number for the load module file is illegal.
c007	F	This file is not load-module file	The specified file is not a load module file.
c008	F	Old coff version	The version of the load module file is illegal.
c009	A	Not enough memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.
c00a	F	Illegal address	The address is illegal.
c00b	F	LM not load	The load module file has not been loaded.
c00c	F	Illegal argument	This is an internal error.
c00d	F	User program is emulating	A user program is running. This command cannot be executed.
c00e	F	User program is tracing	The tracer is running. This command cannot be executed.
c010	A	Communication failed	Communication with the IE is impossible. Check whether the IE is abnormal.
c011	F	Illegal file format	The format of the load module file (LNK) is illegal.
c012	F	Check sum error	A checksum error occurred in reading the load module file. Check the load module file.
c013	F	Too big size	The address range for uploading has exceeded 1M byte.
c014	F	Cannot write file	An attempt to write to the file failed.
c100	F	Not support	The Tektronix format is not supported.
d001	F	Not enough memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.
e000	F	Illegal argument	This is an internal error.
e001	F	Illegal start address	The start address is illegal.
e002	F	Illegal end address	The end address is illegal.
e003	F	Size too long	The address value is illegal.
e004	F	Can’t open file	The specified file cannot be opened.

Error messages (9/9)

Error No.	Type	Message	Explanation
e005	F	Can’t read file	An attempt to read the file failed. It is likely that the file has collapsed.
e006	F	Can’t seek file	An attempt to seek the file failed.
e007	F	Can’t write file	An attempt to write to the file failed.
e008	F	Not enough memory	There is no sufficient memory. End unnecessary applications, or close the Debugger window.
e009	F	Illegal file format	The format of the file is illegal.
XXXX	F	Internal error	An internal error occurred.

Appendix B Key Functions

Debugging can be carried out more effectively when ID78K0 is operated using the special function keys. In the following explanation of the special function keys, general key representations (generic key representations) are used. For the IBM-PC/AT Series, the key representations may differ slightly depending on the keyboard type.

B.1 Functions of Special Function Keys

Key		Function
PC-9801 and 9821 Series	**IBM-PC/AT Series**	
BS	BackSpace	Deletes the character immediately before the cursor and moves the cursor to the position of the deleted character. The character string following the cursor is moved back.
COPY	PrintScreen	Captures the entire screen into the clipboard as a bit image. (Windows function)
ESC	Esc	**<1>** Closes the pulldown menu. **<2>** Closes the modal dialog box.
GRPH	Alt	Moves the cursor to the menu bar.
HELP	End	Displays the last line. Also, the cursor is positioned to the last line.
HOME CLR	Home	Displays the first line. Also, the cursor is positioned to the first line.
ROLL UP	PageUp	Scrolls the display up by one screen. Also, the cursor is positioned to the top of the screen.
ROLL DOWN	PageDown	Scrolls the display down by one screen. Also, the cursor is positioned to the top of the screen.
SPACE	Space	Inserts one blank.
TAB	Tab	Positions the cursor to the next item.
↑	↑	Moves the cursor up. Scrolls the screen down by one line when the cursor is positioned to the top of the screen.
↓	↓	Moves the cursor down. Scrolls the screen up by one line when the cursor is at the bottom of the screen.
←	←	Moves the cursor to the left. Scrolls the screen to the right by one item when the cursor is in the leftmost column.
→	→	Moves the cursor to the right. Scrolls the screen to the left by one item when the cursor is in the rightmost column.
↵	↵	Confirms input data.

B.2 Functions of Special Function Keys (CTRL + Key)

Key (Common to the PC-9801, 9821, and IBM-PC/AT Series)	Function
A	Using the data value in the current window as an address to jump to, disassembles and displays the program starting from that address. Opens the Assemble window.
B	Sets a breakpoint in a selected line.
C	Copies a selected character string to the clipboard buffer.
D	PC setting and window view: The Call dialog box is opened.
E	PC setting.
F	Switches a window to modify mode. This has the same effect as clicking the ToModify button.
G	Executes a program. This has the same effect as clicking the  button.
H	Switches a window to the Hold state.
I	Switches a window to the Active state.
M	Using the data value in the current window as an address to jump to, displays the contents of memory starting from that address. Opens the Memory window.
O	If the Source window is current: Allows the user to select a source view file. Opens the source file select dialog box. Otherwise: Displays an appropriate view file in the current window. Opens the view file save dialog box.
P	Stops the execution of a program. This has the same effect as clicking the  button.
R	Performs step execution until control returns to the calling function. This has the same effect as clicking the  button.
S	Saves the contents of the current window to a view file.
T	Performs step execution. This has the same effect as clicking the  button.
U	Using the data value in the current window as an address to jump to, displays an appropriate source text and source line. Opens the Source window.
V	Pastes the contents of the clipboard buffer to the text cursor position.
W	Switches a window to view mode. This has the same effect as clicking the ToView button.
X	Performs Next step execution. This has the same effect as clicking the  button.
Z	Cancels the previous editing operation.

Appendix C Menus

This Appendix lists the menus supported by ID78K0.

Symbols used in the menu lists

Symbol	Meaning
[Item]	Item on a menu bar
No symbol	Item in a pull-down menu
→ **(arrow)**	Item in a cascaded menu The number of arrows corresponds to the nesting level.

Table C-1 Main Window (1/4)

Menu	Mnemonic	Explanation
[File]		
Open...	CTRL+O	Opens a file.
Save	CTRL+S	Saves the contents of the current window into the view file.
Save As...		Saves the contents of the current window into a view file having a different name.
Close		Closes the current window.
Print		Prints the contents of the current window.
Down load...		Downloads a program.
Up load...		Uploads a program.
Open/Save Project ▶		
→Open Project...		Opens a project file.
→Save		Overwrites the project file with the current debugging environment.
→Save As...		Saves the current debugging environment into a project file.
Open/Save Log		Records the history of execution.
Exit		Exits from the debugger.
[Edit]		
Undo	CTRL+Z	Cancels the most recent editing.
Copy	CTRL+C	Copies a selected character string into the clipboard buffer.
Paste	CTRL+V	Pastes the contents of the clipboard buffer at the point to which the text cursor is positioned.
Write in		Writes the modified contents into the target device.
Restore		Cancels the modified contents.
Memory ▶		
→Memory Fill...		Initializes memory.
→Memory Copy...		Copies the contents of memory.
→Memory Compare...		Compares the contents of memory.
→File Compare...		Compares the view file with the contents of memory.

Table C-1 Main Window (2/4)

Menu	Mnemonic	Explanation
[View]		
Search...		Searches for a character string or numerical value.
Address...		Displays the contents of memory at a specified address.
View Variable...		Displays the value of a specified variable temporarily.
Watch Variable...		Displays the value of a specified variable continuously.
Add Variable...		Adds a variable to the Variable window.
Sym To Adr...		Converts symbols.
Delete		Deletes a specified value.
Bin		Selects binary display format.
Oct		Selects octal display format.
Dec		Selects decimal display format.
Hex		Selects hexadecimal display format.
Proper		Selects a default display format for each variable.
Event ?		Displays event information.
Memory ▶		
→Nibble		Displays data in nibble format.
→Byte		Displays data in byte format.
→Word		Displays data in word format.
→Long		Displays data in long format.
→Ascii		Switches on or off ASCII view mode.
Sfr ▶		
→Address Sort		Selects alphabetic display order or display in order of addresses.
→Pick Up		Displays only modified SFRs.
→Attribute ▶		
→→Show		Displays the attribute view area.
→→Hide		Hides the attribute view area.
→Compulsion Read		Performs forced reading of a read-protected SFR.
→Synchronize		Writes the modified SFRs to the target device.
Trace View ▶		
→Trace View...		Selects the trace view contents.
→Snap View...		Selects the snapshot trace view contents.
→Normal Title		Displays the trace frame titles.
→Snap Title		Displays the snapshot frame titles.
→All Title		Displays all titles.
→Open Frame...		Specifies a view frame number.
→Pick Up...		Selects a view frame.
Coverage ▶		
→ 1 Byte		Displays data in 1-byte units.
→64 Byte		Displays data in 64-byte units.

Table C-1 Main Window (3/4)

Menu	Mnemonic	Explanation
[Option]		
Tool Bar		Displays or hides the tool bar.
Status Bar		Displays or hides the status bar.
Button		Displays or hides the buttons in the window.
Source Mode		Selects the source mode.
Instruction Mode		Selects the instruction mode.
Configuration...		Sets the environment.
Source Path...		Sets source path information.
Extended Option...		Sets extended options.
Mask Option...		Sets mask options.
[Execute]		
Stop	CTRL+P	Stops the execution of a program.
Go	CTRL+G	Executes a program.
Return	CTRL+R	Executes a program, step by step, until control is returned to the calling function.
Step	CTRL+T	Executes a program step by step.
Next	CTRL+X	Performs Next step execution of a program.
Go & Go		Repeatedly executes a program.
Go & Come		Executes a program up to a specified address.
Slowmotion		Continues step-by-step execution.
CPU Reset & Go		Resets the CPU before starting execution.
CPU Reset...		Resets the CPU.
Set BP	CTRL+B	Sets a breakpoint.
Set PC	CTRL+E	Sets the address in the program counter.
Call...	CTRL+D	Sets PC in the specified address and moves.
ExtSenceClip...		Sets external sense clip mode.
Trace ▶		
Cond. Trace		Sets conditional tracing mode.
Machine All. Trace		Sets machine cycle, all-tracing mode.
Event All. Trace		Sets event cycle, all-tracing mode.
Trace Full Break		Breaks after full tracing.
[Operation]		
Active	CTRL+I	Puts the window in the active state.
Hold	CTRL+H	Puts the window in the hold state.
ToModify	CTRL+F	Puts the window in modify mode.
ToView	CTRL+W	Puts the window in view mode.
Window Connect ▶		
→SourceText		Links to the Source window.
→Assemble		Links to the Assemble window.
→Memory		Links to the Memory window.

Table C-1 Main Window (4/4)

Menu	Mnemonic	Explanation
[Browse]		
SourceText...		Opens the Source window.
Variable...		Opens the Variable window.
Assemble...		Opens the Assemble window.
Memory...		Opens the Memory window.
Register...		Opens the Register window.
Stack Trace...		Opens the Stack window.
Sfr...		Opens the SFR window.
Local Variable...		Opens the Local Variable window.
BreakSet...		Opens the Break dialog box.
Timer...		Opens the Timer window.
Trace ▶		
→TraceSet...		Opens the Trace dialog box.
→TraceView...		Opens the Trace View dialog box.
→SnapShotTraceSet...		Opens the Snap-Shot dialog box.
Event ▶		
→EventSet...		Opens the Event Set dialog box.
→EventManager...		Opens the Event Manager.
→EventLinkSet...		Opens the Event Link dialog box.
Coverage ▶		
→View...		Opens the Coverage window.
→Clear...		Opens the Coverage Memory Clear dialog box.
→Condition...		Opens the Coverage Condition Setting dialog box.
→Efficiency...		Opens the Coverage Efficiency View dialog box.
[Jump]		
SourceText...	CTRL+U	Jumps to the Source window.
Assemble...	CTRL+A	Jumps to the Assemble window.
Memory...	CTRL+M	Jumps to the Memory window.
[Window]		
Cascade		Displays the window in cascade style.
Tile		Displays the window in tile style.
Arrange Icons		Re-arranges the icons.
Close All		Closes all windows except the main window.
[Help]		
About...		Displays the information about the version.

Table C-2 Event Manager

Menu	Mnemonic	Explanation
[File]		
Open...		Opens an event setting file.
Save		Saves the current event settings into the event setting file, overwriting the previously saved setting.
Save As...		Saves the current event settings into a specified event setting file.
Print		Prints the event registration/setting information.
Close		Closes the Event Manager.
[Edit]		
Undo		Cancels the most recent editing.
Copy		Copies a specified icon using a different name.
All Select		Selects all icons.
Delete		Deletes a specified icon.
[View]		
Name		Sorts the icons into event name order.
Kind		Sorts the icons into event type order.
Detail		Switches between normal view and detail view.
[Execute]		
Set Break		Enables a break condition.
Cancel Break		Disables a break condition.
Set Trace		Enables a trace condition.
Cancel Trace		Disables a trace condition.
Set SnapShotTrace		Enables a snapshot condition.
Cancel SnapShotTrace		Disables a snapshot condition.
[Operation]		
BreakSet...		Opens the Break dialog box.
TraceSet...		Opens the Trace dialog box.
SnapShotTraceSet...		Opens the Snap-Shot dialog box.
EventSet...		Opens the Event Set dialog box.
EventLinkSet...		Opens the Event Link dialog box.
[Jump]		
SourceText...		Jumps to the Source window.
Assemble...		Jumps to the Assemble window.
Memory...		Jumps to the Memory window.

Table C-3 Register Window

Menu	Mnemonic	Explanation
[File]		
Open/save Condition ▶		
→Open Condition...		Opens the selected file for reference.
→Save Condition		Saves the contents of the window into a view file.
→Save File as...		Saves the current event settings into a specified view file.
Close		Closes the Register window.
[Edit]		
Undo		Cancels the most recent editing.
Copy		Copies a selected character string into the clipboard buffer.
Paste		Pastes the contents of the clipboard buffer at the point to which the text cursor is positioned.
Write in		Writes the modified contents into the target device.
Restore		Cancels the modified contents.
[View]		
Absolute Name		Displays absolute register names.
Functional Name		Displays functional register names.
Register		Displays registers individually.
Register Pair		Displays register pairs.
Bin		Displays data in binary format.
Oct		Displays data in octal format.
Dec		Displays data in decimal format.
Hex		Displays data in hexadecimal format.
[Operation]		
Active		Puts the Register window in the active state.
Hold		Puts the Register window in the hold state.
ToModify		Puts the Register window in modify mode.
ToView		Puts the Register window in view mode.
[Jump]		
SourceText...		Jumps to the Source window.
Assemble...		Jumps to the Assemble window.
Memory...		Jumps to the Memory window.

Table C-4 Variable Window

Menu	Mnemonic	Explanation
[File]		
Open/save Condition ▶		
→Open Condition...		Opens the selected file for reference.
→Save Condition		Saves the contents of the window into a view file.
→Save File as...		Saves the contents of the window into a specified view file.
Close		Closes the Variable window.
[Edit]		
Undo		Cancels the most recent editing.
Copy		Copies a selected character string into the clipboard buffer.
Paste		Pastes the contents of the clipboard buffer at the point to which the text cursor is positioned.
Write in		Writes the modified contents into the target device.
Restore		Cancels the modified contents.
[View]		
Bin		Displays variable values in binary format.
Oct		Displays variable values in octal format.
Dec		Displays variable values in decimal format.
Hex		Displays variable values in hexadecimal format.
Proper		Displays variable values in default format for each variable.
[Operation]		
Active		Puts the Variable window in the active state.
Hold		Puts the Variable window in the hold state.
ToModify		Puts the Variable window in modify mode.
ToView		Puts the Variable window in view mode.
Delete		Removes a specified variable from the Variable window.

Table C-5 Timer Window

Menu	Mnemonic	Explanation
[File]		
Open/save Condition ▶		
→Open Condition...		Opens a file.
→Save Condition		Saves the contents of the window into the original file.
→Save File as...		Saves the contents of the window into a specified file.
Close		Closes the Timer window.
[Operation]		
Active		Places the Timer window in the active state.
Hold		Places the Timer window in the hold state.

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