NEC

User's Manual

AZ850 Ver. 3.10

System Performance Analyzer

Target Devices
V850 Series™
Target Real-Time OS
RX850 Ver. 3.13 or Later
RX850 Pro Ver. 3.13 or Later

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[MEMO]

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Major Revisions in This Edition

Page	Description
Throughout	• Modification of AZ850 version to Ver. 3.10 • Modification from V850 Family to V850 Series
p.17	Modification of description in **1.4 Operating Environment**
p.18	Modification of installation procedure in **2.1 Installation Procedure**
pp.19, 20	Change of name of file for AZ monitor creation in **2.2 Directory Configuration**
p.21	Modification of uninstallation procedure in **2.3 Uninstallation Procedure**
pp.23, 27 to 30	**3.1 AZ850 Operation Procedure** • Modification and addition of screen diagram and description for the following windows and dialog boxes (4) Perform settings in AZ Option dialog box, (11) Perform check using CPU window, (12) Perform check using Pattern window, (13) Perform check using Trace View window, (14) Perform check using Call Graph window
pp.56 to 61, 65, 66, 69, 70, 76, 80 to 83, 86 to 88, 90, 92, 95 to 98, 100, 103 to 106, 109, 111, 113, 115, 129, 132, 157, 164, 166	**6.3 Description of Windows and Dialog Boxes** • Modification of description on the following windows and dialog boxes AZ main window, AZ Option dialog box, Analyze Window [task level], Object Select dialog box [task level], Pattern Search dialog box [task level], CPU Window [task level], Pattern Set dialog box [task level], Pattern Window [task level], Trace View Window [task level], Trace Search dialog box [task level], Analyze Window [function level], Pattern Search dialog box [function level], Object Select dialog box [function level], Trace Search dialog box [function level], Function Search dialog box [function level], Function Detail Information dialog box [function level]
p.167	**APPENDIX A DEBUGGING METHOD USING AZ850** Modification of description in **(4) Settings in <AZ Option> dialog box**
pp.170 to 172	**APPENDIX B ERROR MESSAGE LIST** • Addition of error messages (error numbers 1040, 1500, and 1700) • Deletion of error message (error number 1020) • Overall correction of description on other error messages

The mark ⋆ shows major revised points.

INTRODUCTION

Target Readers

This manual is intended for users who wish to design and develop application systems using the V850 Series™.

Purpose

This manual's purpose is to help the user understand the functions and the operation method of the AZ850.

Organization

This manual is organized as follows.

- Outline
- Instructions
- Operation method
- Trace form
- Trace data
- Window reference

How to Use this Manual

This manual assumes that the reader has general knowledge of microcontrollers, C language, assembly language, and debugging as well as basic knowledge of the Windows operation method.

To learn about the hardware functions and instruction functions of the V850 Series:
→ Read the user's manual for each product.

> "RTOS" is used as the representative product name in descriptions that are the same for the RX850 and the RX850 Pro.
> If using the RX850, read "RTOS" as "RX850," and if using the RX850 Pro, read "RTOS" as "RX850 Pro."

Conventions

< >:	Indicates a window or dialog box title.
[ ]:	Indicates a menu.
text :	Indicates a button in a window or dialog box.
<< >>:	Indicates a character string displayed in a window or dialog box.
Data significance:	Higher digits on the left and lower digits on the right
Memory map addresses:	Higher addresses on the top and lower addresses on the bottom
Active low representation:	$\overline{xxx}$ (overscore over pin or signal name)
Note:	Footnote for item marked with Note in the text
Caution:	Information requiring particular attention
Numerical representation:	Binary...XXXX or XXXXB
	Decimal...XXXX
	Hexadecimal...0xXXXX
Prefix indicating power of 2 (address space, memory capacity)	
	K (Kilo) $2^{10} = 1024$
	M (Mega) $2^{20} = 1024^2$

Related Documents Please use the following documents in conjunction with this manual.
The related documents listed below may include preliminary versions. However, preliminary versions are not marked as such.

Documents Related to V850 Series Development Tools (User's Manuals)

Document Name		Document Number
IE-703002-MC (In-Circuit Emulator for V853™, V850/SA1™, V850/SB1™, V850/SB2™, V850/SF1™, V850/SV1™)		U11595E
IE-V850E-MC (In-Circuit Emulator for V850E/IA1™, V850E/IA2™), IE-V850E-MC-A (In-Circuit Emulator for V850E/MA1™, V850E/MA2™)		U14487E
IE-703003-MC-EM1 (In-Circuit Emulator Option Board for V853)		U11596E
IE-703017-MC-EM1 (In-Circuit Emulator Option Board for V850/SA1)		U12898E
IE-703037-MC-EM1 (In-Circuit Emulator Option Board for V850/SB1, V850/SB2)		U14151E
IE-703040-MC-EM1 (In-Circuit Emulator Option Board for V850/SV1)		U14337E
IE-703079-MC-EM1 (In-Circuit Emulator Option Board for V850/SF1)		U15447E
IE-703102-MC (In-Circuit Emulator for V850E/MS1™)		U13875E
IE-703102-MC-EM1, IE-703102-MC-EM1-A (In-Circuit Emulator Option Board for V850E/MS1)		U13876E
IE-703107-MC-EM1 (In-Circuit Emulator Option Board for V850E/MA1)		U14481E
IE-703116-MC-EM1 (In-Circuit Emulator Option Board for V850E/IA1)		U14700E
CA850 Ver.2.50 C Compiler Package	Operation	To be prepared
	C Language	U16054E
	PM plus	To be prepared
	Assembly Language	U16042E
ID850 Ver. 2.40 Integrated Debugger	Operation Windows Based	U15181E
SM850 Ver. 2.40 System Simulator	Operation Windows Based	U15182E
SM850 Ver. 2.00 or Later System Simulator	External Part User Open Interface Specifications	U14873E
RX850 Ver. 3.13 or Later Real-Time OS	Basics	U13430E
	Installation	U13410E
	Technical	U13431E
RX850 Pro Ver. 3.13 Real-Time OS	Basics	U13773E
	Installation	U13774E
	Technical	U13772E
RD850 Ver. 3.01 Task Debugger		U13737E
RD850 Pro Ver. 3.01 Task Debugger		U13916E
AZ850 Ver. 3.10 System Performance Analyzer		This manual
PG-FP4 Flash Memory Programmer		U15260E

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CHAPTER 1 OUTLINE

1.1 Outline

As microprocessors become increasingly more powerful and sophisticated, user programs are also growing larger and more complex. Although logic debugging of such user programs can easily be done with a conventional debugger, correcting bugs due to processing timing and performing time-related analysis such as total-system evaluation become very time consuming operations.

In response to these market conditions, NEC developed the V850 Series, which is a powerful family of microprocessors included in the V800 Series™, and has now developed and released the **AZ850** system performance analyzer, which is designed to support quantitative performance analysis of user programs.

The AZ850 is a performance analysis tool for analyzing the execution transition status for applications created for the V850 Series and applications that embed the **RX850** or **RX850 Pro** real-time OS for the V850 Series.

By using the AZ850 with a debugger, it is possible to trace the occurrence of events (system calls, interrupts, etc.) and represent this data in a graphical format. The use of these functions enables easy analysis of the execution transition status of functions and tasks, as well as the status of access to various objects such as event flags and semaphores, which are functions of real-time OSs.

The specifications of the AZ850 conform to the Tool Interface Protocol (**TIP**), and as long as a debugger (even one not made by NEC) that supports this interface is used, the functions of the AZ850 can easily be used.

1.2 Functions and Features

The functions and features of the AZ850 are described below.

- Graphical display of task execution transition status
  By displaying the execution transition status for tasks and interrupts (horizontal axis = time, vertical axis = function name/task name, etc.), system status changes caused by function call/recovery, task switching, the occurrence of interrupts, etc., can easily be analyzed. Since the status of access to each object as the result of the issue of system calls is displayed in symbol form, the transition of functions, the task execution sequence, and status transitions can easily be understood.

- Graphical display of **CPU** use time
  The execution efficiency of the entire system can be grasped by displaying the CPU use status in a specified time range.

- Processing time statistics
  The worst value, average value, etc., can be obtained by performing frequency calculations of the processing execution time for user programs.

- Linked operation with debugger window
  It is possible to jump from the AZ850 window to windows displaying source text, disassemble text, and memory capacity, allowing easy identification of problems.

The AZ850 provides the following two trace forms, allowing the selection of the best method for the debugging environment employed by the user.

- Soft trace form
  A monitor function is provided on the target system, and AZ trace data is collected using a monitor program[Note].

  Note The monitor program must be prepared according to the environment employed by the user. Refer to section 4.1 Soft Trace Form.

- Hard trace form
  AZ trace data is collected using the trace function of an in-circuit emulator or simulator.

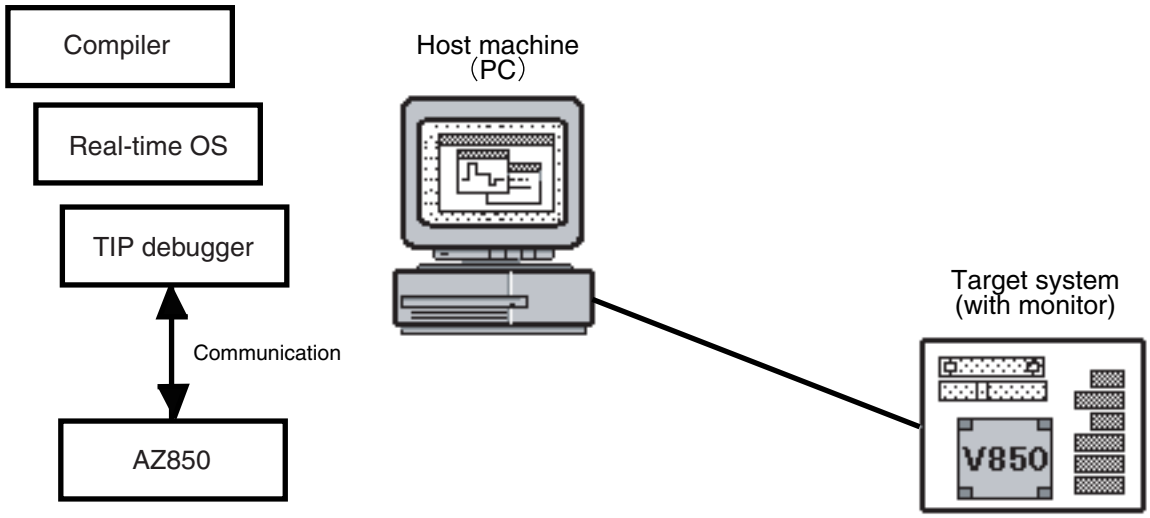
Note that, the soft trace form is not supported for function trace in the current AZ850. Only hard trace is supported. Moreover, the function trace function cannot be used with an NEC in-circuit emulator and the ID850. When using the function trace function, use the SM850 simulator.

1.3 System Configuration

The AZ850 expands the debugger functions by transmitting debugger and TIP specification messages. Various AZ850 system configurations are shown for the debugging environments that can be used.

1.3.1 When using debug monitor

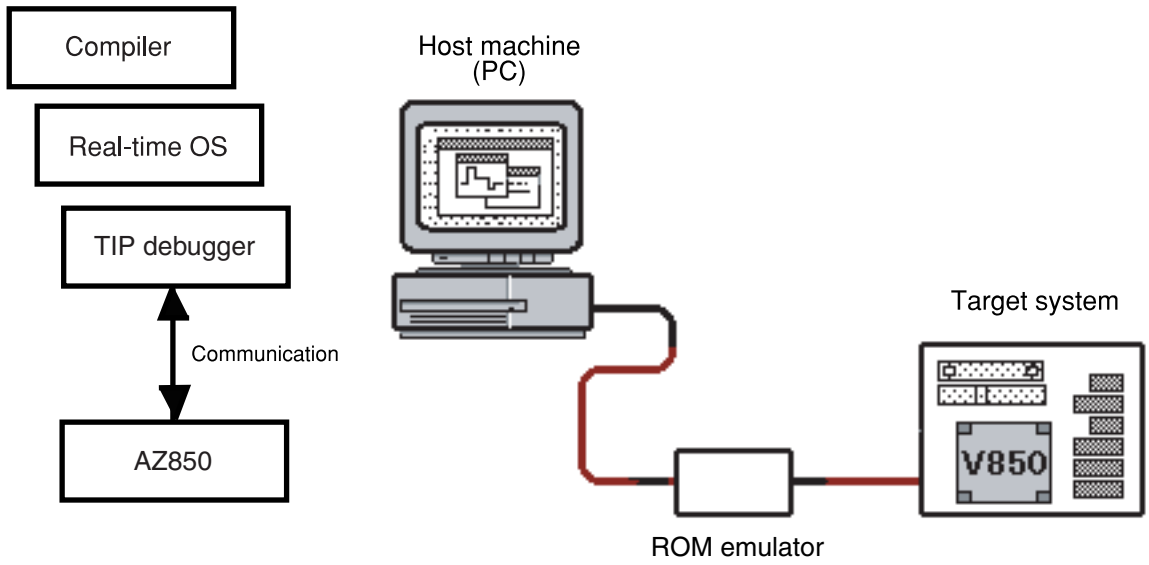
Figure 1-1 System Configuration Diagram (When Using Debug Monitor)



Caution One unused timer counter is required on the target system.

1.3.2 When using ROM emulator

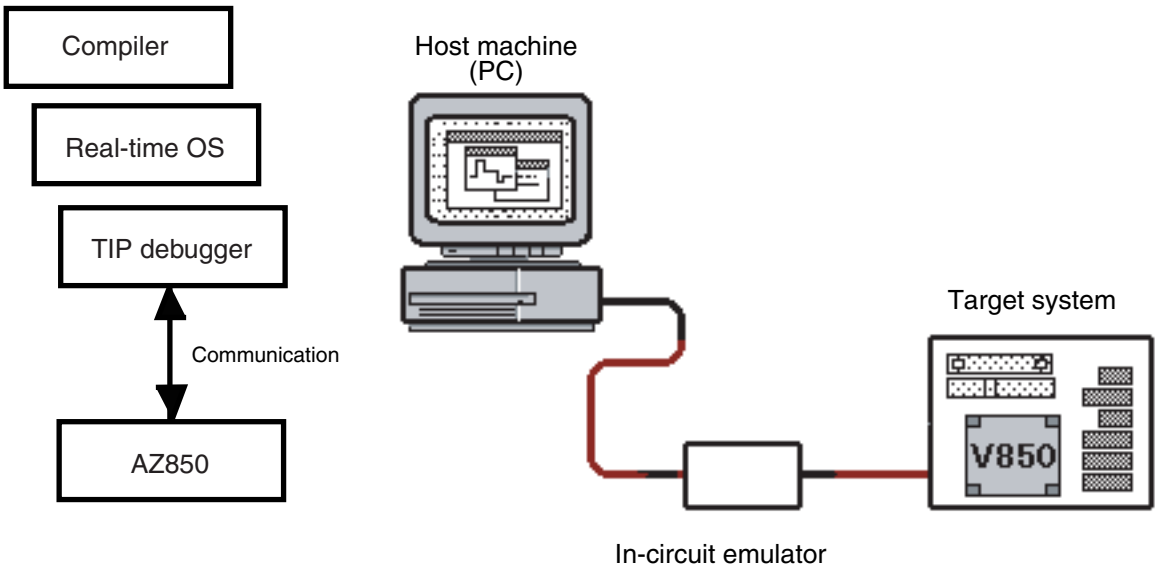
Figure 1-2 System Configuration Diagram (When Using ROM Emulator)



Caution One unused timer counter is required on the target system.

1.3.3 When using in-circuit emulator

Figure 1-3 System Configuration Diagram (When Using In-Circuit Emulator)

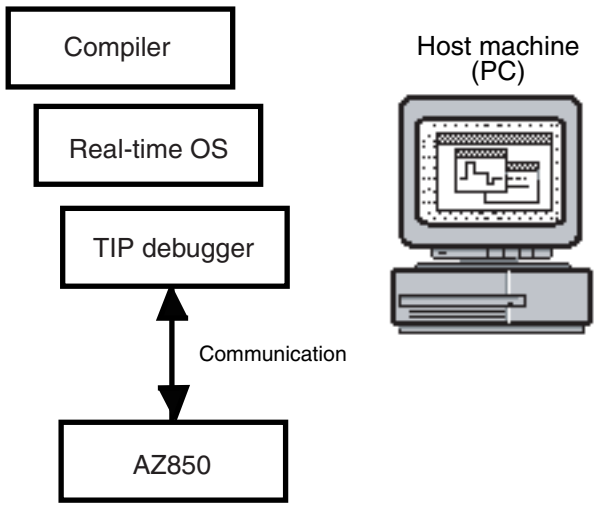


Cautions 1. When using the AZ850 with the soft trace form, the AZ monitor must be linked to the load module. Moreover, one unused timer counter is required on the target system.

2. Currently, it is not possible to perform function trace with the AZ850 using an NEC in-circuit emulator (ICE) and the ID850. Task trace, however, can be performed.

1.3.4 When using simulator

Figure 1-4 System Configuration Example (When Using Simulator)



Caution When using the AZ850 with the soft trace form, the AZ monitor must be linked to the load module. Moreover, one unused timer counter is required on the target system.

1.4 Operating Environment

When using the AZ850, an environment in which a debugger can operate is required.

(1) Host machine

PC-9821 series, PC98-NX series, or IBM-PC/AT compatibles that support the following OSs

★ • OS: Windows 98 Second Edition, Windows Me, Windows NT™ 4.0 Workstation, Windows 2000 Professional, Windows XP Professional

• Screen size: 640 × 400 pixels or more (800 × 600 pixels or more recommended)

(2) Software

• C compiler package

★ CA850 Ver. 2.41: Made by NEC

CCV850/CCV850e: Made by Green Hills Software™, Inc.

Caution Function-level trace is supported only by the CA850.

• Real-time OS

RX850 Ver. 3.13 or later

RX850 Pro Ver. 3.13 or later

• Debugger

TIP debugger

(3) ROM emulator

ROM emulator that can be connected to TIP debugger

(4) In-circuit emulator

In-circuit emulator that can be connected to TIP debugger

(5) Simulator

TIP simulator

CHAPTER 2 INSTALLATION

This chapter describes how to install and uninstall the AZ850.

2.1 Installation Procedure

This section describes how to install the AZ850. Once the AZ850 has been installed once, to install it again, it is necessary to uninstall it first.

The supply medium for the AZ850 is one CD-ROM each for the object release version and the source release version.

- Installation directory: c:\nectools32
- CD drive: Q drive
- Directory to which Windows is to be installed: b: \Windows

★ The installation procedure is described below.

<1> Start Windows.

<2> Insert the CD-ROM in the CD drive (Q drive). The setup program then starts automatically. If the setup program fails to start automatically, manually start it by starting Explorer and double-clicking “Setup.exe” in the AZ850\DISK1 folder in the Q drive. Perform installation in accordance with the messages displayed on the screen.

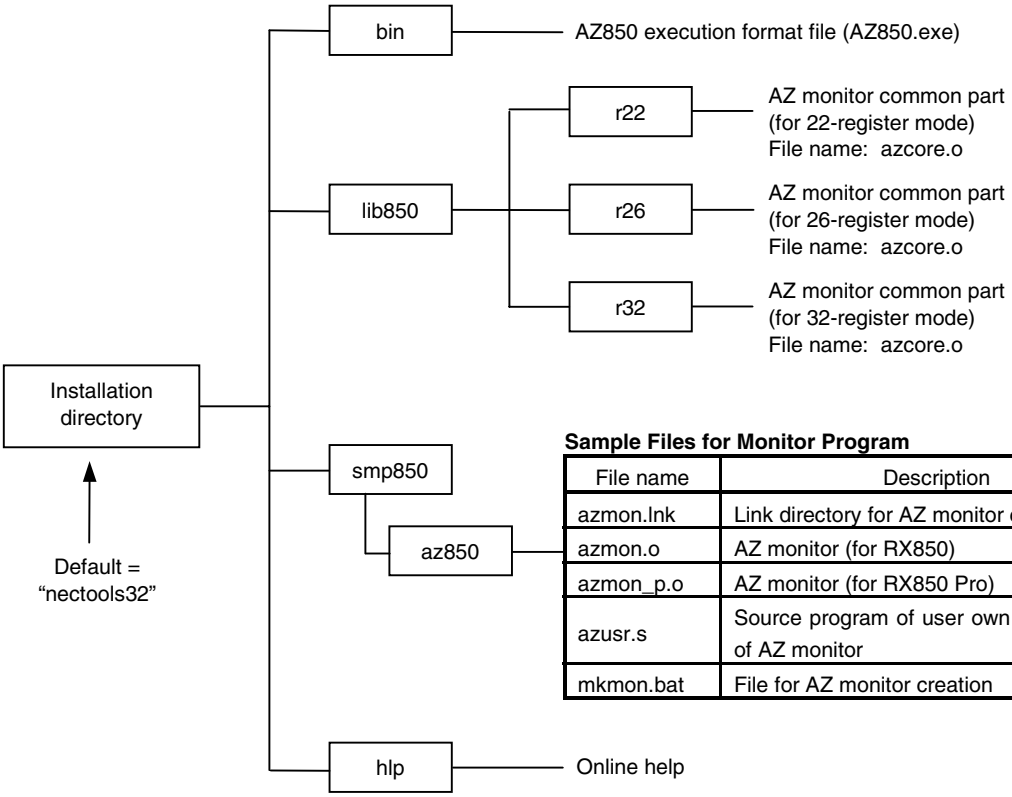
<3> Make sure that the files stored in the AZ850 supply media have been installed in the host machine by using Windows Explorer, etc.
For details of each directory, refer to **2.2 Directory Configuration**.

2.2 Directory Configuration

This section describes the directory configuration of the files that have been read from the supply medium in the process of installing the AZ850.

2.2.1 NEC compiler version

Figure 2-1 Directory Configuration (NEC Compiler Version)



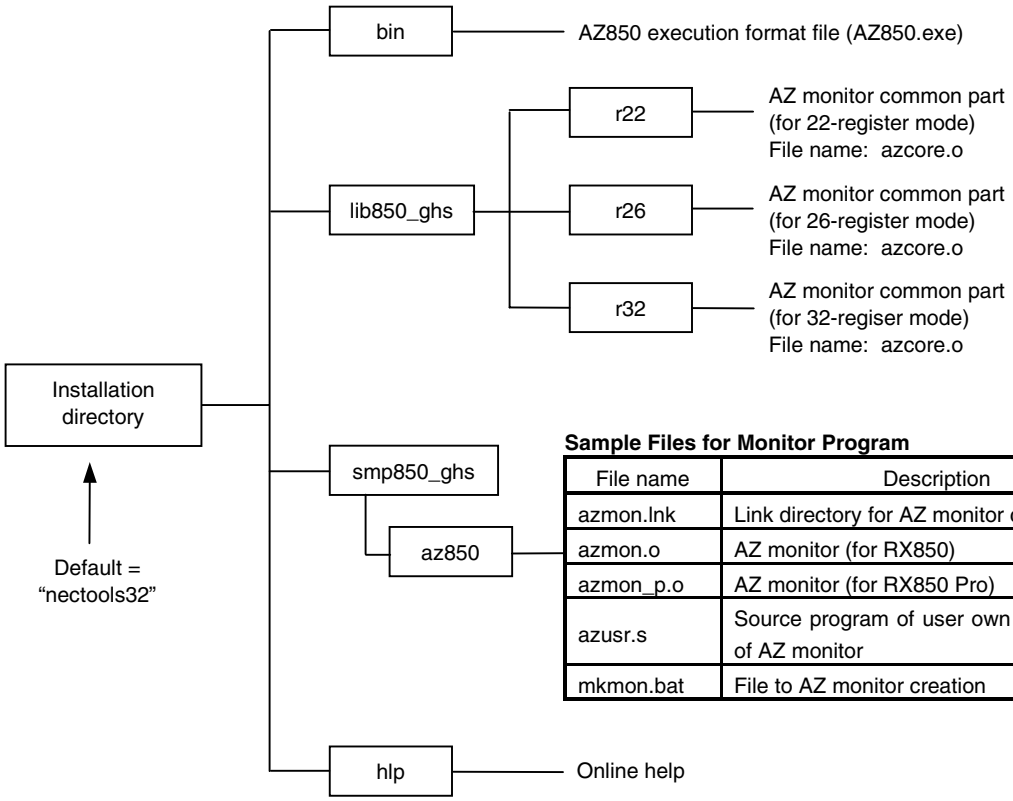
Sample Files for Monitor Program

File name	Description
azmon.lnk	Link directory for AZ monitor creation
azmon.o	AZ monitor (for RX850)
azmon_p.o	AZ monitor (for RX850 Pro)
azusr.s	Source program of user own coding block of AZ monitor
mkmon.bat	File for AZ monitor creation

★

2.2.2 GHS compiler version

Figure 2-2 Directory Configuration (GHS Compiler Version)



Sample Files for Monitor Program

File name	Description
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azmon.o	AZ monitor (for RX850)
azmon_p.o	AZ monitor (for RX850 Pro)
azusr.s	Source program of user own coding block of AZ monitor
mkmon.bat	File to AZ monitor creation

★

2.3 Uninstallation Procedure

This section describes how to uninstall components.

<1> Start Windows.

★ <2> Activate “Add/Remove Application” (“Add or Remove Programs” in the case of Windows XP) in the Control Panel and select the item to be uninstalled (“NEC AZ850 -- Analyzer Execution Format”, etc.). Then execute uninstallation.

CHAPTER 3 OPERATION METHOD

This chapter describes the operation method for the AZ850.

3.1 AZ850 Operation Procedure

The basic operation method when using the AZ850 is described in sequence below.

(1) Start debugger

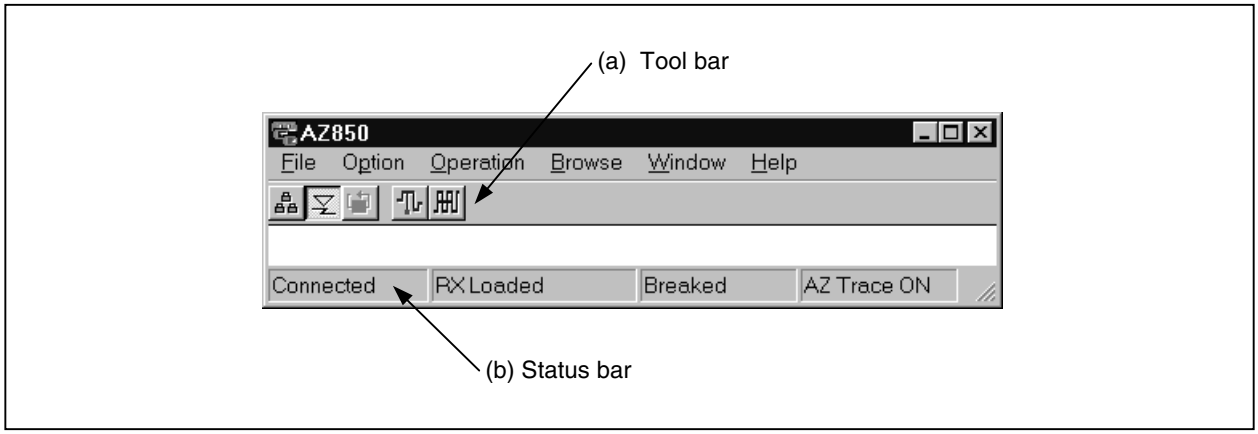
Start the debugger to be used.

(2) Start AZ850

Start the AZ850. The <AZ850> main window appears.

At this time, check if <<Connected>> appears in the status display area. If <<Connected>> is displayed, the connection with the debugger has been successfully performed.

Figure 3-1 AZ Main Window

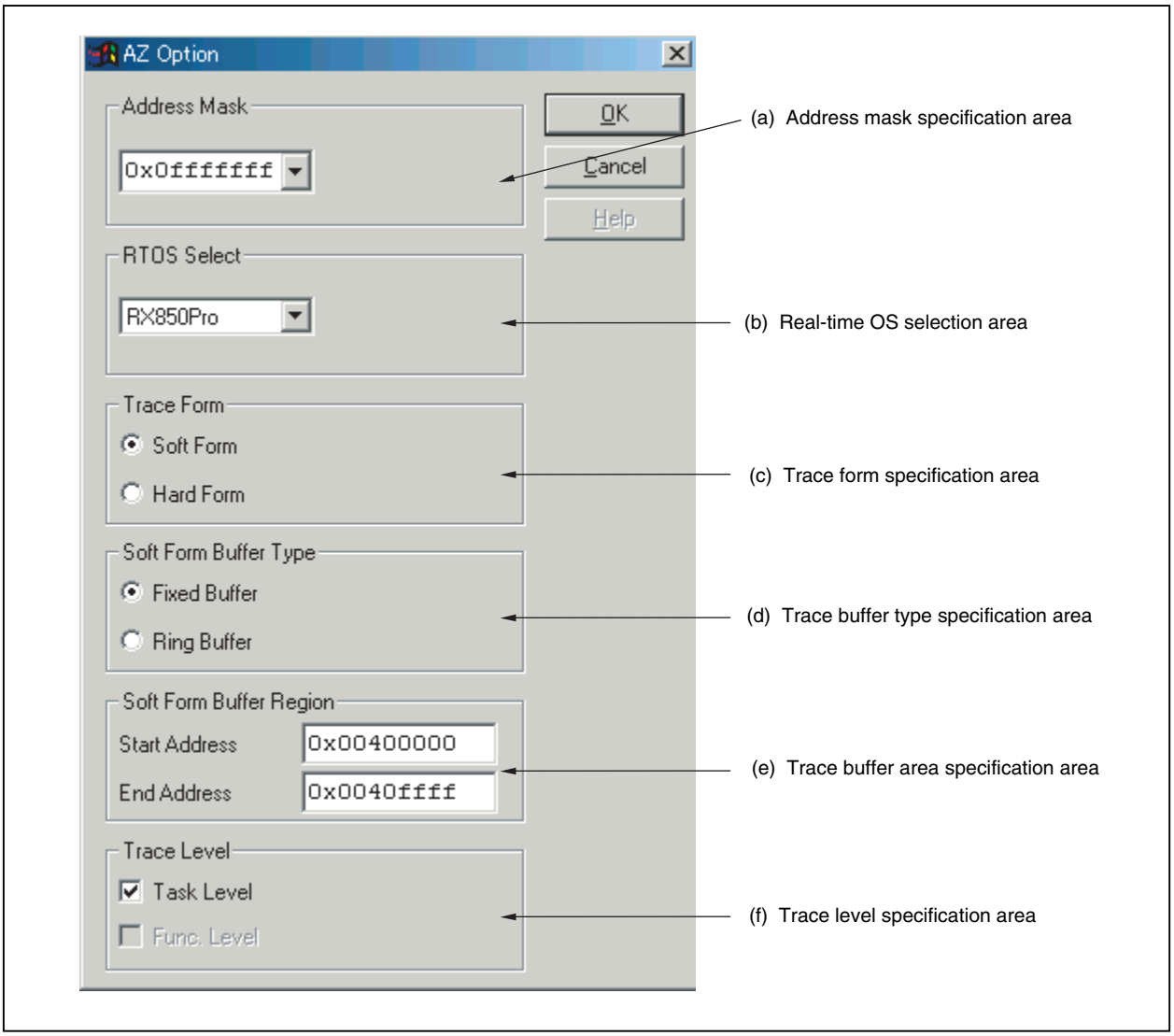


(3) Download load module

Download the load module prepared for the AZ850 to the debugger.

★ **(4) Perform settings in AZ Option dialog box**

Open the <AZ Option> dialog box and set the following options in that dialog box. To open the dialog box, click the button.



(a) Address mask specification area (Address Mask)

Specify the upper limit value of the physical address space on the chip.

For details, refer to **CHAPTER 6 WINDOW REFERENCE**.

(b) Real-time OS selection area (RTOS Select)

To perform trace at the task level, select either the RX850 or the RX850 Pro as the real-time OS to be used.

(c) Trace form specification area (Trace Form)

Specify the trace form for AZ trace, either soft trace form <<Soft Form>> or hard trace form <<Hard Form>>. The default is hard trace form. However, if the debugger that is connected does not support the hard trace form, the default is the soft trace form.

For details about the soft trace form and hard trace form, refer to sections 4.1 and 4.2.

(d) Trace buffer type specification area (Sort Form Buffer Type)

To select the soft trace form, select either a fixed buffer <<Fixed Buffer>> or ring buffer <<Ring Buffer>> as the buffer type to load trace data.

- If fixed buffer is selected
  When the trace buffer becomes full, trace collection stops. Therefore, the trace data up to the location where the program execution was stopped is not necessarily loaded.

- If ring buffer is selected
  When the trace buffer becomes full, the trace data gets overwritten starting from the oldest data.

(e) Trace buffer region specification area (Sort Form Buffer Region)

Specify the <<Start Address>> and the <<End Address>> of the trace buffer region.

If the soft trace form has been selected, the trace data collected by the AZ850 is stored once in the target memory. Thus, it is necessary to specify an unused area in the target memory. Also, set the start address and end address so that the size of the area is in the range of 4 KB to 4 MB.

(f) Trace level specification area (Trace Level)

If hard trace form has been selected, set the trace level for the AZ trace data to be collected.

- If only the task level (**Task Level**) has been selected
  The AZ trace data at the task level is collected.

- If only the function level (**Func. Level**) has been selected
  The AZ trace data at the function level is collected.

- If both the task and function levels have been selected
  Both AZ trace data at the task level and AZ trace data at the function level are collected.

However, in the case of the soft trace form, this setting is fixed to “Task Level”.

(5) Select measurement target

In the main window, select [Option (P)], [Select Measurement Target (M)], [Function Level (F)]. The dialog box for function level measurement target selection appears. In this dialog box, select the module to be measured. Note that this setting is ignored in the case of task-level trace.

(6) Switch to AZ trace mode

To enable the trace function of the AZ850, set “AZ Trace ON”. (To do this, select [Operation (O)], [AZ Trace ON (O)].) This setting allows the collection of trace data at the AZ task level or function level.

Caution The AZ trace ON setting cannot be performed until downloading of the load module has been completed.

(7) Execute user program

Execute the user program on the debugger.

The trace data for the AZ850 starts being collected in the trace buffer when execution of the user program begins.

(8) Stop user program

Stop the user program on the debugger. (If a breakpoint has been set, it is maintained until the break.)

Collection of trace data for the AZ850 stops at the same time that the user program is stopped.

(9) Upload trace data

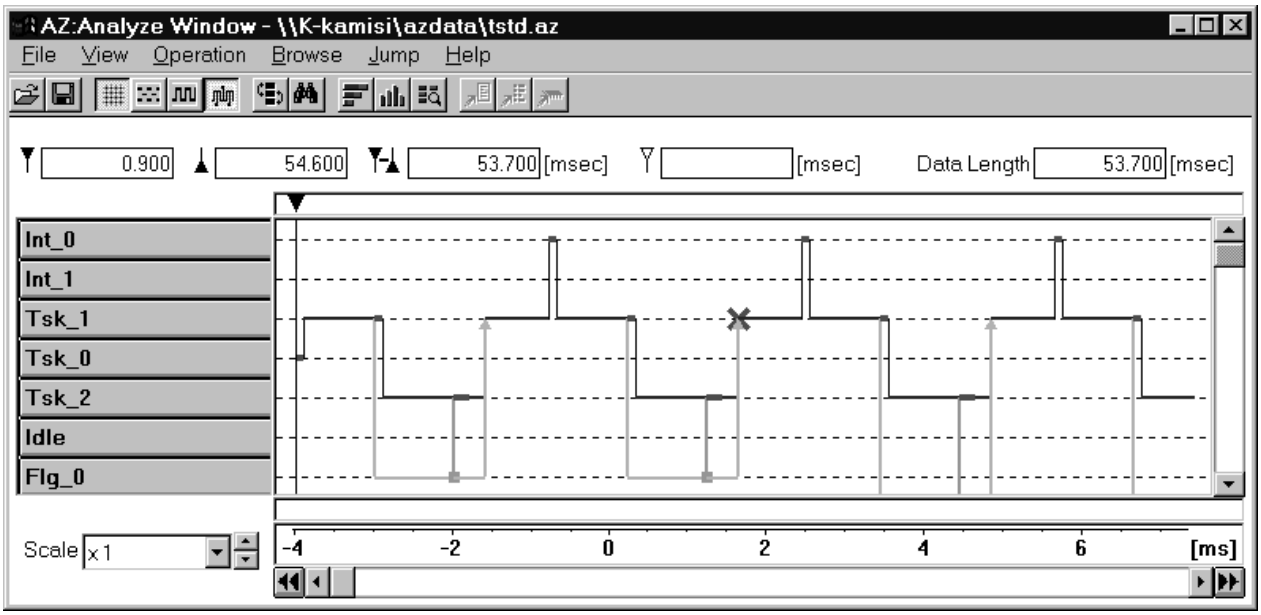
After stopping the application program, click the  button on the tool bar in the main window to upload the collected trace data to the AZ850.

(10) Perform check using Analyze window

Open the <Analyze Window> and check the collected AZ trace data with execution transition diagrams for individual tasks.

(a) To display execution transition diagrams...

From the menu bar in the <AZ850>, main window select [Browse (B)], [Execution Transition (Z)], [Task Level (T)], or click the button on the tool bar.



(b) To check the operation of an object...

Check the operation of the specified object using the “Simple Search Button” displayed by clicking an object name.

(c) To check the transition status of a task or interrupt...

From the <Pattern Search> dialog box displayed from this window, search the switching point of a specific task, the location where an interrupt has occurred, or the location where a specific system call has occurred.

→ The search result is displayed in the execution transition diagram.

(d) To analyze the processing time for a task or interrupt...

From the <Pattern Set> dialog box displayed from this window, perform search or analysis of the set pattern (specific processing).

→ The search result is displayed in the execution transition diagram.

→ The distribution status according to the set pattern processing time is displayed in the <Pattern Window>.

★ **(11) Perform check using CPU window**

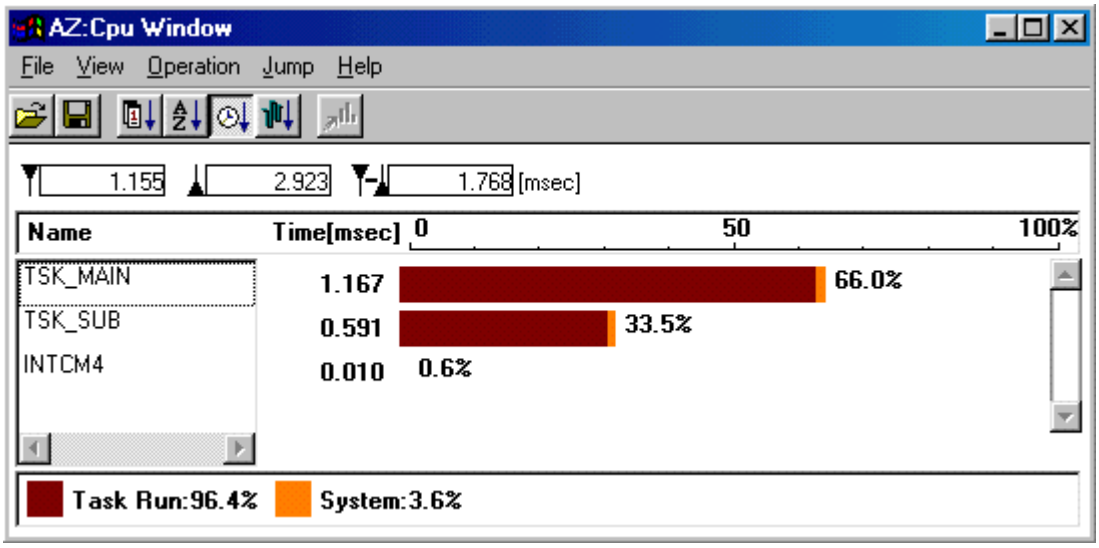
From the <CPU Window>, check the CPU use status within the defined interval.

(a) To display the CPU utilization rate

Set the up cursor and down cursor to define the interval for which the CPU utilization rate is to be measured in the execution transition diagram.

The CPU utilization rate is measured during the interval indicated with the up cursor and down cursor.

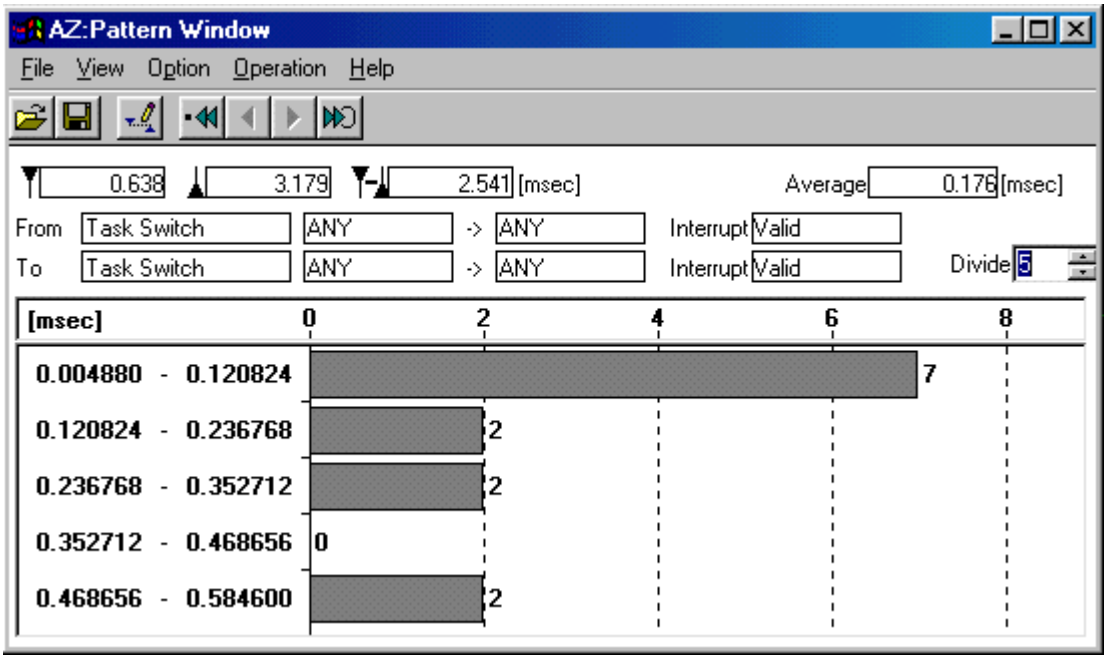
After setting the cursors, display the <CPU Window>. To open this window, click the  button.



Remark If the <CPU Window> is active, moving the up cursor or the down cursor in the task level execution transition diagram causes automatic update of the CPU utilization rate.

★ **(12) Perform check using Pattern window**

From the <Pattern Window>, check the execution time distribution status of the specified pattern.



(a) To display the pattern distribution...

[Display of any pattern]

<1> In the <Analyze Window>, set the up cursor and down cursor to define the interval for which the pattern distribution status is to be tabulated.

<2> From the menu bar in the <Analyze Window>, select [Browse (B)], [Patter Distribution (P)], or click the button on the tool bar.

<3> In the <Pattern Set> dialog box that is automatically displayed, click the OK button after setting the conditions for the pattern for which tabulation is to be performed.

[Display of pattern from CPU window]

<1> In the <Analyze Window>, set the up cursor and down cursor to define the interval for which the pattern distribution status is to be tabulated.

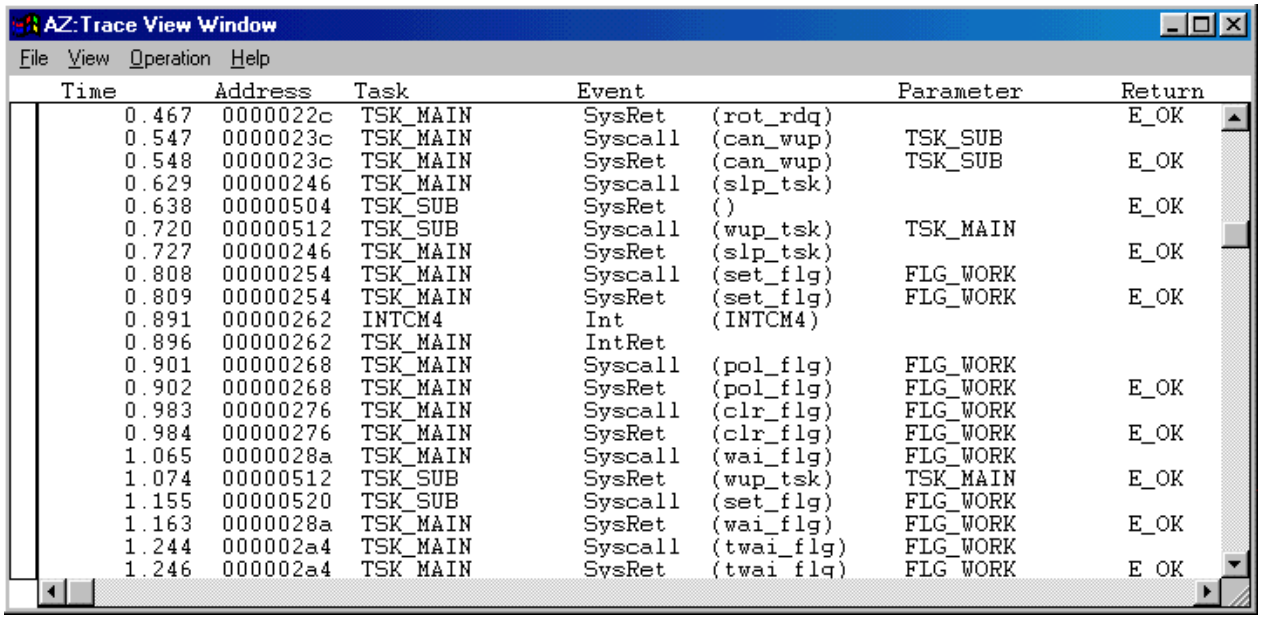
<2> From the menu bar in the <CPU Window>, after selecting an object from the list, select [Jump (J)], [Pattern Distribution (P)], or click the button on the tool bar.

The pattern distribution displayed with this method consists of data tabulated in the specified object-processing interval (mode using switching of specified object as start point/end point).

Remark If the <Pattern Window> is active, moving the up cursor or the down cursor in the task level execution transition diagram causes automatic update of the pattern distribution contents.

★ **(13) Perform check using Trace View window**

From the <Trace View Window>, perform an even more detailed check of the collected AZ trace data.



(a) To display AZ trace data...

Move the up temporary cursor that the desired position in the execution transition diagram.

If the up temporary cursor is not displayed, the first trace data becomes the display start position.

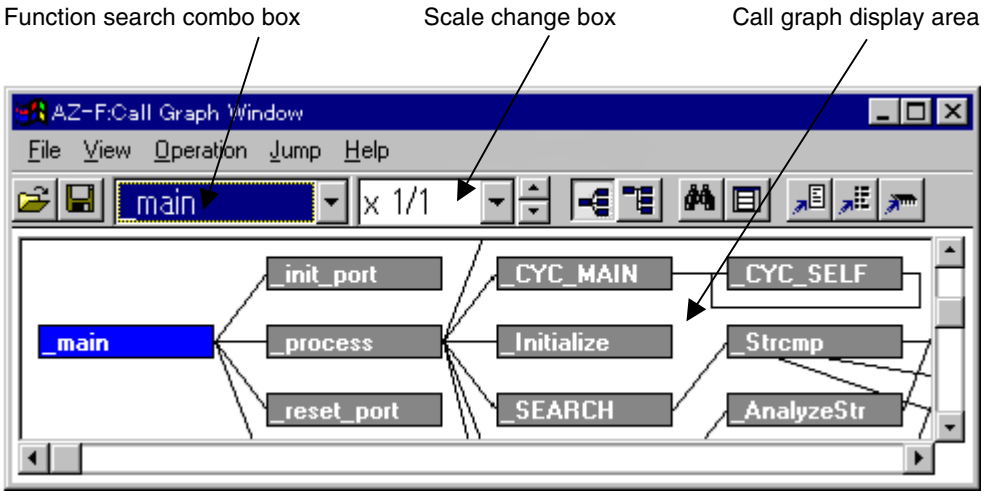
After setting the cursor, open the <Trace View Window>.

Remarks 1. If the <Trace View Window> is active, moving the up cursor in the task level execution transition diagram causes automatic update of the AZ trace data display start position.

2. When the soft trace form is used, the contents of the trace buffer are cleared by newly setting AZ trace ON.

★ **(14) Perform check using call graph window**

Select [Browse (B)], [Call Graph (G)] in the <Analyze Window (function level)> to open the <Call Graph Window>. In this window, check the function call configuration.



Then continue debugging by repeating steps (6) to (14) as needed.

CHAPTER 4 TRACE FORMS

This chapter describes the two trace forms supported by the AZ850.

The trace forms supported by the AZ850 are the soft trace form and the hard trace form.

The soft trace form provides a monitor program on the target system, and performs trace linking programs that have a monitor function for user programs.

The hard trace form uses a trace function with an in-circuit emulator or simulator, and enables tracing without any modification to user programs.

The AZ850 is used by selecting one of these two trace forms according to the user's debugging environment.

Table 4-1 Relationship Between Trace Form and Debugging Environment

Trace Form / Debugging environment	Soft Trace Form	Hard Trace Form
Debugging monitor	○	×
ROM emulator	○	×
In-circuit emulator	○	○
Simulator	○	○

Note that the soft trace form in the case of function tracing is not supported by the AZ850 at present. Only the hard trace form is supported in this case. Moreover, if the compiler is a GHS version compiler, the function trace form cannot be used.

The soft trace form and the hard trace form are described in detail below.

4.1 Soft Trace Form

The soft trace form provides a monitor function on the target system, and collects AZ trace data using a monitor program. When the AZ850 is used with this method, the trace data is saved to the user memory area specified in the <AZ Option> dialog box.

The monitor program used in the soft trace form must be prepared according to the user's environment. The procedure for preparing this monitor program is described below.

The soft trace form supports only task-level trace and cannot be used for function-level trace. In other words, this method can be used only for applications that use the **RX850** or **RX850 Pro**.

4.1.1 Monitor program (AZ monitor) creation flow

When the AZ850 is used with the soft trace form, the AZ850 collects AZ trace data using a monitor program (AZ monitor). The time information that is required at this time is obtained by using the user's target timer counter for the AZ850. In other words, a single timer counter dedicated to the AZ850 is used. As a result, the control block of this timer counter must be coded according to the target employed by the user (user own coding block) to complete the AZ monitor.

The AZ monitor creation flow is as follows.

<1> Create the source for the user own coding block for the monitor (NEC version: azusr.s, GHS version: azusr.850).
<2> Assemble the source prepared in <1> to create azusr.o.
<3> Link the object prepared in step <2> and the monitor common part to create the AZ monitor (azmon.o).

azmon.o created in step <3> becomes the AZ monitor. The soft trace form can be realized by linking this object to the user program.

4.1.2 Creating user own coding block

The control block of the timer counter of the target that is used must be coded.

A sample user own coding block is shown in the following directory. Use it as reference when creating the user own coding block.

- When using NEC's CA850
  nectools32 \ smp850 \ az850 \ azusr.s
- When using GHS's CCV850/CCV850E
  nectools32 \ smp850_ghs \ az850 \ azusr.850

The sample is as follows.

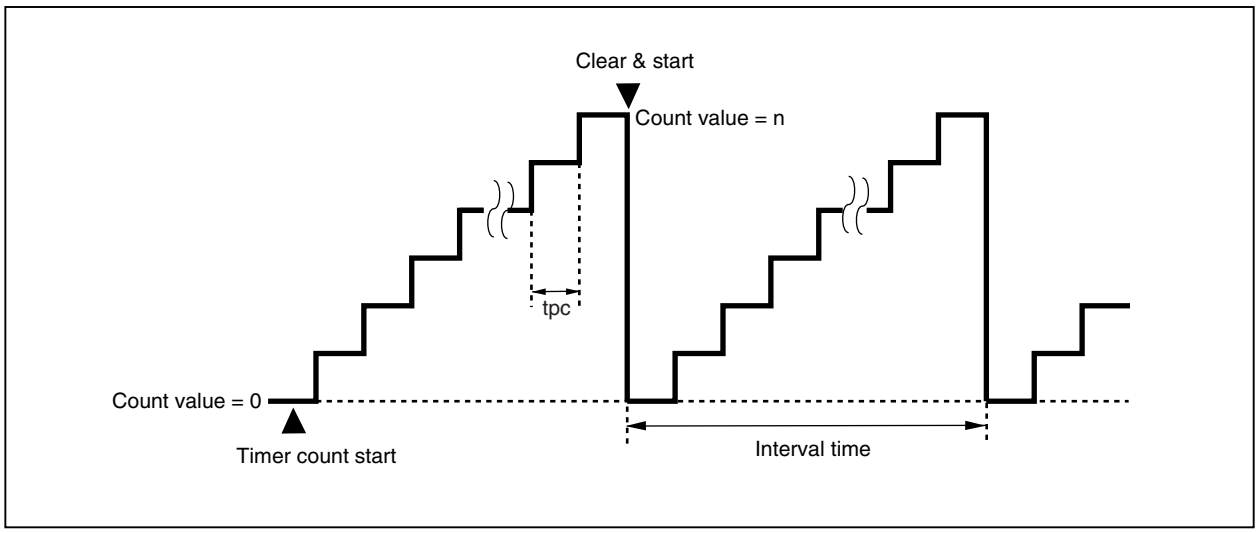
Figure 4-1 User Own Coding Block (azusr.s/azusr.850) Sample

```
    .globl  __AZMON_MaxCount
    .globl  __AZMON_CountMode
    .globl  __AZMON_TimePerCount
    .globl  __AZMON_InitTimer
    .globl  __AZMON_GetCounter

    .text
    .align  4
__AZMON_MaxCount:
    .word   MaxCountValue     …Maximum timer count value

    .text
    .align  4
__AZMON_CountMode:
    .byte   CountMode         … Timer count mode

    .text
    .align  4
__AZMON_TimePerCount:
    .float  TimePerCount      … Time per count (Unit: μsec)

    .text
    .align  4
__AZMON_InitTimer:

    The-Code-of-InitTimer     … Timer's initialization processing code

    Jmp     [lp]

    .text
    .align  4
__AZMON_GetCounter:

    The-Code-of-GetCounter    … Timer's count value acquisition processing code
    Jmp     [lp]
```

The user own coding block data and function specifications are described below.

Figure 4-2 provides an example of the timer counter specifications.

Figure 4-2 Timer Counter Operation Example (In Case of Up Counter)



Name	Type	Description
__AZMON_MaxCount	Data	Specifies the maximum timer count value (n value in Figure 4-1). Data type: Specified with 4-byte integer format (.word)
__AZMON_CountMode	Data	Specifies timer count mode. Data type: Specified with 1-byte integer format (.byte) Data setting value: 0x00 … Up counter 0x01 … Down counter
__AZMON_TimePerCount	Data	Specifies the time per count in microsecond units (μsec) (tpc value in Figure 4-1). Data type: Specified with 4-byte floating-point format (.float).
__AZMON_InitTimer	Function	Specifies timer initialization processing. Input register: lp … Return address Output register: None Destructible register: Depends on C language calling restrictions.
__AZMON_GetCounter	Function	Specifies timer counter value get processing. Input register: lp … Return address Output register: r10 … Counter value Destructible registers: r1, r11

Cautions 1. If the ld.h instruction is used during timer counter value get processing (_ _AZMON_GetCounter), the r10 value gets expanded to 4 bytes. For this reason, it is necessary to mask this value using the andi instruction.

Example
```
ld.h  0[r1],  r10
Andi  0xffff, r10, r10
```

2. The accuracy when performing display as AZ trace data depends on the _ _AZMON_TimePerCount value (tpc value in Figure 4-1). In the case of a timer counter that takes 1 μs to count up 1 unit, the time unit displayed by the AZ850 is 1 μs.

3. If the event interval for the collected AZ trace data is longer than the interval time of the timer counter, the correct time cannot be displayed.

4.1.3 Creating AZ monitor

After creating the user own coding block, complete the AZ monitor (azmon.o) using the method indicated below. The following commands must be input at the MS-DOS prompt.

(1) When using NEC's CA850

<1> Assemble azusr.s to create azusr.o

```
as850  -cpu  cpu name -cn  -o  azusr.o  azusr.s
```

Remark Input the name of the CPU that is used for the cpu name. For instance, in the case of the V853, this would be 3003.

<2> Link azusr.o and azcore.o to create azmon.o

[When using RX850]

```
ld850 -r -D azmon.lnk -o azmon.o ..\..\lib850\r**\azcore.o azusr.o
```

Remark r** is either r22, r26, or r32. Select r** according to the register mode that is used.

[When using RX850 pro]

```
ld850 -r -D azmon.lnk -o azmon.o ..\..\lib850\r32\azcore_p.o azusr.o
```

★ It is also possible to create the AZ monitor by using mkmon.bat in the nectools32 \ smp850 \ az850 directory. However, it is necessary to modify the tool path in mkmon.bat according to the development environment that is used.

(2) GHS's CCV850/CCV850E

<1> Assemble azusr.850 to create azusr.o

```
ccv850 (or ccv850e) -c -o azusr.o azusr.850
```

<2> Link azusr.o and azcore to create azmon.o

[When using RX850]

```
lx -r -o azmon.o ..\..\lib850\r**\azcore.o azusr.o
```

Remark r** is either r22, r26, or r32. Select r** according to the register mode that is used.

[When using RX850 Pro]

```
lx -r -o azmon.o ..\..\lib850\r32\azcore_p.o azusr.o
```

★ It is also possible to create the AZ monitor by using mkmon.bat in the nectools32 \ smp850 \ az850 directory. However, it is necessary to modify the tool path in mkmon.bat according to the development environment that is used.

4.1.4 Initializing AZ monitor

The AZ monitor must be initialized before it is operated. Initialization of the AZ monitor must be performed prior to starting up the RX850 or RX850 Pro. It is recommended to perform initialization in the initialization handler (“init_handler()” in the case of the RX850, and “varfunc()”) in the case of the RX850 Pro).

The AZ initialization routine “Azlnit()” is provided for initializing the AZ monitor. Call Azlnit() in init_handler() or varfunc(). Azlnit() is a function without return value and argument. Figure 4-3 shows an example of describing the initialization block of the AZ monitor.

Figure 4-3 AZ Monitor Initialization Description Example

```
void
init_handler()
}
        /*
         *       Initialize AZ Moniter
         */
        AzInit();

        return;
}
```

4.1.5 Definition of AZ monitor sections

In the case of soft trace, AZ monitor sections must be prepared. These sections must be defined in a link directive file (section map file).

The section names for the AZ monitor are as follows.

Section name	Description	Placement attribute	Size
.azmon_b	AZ monitor work area	bss	40 bytes
.azmon_t	AZ monitor text/data area	text	Approx. 900 bytes

An example of the link directive file (section map file) when these areas are defined is shown below.

Figure 4-4 Example of Description When Using NEC's CA850

```
                    :
TEXT:!LOAD?RW V0x00001000{
       .text        =$PROGBITS ?AW .text;
       .azmon_t     =$PROGBITS ?AW .azmon_t;
};

DATA:!LOAD?RW V0x00100000{
       .data        =$PROGBITS ?AW .data;
       .sdata       =$PROGBITS ?AWG .sdata;
       .sbss        =$NOBITS ?AWG .sbss;
       .bss         =$NOBITS ?AW .bss;
       .azmon_b     =$NOBITS ?AW .azmon_b;
};
                    :
```

Figure 4-5 Example of Description When Using GHS's CCV850/CCV850E

```
                    :
       .text          0x00001000    :
       .azmon_t                     :

       .data          0x00010000    :
       .sdata                       :
       .sbss                        :
       .bss                         :
       .azmon_b                     :
                    :
```

4.1.6 AZ monitor embedding method

The AZ monitor embedding method is described below.

AZ monitor “azmon.o” is linked according to objects obtained by compiling/assembling user programs, libraries required by RX850 or RX850 Pro applications, and link directive file (section map file) defined in the AZ monitor section as described in section 4.1.2.

When the RX850 is used, define “trace information” in the configuration file. For details about the configuration file, refer to **RX850 Instruction User’s Manual (U13410E)**.

4.2 Hard Trace Form

The hard trace form uses the trace function of an in-circuit emulator or simulator to collect AZ trace data. When the AZ850 is used with this method, the trace data is stored in the debugger's trace buffer area.

In the case of the hard trace form, tracing can be performed without adding monitor or other programs to the user application.

The hard trace execution methods for task-level trace and function-level trace using the RX850 or RX850 Pro are described below.

4.2.1 In case of task-level trace using RX850/RX850 Pro

When performing task-level trace with hard trace, it is not necessary to provide information for getting trace data in the application program, because AZ trace information is described in the nucleus of the RX850 and RX850 Pro itself.

It is not particularly necessary to perform linking of AZ trace objects when creating applications. However, when using the RX850, define "trace information" in the configuration file. For details about the configuration file, refer to the **RX850 Instruction User's Manual (U13410E)**.

The following cautions must be observed.

(1) Regarding setting of events on debugger

In the case of the hard trace form, the AZ850 uses the debugger's trace conditions. Thus, if many trace conditions are used on the debugger side, it may not be possible to perform AZ trace mode settings.

The trace condition of the debugger used by the AZ850 is as follows.

[Trace condition]

Qualify trace condition (for write access): 1

(2) Regarding time accuracy

In the case of the hard trace form, the time accuracy is the same as the time accuracy for the time lag of trace data for the trace function on the debugger side.

The AZ850 calculates the task execution time from the CPU's system clock. Therefore, if the system clock is set to the STOP mode or the IDLE mode, time information is not guaranteed.

4.2.2 In case of function-level trace

Caution Currently, function tracing with the AZ850 using NEC's in-circuit emulator (ICE) and the ID850 is not possible. If using the function trace function, use the SM850 simulator.

In the case of function-level trace, it is necessary to provide information for getting trace data in the application program.

If the application is written in C language, AZ trace information can be output by attaching the "-g option" and the "-Xaz option" for NEC's CA850 C compiler. Thus, it is not necessary to add descriptions to C source programs. However, the CCV850 and CCV850E C compilers made by GHS do not provide an AZ trace output option, so that it is not possible to perform function level tracing.

If the application is described in assembly language, it is necessary to add the following descriptions to the program.

- Specify "`.globl`" and "`.frame`" for labels indicating beginning of function
- Describe "`.option az_info_j`" immediately before instructions performing system calls
- Describe "`.option az_info_r`" immediately before instructions performing function return
- Describe "`.option az_info_ri`" immediately before instructions ending interrupt processing

Figure 4-6 shows an example of description in assembly language.

Figure 4-6 Assembly Language Description Example

```
    .globl  _func, 4            … Function definition
    .frame  _func, 4

_func:                          …  Beginning of function
            :
            :
    .option az_info_j           … Description addition
    jarl    _funcl, lp          … Function call processing
            :
            :
    mov     #_func2, r11
    mov     #L1, lp
    .option az_info_j           … Description addition
    jmp     [r11]               … Function call processing

L1:
            :
            :
    .option az_info_j           … Description addition
    jmp     [lp]                … Function return processing

_intr:                          … Beginning of interrupt handler
            :
            :
    .option az_info_j           … Description addition
    reti                        …  Interrupt end processing
```

When creating an application, it is not particularly necessary to link AZ trace objects.

The following cautions about debugging must be observed.

(1) Memory mapping

When using the V850E in-circuit emulator (ICE) with NEC's ID850 debugger, function-level tracing can be performed only in the internal ROM space. Note that function-level tracing cannot be performed for programs mapped to external memory.

(2) Number of set events on debugger

In the case of the hard trace form, the AZ850 uses the trace conditions of the debugger. As a result, if many trace conditions are used on the debugger side, it may not be possible to set the AZ trace mode.

The trace conditions and expanded trace conditions of the debugger used by the AZ850 are as follows.

[Trace conditions]

Qualify trace conditions (for write access): 3

[Expanded trace conditions]

When using NEC's ID850 debugger:	Use all tag memories
When using NEC's SM850 simulator:	Use all event memories

(3) Time accuracy

In the case of the hard trace form, the time accuracy is the same as the time accuracy for the time lag of trace data for the trace function on the debugger side.

The AZ850 calculates the task execution time from the CPU's system clock. Therefore, if the system clock is set to the STOP mode or the IDLE mode, time information is not guaranteed.

4.3 Trace Memory

The memory area that is used for AZ trace and the trace memory clear timing are as follows.

- **Soft trace form**

  [Used memory area]

  Set the trace memory area when initializing the AZ monitor.

  [Trace memory clear]

  The contents of the trace memory are cleared by again setting “AZ trace ON” after switching from “AZ trace ON” to “AZ trace OFF”. (If the user program has been reexecuted without clearing the trace memory, the data following the trace data written the previous time is written to the trace memory, and when the trace memory becomes full, trace data collection stops.)

- **Hard trace form**

  [Used memory area]

  Use the trace memory area of the debugger.

  [Trace memory clear]

  The previously collected trace data is cleared every time the user program is executed.

CHAPTER 5 TRACE DATA

This chapter describes the AZ trace data detection locations and contents, and the contents that can be guaranteed when using the AZ850.

5.1 AZ Trace Data Detection Contents

The locations that can be detected as AZ trace data and their contents are described below.

(1) Task level

Table 5-1 Detectable Contents in Case of Task Trace

Detected Location	Detected Contents
System call entry	Time Execution system call name System call output address System call target object ID
System call exit	Time System call return value
Interrupt entry	Time Interrupt source code Interrupt occurrence address
Interrupt exit	Time
Task switch	Time ID of task to which operation will shift (or idle status)
Task starter	Time Task entry address

However, the items listed below cannot be detected as AZ trace data.

- Exceptions (TRAP instruction, CPU exceptions such as illegal instruction code)
- Cyclic startup handler start and end
- System call (ext_tsk, exd_tsk, ret_int, ret_wup) output address

(2) Function trace

Table 5-2 Detectable Contents in Case of Function Trace

Detected Location	Detected Contents
Function call	Time Output address Start address of call destination function
Function return	Time Return address Return address of call destination
Interrupt entry	Time Interrupt occurrence address Start address of interrupt handler
Interrupt exit	Time Return address Return address of interrupt handler
I/O access	Time I/O address Data Access status (Read/Write)

However, the items listed below cannot be detected as AZ trace data.

- Interrupt occurrence addresses when an interrupt occurs
- Return addresses upon RETI instruction
- Execution addresses upon I/O access

5.2 Debugging Possible with AZ850

The types of debugging that are possible using the functions of the AZ850 are described below.
For details about the operation method, refer to the window descriptions in **CHAPTER 6 WINDOW REFERENCE**.

(1) Verification using the <Analyze Window>

This window displays the collected AZ trace data using execution transition diagrams.
Verification/analysis of system errors and of the entire system can be performed from this window and the various windows that are displayed from it.

- Checking the system call issue status
  In addition to execution transition diagrams showing the system flow with the name/interrupt name as the vertical axis, the system calls supplied by the real-time OS are shown using various marks.
  Furthermore, it is possible to select specific locations within AZ trace data by opening the <Trace View> window from any marked point.

- Checking object operation
  The operation of specified objects (functions, tasks, interrupts, etc.) can be searched on execution transition diagrams.

- Searching the occurrence location of specific events
  The “Certain Event” set in the <Pattern Search> dialog box can be searched on execution transition diagrams.
  Searching the switching location for particular tasks, locations where an interrupt has occurred, and locations where a particular system call has been issued can easily be done by using this function.

- Jumping to debugger window from a given location
  The windows displaying source text/disassemble text/memory contents corresponding to tasks/interrupts specified with the up temporary cursor in the execution transition diagram can be opened on the debugger.

(2) Verification using the <Pattern Window>

The pattern (particular processing) set with the <Set Pattern> dialog box is searched in the execution transition diagram and the distribution status of that pattern is displayed in this window.

It is possible to obtain the worst execution time value and average execution time value for user program processing from this window.

- Histogram display of function/task/interrupt processing time
  The tabulated results for the searched pattern are displayed in histogram form with the execution time interval as a parameter.

- Search using function/task/interrupt processing time
  Pattern locations where the execution time interval is maximum or minimum are searched in the processing time of the searched pattern and the results of this search are displayed in the execution transition diagram.
  This enables the easy search of locations where particular patterns are processed.

(3) Verification using the <CPU Window>

This window displays the CPU usage status in the time range specified in the execution transition diagram.

From this window, it is possible to check the execution time of given tasks/interrupts and evaluate the performance of the target data from the idle time and interrupt time.

- Check of execution time of given function/task/interrupt, or check of CPU usage percentage
- Check of function/task execution time percentages within time interval for which data is collected
- Check of system execution time percentages within time interval for which data is collected

(4) Verification using the <Trace View Window>

This window displays in list form the collected AZ trace data contents.

- Checking AZ trace data
  In addition to the processing time, execution addresses, and executed task/interrupt name, the system call issue status provided by the real-time OS is displayed, enabling even finer debugging in task units.

- Verification of function name/task name/event type/system call argument name
  It is possible to perform searches using conditions such as task name, interrupt name, event type, system call argument name, etc.

CHAPTER 6 WINDOW REFERENCE

This chapter describes in detail the functions of the windows and dialog boxes of the AZ850.

6.1 Outline of Windows and Dialog Boxes of AZ850

Table 6-1 shows the windows and dialog boxes of the AZ850.

Table 6-1 List of Windows and Dialog Boxes of AZ850

[Common window]

Window/Dialog Box Name	Description	Page
AZ850 Main Window	Window for performing basic operations of the AZ850	p.53
★ AZ Option dialog box	Trace form and trace level settings	p.59
File Select dialog box	Loading and saving of contents displayed in AZ850 windows to “display file”	p.62

[Task-level window]

Window/Dialog Box Name	Description	Page
Analyze Window	Display of execution transition diagram of collected AZ trace data	p.65
Object Select dialog box	Selection of shown objects and specification of sequence changes in execution transition diagram	p.80
Pattern Search dialog box	Search condition settings in execution transition diagram and search using these conditions	p.83
CPU Window	Display of CPU usage status in time interval specified in execution transition diagram	p.87
Pattern Set dialog box	Settings for patterns displayed in <Pattern Window>	p.92
Pattern Window	Histogram display of the results summed up by execution time width of appearance ratio for specification pattern in execution transition diagram.	p.96
Trace View Window	List display of collected AZ trace data	p.103
Trace Search dialog box	Setting of search conditions in <Trace View Window> and search under these conditions	p.109

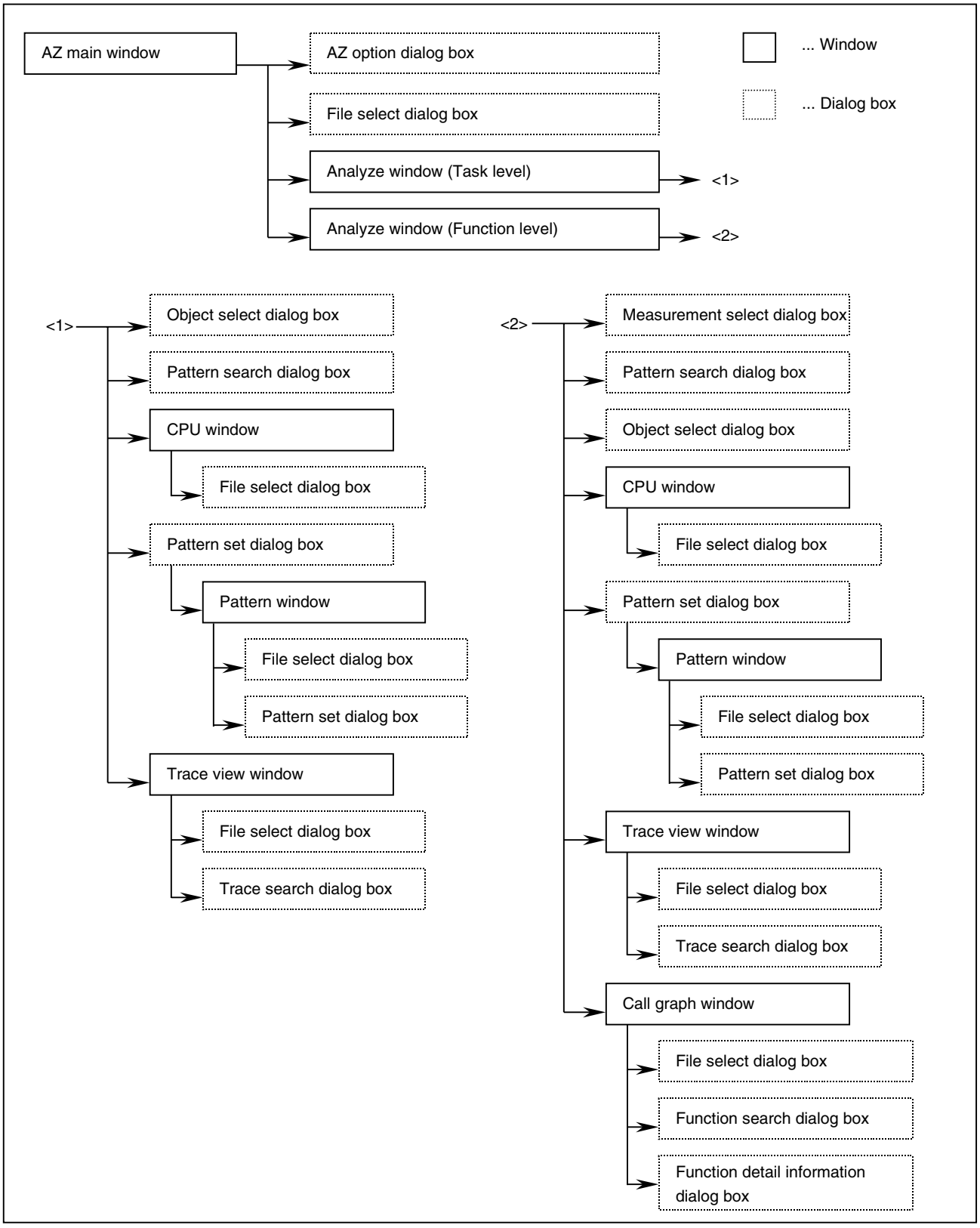
[Function-level window]

Window/Dialog Box Name	Description	Page
Analyze Window	Display of execution transition diagram of collected AZ trace data	p.112
Measurement Select dialog box	Selection of object to be measured when AZ trace data is collected	p.124
Pattern Search dialog box	Search condition settings in execution transition diagram and search using these conditions	p.127
Object Select dialog box	Selection of shown objects and specification of sequence changes in execution transition diagram	p.130
CPU Window	Display of CPU usage status in time interval specified in execution transition diagram	p.133
Pattern Set dialog box	Settings for patterns displayed in <Pattern Window>	p.140
Pattern Window	Histogram display of the results summed up by execution time width of appearance ratio for specification pattern in execution transition diagram.	p.143
Trace View Window	List display of collected AZ trace data	p.150
Trace Search dialog box	Setting of search conditions in <Trace View Window> and search under these conditions	p.155
Call Graph Window	Display of diagram indicating the relationship between caller functions and callee functions in a zone between the up cursor and down cursor on the execution transition diagram	p.158
Function Search dialog box	Search of function/interrupt name in the <Call Graph Window>	p.163
Function Detail Information dialog box	Display of detailed information on the parent function, source function, and child function displayed in the <Call Graph Window>.	p.165

6.2 Relationships Among AZ850 Windows and Dialog Boxes

Figure 6-1 shows the relationships among the windows and dialog boxes of the AZ850.

Figure 6-1 Relationships Among Windows and Dialog Boxes of AZ850



6.3 Description of Windows and Dialog Boxes

The windows and dialog boxes are described using the following format.

Window/Dialog Box Name [Task Level/Function Level]

[Window/Dialog Box Name]

[Outline]

Outlines the function of the window or dialog box, and describes how to open it.

[Window]

Shows a picture of the window or dialog box screen.

[Function]

Describes in detail the function of the window or dialog box.

[Function Buttons]

Describes the operation of the buttons in the window or dialog box, detailing which item the button operation affects and what happens when the button is clicked.

[Menu Bar]

Lists the menu items displayed when the described menu bar item is clicked, and the function of each of the items thus displayed.

[Caution]

Describe cautions applying to the operation of the window or dialog box.

[Error]

Describes the errors or the warnings that may occur when operating the window or dialog box.

AZ Main Window

[AZ850]

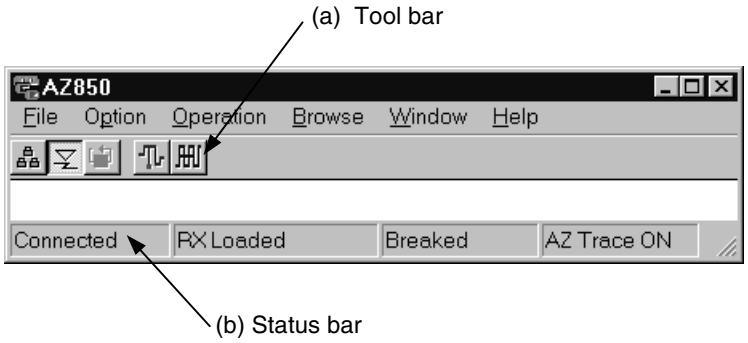
[Outline]

This window, which opens automatically after the AZ850 is started up, is used to perform basic operations of the AZ850.

When using the AZ850, start operations from this window.

[Window]

Figure 6-2 AZ Main Window



[Function]

This section describes the following item.

(1) Description of each area

(1) Description of each area

(a) Tool bar

The tool bar consists of buttons used to execute menu items that are used relatively frequently.

- **<AZ Option> dialog box display button** 

  This button opens the <AZ Option> dialog box.

  Specify the desired options to be used when performing AZ trace in this dialog box.

- **[AZ Trace ON/OFF] button** 

  This is a toggle button that enables/disables the AZ850 trace function.

  AZ trace data can be collected by setting “AZ Trace ON”.

Cautions 1. To set "AZ Trace ON", the AZ850 must be in the following status.

- **In case of soft trace**
  Both RTOS and AZ monitor must have been downloaded ([RX+AZ Loaded] displayed on status bar)
- **In case of hard trace**
  When both RTOS and AZ monitor have been downloaded at the task level ([RX+AZ Loaded] displayed on the status bar), when an application program including function information is loaded in the debugger ([FncInfo Loaded] displayed on the status bar), or when RTOS and an application program including function information have been loaded ([RX/FncInfo Loaded] is displayed on the status bar)

2. When using the soft trace form, the trace memory contents are cleared by again setting "AZ Trace ON" after switching from "AZ trace ON" to "AZ trace OFF".

- **[Upload] button** 
  Clicking this button causes the trace data obtained by executing the user program to be uploaded and from the trace memory and converted to AZ trace data.

Cautions 1. When the <Analyze Window> is open, clicking this button causes the execution transition diagram to be updated to the latest AZ trace data.

2. This button cannot be selected if there is no trace data in the trace memory.

- **<Analyze Window> display button** 
  This button is used to open the task-level <Analyze Window>.
  The execution transition diagrams of individual tasks can be checked from this window.
- **<Analyze Window> display button** 
  This button is used to open the function-level <Analyze Window>.
  The execution transition diagram of individual functions can be checked from this window.

(b) Status bar

This area displays the various statuses of the AZ850.

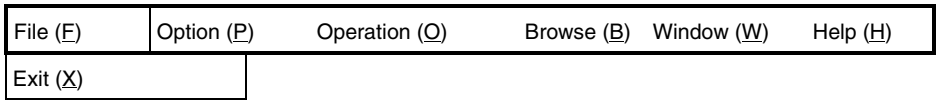
- **Connection status display area (1st from the left)**
  Indicates the status of connection with the debugger.
  Connected: The AZ850 is connected to the debugger.
  Not connected: The AZ850 is not connected to the debugger.
- **Load module status display area (2nd from the left)**
  Displays the load module status uploaded from the debugger.
  This area does not indicate whether the AZ850 is unconnected to the debugger.

RX+AZ Loaded	Status where both RTOS and AZ monitor have been downloaded (in case of soft trace form)
RX Loaded	Status where RTOS has been downloaded (in case of hard trace form)
FncInfo Loaded	Status where function information is loaded
RX+AZ/FncInfo Loaded	Status where RTOS, AZ monitor, and all function information have been downloaded (in case of hard trace form)
RX/FncInfo Loaded	Status where both RTOS information and function information have been downloaded (in case of hard trace)
RX+AZ/FncInfo None	Status where only one or none of RTOS information, AZ monitor, or function information has been downloaded (in case of hard trace form)
RxFncInfo None	Status where either or none of RTOS information and function information has been downloaded (in case of hard trace form)

- **Load module execution status display area (3rd from left)**
  Displays the user program execution status.
  This area does not show whether the AZ850 is unconnected to the debugger.
  Running: Status of user program being executed
  Breaked: Status of user program operation undergoing break
- **Trace mode status display area (4th from left)**
  Displays AZ trace ON/OFF.
  This area does not display whether the AZ850 is unconnected to the debugger and whether load module download (download of required symbol information) has been completed.
  AZ Trace ON: Status where AZ trace ON has been set
  AZ Trace OFF: Status where AZ trace OFF has been set

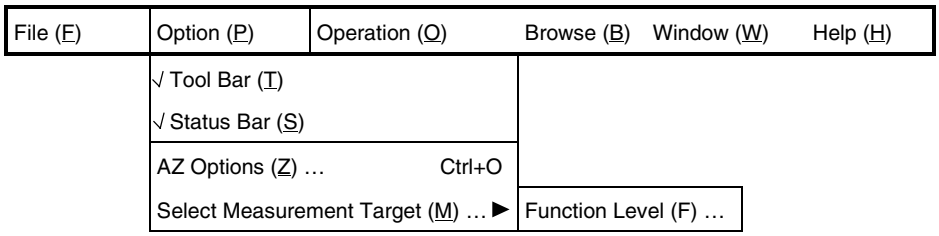
[Menu Bar]

(1) [File (F)] menu



Exit (X) Terminates the AZ850.

★ **(2) [Option (P)] menu**



Tool Bar (T) — Specifies whether or not to display the tool bar on this window. The tool bar is displayed when this item is selected.

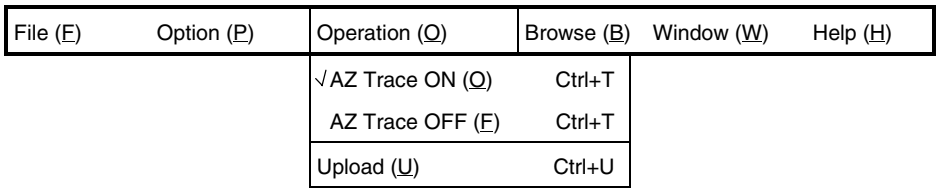
Status Bar (S) — Specifies whether or not to display the status display area on this window. The status display area is displayed when this item is selected.

AZ Options (Z) — Opens the <AZ Option> dialog box.
Specify the options to be used when performing AZ trace in this dialog box.
This item has the same operation as the  button on the tool bar.

Select Measurement Target (M) — Displays a submenu for opening the <Measurement Select> dialog box.
The following items are displayed as the submenu items.

Function Level (F) — Opens the function-level <Measurement Select> dialog box.

★ **(3) [Operation (O)] menu**



AZ Trace ON (O) — Sets the AZ trace mode to “AZ Trace ON”.
When this item is selected, “AZ Trace ON” is set and trace data is collected in the trace memory as the user program is executed.

AZ Trace OFF (F) — Sets the AZ trace mode to “AZ Trace OFF”.
When this item is selected, “AZ Trace OFF” is set and trace data is not collected in the trace memory as the user program is executed.

Upload (U) — Uploads trace data.
The trace data obtained by executing the user program is read from the trace memory and converted into AZ trace data.
Furthermore, if the <Analyze Window> is opened, clicking this button updates the execution transition diagram to the latest AZ trace data.
This item has the same operation as the  button on the tool bar.

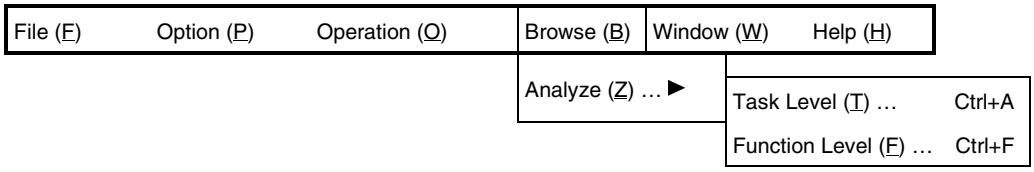
Cautions 1. [AZ Trace ON] cannot be selected unless the AZ850 is in the following status.

- **In case of soft trace**
  Status where both RTOS and AZ monitor have been downloaded ([RX+AZ Loaded] displayed on status bar)
- **In case of hard trace**
  When both RTOS and AZ monitor have been downloaded at the task level ([RX+AZ Loaded] displayed on the status bar), when an application program including function information is loaded in the debugger ([FncInfo Loaded] displayed on the status bar), or when RTOS and an application program including function information have been loaded ([RX/FncInfo Loaded] is displayed on the status bar)

2. [AZ Trace ON] cannot be selected during user program execution.

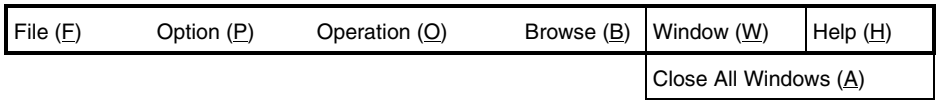
3. [Upload] cannot be selected when there is no trace data in the trace memory.

★ **(4) [Browse (B)] menu**



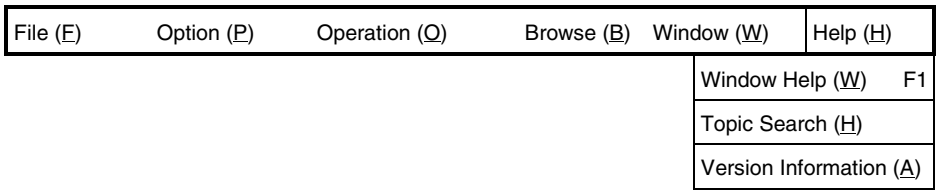
Analyze (Z)	Displays a submenu for opening the <Analyze Window>. The following items are displayed as the submenu items.
Task Level (T)	Opens the task level <Analyze Window>. This item has the same operation as the  button on the tool bar.
Function Level (F)	Opens the function level <Analyze Window>. This item has the same operation as the  button on the tool bar.

(5) [Window (W)] menu



Close All Windows (A)	Closes all the windows and dialog boxes of the AZ850.

★ (6) [Help (H)] menu



Window Help (W)	Displays the Help topics for this window.
Topic Search (H)	Displays the help <Topic Search> dialog box of the AZ850.
Version Information (A)	Opens the <Version Display> dialog box of the AZ850.

[Caution]

- To set “AZ Trace ON”, the AZ850 must be in the following status.
- In case of soft trace form
  Status where both RTOS and AZ monitor have been downloaded ([RX+AZ Loaded] displayed on status bar).
- In case of hard trace form
  When both RTOS and AZ monitor have been downloaded at the task level ([RX+AZ Loaded] displayed on the status bar), when an application program including function information is loaded in the debugger ([FncInfo Loaded] displayed on the status bar), or when RTOS and an application program including function information have been loaded ([RX/FncInfo Loaded] is displayed on the status bar)
  “AZ trace ON” cannot be set during user program execution.
- If using the AZ850 with the soft trace form, the contents of the trace memory are cleared by setting “AZ Trace ON”.
- If using the hard trace form, the AZ850 sets trace conditions to the debugger. Thus, if many trace conditions are used on the debugger side, it may not be possible to set “AZ Trace ON”. (For details, refer to the manual of the debugger that is used).
- Even if trace data is uploaded, the main window itself does not change. To see the trace data contents, it is necessary to open the <Analyze Window> after uploading the trace data.

[Error]

- When uploading data, the <Error> dialog box appears if there is no trace data in the trace memory.
- When switching the AZ trace mode, the <Error> dialog box appears upon occurrence of an error.
- If an error occurs during trace data uploading, the <Error> dialog box appears.

AZ Option Dialog Box

[AZ Option]

★ **[Outline]**

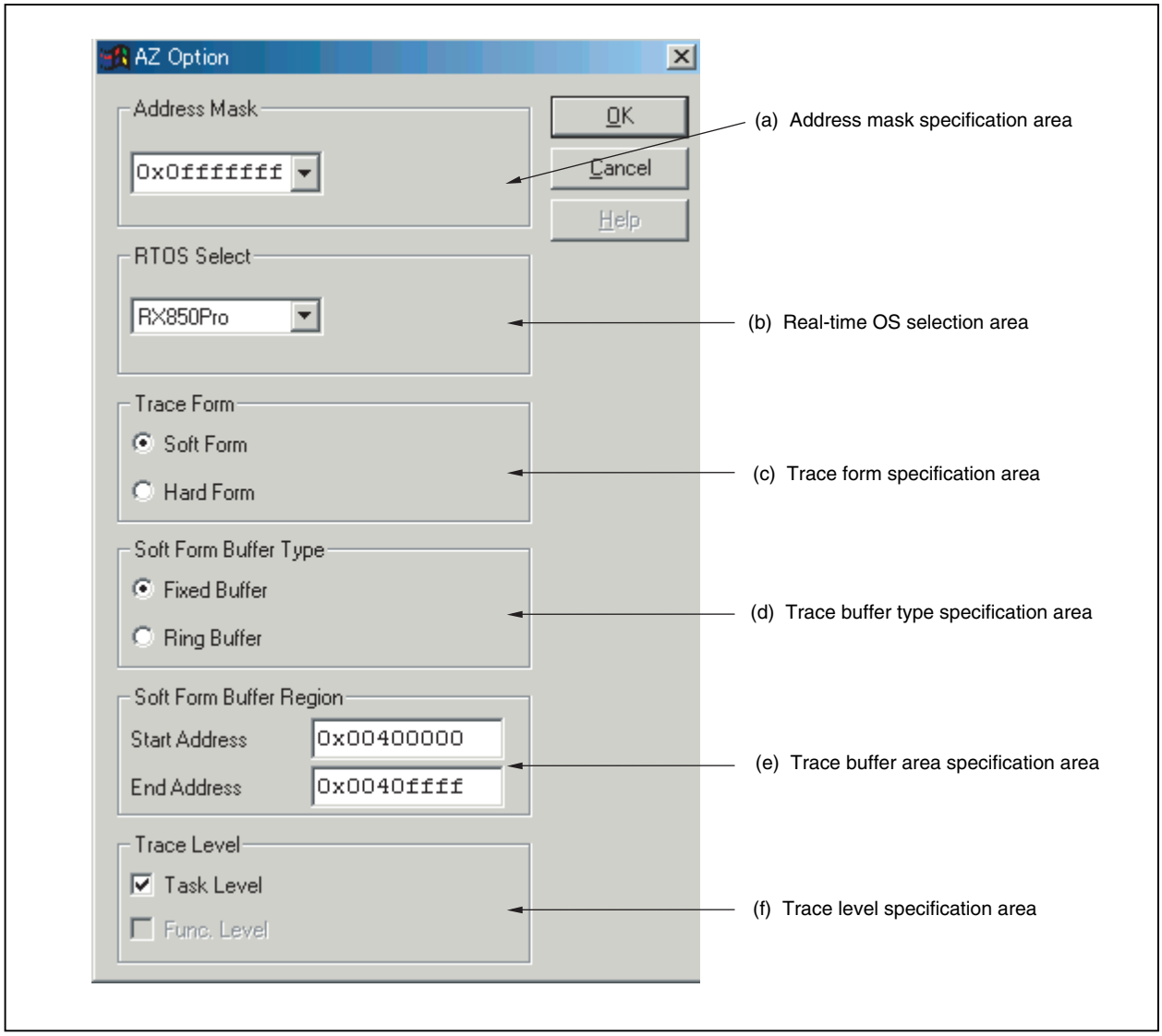
This dialog box is used to specify the trace form for the AZ850, the target real-time OS, the trace buffer type, the trace buffer area, and the trace level of the AZ trace data to be collected.

This dialog box can be opened with one of the following operations.

- In the AZ main window, select [Open (P)] from the menu bar, then [AZ Options (Z)].
- In the AZ main window, click the  button.
- Press the ALT + P, Z keys in that order.
- Press Ctrl + O keys.

[Window]

★ **Figure 6-3 AZ Option Dialog Box**



[Function]

This section describes (1) each area and (2) the trace forms specified in the <AZ Option> dialog box.

(1) Description of each area
(2) Regarding trace from specified in the <AZ Option> dialog box

(1) Description of each area

★ **(a) Address mask specification area**

This area specifies the upper limit value of the physical address space on the chip. Select the value according to the chip used as shown below.
Select 0x00ffffff for the V851, V852, V853, V854, V850/SA1, V850/SB1, and V850/SB2.
Select 0x03ffffff for the V850E/MS1.
Select 0x0fffffff for the V850E/MA1 and V850E/IA1.
Refer to the user's manual of each chip for chips not described here.

(b) Real-time OS selection area

When performing trace at the task level, select the real-time OS used by the load module downloaded on the debugger from the drop-down box.

- **RX850**
  Select this item to use the RX850.
- **RX850 Pro**
  Select this item to use the RX850 Pro.

(c) Trace form specification area

This area is used to specify the AZ850 trace form.
Select the environment to be used by selecting one of the option buttons.

- **Soft Form (soft trace form)**
  Select this item to collect AZ trace data from the monitor program with a monitor function provided on the target system.
- **Hard form (Default: hard trace form)**
  Select this item to collect AZ trace data using the trace function of an in-circuit emulator or simulator.

(d) Trace buffer type specification area

This area is used to specify the type of trace buffer when specifying the soft trace form (Soft Form) as the trace form.
Select the environment to be used by selecting one of the option buttons.

- **Fixed Buffer**
  The trace buffer is a fixed buffer.
  When the trace buffer becomes full, trace collection ends. Therefore, the trace data up to the location where the program execution was stopped is not necessarily collected.
- **Ring Buffer**
  The trace buffer is a ring buffer.
  When the trace buffer becomes full, the older trace data is overwritten.

(e) Trace buffer area specification area

This area is used to specify the trace buffer area to be used with the soft trace form.
Specify the start address and end address in the respective text boxes.
In the case of the soft trace form, the trace data collected by the AZ850 is stored for a while in the target memory. Thus, an unused area in the target memory must be specified as the trace buffer area.
The trace buffer area must be specified so that its size is between 4 KB and 4 MB.

(f) Trace level specification area

This area is used to specify the trace level of the AZ trace data to be collected.

- When only Task Level is selected: Collects AZ trace data of task level.
- When only Func. Level is selected: Collects AZ trace data of function level.
- When both Levels are selected: Collects AZ trace data of task level and function level in mix.

As the default level, Task Level is selected. If Soft Form is specified as the trace mode, only “Task Level” can be specified as the trace level.

(2) Regarding trace form specified in <AZ Option> dialog box

The AZ850 trace forms consist of the soft trace form and the hard trace form, and one of these must be specified. The default is the hard trace form. However, if the connected debugger does not support the hard trace form, the soft trace form becomes the default.

[Function Buttons]

Operation Target	Button	Function
★ Condition	OK	AZ850 operates with the specified physical address upper limit value, RTOS type, trace form, trace buffer area, and trace level.
–	Cancel	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

[Errors]

- When the OK button is clicked without selecting a trace level, the <Error> dialog box appears.
- If the address range specified during trace buffer area specification is incorrect, pressing the OK button causes the <Error> dialog box to appear.

File Select Dialog Box

[Open File]

[Outline]

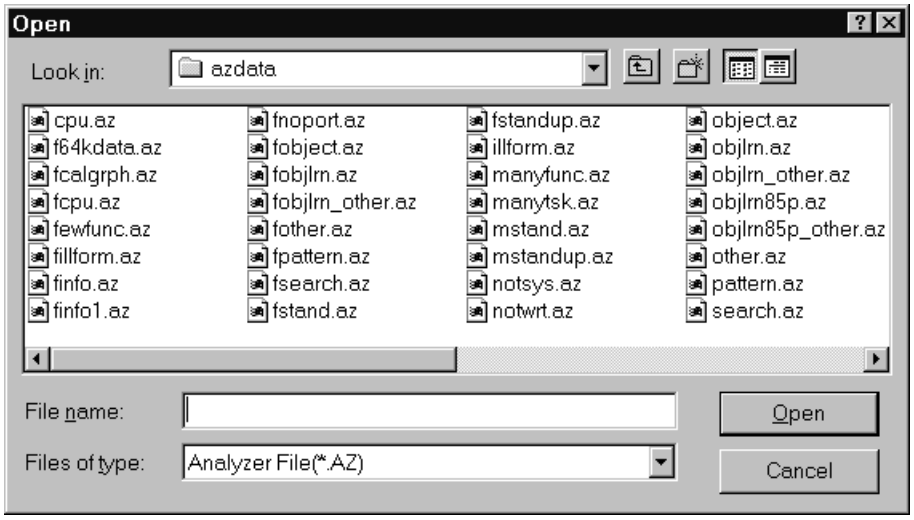
This dialog box is used to select files when loading or saving display files.

This dialog box can be opened with one of the following operations.

- From the menu bar in each window, select [File (E)], then [Open (O)].
- From the menu bar in each window, select [File (F)], then [Save As (A)].
- In each window, click the  button.
- In each window, click the  button.
- In each window, press the ALT + F , O keys in that order.
- In each window, press the ALT + F , A keys in that order.

[Window]

Figure 6-4 File Select Dialog Box (Open)



[Function]

This section describes the following items.

(1) Display file extensions and file format
(2) Display information reproduction

(1) Display file extensions and file format

Display files vary from window to window, and are differentiated by their extension.

Table 6-2 shows the default extension of display files corresponding to the various windows of the AZ850 and their file format.

Table 6-2 Display File Types and Extensions

Display File Type	Extension	File Format
Analyze Window	.AZ	Binary format
CPU Window	.AZC	CSV format
Pattern Window	.AZP	
Trace View Window	.AZT	

(2) Display information reproduction

Reproduction of display information by loading a display file differs as follows for each window.

(a) In case of <Analyze Window>

The display information is reproduced in the currently open <Analyze Window>.

Therefore, to hold the currently displayed execution transition diagram, first place the <Analyze Window> in the hold status, then open a new <Analyze Window> and load the display file.

(b) In case of other windows

A window in the hold status is newly opened and the display information is reproduced in this window.

Therefore, the display information of the currently displayed window is saved as is on the screen.

[Function Buttons]

Operation Target	Button	Function
Select File	OK	Loads/saves selected display file.
–	Cancel	Closes this dialog box.
–	Help	Displays the help topics for this window.

[Error]

- If the file name format is not correct, an <Error> dialog box appears.
- If loading a file that does not exist is attempted, an <Error> dialog box appears.
- If saving data to a write-protected file is attempted, an <Error> dialog box appears.
- If saving data by specifying a file name that already exists is attempted, a message confirming whether it is OK to overwrite the existing file appears.
- If loading data that cannot be handled in the current window is attempted, an <Error> dialog box appears.

Analyze Window [Task Level]

[Analyze window]

[Outline]

The collected AZ trace data is displayed in execution transition diagrams for each task by executing the user program.

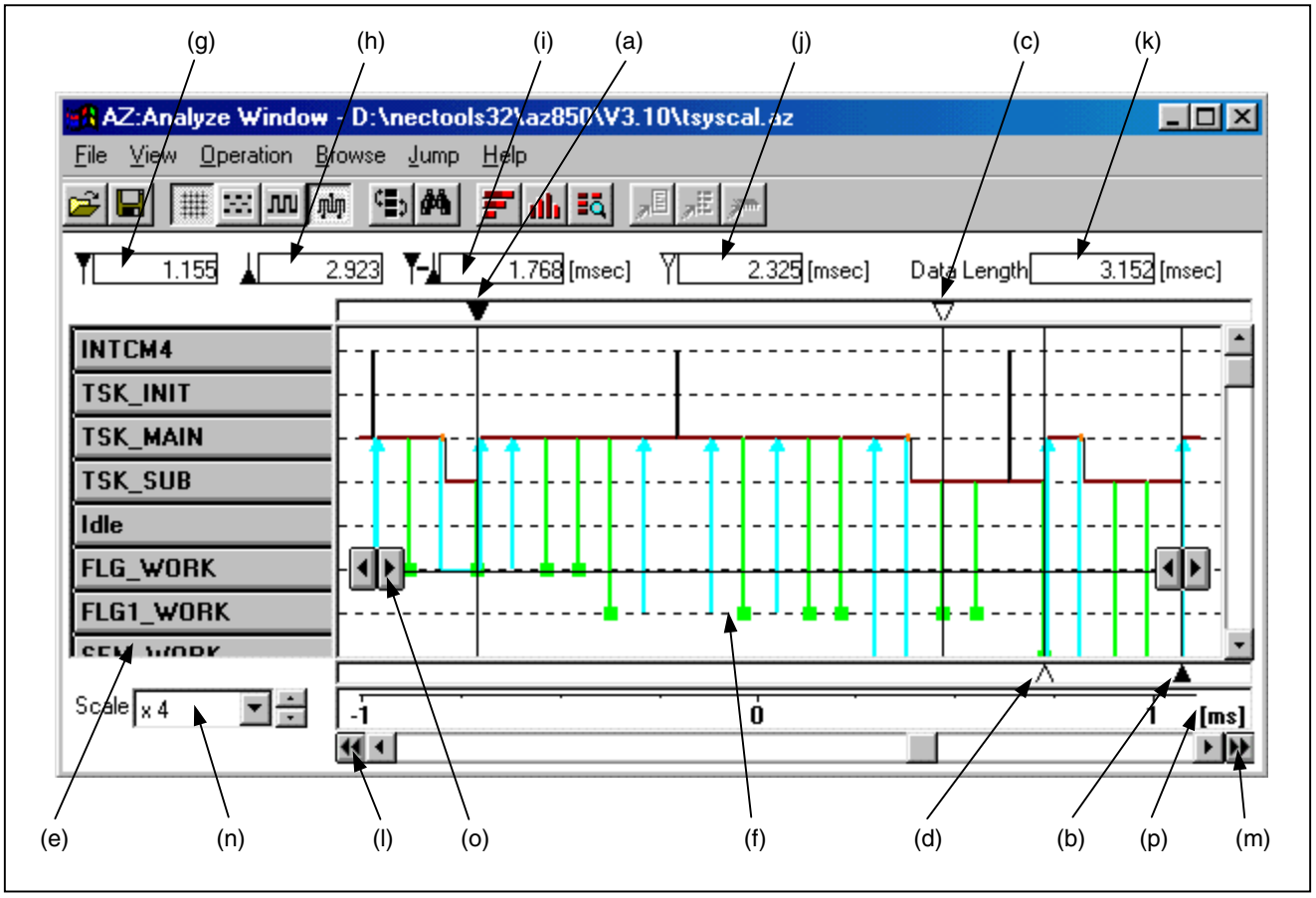
System timing errors and overall system verification and analysis can be done for single tasks from this window and the various windows displayed from it.

This window can be opened with one of the following operations.

- In the AZ main window, select [Browse (B)] from the menu bar, then [Analyze (Z)] and [Task Level (T)].
- In the AZ main window, click the  button.
- Press the ALT + B, Z, and T keys in that order.
- ★ Press the Ctrl + A keys.

[Window]

★ **Figure 6-5 Analyze Window (Task Level)**



(a) Up cursor
(b) Down cursor
(c) Up temporary cursor
(d) Down temporary cursor
(e) Object
(f) Analysis result (transition diagram) display
(g) Time display of up cursor position
(h) Time display of down cursor position
(i) Inter-cursor time display
(j) Time display of up temporary cursor position
(k) Data length
(l) Jump to beginning button
(m) Jump to end button
(n) Scale modify button
(o) Simple search buttons
(p) Time area
(q) Pop-up display

[Function]

This section describes the following items.

(1) Description of each area
(2) Execution transition diagram display method
(3) Object names
(4) Execution transition diagram viewing method
(5) Verification method in execution transition diagram

(1) Description of each area

(a) Up cursor

This cursor is used to check the processing time in AZ trace data and to specify ranges when performing various calculations. (It is used to specify the beginning of the range for which a calculation is to be done.)

[Operation Method]

Click on the desired start location in the transition diagram with the mouse while pressing the Shift key.

(b) Down cursor

This cursor is used to check the processing time in AZ trace data and to specify ranges when performing various calculations. (It is used to specify the end of the range for which a calculation is to be done.)

[Operation Method]

Click on the desired end location in the transition diagram with the mouse while pressing the Ctrl key.

(c) Up temporary cursor

This cursor is used to display the result position during search using the simple search button or pattern search, and to specify the start position when jumping to the debugger window.

To display search results using the <Pattern Window>, this cursor indicates the start position of the searched pattern.

When the up cursor is moved, the up temporary cursor also moves to the same position.

[Operation Method]

Click the right button of the mouse.

(d) Down temporary cursor

When displaying the search result in the <Pattern Window>, this cursor shows the end position of the searched pattern.

When the down cursor is moved, the down temporary cursor also moves to the same position.

(e) Object

These buttons indicate objects in AZ trace data.

They indicate RTOS-related resources such as tasks, events, and flags, and mailboxes. For details about the object names, refer to section **(3) Object names** below.

When an object name is clicked, the simple search button appears. Clicking the object name once more makes the simple search button disappear.

(f) Analysis result (transition diagram) display

This area displays the analysis result for the user program.

For details about the marks on the transition diagram, refer to section **(4) Execution transition diagram viewing method** below.

(g) Time display of up cursor position

This box displays the relative time from the start of AZ trace data collection until the up cursor position.

The unit is milliseconds (msec).

(h) Time display of down cursor position

This box displays the relative time from the start of AZ trace data collection until the down cursor position.

The unit is milliseconds (msec).

(i) Inter-cursor time display

This box displays the time interval between the up cursor and the down cursor. The unit is milliseconds (msec).

(j) Time display of up temporary cursor position

This box displays the relative time from the start of AZ trace data collection until the up temporary cursor position. The unit is milliseconds (msec).

(k) Data length

This box indicates the time interval from the start to the end of AZ trace data.

(l) Jump to beginning button

This button is used to move the up cursor and display screen to the beginning of the AZ trace data.

(m) Jump to end button

This button is used to move the down cursor and display screen to the end of the AZ trace data.

(n) Scale modify button

This button is used to change the display scale for execution transition diagrams. Any display scale can be selected using the pull-down menu or the spin buttons.

(o) Simple search buttons

These buttons are used to search the operation of selected objects.

When the  button displayed upon clicking an object name is clicked, the object operation is searched in the time axis direction in the execution transition diagram, and the up temporary cursor moves to the search position.

When the  button is clicked, the operation of the object selected in the opposite direction as the time axis is searched and the up temporary cursor moves to the search position.

(p) Time area

This area displays the standard event interval time displayed in the execution transition diagram.

The unit is displayed at the right extremity of this area. In the example shown in Figure 6-5, The unit is milliseconds (msec).

★ **(q) Pop-up display**

The following contents pop up when the mouse pointer is placed on the event or object buttons in the <Analyze Window>.

- Object button (in case of RX850)
  Object name
- Object button (in case of RX850 Pro)
  Object name (object ID number)
- Vertical line indicating task switch
  Time at which a task is switched
  Task name or interrupt name before switch
  Task name or interrupt name after switch
- Orange-colored horizontal line indicating system call
  The time from when a system call is issued to the end of the system call (the time taken for the system call)
  Syscall (system call name)
  Target object name (this may not be displayed depending on the system call)
- Orange-colored horizontal line indicating interrupt
  The time from when an interrupt is generated to the end of the interrupt (the time taken for the interrupt)
  Int (interrupt name)
- Vertical line indicating access for object
  System call issuance time: The task name that generates an event
  Syscall or SysRet (system call name)
  Target object name
- The mark × indicating system call error
  System call end time
  Return value

(2) Execution transition diagram display method

The execution transition diagram for the collected AZ trace data can be displayed in this window by performing the following operation.

[Operation Method]

<1> Collect the AZ trace data.

<2> Open this window. (Select [Browse (B)] from the menu bar in the AZ main window, then select [Analyze (Z)], [Task Level (T)], or click the  button on the tool bar.)

Data is not automatically updated in this window. Therefore, to display as an execution transition diagram trace data newly collected by re-executing the user program, perform upload (from the AZ main window, select [Operation (O)], then [Upload [U], or click the  button]).

(3) Object names

The buttons that indicate objects are displayed as follows.

- **RX850 objects**

  RX850 objects are displayed using the symbol names specified with the RX850 configurator.

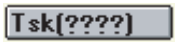
★ The object name pops up when the mouse pointer is placed on the object button.

However, idle tasks are displayed as follows.

	Idle task

Items for which the task ID is not known are displayed as follows as unknown tasks.

The task ID is unknown from program execution start to task switching when the program is executed in the middle of a task.

	Task with unknown ID

★ 	Long object name (XXXX: object name)

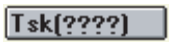
★ • **RX850 Pro objects**

A task is displayed with the function name specified by the user and the task ID number.

Other object names are displayed with the resource type and the ID number.

However, the correspondence between the function name and the task ID number may not be displayed correctly because the function name information is read from the target memory to which the RX850 Pro system management table is allocated when upload processing is performed.

The function name or object name pops up when the mouse pointer is placed on the object button.

	Task (nnnn: Task ID No. (hexadecimal))
	Event flag (nnnn: Event flag ID No. (hexadecimal))
	Semaphore (nnnn: Semaphore ID No. (hexadecimal))
	Mailbox (nnnn: Mailbox ID No. (hexadecimal))
	Memory pool (nnnn: Memory pool ID No. (hexadecimal))
	Idle task
	Task with unknown ID

The function name is displayed as follows when it is long.

★ 	Long function name (XXXX: Object name and YYYY: Task ID number)

- **Interrupts**

  Interrupts are displayed with the interrupt handler name obtained from the debugger.
  However, if the interrupt handler name could not be obtained from the debugger, the following default names are displayed.

Int(nnnn)	Maskable interrupt (nnnn: Exception code (hexadecimal))
NMI	Non-maskable interrupt

- **Other objects**

Etc.	Objects set in the “Hide objects” area in the <Object Select> dialog box

(4) Execution transition diagram viewing method

There are the following three display modes for execution transition diagrams, which can be selected by selecting from the menu bar in the <Analyze Window> [View (V)], then [Display Mode (V)].

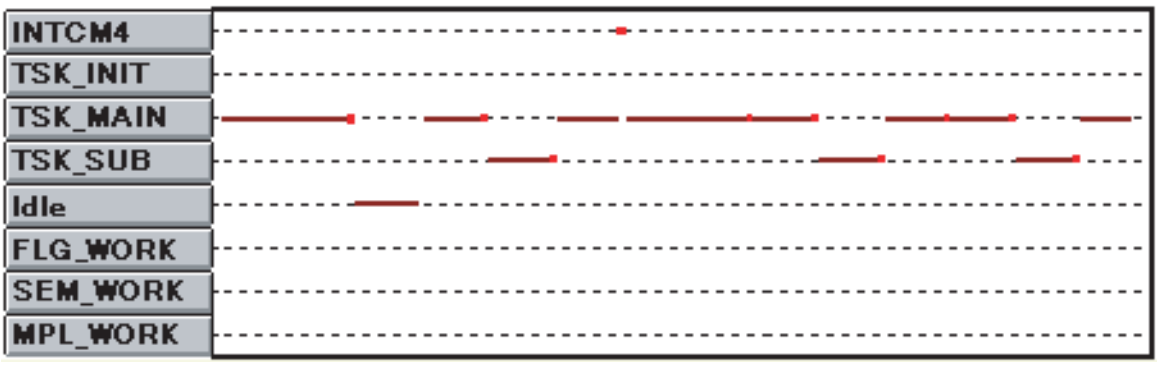
(a) Vertical line delete mode
(b) Standard mode
(c) Detailed mode (default)

Remark Whether or not to display grid lines in transition diagrams can be selected by selecting from the menu bar in this window [View (V)], then [Grid Mode (G)].

(a) Vertical line delete mode

This mode displays horizontal lines only for CPU run locations.
The vertical line delete mode is suitable when analyzing AZ trace data in a wide range.

Figure 6-6 Analyze Window (Task Level) (Vertical Line Delete Mode)

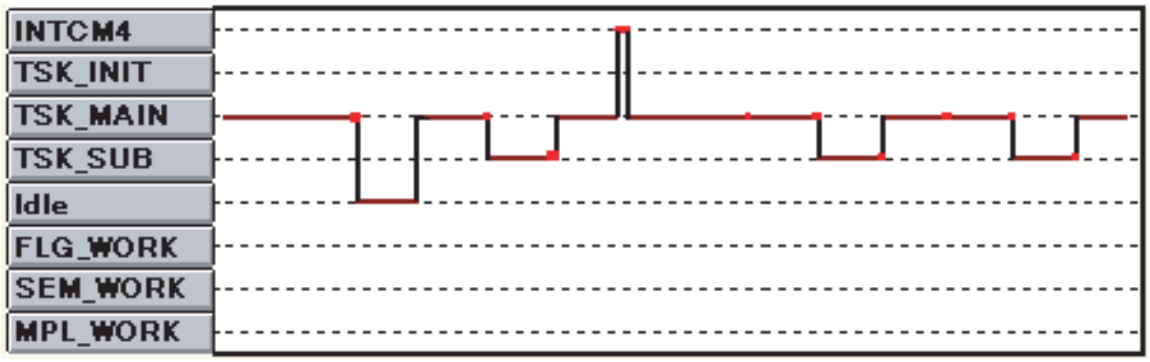


Remark Black lines indicate user program processing, and red lines indicate system call processing.

(b) Standard mode

This mode displays CPU transition traces as linked lines.

Figure 6-7 Analyze Window (Task Level) (Standard Mode)



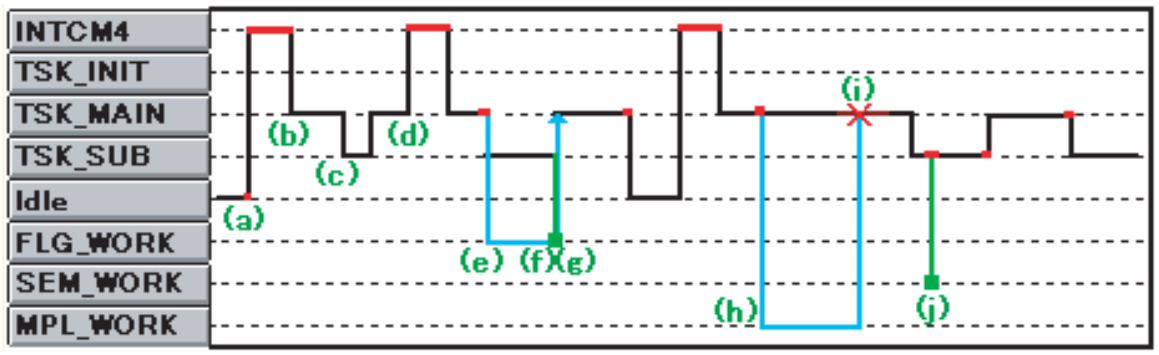
Remark Black lines indicate user program processing, and red lines indicate system call processing.

(c) Detailed mode (default)

This mode displays system calls of memory pool management and synchronous communication management functions among RTOS system calls, in addition to CPU transition traces, as “marks” (refer to Table 6-3 and Table 6-4).

The detailed mode is suitable when analyzing access to objects.

Figure 6-8 Analyze Window (Task Level) (Detailed Mode)



Remark Black lines indicate user program processing, and red lines indicate system call processing.

(a) Interrupt acknowledged in idle state (HALT state), and processing moves.
(b) Processing has moved to TSK_MAIN.
(c) Processing has moved to TSK_SUB.
(d) Interrupt has been acknowledged.
(e) TSK_MAIN has issued wai_flg system call to FLG_WORK event flag.
Since TSK_MAIN is in wait status, processing has moved to TSK_SUB.
(f) TSK_MAIN indicates that the issued wai_flg system call has returned and that wait has been released.
(g) TSK_MAIN has issued set_flg to FLG_WORK.
(h) TSK_MAIN has issued get_blf system call to MPL_WORK memory pool.
(i) System call in (h) has been returned with an error return.
(j) TSK_SUB has issued the sig_sem system call for the SEM_WORK semaphore.

Table 6-3 List of Marks on Execution Transition Diagram (Task Level) (When RX850 Embedded)

Mark	Access Target	Issued system call	Meaning
↑	Event flag	wai_flg / pol_flg / twai_flg / vwai_flg1 / vtwai_flg1 / vpol_flg1	Indicates that system call has been issued and returned for access target.
	Semaphore	wai_sem / twai_sem / preq_sem	
	Mailbox	rcv_msg / trcv_msg / prcv_msg	
	Variable-length memory block	get_blk / tget_blk / pget_blk	
	Fixed-length memory block	get_blf / tget_blf / pget_blf	
↓	Event flag	set_flg / clr_flg / vset_flg1 / vclr_flg1	
	Semaphore	sig_sem	
	Mailbox	snd_msg	
	Variable-length memory block	rel_blk	
	Fixed-length memory block	rel_blf	
×	Indicates that the issued system call has resulted in an error.		

Table 6-4 List of Marks on Execution Transition Diagram (Task Level) (When RX850 Pro Embedded)

Mark	Access Target	Issued System Call	Meaning
	Event flag	wai_flg / pol_flg / twai_flg	Indicates that system call has been issued and returned for access target.
	Semaphore	wai_sem. / twai_sem / preq_sem	
	Mailbox	rcv_msg / trcv_msg / prcv_msg	
	Memory pool	get_blk / tget_blk / pget_blk	
	Event flag	del_flg	
	Semaphore	del_sem	
	Mailbox	del_mbx	
	Memory pool	del_mpl	
	Event flag	del_flg	
	Semaphore	del_sem	
	Mailbox	del_mbx	
	Memory pool	del_mpl	
	Indicates that the issued system call has resulted in an error.		

(5) Verification method in execution transition diagram

The collected AZ trace data can be verified in this window using the following methods.

(a) Object processing search
(b) Search using Pattern Search dialog box
(c) Search using <Pattern Window>

(a) Object processing search

The specified object processing can be searched using the simple search button.

[Operation Method]

<1> If the up temporary cursor is displayed in the execution transition diagram, move the up temporary cursor to the search start position. If it is not displayed, move the up cursor to the search start position.

<2> Click the object name whose operation is to be verified. The simple search button is displayed as a result. The simple search button is displayed immediately on the right of the object name and also at the right end of the transition diagram.

<3> Click the simple search button.

 : The specified object processing is searched in the time axis direction in the execution transition diagram, and the up temporary cursor moves to the search position.

 : The specified object processing is searched in the opposite direction to the time axis in the execution transition diagram, and the up temporary cursor moves to the search position.

If the searched point is not displayed on the currently displayed execution transition diagram, that point is moved on the graph so that it coincides with 0 on the graduation.

The simple search button disappears from the screen when the button indicating the object name is clicked again.

(b) Search using <Pattern Search> dialog box

In the <Pattern Search> dialog box, the specified pattern is searched on the transition diagram. The search results are displayed by the up temporary cursor on the transition diagram.

When using the <Pattern Search> dialog box, the transition status of tasks and interrupts can be searched.

For details, refer to the <Pattern Search> dialog box description.

(c) Search using <Pattern Window>

In the <Patter Window>, the specified pattern set in the <Pattern Set> dialog box is searched on the transition diagram. The search results are displayed by the up and down temporary cursors on the transition diagram.

When using the <Pattern Window>, task and interrupt processing sections can be searched.

For details, refer to the <Pattern Window> Description.

[Function Buttons]

(1/2)

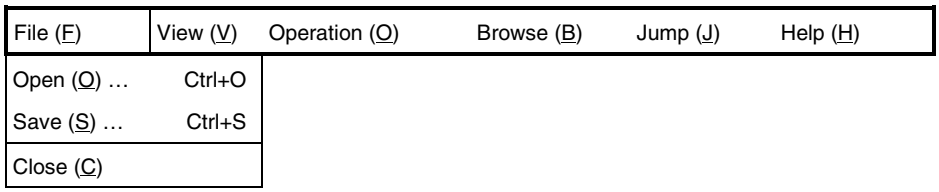
Operation Target	Button	Function
–		Opens the <File Select> dialog box. The previously saved <Analyze Window> trace data is read and a transition diagram is displayed.
–		Opens the <File Select> dialog box. The trace data currently displayed in the <Analyze Window> is saved to a file.
–		Sets the transition diagram grid mode ON/OFF.
–		Sets the vertical line delete mode as the transition diagram display mode.
–		Sets the standard mode as the transition diagram display mode.
–		Sets the detailed mode as the transition diagram display mode.
–		Opens the <Object Select> dialog box.
–		Opens the <Pattern Search> dialog box.
–		Opens the <CPU Window> and displays the CPU utilization rate between the up cursor and down cursor. If an active <CPU Window> is already displayed, the contents of this window are updated.
–		Opens the <Pattern Set> dialog box. When pattern conditions are set, the <Pattern Window> is displayed between the up cursor and down cursor. If an active <Pattern Window> is already displayed, the contents of this window are updated.
–		Opens the <Trace View Window> from the position specified with the up temporary cursor. If an active <Trace View Window> is already displayed, the contents of this window are updated.
–		Opens the <Source Text Window> from the position specified with the up temporary cursor. If an active <Source Text Window> is already displayed, the contents of this window are updated.
–		Opens the <Disassemble Window> from the position specified with the up temporary cursor. If an active <Disassemble Window> is already displayed, the contents of this window are updated.

(2/2)

Operation Target	Button	Function
–		Displays the memory list on the debugger from the position specified with the up temporary cursor. If the memory list is already displayed in an active window, the contents of that window are updated.

★ **[Menu Bar]**

(1) [File (F)] menu



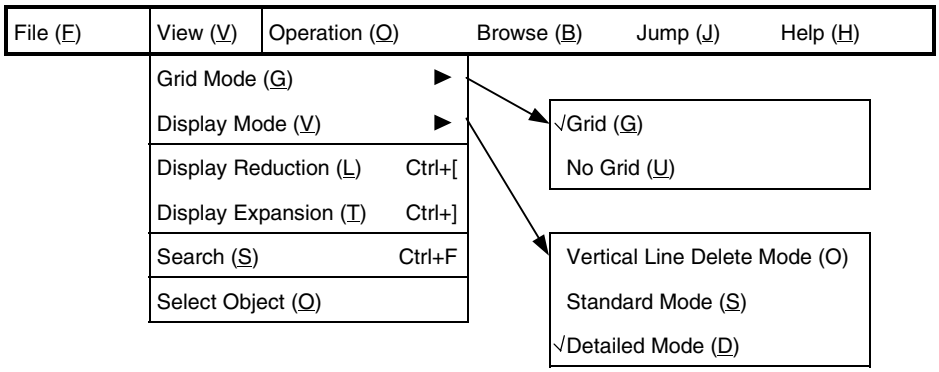
Open (O) — Opens the <File Select> dialog box. The previously saved files displayed in this window are read.
The default extension of the display file for this window is .az.

Save (S) — Opens the <File Select> dialog box.
Saves the currently displayed execution transition diagram data to a display file, either as a new file or as a file with a different name.
The default extension of the display file for this window is .az.

Close (C) — Closes this window.

Caution If the execution transition diagram is not displayed, the [Save (S)] item cannot be selected.

(2) [View (V)] menu



Grid Mode (G) — Displays the submenu for specifying display/hide grid lines on execution transition diagram.
The following submenu is displayed.

- Grid (G) — Display grid lines.
- No Grid (U) — Don't display grid lines.

Display Mode (V) — Displays the submenu for specifying the execution transition diagram display mode.
The following submenu is displayed.

- Vertical Line Delete Mode (O) — Does not display vertical lines on execution transition diagram.
  This item has the same operation as the  button.
- Standard Mode (S) — Displays only the CPU execution transitions.
  This item has the same operation as the  button.
- Detailed Mode (D) — At the task level, indicates the real-time OS system call access status, and at the function level, indicates the CPU's execution transition and I/O access with marks (default).
  This item has the same operation as the  button on the tool bar.

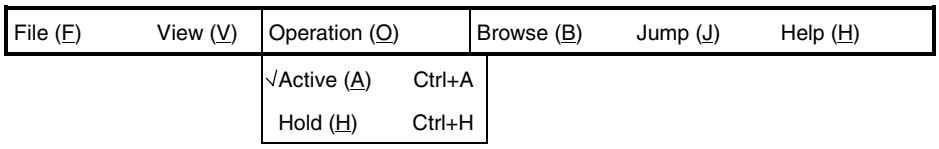
Display Reduction (L) — Reduces the execution transition diagram display scale. This item performs the same operation as reduction using the scale modify button (refer to Figure 6-5).

Display Expansion (T) — Expands the execution transition diagram display scale. This item performs the same operation as expansion using the scale modify button (refer to Figure 6-5).

Search (S) — Opens this window's trace level <Pattern Search> dialog box.
This item performs the same operation as the  button.

Object Select (O) — Opens this window's trace level <Object Select> dialog box.
This item has the same operation as the  button.

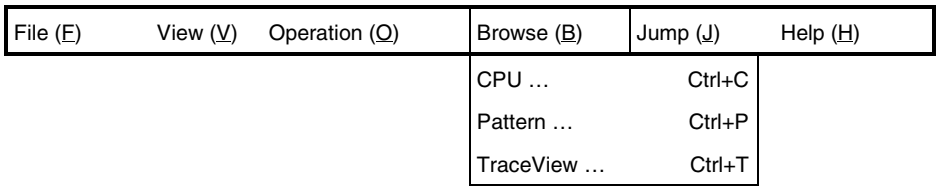
(3) [Operation (O)] menu



Active (A) — Switches this window from hold status to active status.

Hold (H) — Switches this window from active status to hold status.

(4) [Browse (B)] menu

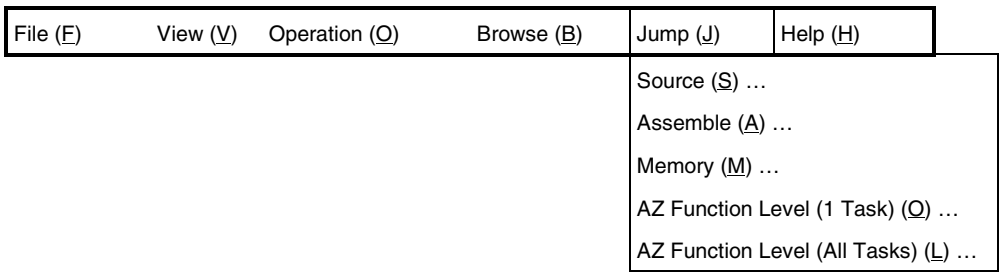


CPU Utilization Rate (C) — Opens this window's trace-level <CPU Window>.
If an active <CPU Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

Pattern Distribution (P)
Opens this window's trace level <Pattern Set> dialog box.
When a pattern is set in this dialog box, the <Pattern Window> appears. If an active <Pattern Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

Trace View (T)
Opens this window's trace level <Trace View Window>. If an active <Trace View Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

(5) [Jump (J)] menu



Source (S)
Displays the source text on the debugger from the position specified with the up temporary cursor. If the source text is already displayed in an active window, the contents of this window are updated.
This item has the same operation as the  button.

Assemble (A)
Displays the disassemble text on the debugger from the position specified with the up temporary cursor. If the disassemble text is already displayed in an active window, the contents of this window are updated.
This item has the same operation as the  button.

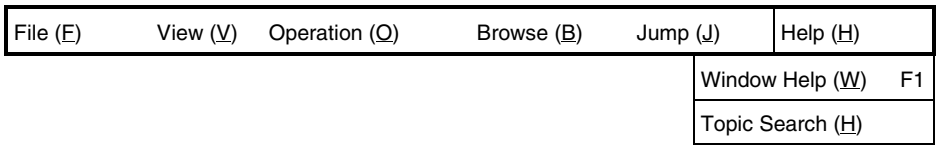
Memory (M)
Displays the memory list on the debugger from the position specified with the up temporary cursor. If the memory list is already displayed in an active window, the contents of this window are updated.
This item has the same operation as the  button.

AZ Function Level (1 Task) (O)
Opens the function-level <Analyze Window> only for the task specified with the up temporary cursor (set immediately before moving to the task to be specified). If an active function-level <Analyze Window> is already displayed, the contents of this window are updated.

AZ Function Level (All Tasks) (L)
Opens the function-level <Analyze Window> for all tasks. If an active <Analyze Window> is already displayed, the contents of this window are updated.

Caution If no address information exists for the position specified with the up temporary cursor, none of the items in the [Jump (J)] menu can be selected.

(6) [Help (H)] menu



Window Help (W)	Displays the Help topics for this window.
Topic Search (H)	Displays the help <Topic Search> dialog box of the AZ850.

[Caution]

- Data is not automatically updated in this window. Thus, to collect new trace data by re-executing the application program, data update by performing upload (from the AZ main window, select [Operation (O)], then [Upload (U)]) must be performed.
- If there is no address information in the trace data at the position specified with the up temporary cursor, none of the items in the [Jump (J)] menu can be selected.
- Task names in the RX850 Pro are displayed as “function name [task ID number]”.
  However, when an attempt is made to perform dynamic processing for a task, the correspondence between the function name and the task ID number may not be displayed correctly because the function name information is read from the target memory to which the RX850 Pro system management table is allocated when upload processing is performed.

[Supplement]

- An AZ file can be opened by dragging and dropping the file icon on the <Analyze Window>.

[Error]

- If an active execution transition display window exists, making a window in the hold status active causes the <Error> dialog box to appear.
- Reading an AZ file whose real-time OS differs from the real-time OS specified in the <AZ Option> dialog box causes the <Error> dialog box to appear.

Object Select Dialog Box [Task Level]

[Object Select]

[Outline]

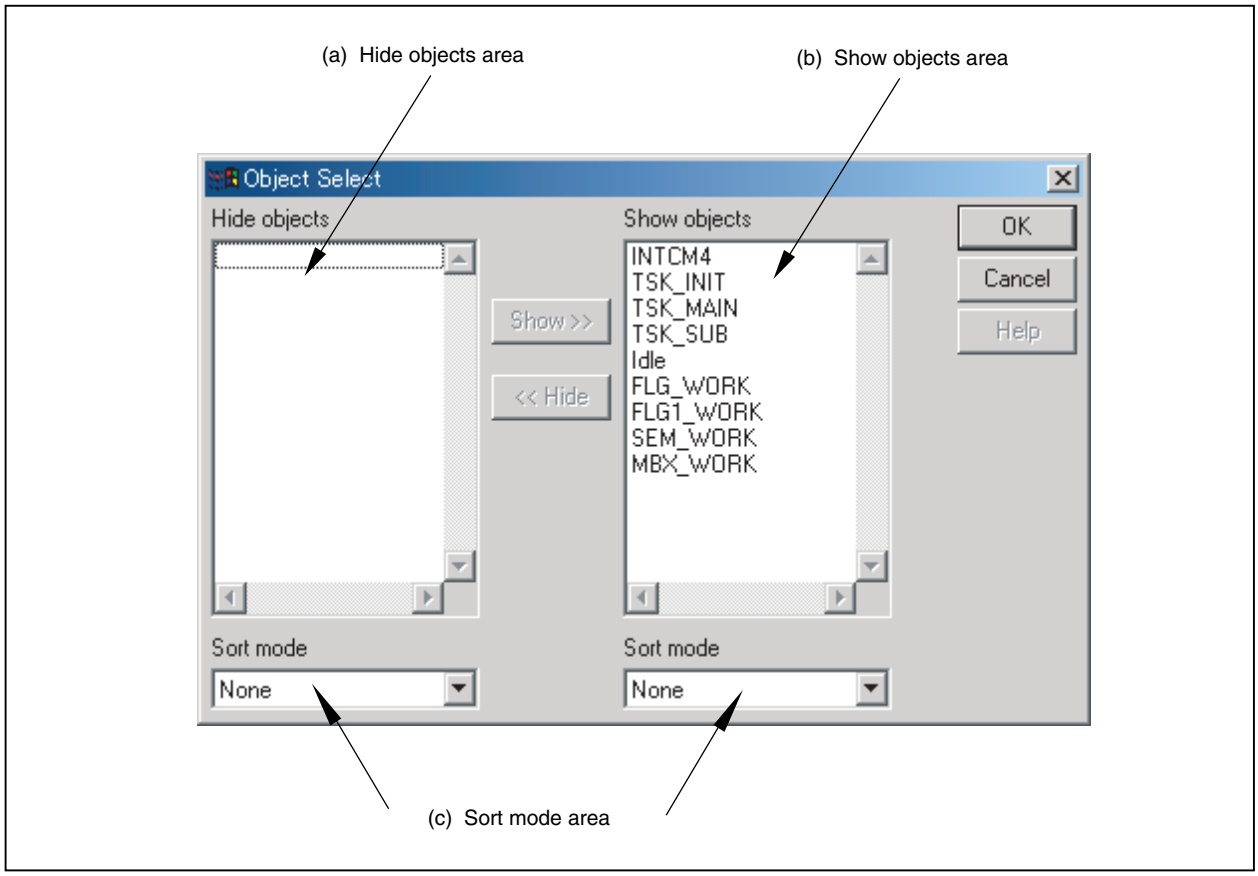
This dialog box is used to select objects to be displayed and to change their sequence in the execution transition diagram of the task-level <Analyze Window>.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [View (V)], then [Object Select (O)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + V, O keys in that order.

[Window]

★ **Figure 6-9 Object Select Dialog Box (Task Level)**



[Function]

This section describes the following items.

(1) Description of each area
(2) Shown object limitation method
(3) Shown object addition method
(4) Shown object sequence modification method

(1) Description of each area

(a) Hide objects area

This area displays the list of objects among those included in AZ trace data that are not displayed in execution transition diagrams. The horizontal scroll bar becomes active when a long object name is ★ displayed. The vertical scroll bar becomes active when the number of files displayed in this area exceeds the space.

(b) Show objects area

★ This area displays the list of objects displayed in execution transition diagrams. The horizontal scroll bar becomes active when a long object name is displayed. The vertical scroll bar becomes active when the number of files displayed in this area exceeds the space.

The default is to display all objects included in the AZ trace data.

The sequence in which objects are listed in this area is reflected in execution transition diagrams.

(c) Sort mode area

This area is used to select the display sequence used in the lists in the hide objects area and the show objects area.

(2) Shown object limitation method

The objects that are displayed in execution transition diagrams can be limited (deleted) by performing the following operation.

<1> Select objects that do not need to be displayed in execution transition diagrams from the list displayed in the Show object area.

<2> Click the [<<Hide] button. The selected objects are moved to the hide objects area. If, at this time, the destination is specified, the objects in question are inserted immediately before this specified destination, and if the destination is not specified, they are inserted at the very end of the list.

<3> Click the [OK] button to reflect these changes in the execution transition diagram.

Remark Hidden objects are grouped into the [Etc.] object and displayed in execution transition diagrams.

(3) Shown object addition method

Objects to be displayed in execution transition diagrams can be added by performing the following operation.

<1> Select the objects to be displayed in execution transition diagrams among those listed in the hide objects area.

<2> Click the [Show>>] button. The selected objects are moved to the show objects area. If, at this time, the destination is specified, the objects in question are inserted immediately before this specified destination, and if the destination is not specified, they are inserted at the very end of the list.

<3> Click the [OK] button to reflect these changes in the execution transition diagram.

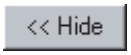
(4) Shown object sequence modification method

Objects in the hide objects area and show objects area are displayed classified into interrupts, idle, event flags, semaphores, mailboxes, and memory pools (default).

To modify the display sequence, select a setting from the sort mode drop-down list in the sort mode area. The display sequence in the show objects area is reflected to the execution transition diagram.

Sort Mode	Meaning
None	Unsorted mode (default)
Appear	Order of appearance in AZ trace data
Name	Name sequence for objects
ID	ID sequence for objects
Priority	Priority sequence (however, this setting is valid only for tasks.)

[Function Buttons]

Operation Target	Button	Function
Object		Moves objects selected in the show objects area to the hide objects area. If the destination is specified, the objects are inserted immediately this specified destination, and if the destination is not specified, they are inserted at the very end of the list.
Object		Moves objects selected in the hide objects are to the show objects area. If the destination is specified, the objects are inserted immediately this specified destination, and if the destination is not specified, they are inserted at the very end of the list.
–		Displays objects on execution transition diagram based on the objects displayed in the show objects area.
–		Closes this dialog box.
★ –		Opens an explanation window for this dialog box.

Pattern Search Dialog Box [Task Level]

[Pattern Search]

[Outline]

This dialog box is used to set search conditions when searching given events in execution transition diagrams.

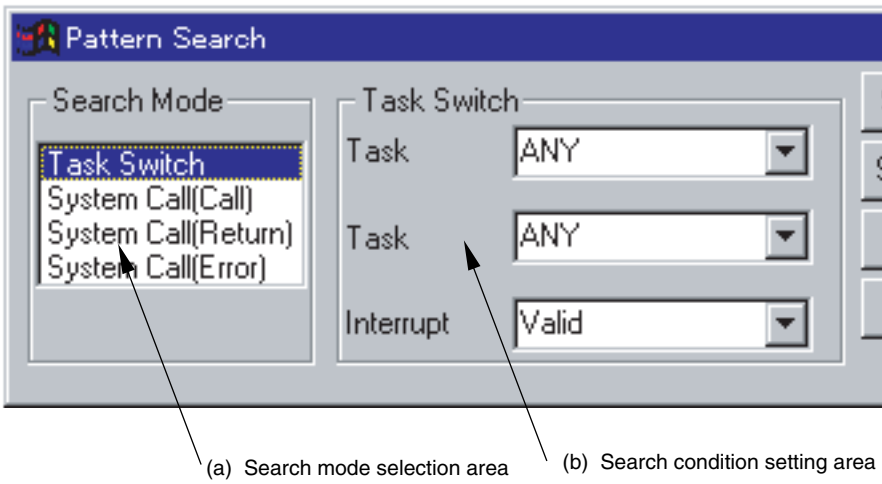
These events refer to switching points from a specified task or interrupt to a specified task or interrupt, or a given status of a specified system call.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [View (V)], then [Search (S)].
- In the <Analyze Window> click the  button.
- In the <Analyze Window>, press the ALT + V, S keys in that order.
- ★ In the <Analyze Window>, press the Ctrl + F keys.

[Window]

Figure 6-10 Pattern Search Dialog Box (Task Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Search method

(1) Description of each area

(a) Search mode selection area

This area is used to select the search mode.

The search mode indicates the type of event to be searched in the execution transition diagram. Table 6-5 lists the various search modes.

Table 6-5 Pattern Search Modes (Task Level)

Search Mode	Description
Task Switch	Search of task switching location
System Call (Call)	Search of location where a system call was called
System Call (Return)	Search of location where a system call was returned
System Call (Error)	Search of location where a system call resulted in an error being returned.

(b) Search condition setting area

This area is used to set the search conditions for the search mode specified in the search mode selection area.

The contents displayed in this area differ depending on the specified search mode.

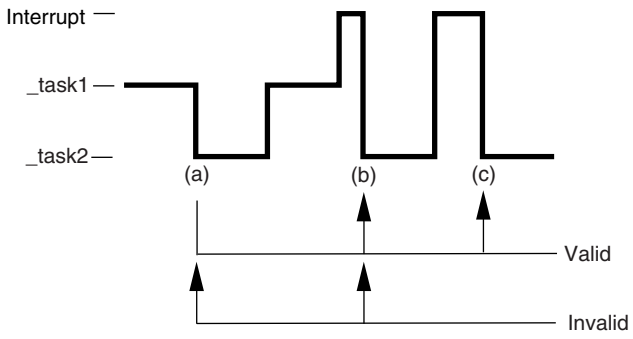
The search conditions set for each item can be directly input from the keyboard or selected from the drop-down list.

Table 6-6 lists the conditions that can be set.

Table 6-6 Pattern Search Conditions (Task Level) (When Task Switch Is Specified as Search Mode)

Item	Meaning of Condition
Task (high)	Specifies the task name or interrupt name before switching. If the user is not specific about the task or interrupt, specify “ANY”.
Task (low)	Specifies the task name or interrupt name after switching. If the user is not specific about the task or interrupt, specify “ANY”.
Interrupt	Specifies whether or not to include switching to (from) an interrupt among the search targets. Select “Valid” to set interrupt transitions as a search target, and set “Invalid” to exclude interrupt transitions from search targets.

Remark For the Interrupt item, the search position when “Valid” or “Invalid” is specified is as follows. (Search condition: Switching from [ANY] to [_task2]).



[(a) in above figure]

Valid … Since switching is done from [_task1] to [_task2], search is performed.

Invalid … Since switching is done from [_task1] to [_task2], search is performed.

[(b) in above figure]

Valid … Since switching is done from [interrupt] to [_task2], search is performed.

Invalid … Switching from interrupt servicing is ignored, but since switching from [_task1] to [_task2] is performed, search is performed.

[(c) in above figure]

Valid … Since switching from [interrupt] to [_task2], search is performed.

Invalid … Since switching from interrupt servicing is ignored, the sequence is seen as [_task2] → [_task2] and thus switching is considered not to have occurred, and as a result search is not performed.

Table 6-7 Pattern Search Conditions (Task Level)
(When System Call (Call, Return, Error) Is Specified as Search Mode)

Item	Meaning of Condition
Task	Specifies the task name or interrupt name that issued a system call. If the user is not specific about the task or interrupt, specify “ANY”.
System Call	Specifies the system call name. If the user is not specific about the system call, specify “ANY”.
Object	Specifies the target object for the system call. If the user is not specific about the object, specify “ANY”.

(2) Search method

[Operation Method]

<1> Specify the position to be used as the search start point.
If the up temporary cursor is displayed in the execution transition diagram, move it to the search start position. If it is not displayed, move the up cursor to that position.

<2> In the search mode selection area, on this dialog box, select the search mode.

<3> In the search condition setting area, either input the search condition for each item from the keyboard or select the search condition from the drop-down list.

<4> Click the Search(Fore) button or the Search(Back) button.

The search is performed as follows.

- If the Search(Fore) button is clicked

  The search is performed from the specified start point along the time axis, and the up temporary cursor moves to the search result position.

- If the Search(Back) button is clicked

  The search is performed from the specified start point in the direction opposite to the time axis, and the up temporary cursor moves to the search result position.

[Function Buttons]

Operation Target	Button	Function
Search condition	Search(Fore)	The location corresponding to the specified search condition is searched from the position indicated by the up cursor or the up temporary cursor in the execution transition diagram along the time axis. The up temporary cursor in the execution transition diagram moves to the search result position.
Search condition	Search(Back)	The location corresponding to the specified condition is searched from the position indicated by the up cursor or the up temporary cursor in the execution transition diagram in the direction opposite to the time axis. The up temporary cursor in the execution transition diagram moves to the search result position.
–	Close	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

[Error]

If no event meeting the set search condition exists in the AZ trace data, a warning sound is emitted.

CPU Window [Task Level]

[CPU Window]

[Outline]

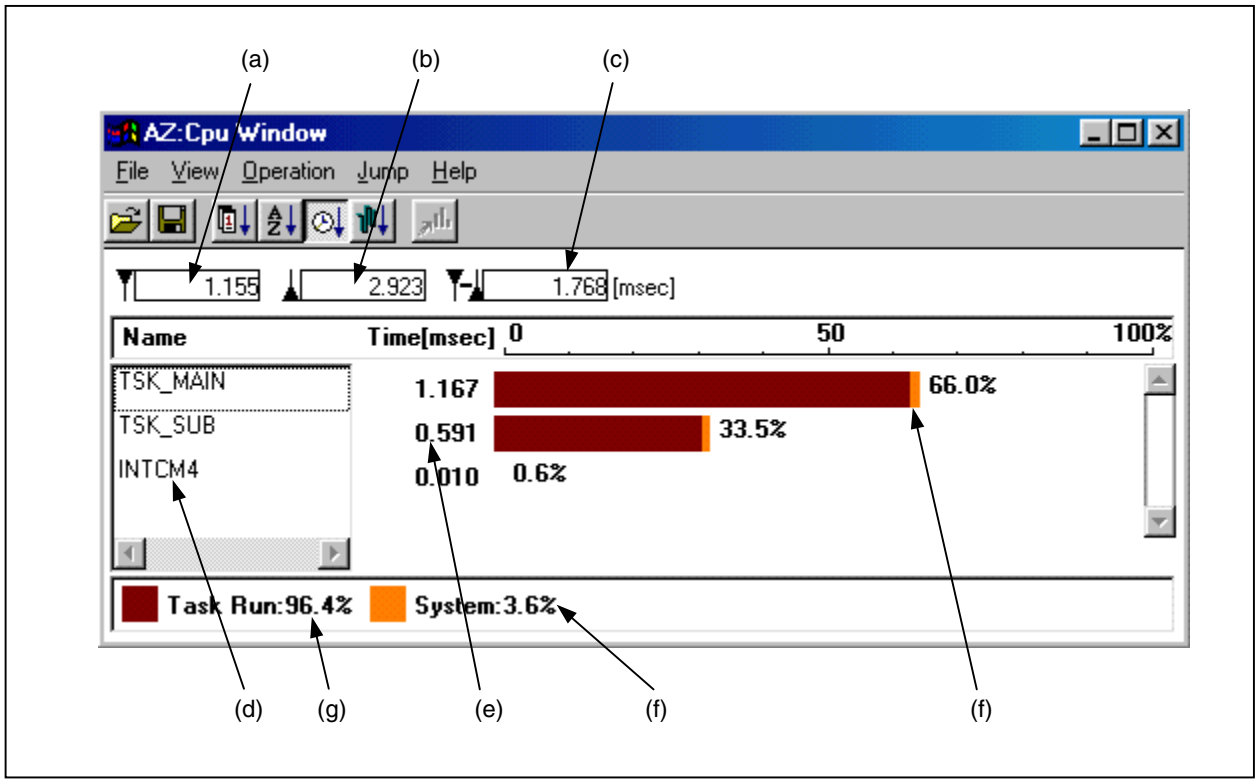
This window displays the CPU usage status in the time range between the up cursor and the down cursor in the execution transition diagram.

From this window, it is possible to check the execution time for specified tasks, interrupts, etc., and to evaluate the target data performance from the idle time and interrupt time. This window can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [Browse (B)], then [CPU Utilization Rate (C)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + B, C keys in that order.
- ★ In the <Analyze Window>, press the Ctrl + C keys.

[Window]

★ **Figure 6-11 CPU Window (Task Level)**



(a) Up cursor position time display
(b) Down cursor position time display
(c) Up/down cursor time display
(d) Object name
(e) Total object execution time display
(f) CPU utilization rate graph display
(g) Task execution time percentage display
(h) System execution time percentage display

[Function]

This section describes the following items.

(1) Description of each area
(2) CPU utilization rate display method
(3) Jump function in <CPU Window>

(1) Description of each area

(a) Up cursor position time display

Displays the time when CPU utilization rate calculation was started.
This is the relative time from the start of AZ trace data collection until the position of the up cursor in the execution transition diagram. The unit is milliseconds (msec).

(b) Down cursor position time display

Displays the time when CPU utilization rate calculation was ended.
This is the relative time from the start of AZ trace data collection until the position of the down cursor in the execution transition diagram. The unit is milliseconds (msec).

(c) Up/down cursor position time display

Displays the time interval during which CPU utilization rate data was calculated.
This is the time interval between the up cursor and the down cursor. The unit is milliseconds (msec).

★ **(d) Object name**

Displays list of object names that exist within calculation time interval.
The horizontal scroll bar becomes active when a long object name is displayed.

(e) Total object execution time display

Displays the tasks during the calculation time interval, the task execution time during interrupt processing, and the system processing time total.

(f) CPU utilization rate graph display

Displays CPU utilization rate for objects existing in calculation time interval.
The display is split into “task execution ratio” and “system processing ratio”.

(g) Task execution time percentage display

Displays the percentage of task execution time during calculation time interval.

(h) System execution time percentage display

Displays the percentage of system execution time during calculation time interval.

(2) CPU utilization rate display method

CPU utilization rate is calculated during the time interval between the up cursor and the down cursor in the execution transition diagram.

[Operation Method]

<1> Define the interval for which the CPU utilization rate is to be calculated by setting the up cursor and down cursor in the execution transition diagram.

<2> From the menu bar in the <Analyze Window>, select [Browse (B)], then [CPU Utilization Rate (C)] to open this window.

Remark When the <CPU Window> is open, moving the up cursor or the down cursor in the execution transition diagram causes automatic update of the CPU utilization rate.

(3) Jump function from <CPU Window>

After specifying an object in the list with the mouse, selecting [Jump (J)] in this window causes the next window to appear.

- **Pattern Window**

  Displays the pattern distribution for the specified object processing time.

  The pattern displayed here is automatically set as follows.

  Start point: Task Switch [ANY] → [Specified task] ; [Valid]

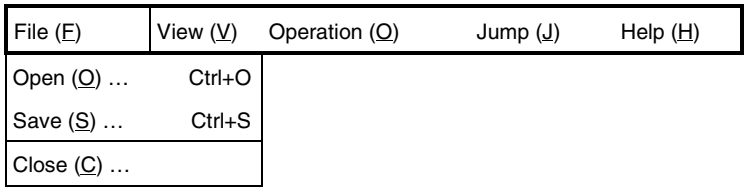
  End point: Task Switch [Specified task] → [ANY] ; [Valid]

[Function Buttons]

Operation Target	Button	Function
–		Opens the <File Select> dialog box. The display data in the previously saved CPU Window is read and displayed.
–		Opens the <File Select> dialog box. The display data displayed in the current CPU Window is saved to a file.
–		Changes the graph display sequence to order of appearance of trace data.
–		Changes the graph display sequence to object name sequence (alphabetical order).
–		Changes the graph display sequence to execution time length order.
–		Changes the graph display sequence to order of appearance in <Analyze Window>.
Object		Displays the <Pattern Window> corresponding to the specified object. If an active <Pattern Window> is already displayed, its contents are updated.

★ **[Menu Bar]**

(1) [File (F)] menu



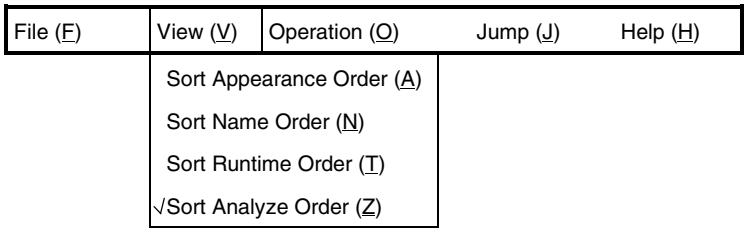
Open (O) — Opens the <File Select> dialog box. The previous saved display file in this window is read.
The default extension of the display file for this window is .azc.

Save (S) — Opens the <File Select> dialog box.
Save the display file containing the information currently displayed in this window for the first time or with a new name.
The default extension of the display file for this window is .azc.

Close (C) — Closes this window.

Caution If the CPU utilization rate graph is not displayed, [Save As (A)] cannot be selected.

(2) [Display (V)] menu



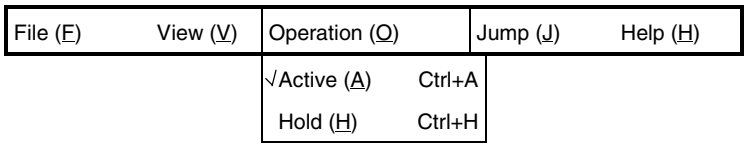
Sort Appearance Order (A) — Changes the graph display sequence to order of appearance of AZ trace data.
This item has the same operation as the  button.

Sort Name Order (N) — Changes the graph display sequence to name sequence (alphabetical order).
This item has the same operation as the  button.

Sort Runtime Order (T) — Changes the graph display sequence to execution time length order. (Default)
This item has the same operation as the  button.

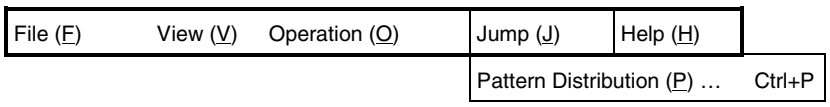
Sort Analyze Order (Z) — Changes the graph display sequence to object appearance sequence in execution transition diagram.
This item has the same operation as the  button.

(3) [Operation (O)] menu



Active (A) Switches this window from hold status to active status.
Hold (H) Switches this window from active status to hold status.

(4) [Jump (J)] menu

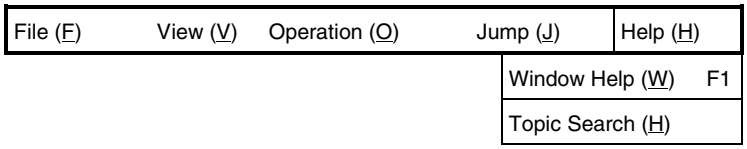


Pattern Distribution (P) Opens the <Pattern Window> corresponding to the specified object. If an active <Pattern Window> is already displayed, the contents of this window are updated.
The patterns displayed here is automatically set as follows.

Start point: Task Switch [ANY] → [Specified Object] ; [Valid]
End point: Task Switch [Specified Object] → [ANY] ; [Valid]

This item has the same operation as the  button.

(5) [Help (H)] menu



Window Help (W) Displays the help topics for this window.
Topic Search (H) Displays the help <Topic Search> dialog box of the AZ850.

[Caution]

- This window closes when the task-level <Analyze Window> is closed.

[Error]

- When an active <CPU Window> already exists, trying to make a <CPU Window> in the hold status active causes an <Error> dialog box to appear.

Pattern Set Dialog Box [Task Level]

[Pattern Set]

[Outline]

This dialog box is used to set the pattern search mode and the search conditions as pattern settings for displaying the <Pattern Window>.

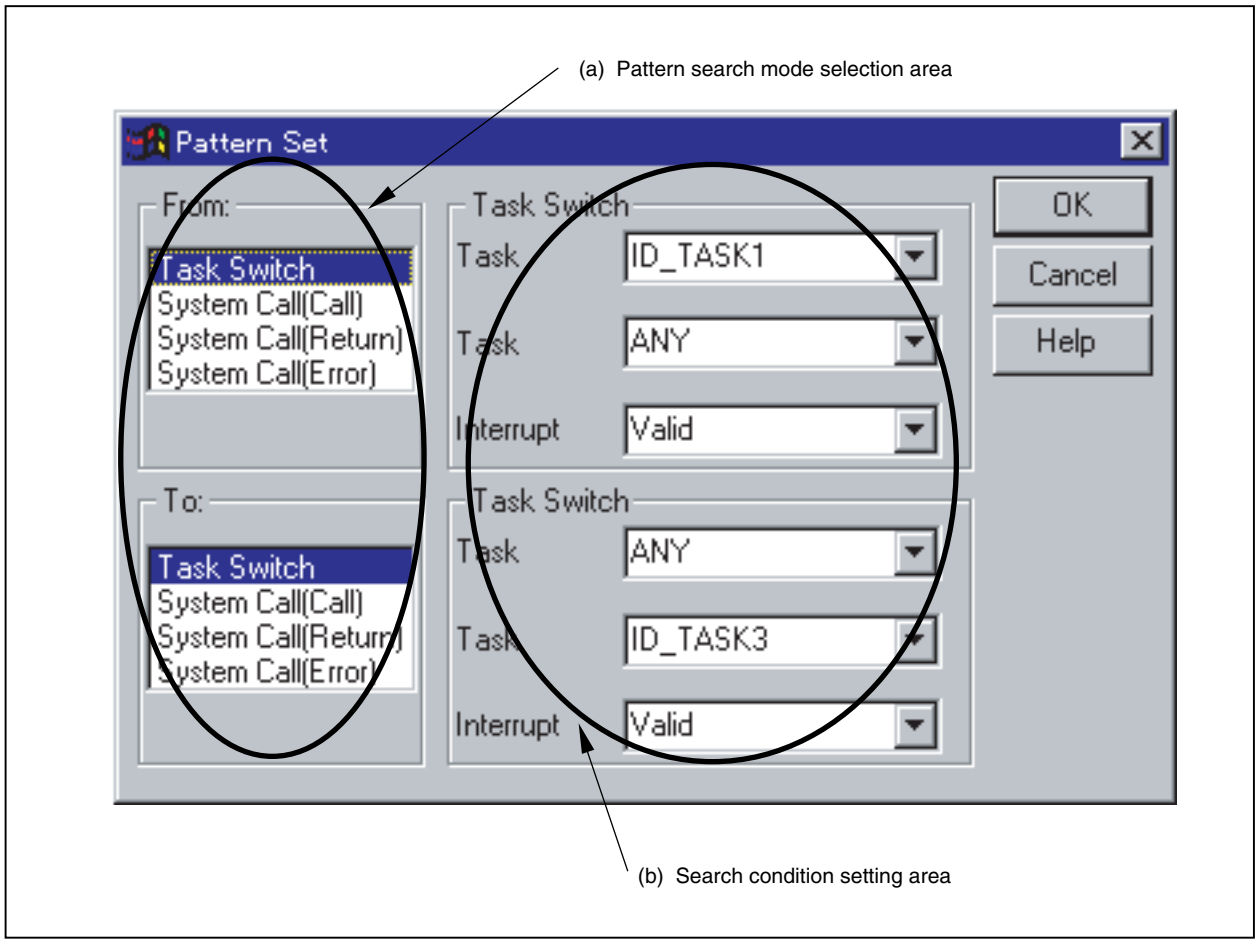
A pattern refers to the processing interval (CPU run interval) from the occurrence of a given event (task switching, interrupt occurrence, system call status, etc.) to the end of that event or the occurrence of a different event.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [Browse (B)], then [Pattern Distribution (P)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + B, P keys in that order.
- ★ In the <Analyze Window>, press the Ctrl + P keys.

[Window]

Figure 6-12 Pattern Set Dialog Box (Task Level)



Caution The contents displayed in the search condition setting area differ depending on the selection made in the pattern search mode selection area.

[Function]

This section describes the following.

(1) Description of each area
(2) Pattern search/calculation method

(1) Description of each area

(a) Pattern search mode selection area

This area is used to select the pattern mode.

The pattern mode indicates the type of event used for the pattern start point (From:) to the end point (To:) to be calculated in the <Pattern Window>.

Table 6-8 lists the various pattern modes.

Table 6-8 Pattern Modes (Task Level)

Pattern Mode	Description
Task Switch	Mode using task switching locations are start/end points.
System Call (Call)	Mode using location where a system call was called as start/end points.
System Call (Return)	Mode using location where a system call was returned as start/end points.
System Call (Error)	Mode using location where a system call returned error as start/end points.

(b) Search condition setting area

This area is used to set the pattern condition for the pattern mode for the pattern start/end points specified in (a).

The contents displayed in this area differ according to the specified pattern mode.

The pattern conditions set for each item can either be directly input from the keyboard or selected from the drop-down list.

The conditions that can be set are as follows.

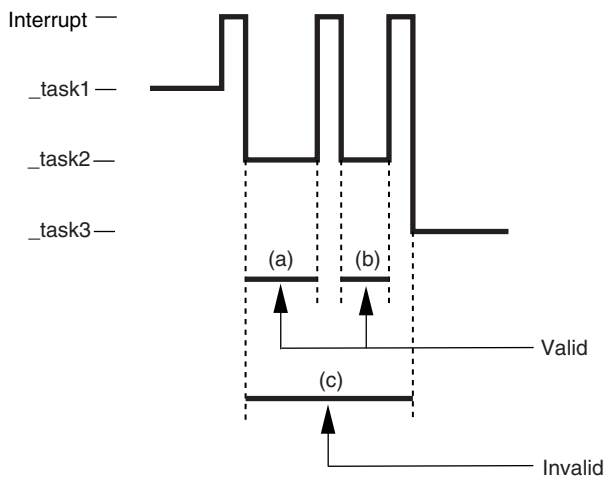
Table 6-9 Pattern Conditions (Task Level) (When Task Switch Is Specified as Search Mode)

Item	Meaning of Condition
Task (high)	Specifies the task name or interrupt name prior to switching. If the user is not specific about the task or interrupt, specify “ANY”.
Task (low)	Specifies the task name or interrupt name after switching. If the user is not specific about the task or interrupt, specify “ANY”.
Interrupt	Specifies whether or not to include switching to (from) an interrupt among the search targets. Select “Valid” to set interrupt transitions as a search target, and set “Invalid” to exclude interrupt transitions from search targets.

Remark For the Interrupt item, the search position when “Valid” or “Invalid” is specified is as follows.

Search condition: FROM: [ANY] → [_task2]

To: [_task2] → [ANY]



If “Valid” is specified

(a) and (b) are detected as patterns because interrupts are detected as switch targets.

If “Invalid” is specified

(c) is detected as a pattern because interrupts are not detected as switch targets.

In this case, regarding the pattern start/end time, the interrupt exit time is calculated and the interrupt time is also included in the pattern execution time.

Table 6-10 Pattern Conditions (Task Level)
(When “System Call (Call, Return, Error) Is Specified as Search Mode)

Item	Meaning of Condition
Task	Specifies the task name or interrupt name that has issued a system call. If the user is not specific about the task or interrupt, specify “ANY”.
System Call	Specifies the system call name. If the user is not specific about the system call, specify “ANY”.
Object	Specifies the system call’s target object. If the user is not specific about the object, specify “ANY”.

Remarks A typical pattern setting example is provided below.

[Interrupt processing time analysis]

From: Task Switch [ANY] → [INTP10] ; [Valid]

To: Task Switch [INTP10] → [ANY] ; [Valid]

[System call processing time analysis] (Analysis of processing time until _task1 issues system call to wai_sem, and _sem1 can be acquired)

From: System Call(Call) [_task1] → [wai_sem] ; [_sem1]

To: System Call(Return) [_task1] → [wai_sem] ; [_sem1]

[Analysis of processing time from system call issue to startup of different task] (Analysis of processing time until _task1 issues wai_tsk and processing moves to _task2)

From: System Call(Call) [_task1] → [wai_tsk]

To: Task Switch [ANY] → [_task2]

[Analysis of interval for which error return occurred] (Analysis of interval of location for which error return occurred in _task1)

From: System Call(Error) [_task1] → [ANY] ; [ANY]

To: System Call(Error) [_task1] → [ANY] ; [ANY]

(2) Pattern search/calculation method

The specified pattern is searched/calculated and the <Pattern Window> is opened by performing the following operation.

[Operation Method]

<1> Set the up cursor and the down cursor in the execution transition diagram in the interval for which the pattern distribution status is to be calculated, in order to open this dialog box.

<2> Select the pattern mode to be used as the start point of the pattern to be calculated from the “From:” item in this dialog box.

<3> Select the pattern mode to be used as the end point of the pattern to be calculated from the “To: item.

<4> In the search condition setting area, either input the pattern conditions for “From:” and “To:” directly from the keyboard, or select them from the drop-down list.

<5> Click the OK button.

[Function Buttons]

Operation Target	Button	Function
Pattern condition	OK	Searches/calculates the specified pattern in the time interval set with the up cursor and the down cursor in the execution transition diagram and opens the <Pattern Window>.
–	Cancel	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

[Error]

- If no pattern satisfying the set search conditions exists in the AZ trace data, the <Error> dialog box appears.

Pattern Window [Task Level]

[Pattern Window]

[Outline]

The pattern set in the <Pattern Window> is searched in the time interval set with the up cursor and the down cursor in the execution transition diagram, and the a histogram of the frequency of occurrence of this pattern is displayed in this window.

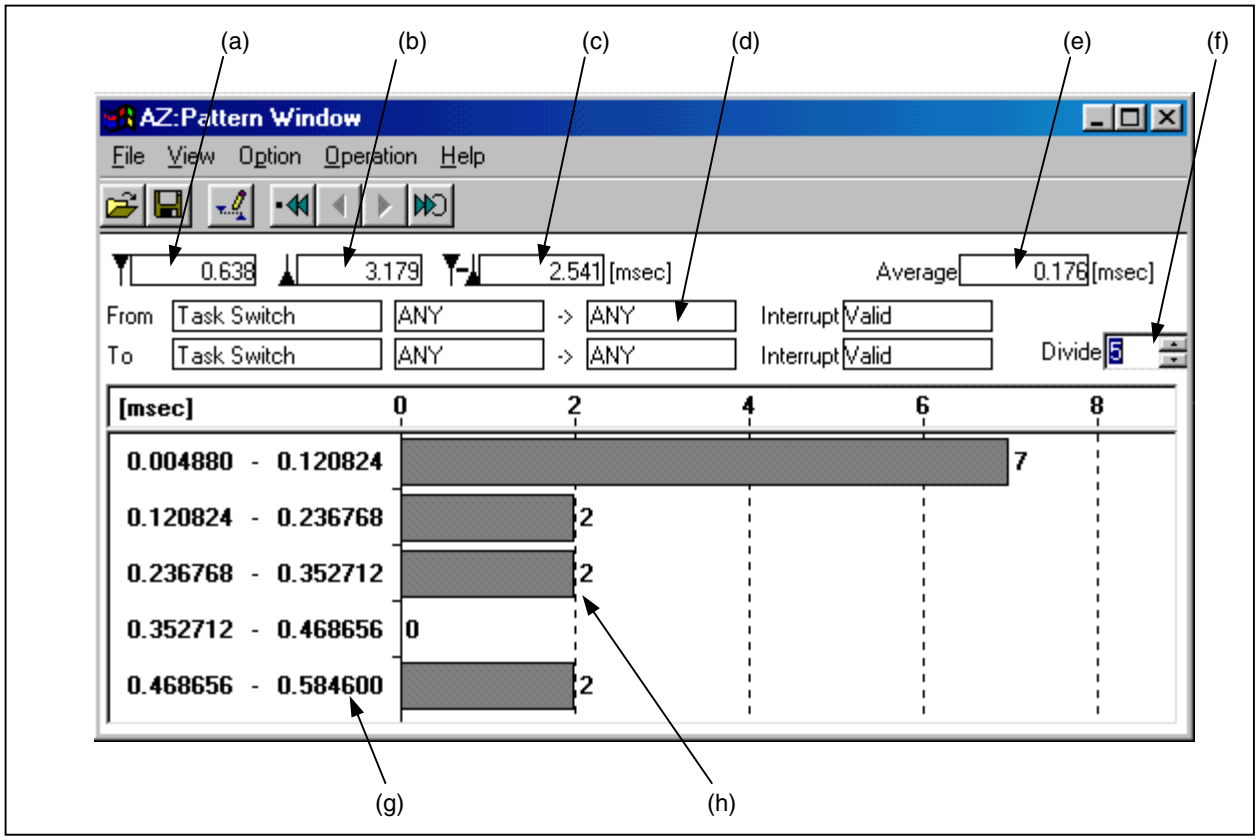
A pattern refers to the processing interval (CPU run interval) from the occurrence of a given event (task switching, interrupt occurrence, system call status, etc.) to the end of that event or the occurrence of a different event. The execution time worst value and average value for various processes of the user program can be obtained from this window.

This window can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [Browse (B)], then [Pattern Distribution (P)], and perform settings in the <Pattern Set> dialog box.
- In the <Analyze Window>, click the  button and set the condition in the <Pattern Set> dialog box.
- In the <Analyze Window>, press the ALT + B, and P keys in that order, and perform settings in the <Pattern Set> dialog box.
- ★ In the <Analyze Window>, press the Ctrl + P keys and perform settings in the <Pattern Set> dialog box.
- From the menu in the CPU window, select [Jump (J)], then [Pattern Distribution (P)].
- In the <CPU Window>, click the  button.
- ★ In the <CPU Window>, press the Ctrl + P keys and perform settings in the <Pattern Set> dialog box.

[Window]

★ **Figure 6-13 Pattern Window (Task Level)**



(a) Up cursor position time display
(b) Down cursor position time display
(c) Up/down cursor time display
(d) Pattern set condition display
(e) Average value display
(f) Histogram split display
(g) Processing time display area
(h) Pattern distribution display area

[Function]

This section describes the following items.

(1) Description of each area
(2) Pattern distribution display method
(3) Pattern distribution viewing method
(4) Search from <Pattern Window>

(1) Description of each area

(a) Up cursor position time display

Displays the time when pattern distribution status calculation was started.

This is the relative time from the start of AZ trace data collection until the position of the up cursor in the execution transition diagram. The unit is milliseconds (msec).

(b) Down cursor position time display

Displays the time when pattern distribution status collection ended.

This is the relative time from the start of AZ trace data collection until the position of the down cursor in the execution transition diagram. The unit is milliseconds (msec).

(c) Up/down cursor position time display

Displays the time interval during which the pattern distribution status was calculated.

This is the time interval between the up cursor and the down cursor. The unit is milliseconds (msec).

★ **(d) Pattern setting condition display**

Displays the pattern conditions set in the <Pattern Set> dialog box.

The object name pops up when the mouse pointer is placed on this area. When the object name is long, a part of object name is omitted.

(e) Average value display

Displays the average value for the set pattern execution time. The unit is milliseconds (msec).

(f) Histogram split number display

Displays the histogram split number. The split number can be freely changed from 1 to 100 by clicking the button on the right.

(g) Processing time display area

Displays the time interval during which the set pattern was processed.

(h) Pattern distribution display area

Displays in histogram form the processing time of the set pattern calculated during the time interval set with the up cursor and the down cursor in the execution transition diagram.

(2) Pattern distribution display method

Pattern distribution calculation is done during the time interval set with the up cursor and the down cursor in the execution transition diagram.

[Operation Method]

<1> Set the up cursor and the down cursor in the execution transition diagram to define the interval for which the pattern distribution status is to be calculated.

<2> From the menu bar in the <Analyze Window>, select [Browse (B)], then [Pattern Distribution (P)].

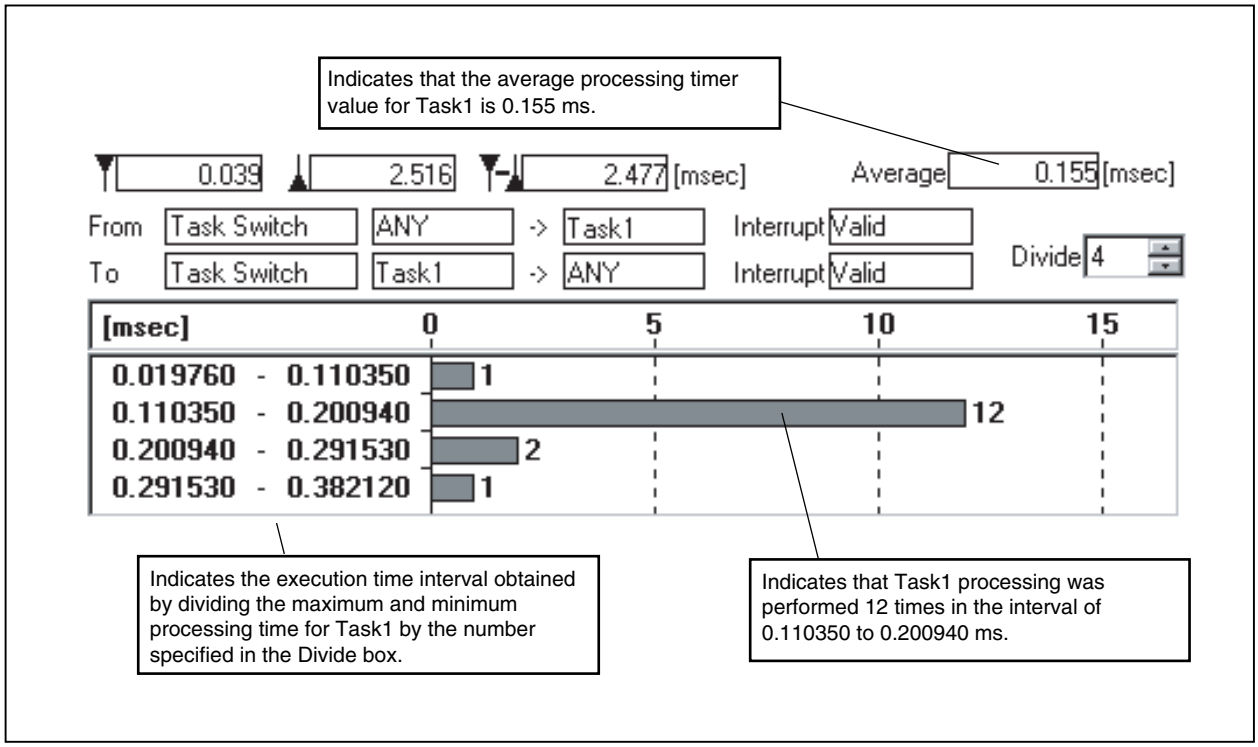
<3> In the <Pattern Set> dialog box that opens automatically, set the conditions of the pattern to be calculated and displayed, and then click the OK button.

Remark When the <Pattern Window> is open, moving the up cursor or the down cursor in the execution transition diagram causes automatic update of the pattern distribution contents.

(3) Pattern distribution viewing method

The pattern distribution shown in Figure 6-14 is an example for the analysis of the TSK_MAIN processing time.

Figure 6-14 Pattern Distribution Viewing Method (Task Level)



(4) Search from <Pattern Window>

By using the function buttons in the <Pattern Window>, the pattern locations for which the execution time interval is minimum/maximum (or ascending/descending order of time interval) are searched, and the search results are displayed on an execution transition diagram.

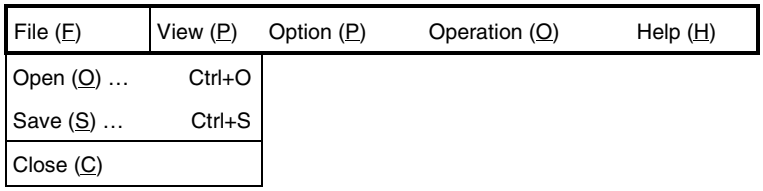
The up temporary cursor moves to the start position of the searched pattern, and the down temporary cursor moves to the end position.

[Function Buttons]

Operation Target	Button	Function
–		Opens the <File Select> dialog box. The previously saved <Pattern Window> contents are read and displayed.
–		Opens the <File Select> dialog box. The display data currently displayed in the <Pattern Window> is saved to a file.
–		Opens the <Pattern Set> dialog box.
–		Displays in the <Analyze Window> the location in the searched pattern where the execution time interval is minimum.
–		Searches the location with the next smaller execution time interval compared to the currently searched location.
–		Searches the location with the next larger execution time interval compared to the currently searched location.
–		Displays in the <Analyze Window> the location in the searched pattern where the execution time interval is maximum.

★ **[Menu Bar]**

(1) [File (F)] menu

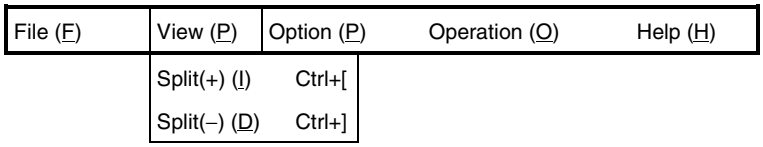


Open (O) — Opens the file select dialog box <Open>. The file containing the previously saved window contents is read.
The default extension of the display file of this window is .azp.

Save (S) — Opens the file select dialog box <Open>. Saves the current display information in this window to a display file, either as a new file or as a file with a different name.
The default extension of the display file for this window is .azp.

Close (C) — Closes this window.

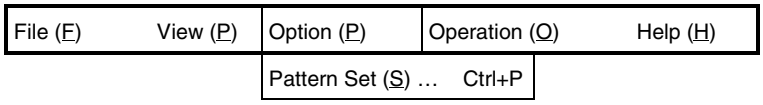
(2) [View (V)] menu



Split(+) (I) — Increases histogram split number by 1.

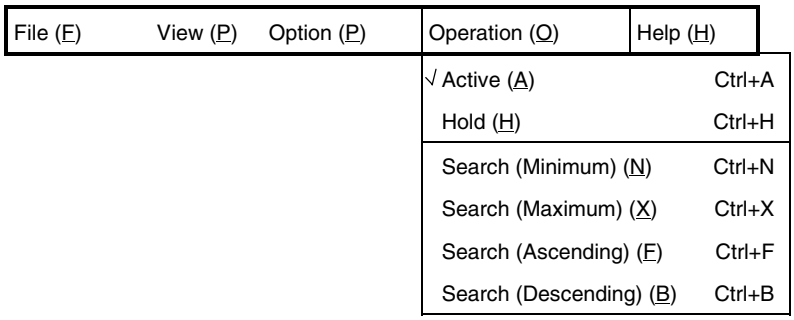
Split(-) (D) — Decreases histogram split number by 1.

(3) [Option (P)] menu



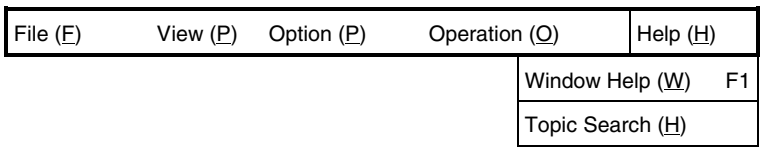
Pattern Set (S) — Opens the trace-level <Pattern Set> dialog box of this window.

(4) [Operation (O)] menu



Active (A)	Switches this window from hold status to active status.
Hold (H)	Switches this window from active status to hold status.
Search (Minimum) (N)	Displays the location with the minimum execution time in the calculated pattern. The up temporary cursor moves to the start position and the down temporary cursor moves to the end point of the searched pattern. This item has the same operation as the  button.
Search (Maximum) (X)	Displays the location with the maximum execution time in the calculated pattern. The up temporary cursor moves to the start position and the down temporary cursor moves to the end point of the searched pattern. This item has the same operation as the  button.
Search (Ascending Order) (F)	Searches the pattern with the next longer execution time compared to the currently searched pattern after the [Search (Minimum) (N)] item is selected or the  button is clicked. The up temporary cursor moves to the start position and the down temporary cursor moves to the end position of the searched pattern. This item has the same operation as the  button.
Search (Descending Order) (B)	Searches the pattern with the next shorter execution time compared to the currently searched pattern after the [Search (Minimum) (N)] item is selected or the  button is clicked. The up temporary cursor moves to the start position and the down temporary cursor moves to the end position of the searched pattern. This item has the same operation as the  button.

(5) [Help (H)] menu



Window Help (W)	Displays the help topics for this window.
Topic Search (H)	Displays the help <Topic Search> dialog box of the AZ850.

[Caution]

- The <Pattern Window> closes when the <Analyze Window> is closed.

[Error]

- When an active <Pattern Window> already exists, trying to make a window in the hold status active causes an <Error> dialog box to appear.
- If a split number over 100 is specified, a warning sound is emitted.

Trace View Window [Task Level]

[Trace View Window]

[Outline]

This window displays the AZ trace data displayed as an execution transition diagram.

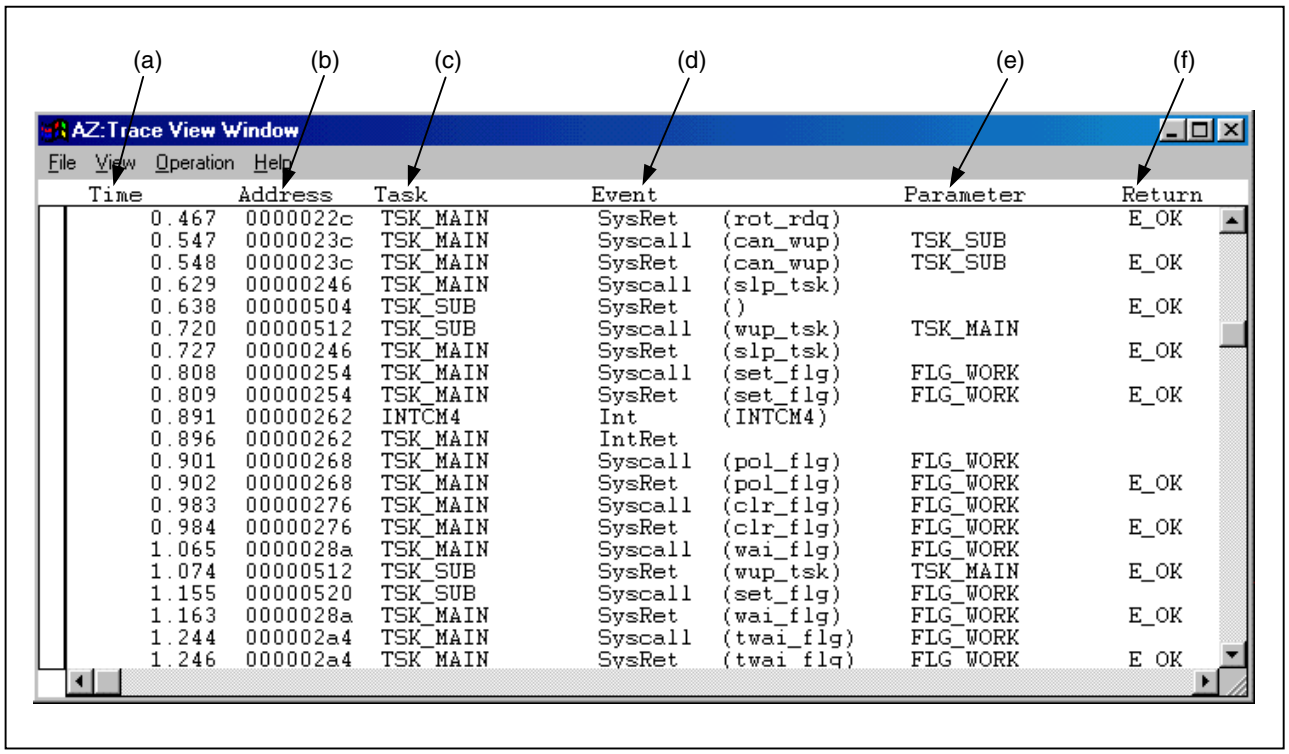
More detailed AZ trace data can be viewed by opening the <Trace View Window> from the <Analyze Window>.

This window can be opened with one of the following operations.

- From the main menu in the <Analyze Window>, select [Browse (B)], then [Trace View (T)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + B, T keys in that order.
- ★ In the <Analyze Window>, press the Ctrl + T keys.

[Window]

★ **Figure 6-15 Trace View Window (Task Level)**



(a) Time display area
(b) Address display area
(c) Task display area
(d) Event display area
(e) Parameter display area
(f) Return display area

[Function]

This section describes the following items.

(1) Description of each area
(2) AZ trace data display method
(3) AZ trace viewing method
(4) AZ trace data search method

(1) Description of each area

(a) Time display area

Displays the relative time from the AZ trace start time. The unit is milliseconds (msec).

(b) Address display area

Displays the user program execution address. It indicates the start address of the following instruction after the actual event occurrence location.

★ #### (c) Task display area

Displays the task name or interrupt name upon occurrence of an event.
The task name (function name in the case of the RX850 Pro) is displayed as follows when it is long.

RX850: “Task name…”
RX850 Pro: “Function name… (xxxx)”

Remark xxxx indicates the task ID number.

(d) Event display area

Displays the type of AZ trace data event.
The types of events that can be displayed are as follows.

- **Syscall**
  Means the issue of a system call. The name of the issued system call is indicated in parentheses.
- **SysRet**
  Means system call return. The name of the returned system call is indicated in parentheses.
- **Int**
  Means the interrupt entry. The name of the interrupt request is indicated in parentheses.
- **IntRet**
  Means the interrupt exit. The name of the interrupt request is indicated in parentheses.
- **TaskStart**
  Means the initial task start.
- **Idle**
  Means transition to the idle status.

(e) Parameter display area

If the AZ trace data is a system call, this area displays the name of the target object of the system call.

★ The object name is displayed as follows when it is long.

RX850: "Object name…"
RX850 Pro: "Object name… (xxxx)"

Remark xxxx indicates the object ID number.

(f) Return display area

If the AZ trace data is a system call (return), this area displays the return value from the system call.

(2) AZ trace data display method

AZ trace data is displayed from the location specified in the execution transition diagram.

[Operation Method]

<1> Indicate the AZ trace data display start position.
If the up temporary cursor is displayed in the execution transition diagram, it becomes the display start position, and if it is not displayed, the beginning of the trace data becomes the display start position.

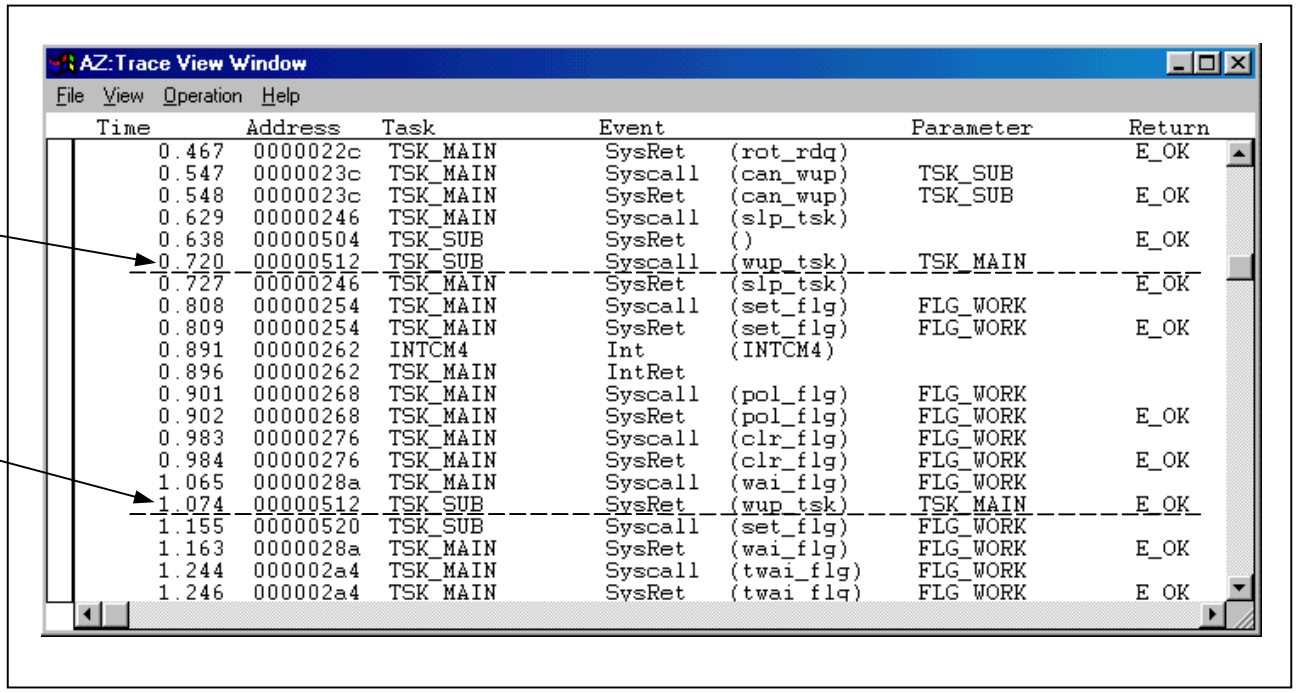
<2> From the menu bar on the <Analyze Window>, select [Browse (B)], then [Trace View (T)], to open this window.

Remark When the <Trace View Window> is open, moving the up temporary cursor in the execution transition diagram causes the AZ trace data display position to move automatically.

★ **(3) AZ trace data viewing method**

Figure 6-16 describes how to read the AZ trace data.

Figure 6-16 AZ Trace Data Viewing Method (Task Level)



(a) At address 00000512 0.720 ms after system startup, task TASK_SUB issued system call wup_tsk to TASK_MAIN.

(b) At address 00000512 1.074 ms after system startup, system call wup_tsk was returned with return value E_OK.

→ For details about return values, refer to the RTOS user's manual.

Remark Regarding SysRet, if no event for which a system call was issued exists in the trace memory, the parentheses include no data. This is caused by execution from a location other than the beginning of the user program, etc.

(4) AZ trace data search method

When opened from the menu bar in this window, search using execution task/interrupt name, event type, system call arguments, etc., as conditions can be performed from the <Trace Search> dialog box.

For details about the search method, refer to the <Trace Search> dialog box section.

[Operation Method]

<1> From the menu bar in this window, select [View (V)], then [Search (S)].

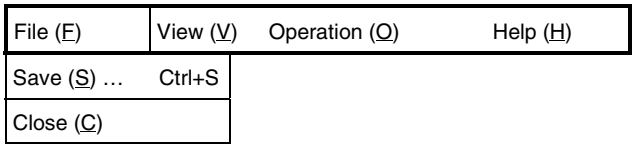
<2> Set the search conditions in the <Trace Search> dialog box that is automatically opened.

<3> The search in the new trace time direction is started by clicking the Search(Fore) button in the <Trace Search> dialog box, and the trace search in the old trace time direction is started by clicking the Search(Back) button.

<4> Update the AZ trace data display position with the search location as the beginning.

★ **[Menu Bar]**

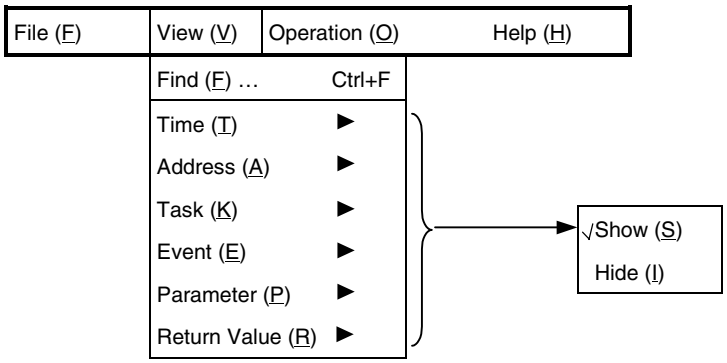
(1) [File (F)] menu



Save (S) — Opens the <File Select> dialog box. Saves the display information of the current window to a display file, either as a new file or as a file with a different name.
The default extension of the display file for this window is .azt.

Close (C) — Closes this window.

(2) [View (V)] menu



Find (F) — Opens the <Trace Search> dialog box.

Time (T) — Specifies Show/Hide for the “Time” item.
Select either Show (S) or Hide (I) from the sub-menu.

Address (A) — Specifies Show/Hide for the “Address” item.
Select either Show (S) or Hide (I) from the sub-menu.

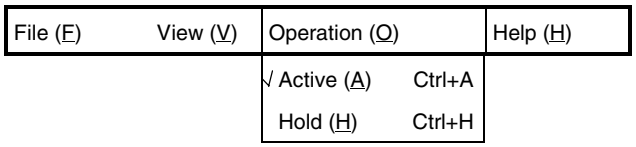
Task (K) — Specifies Show/Hide for the “Task” item.
Select either Show (S) or Hide (I) from the sub-menu.

Event (E) — Specifies Show/Hide for the “Event” item.
Select either Show (S) or Hide (I) from the sub-menu.

Parameter (P) — Specifies Show/Hide for the “Parameter” item.
Select either Show (S) or Hide (I) from the sub-menu.

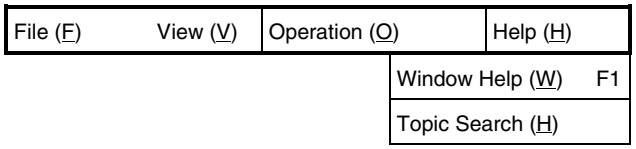
Return Value (R) — Specifies Show/Hide for the “Return” item.
Select either Show (S) or Hide (I) from the sub-menu.

(3) [Operation (O)] menu



Active (A)	Switches this window from hold status to active status.
Hold (H)	Switches this window from active status to hold status.

(4) [Help (H)] menu



Window Help (W)	Displays the help topics for this window.
Topic Search (H)	Displays the help <Topic Search> of the AZ850.

[Caution]

- This window closes when the <Analyze Window> is closed.
- Regarding SysRet, if no event for which a system call was issued exists in the trace memory, the parentheses include no data. This is caused by execution from a location other than the beginning of the user program, etc.

[Error]

- If an active <Trace View Window> exists, making a window in the hold status active causes the <Error> dialog box to appear.

Trace Search Dialog Box [Task Level]

[Trace Search]

★ **[Outline]**

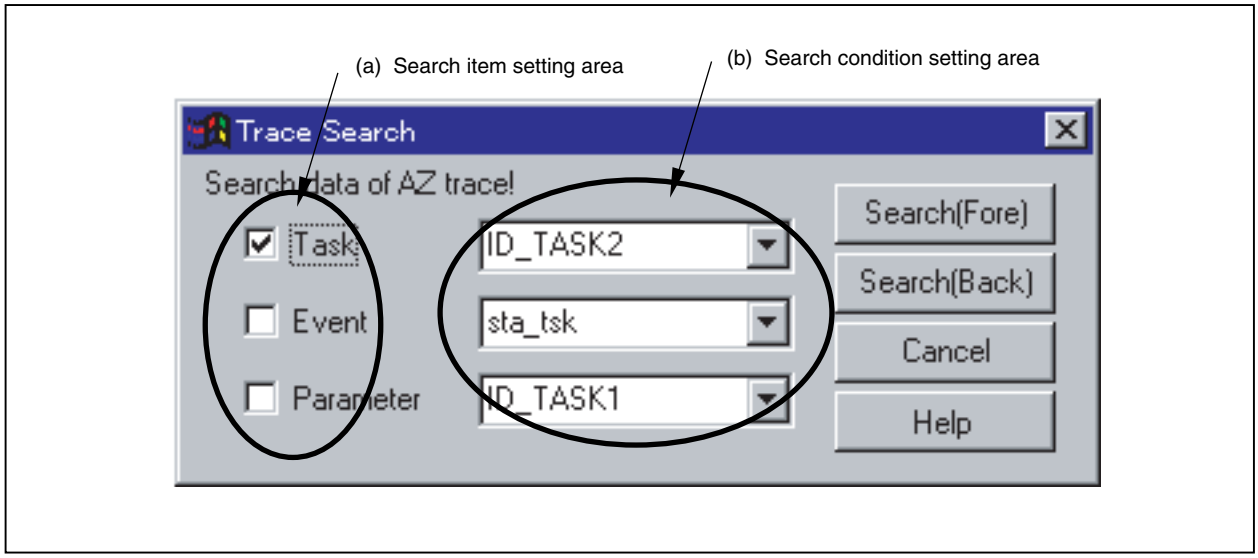
This dialog box is used to set search conditions used for searching AZ trace data in the <Trace View Window>. Execution task name/interrupt name, event type, system call argument, etc., can be set as the search condition.

This dialog box can be opened with one of the following operations.

- In the menu bar in the <Trace View Window>, select [View (V)], then [Search (S)].
- In the <Trace View Window>, press the ALT + V, S keys in that order.
- In the <Trace View Window>, press the Ctrl + F keys.

[Window]

Figure 6-17 Trace Search Dialog Box (Task Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Search method

(1) Description of each area

(a) Search item setting area

This area is used to specify the AZ trace data search items in the <Trace View Window>.

Task Select this to perform search by task name/interrupt name.

Event Select this to perform search by event type.

Parameter Select this to perform search by system call argument.

(b) Search condition setting area

This area is used to specify search conditions for each search item.

The drop-down list displays the task names/interrupt names, event types, and system call arguments that exist in the collected AZ trace data.

(2) Search method

[Operation Method]

<1> In the search item setting area, select the item to be searched.

<2> In the search item setting area, either input the search condition directly from the keyboard, or select it from the drop-down list.

<3> Click the Search(Fore) button or the Search(Back) button.

The search is performed as follows.

- If Search(Fore) button is clicked

  Locations that match the set search condition are searched in the new trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.

- If Search(Back) button is clicked

  Locations that match the set search condition are searched in the old trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.

A trace condition setting example in the <Trace Search> dialog box is shown below.

Figure 6-18 Trace Search Setting Example (When Searching TASK1 Task)

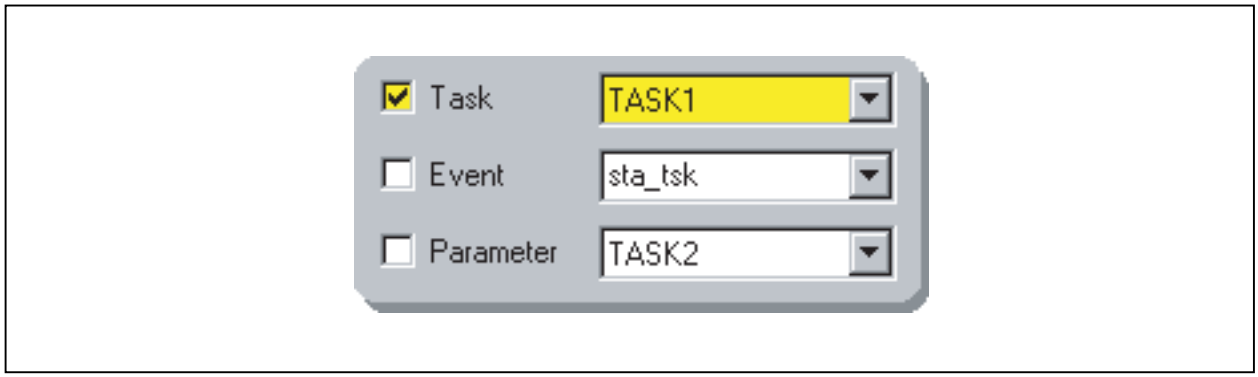


Figure 6-19 Trace Search Setting Example (When Searching Locations for Which TASK1 Task Has Issued sta_tsk System Call)

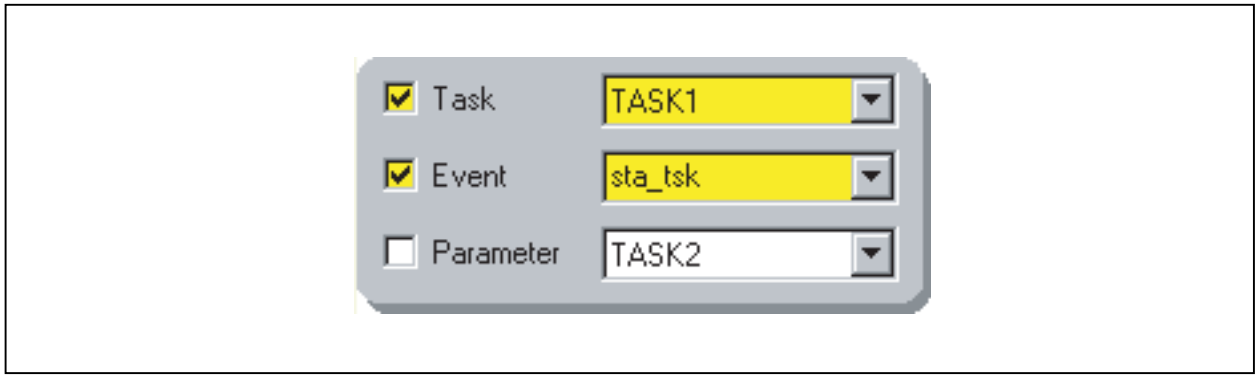
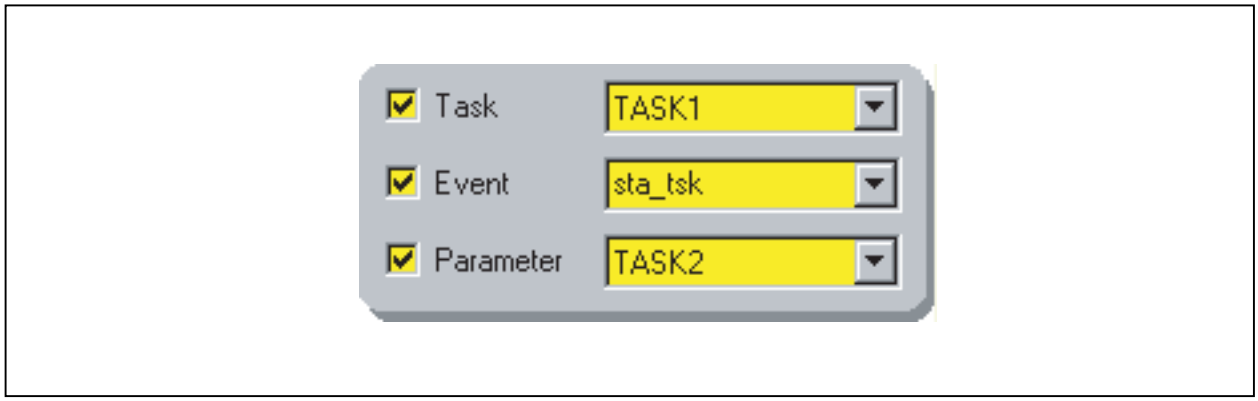


Figure 6-20 Trace Search Setting Example (When Searching Locations for Which TASK1 Task Has Issued sta_tsk System Call to TASK2 Task)



[Function Buttons]

Operation Target	Button	Function
Search condition	Search(Fore)	Locations that match the set search condition are searched in the new trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.
Search condition	Search(Back)	Locations that match the set search condition are searched in the old trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.
–	Cancel	Closes this dialog box.
★ –	Help	Opens an explanation window for this window.

[Error]

- If no location that matches the set search condition exists in the AZ trace data, a warning sound is emitted.
- A warning sound is emitted when the Search(Fore) button or the Search(Back) button is pressed without any item selected in the search item setting area.

Analyze Window [Function Level]

[Analyze window]

[Outline]

The collected AZ trace data is displayed in execution transition diagrams for each function by executing the user program.

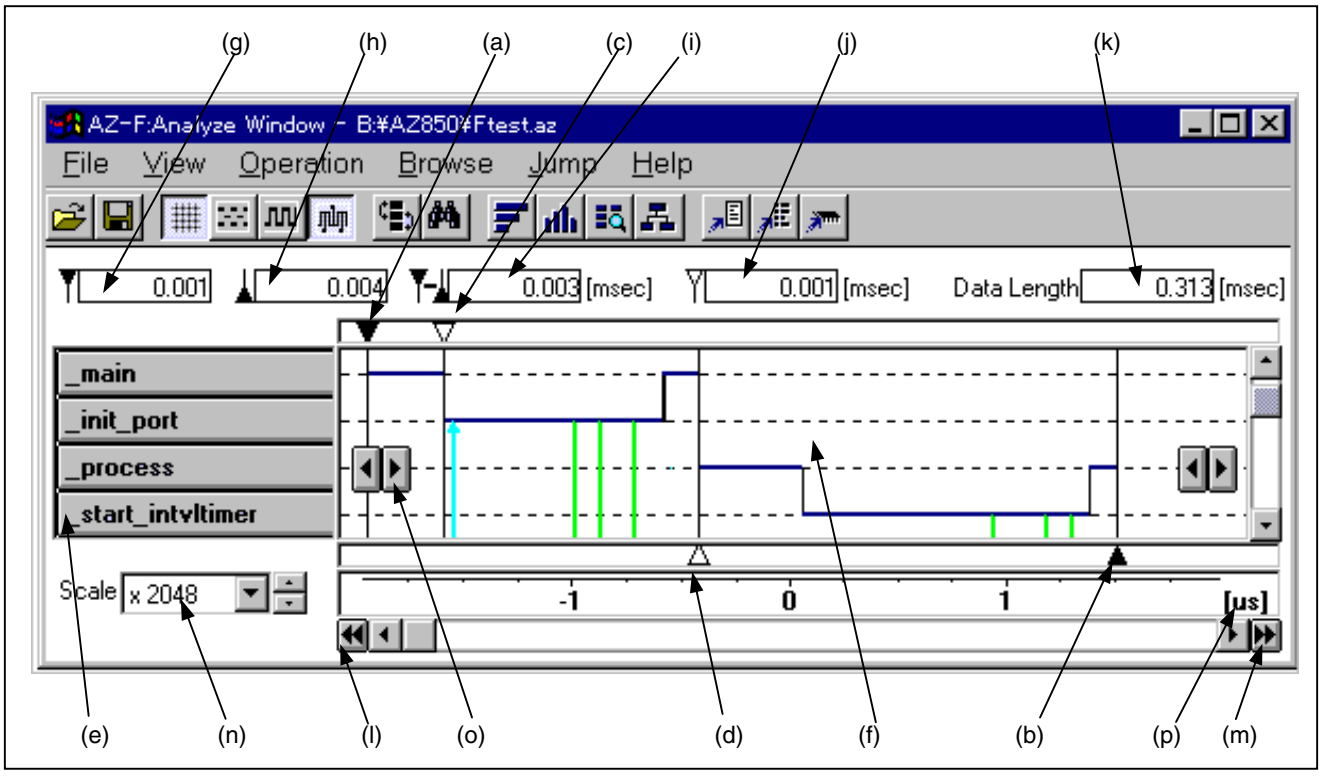
System timing errors and overall system verification and analysis can be done for single function from this window and the various windows displayed from it.

This window can be opened with one of the following operations.

- In the AZ main window, select [Browse (B)] from the menu bar, then [Analyze (Z)] and [Function Level (F)].
- In the AZ main window, click the  button.
- Press the ALT + B, Z, F keys in that order.

[Window]

Figure 6-21 Analyze Window (Function Level)



(a) Up cursor
(b) Down cursor
(c) Up temporary cursor
(d) Down temporary cursor
(e) Object
(f) Analysis result (transition diagram) display
(g) Time display of up cursor position
(h) Time display of down cursor position
(i) Inter-cursor time display
(j) Time display of up temporary cursor position
(k) Data length
(l) Jump to beginning button
(m) Jump to end button
(n) Scale modify button
(o) Simple search buttons
(p) Time area

[Function]

This section describes the following items.

(1) Description of each area
(2) Execution transition diagram display method
(3) Object names
(4) Execution transition diagram viewing method
(5) Verification method in execution transition diagram

(1) Description of each area

(a) Up cursor

This cursor is used to check the processing time in AZ trace data and to specify ranges when performing various calculations. (It is used to specify the beginning of the range for which a calculation is to be done.)

[Operation Method]

Click on the desired start location in the transition diagram with the mouse while pressing the Shift key.

(b) Down cursor

This cursor is used to check the processing time in AZ trace data and to specify ranges when performing various calculations. (It is used to specify the end of the range for which a calculation is to be done.)

[Operation Method]

Click on the desired end location in the transition diagram with the mouse while pressing the Ctrl key.

(c) Up temporary cursor

This cursor is used to display the result position during search using the simple search button or pattern search, and to specify the start position when jumping to the debugger window.

To display search results using the <Pattern Window>, this cursor indicates the start position of the searched pattern.

When the up cursor is moved, the up temporary cursor also moves to the same position.

[Operation Method]

Click the right button of the mouse.

(d) Down temporary cursor

When displaying the search result in the <Pattern Window>, this cursor shows the end position of the searched pattern.

When the down cursor is moved, the down temporary cursor also moves to the same position.

(e) Object

These buttons indicate objects in AZ trace data.

★ They indicate RTOS-related resources such as tasks, events, and flags, and mailboxes. The function name pops up when the mouse pointer is placed on one of the buttons. For details about the object names, refer to section **(3) Object names** below.

When an object name is clicked, the simple search button appears. Clicking the object name once more makes the simple search button disappear.

(f) Analysis result (transition diagram) display

This area displays the analysis result for the user program.

For details about the marks on the transition diagram, refer to section **(4) Execution transition diagram viewing method** below.

(g) Time display of up cursor position

This box displays the relative time from the start of AZ trace data collection until the up cursor position.

The unit is milliseconds (msec).

(h) Time display of down cursor position

This box displays the relative time from the start of AZ trace data collection until the down cursor position.

The unit is milliseconds (msec).

(i) Inter-cursor time display

This box displays the time interval between the up cursor and the down cursor. The unit is milliseconds (msec).

(j) Time display of up temporary cursor position

This box displays the relative time from the start of AZ trace data collection until the up temporary cursor position. The unit is milliseconds (msec).

(k) Data length

This box indicates the time interval from the start to the end of AZ trace data.

(l) Jump to beginning button

This button is used to move the up cursor and display screen to the beginning of the AZ trace data.

(m) Jump to end button

This button is used to move the down cursor and display screen to the end of the AZ trace data.

(n) Scale modify button

This button is used to change the display scale for execution transition diagrams. Any display scale can be selected using the pull-down menu or the spin buttons.

(o) Simple search buttons

These buttons are used to search the operation of selected objects.

When the  button displayed upon clicking an object name is clicked, the object operation is searched in the time axis direction in the execution transition diagram, and the up temporary cursor moves to the search position.

When the  button is clicked, the operation of the object selected in the opposite direction as the time axis is searched and the up temporary cursor moves to the search position.

(p) Time area

This area displays the standard event interval time displayed in the execution transition diagram.

The unit is displayed at the right extremity of this area. In the example shown in Figure 6-5, The unit is milliseconds (msec).

(2) Execution transition diagram display method

The execution transition diagram for the collected AZ trace data can be displayed in this window by performing the following operation.

[Operation Method]

<1> Collect the AZ trace data.

<2> Open this window. (Select [Browse (B)] from the menu bar in the AZ main window, then select [Analyze (Z)], [Function Level (F)], or click the  button on the tool bar.)

Data is not automatically updated in this window. Therefore, to display as an execution transition diagram trace data newly collected by re-executing the user program, perform upload (from the AZ main window, select [Operation (O)], then [Upload [U], or click the  button]).

(3) Object names

The buttons that indicate objects are displayed as follows.

- **Function names**

  A function name is obtained from the symbol information included in a load module and displayed.

- **Interrupts and I/O**

  Interrupts and I/O are displayed with the interrupt handler name and I/O name obtained from the debugger.

★ The function name pops up when the mouse pointer is placed on the object button.

- **Other objects**

Etc.	Objects set in the “Hide objects” area in the <Object Select> dialog box

Other Task	This object indicates execution of tasks other than the one specified only when a task is specified by “Task Select” on the “Object Select” dialog box (at “Task/Function” level).
???	This object indicates that the corresponding information does not exist in the load module when an attempt is made to obtain a function name (it is displayed if the “-g” or “-Xaz” option is not specified at compilation).

(4) Execution transition diagram viewing method

There are the following three display modes for execution transition diagrams, which can be selected by selecting from the menu bar in the <Analyze Window> [View (V)], then [Display Mode (V)].

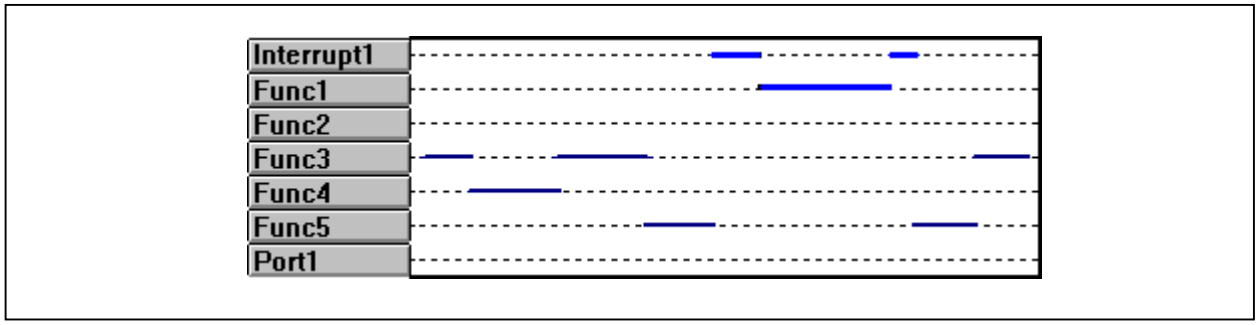
(a) Vertical line delete mode
(b) Standard mode
(c) Detailed mode (default)

Remark Whether or not to display grid lines in transition diagrams can be selected by selecting from the menu bar in this window [View (V)], then [Grid Mode (G)].

(a) Vertical line delete mode

This mode displays horizontal lines only for CPU run locations.
The vertical line delete mode is suitable when analyzing AZ trace data in a wide range.

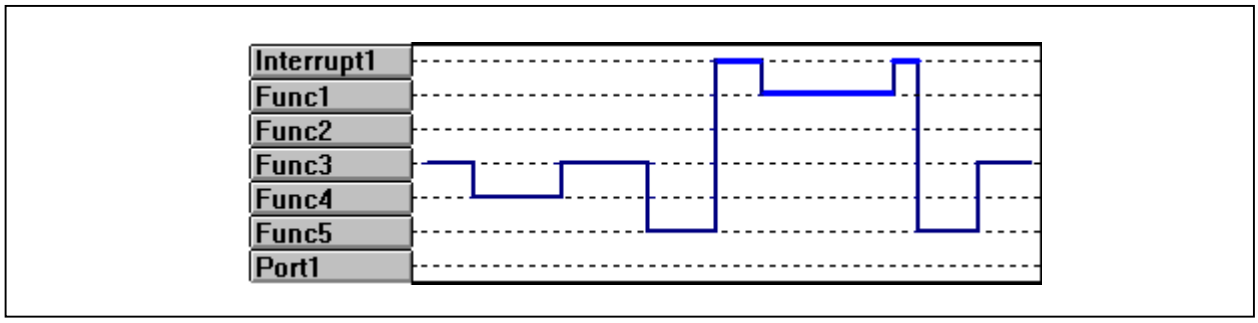
Figure 6-22 Analyze Window (Function Level) (Vertical Line Delete Mode)



(b) Standard mode

This mode displays CPU transition traces as linked lines.

Figure 6-23 Analyze Window (Function Level) (Standard Mode)

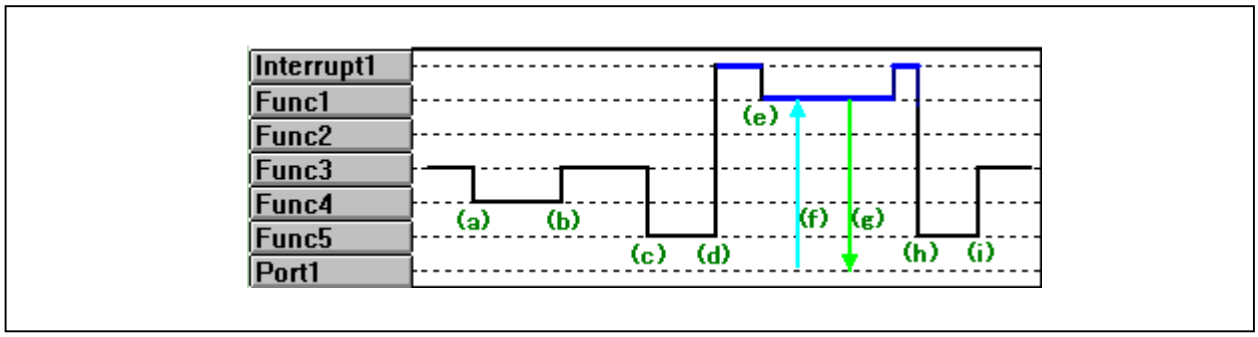


(c) Detailed mode (default)

In addition to CPU transition traces, the marks (a) to (i) show accesses from/to the I/O. The meanings of the marks (a) to (i) are as follows.

The detailed mode is suitable when analyzing access to objects.

Figure 6-24 Analyze Window (Function Level) (Detailed Mode)



(a) Funk3 calls Funk4.
(b) Fun4 returns the processing to Funk3.
(c) Funk3 calls Funk5.
(d) An interrupt is acknowledged.
(e) Funk1 is called by the interrupt handler.
(f) Funk1 outputs (writes) data to Port 1.
(g) Funk1 inputs (reads) data from Port 1.
(h) The interrupt processing is complete and the processing has returned to Funk5.
(i) Funk5 returns the processing to Funk3.

The black solid line indicates the processing of a function and the blue solid line indicates the processing until execution returns to the function that was interrupted.

Table 6-11 List of Marks on Execution Transition Diagram (Function Level)

Mark	Access Target
↓	Indicates output (write) to I/O.
↑	Indicates input (read) from I/O.

(5) Verification method in execution transition diagram

The collected AZ trace data can be verified in this window using the following methods.

(a) Object processing search
(b) Search using Pattern Search dialog box
(c) Search using <Pattern Window>

(a) Object processing search

The specified object processing can be searched using the simple search button.

[Operation Method]

<1> If the up temporary cursor is displayed in the execution transition diagram, move the up temporary cursor to the search start position. If it is not displayed, move the up cursor to the search start position.

<2> Click the object name whose operation is to be verified. The simple search button is displayed as a result. The simple search button is displayed immediately on the right of the object name and also at the right end of the transition diagram.

<3> Click the simple search button.

 : The specified object processing is searched in the time axis direction in the execution transition diagram, and the up temporary cursor moves to the search position.

 : The specified object processing is searched in the opposite direction to the time axis in the execution transition diagram, and the up temporary cursor moves to the search position.

If the searched point is not displayed on the currently displayed execution transition diagram, that point is moved on the graph so that it coincides with 0 on the graduation.

The simple search button disappears from the screen when the button indicating the object name is clicked again.

(b) Search using <Pattern Search> dialog box

In the <Pattern Search> dialog box, the specified pattern is searched on the transition diagram. The search results are displayed by the up temporary cursor on the transition diagram.

When using the <Pattern Search> dialog box, the transition status of functions and interrupts can be searched.

For details, refer to the <Pattern Search> dialog box description.

(c) Search using <Pattern Window>

In the <Patter Window>, the specified pattern set in the <Pattern Set> dialog box is searched on the transition diagram. The search results are displayed by the up and down temporary cursors on the transition diagram.

When using the <Pattern Window>, function and interrupt processing sections can be searched.

For details, refer to the <Pattern Window> Description.

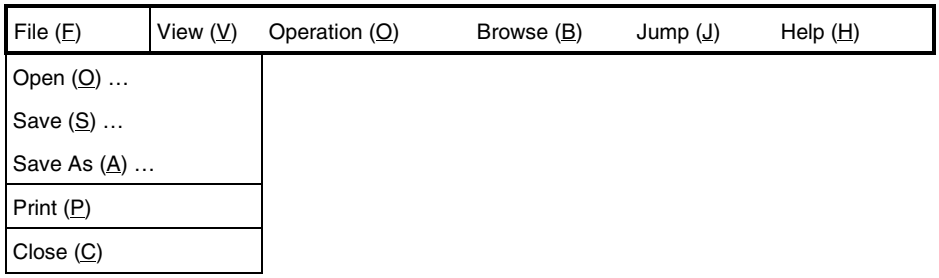
[Function Buttons]

(1/2)

Operation Target	Button	Function
–		Opens the <File Select> dialog box. The previously saved <Analyze Window> trace data is read and a transition diagram is displayed.
–		Opens the <File Select> dialog box. The trace data currently displayed in the <Analyze Window> is saved to a file.
–		Sets the transition diagram grid mode ON/OFF.
–		Sets the vertical line delete mode as the transition diagram display mode.
–		Sets the standard mode as the transition diagram display mode.
–		Sets the detailed mode as the transition diagram display mode.
–		Opens the <Object Select> dialog box.
–		Opens the <Pattern Search> dialog box.
–		Opens the <CPU Window> and displays the CPU utilization rate between the up cursor and down cursor. If an active <CPU Window> is already displayed, the contents of this window are updated.
–		Opens the <Pattern Set> dialog box. When pattern conditions are set, the <Pattern Window> is displayed between the up cursor and down cursor. If an active <Pattern Window> is already displayed, the contents of this window are updated.
–		Opens the <Trace View Window> from the position specified with the up temporary cursor. If an active <Trace View Window> is already displayed, the contents of this window are updated.
–		Opens <Call Graph Window> between the up cursor and down cursor. If an active <Call Graph Window> is already displayed, the contents of this window are updated.
–		Opens the <Source Text Window> from the position specified with the up temporary cursor. If an active <Source Text Window> is already displayed, the contents of this window are updated.
–		Opens the <Disassemble Window> from the position specified with the up temporary cursor. If an active <Disassemble Window> is already displayed, the contents of this window are updated.
–		Displays the memory list on the debugger from the position specified with the up temporary cursor. If the memory list is already displayed in an active window, the contents of that window are updated.

[Menu Bar]

(1) [File (F)] menu



Open (O) — Opens the <File Select> dialog box. The previously saved files displayed in this window are read.
The default extension of the display file for this window is .az.

Save (S) — This menu item is not supported in this version.

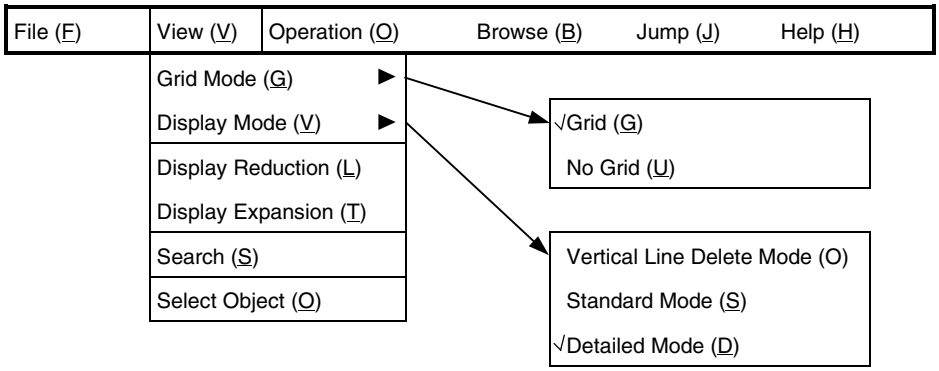
Save As (A) — Opens the <File Select> dialog box.
Saves the currently displayed execution transition diagram data to a display file, either as a new file or as a file with a different name.
The default extension of the display file for this window is .az.

Print (P) — This menu item is not supported in this version.

Close (C) — Closes this window.

Caution If the execution transition diagram is not displayed, the [Save As (A)] item cannot be selected.

(2) [View (V)] menu



Grid Mode (G) — Displays the submenu for specifying display/hide grid lines on execution transition diagram.
The following submenu is displayed.

- Grid (G) — Display grid lines.
- No Grid (U) — Don't display grid lines.

Display Mode (V) — Displays the submenu for specifying the execution transition diagram display mode.
The following submenu is displayed.

Vertical Line Delete Mode (O) — Does not display vertical lines on execution transition diagram.
This item has the same operation as the  button.

Standard Mode (S) — Displays only the CPU execution transitions.
This item has the same operation as the  button.

Detailed Mode (D) — At the task level, indicates the real-time OS system call access status, and at the function level, indicates the CPU's execution transition and I/O access with marks (default).
This item has the same operation as the  button on the tool bar.

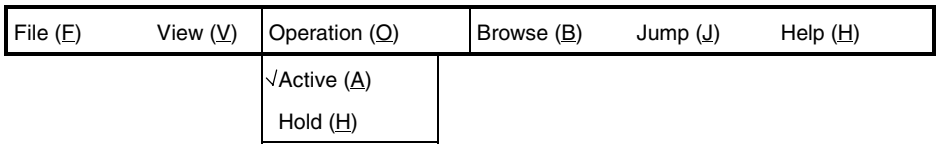
Display Reduction (L) — Reduces the execution transition diagram display scale. This item performs the same operation as reduction using the scale modify button (refer to Figure 6-21).

Display Expansion (T) — Expands the execution transition diagram display scale. This item performs the same operation as expansion using the scale modify button (refer to Figure 6-21).

Search (S) — Opens this window's trace level <Pattern Search> dialog box.
This item performs the same operation as the  button.

Object Select (O) — Opens this window's trace level <Object Select> dialog box.
This item has the same operation as the  button.

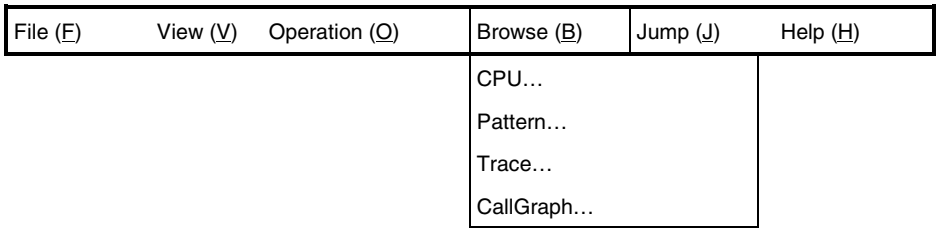
(3) [Operation (O)] menu



Active (A) — Switches this window from hold status to active status.

Hold (H) — Switches this window from active status to hold status.

(4) [Browse (B)] menu



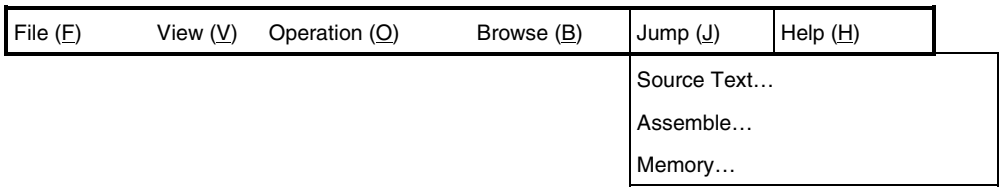
CPU… — Opens this window's trace-level <CPU Window>.
If an active <CPU Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

Pattern… Opens this window's trace level <Pattern Set> dialog box.
When a pattern is set in this dialog box, the <Pattern Window> appears. If an active <Pattern Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

Trace… Opens this window's trace level <Trace View Window>. If an active <Trace View Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

CallGraph… Opens <Call Graph Window> between the up cursor and down cursor. If an active <Call Graph Window> is already displayed, the contents of this window are updated.
This item has the same operation as the  button.

(5) [Jump (J)] menu



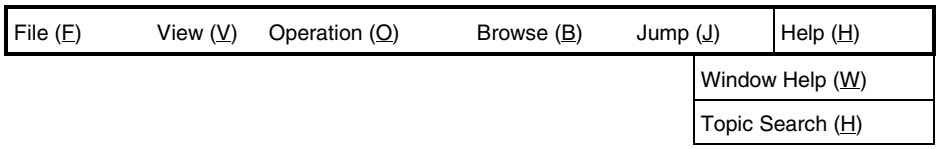
Source (S) Displays the source text on the debugger from the position specified with the up temporary cursor. If the source text is already displayed in an active window, the contents of this window are updated.
This item has the same operation as the  button.

Assemble (A) Displays the disassemble text on the debugger from the position specified with the up temporary cursor. If the disassemble text is already displayed in an active window, the contents of this window are updated.
This item has the same operation as the  button.

Memory (M) Displays the memory list on the debugger from the position specified with the up temporary cursor. If the memory list is already displayed in an active window, the contents of this window are updated.
This item has the same operation as the  button.

Caution If no address information exists for the position specified with the up temporary cursor, none of the items in the [Jump (J)] menu can be selected.

(6) [Help (H)] menu



Window Help (W)	Displays the Help topics for this window.
Topic Search (H)	Displays the help <Topic Search> dialog box of the AZ850.

[Caution]

- Data is not automatically updated in this window. Thus, to collect new trace data by re-executing the application program, data update by performing upload (from the AZ main window, select [Operation (O)], then [Upload (U)]) must be performed.
- If there is no address information in the trace data at the position specified with the up temporary cursor, none of the items in the [Jump (J)] menu can be selected.

[Error]

- If an active execution transition display window exists, making a window in the hold status active causes the <Error> dialog box to appear.

Measurement Select Dialog Box [Function Level]

[Measurement Select]

[Outline]

This dialog box is used to select an object to be measured when AZ trace data at the function level or task/function level is collected.

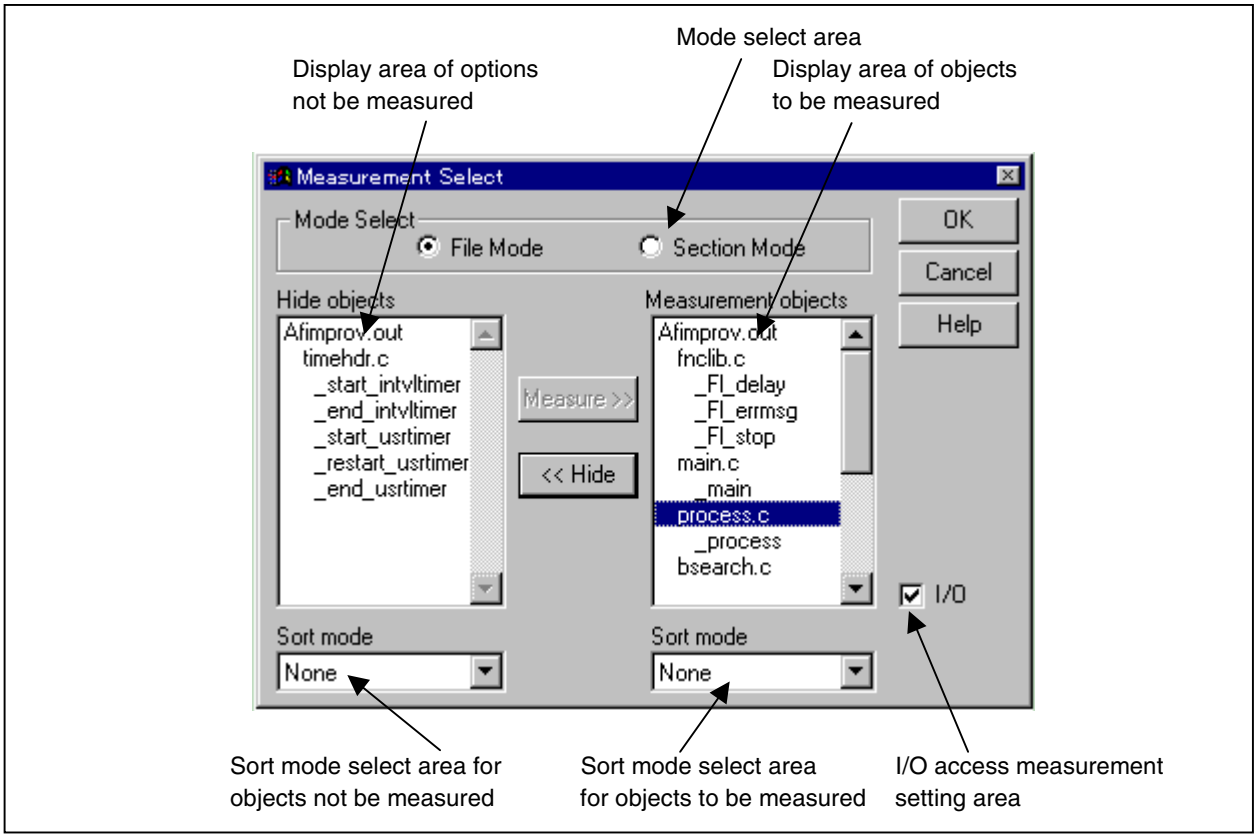
As the default assumption, all the objects are measured. By using this dialog box, therefore, the objects that do not have to be measured can be specified.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <AZ main window>, select [Option (P)], [Select Measurement Target (M)], then [Function level (F)…].
- In the <Analyze Window>, press the ALT + P, M, F keys in that order.

[Window]

Figure 6-25 Measurement Select Dialog Box (Function Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Method for limiting objects to be measured
(3) Method for adding objects to be measured

(1) Description of each area

(a) Mode select area

This area is used to select the display when displaying a list. The following two modes can be selected.

- File Mode

  In this mode, the objects to be measured are selected according to the file group (".c, ".s) of the downloaded module. A list is displayed in the hierarchy of load module name → file name → function name.

- Selection Mode

  This mode is used to select the objects to be measured according to the selection group (".text) of the downloaded module. A list is displayed in the hierarchy of load module name → section name → function name.

(b) Display area for objects to be measured

This area lists the objects to be traced as the function-level AZ trace data.

(c) Display area for objects not to be measured

This area lists the objects not to be traced as the function-level AZ trace data, from all the objects included in the load module. It also lists the objects to be traced as number-level AZ trace data.

(d) Sort mode select area for objects to be measured

This area specifies the order of arrangement on the list of measurement objects.

The following sorting levels can be selected from the drop-down list:

None: No-sort mode (default)

Address: Sorting in order of addresses on load module.

Name: Sorting in order of object identification names.

This area lists the objects to be traced as the AZ trace data of the above levels.

(e) Sort mode select area for objects not to be measured

This area specifies the order of arrangement on the list of hide objects.

The following sorting levels can be selected from the drop-down list:

None: No-sort mode (default)

Address: Sorting in order of addresses on load module.

Name: Sorting in order of object identification names.

(f) I/O access select area

This is a check box that selects whether I/O access is to be measured or not.

If this box is checked, I/O access is measured.

(2) Selecting objects not to be measured

The objects not to be measured can be limited (deleted) by the following operation:

[Operation Method]

<1> Select the display mode of the objects to be displayed on the list from the following two under Mode Select:

- File Mode: Displays the load module name → file name → function name, in that order.
- Selection mode: Displays the load module name → section name → function name, in that order.

<2> Select the object not to be measured from the list displayed under measurement objects.

<3> Click the function button [<<Hide]. The selected object will move to Hide objects. If the destination of the object has been specified, the object is inserted immediately before the specified destination. If no destination has been specified, the object is inserted at the end.

<4> Click the function button [OK].

By double-clicking the location of the section name/file name (*.text/*.c, *.s) on the dialog box, the function names existing in that section/file can be displayed or not displayed.

(3) Adding object to be measured

[Operation Method]

An object to be measured can be added by the following operation:

<1> Select the display mode of the object to be displayed on the list from the following two under Mode Select:

- File Mode: Displays the load module name → file name → function name, in that order.
- Selection mode: Displays the load module name → section name → function name, in that order.

<2> Add the object to be measured to the list displayed under hide objects.

<3> Click the function button [Measure>>]. The selected object will move to measurement objects. If the destination of the object has been specified, the object is inserted immediately before the specified destination. If no destination has been specified, the object is inserted at the end.

<4> Click the function button [OK].

By double-clicking the location of the section name/file name (*.text/*.c, *.s) in the dialog box, the function names existing in that section/file can be displayed or not displayed.

Pattern Search Dialog Box [Function Level]

[Pattern Search]

[Outline]

This dialog box is used to set search conditions when searching given events in execution transition diagrams.

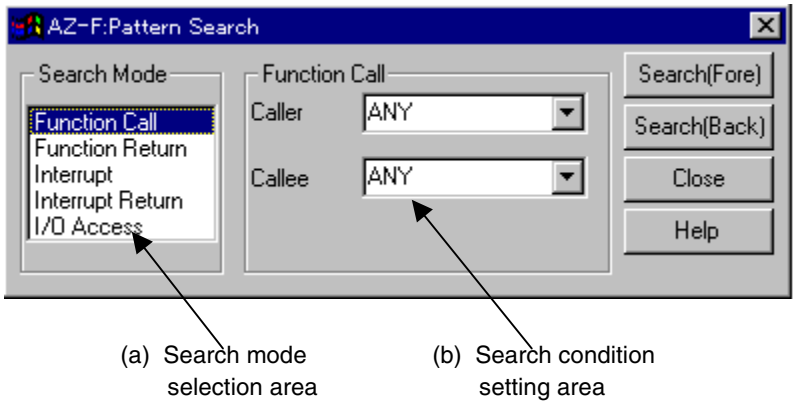
These events refer to switching points from a specified function or interrupt to a specified function or interrupt, or a given status of a specified system call.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [View (V)], then [Search (S)].
- In the <Analyze Window> click the  button.
- In the <Analyze Window>, press the ALT + V, S keys in that order.

[Window]

Figure 6-26 Pattern Search Dialog Box (Function Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Search method

(1) Description of each area

(a) Search mode selection area

This area is used to select the search mode.

The search mode indicates the type of event to be searched in the execution transition diagram. Table 6-12 lists the various search modes.

Table 6-12 Pattern Search Modes (Function Level)

Search Mode	Description
Function Call	Search of location where a function was called.
Function Return	Search of location where a function was returned.
Interrupt	Search of location where an interrupt occurred.
Interrupt Return	Search of location where an interrupt handler was terminated.
I/O Access	Search of location where I/O was accessed.

(b) Search condition setting area

This area is used to set the search conditions for the search mode specified in the search mode selection area.

The contents displayed in this area differ depending on the specified search mode.

The search conditions set for each item can be directly input from the keyboard or selected from the drop-down list.

Table 6-13 lists the conditions that can be set.

Table 6-13 Pattern Search Conditions (Function Level) (When Function Call Is Specified as Search Mode)

Item	Meaning of Condition
Caller	Specify a caller function. If any function will do, specify “ANY”.
Callee	Specify a callee function. If any function will do, specify “ANY”.

Table 6-14 Pattern Search Conditions (Function Level) (When Function Return Is Specified as Search Mode)

Item	Meaning of Condition
Caller	Specify the name of a function from which execution is to return. If any function will do, specify “ANY”.
Callee	Specify the name of a function to which execution is to return. If any function will do, specify “ANY”.

Table 6-15 Pattern Search Conditions (Function Level) (When Interrupt Is Specified as Search Mode)

Item	Meaning of Condition
Function	Specify the name of a function/interrupt at the interrupt source. If any function/interrupt will do, specify “ANY”.
Interrupt	Specify the name of an interrupt. If any interrupt will do, specify “ANY”.

Table 6-16 Pattern Search Conditions (Function Level) (When Interrupt Return Is Specified as Search Mode)

Item	Meaning of Condition
Function	Specify the name of an interrupt. If any interrupt will do, specify “ANY”.
Interrupt	Specify the name of a function/interrupt to which execution is to return from an interrupt. If any function/interrupt will do, specify “ANY”.

Table 6-17 Pattern Search Conditions (Function Level) (When I/O Access Is Specified as Search Mode)

Item	Meaning of Condition
Function	Specify the name of a function/interrupt for I/O access. If any function/interrupt will do, specify “ANY”.
I/O	Specify the name of an I/O to be accessed. If any I/O will do, specify “ANY”.
Access	Specify the access status of the I/O (Read, Write, or Read/Write).

[Function Buttons]

Operation Target	Button	Function
Search condition	Search(Fore)	The location corresponding to the specified search condition is searched from the position indicated by the up cursor or the up temporary cursor in the execution transition diagram along the time axis. The up temporary cursor in the execution transition diagram moves to the search result position.
Search condition	Search(Back)	The location corresponding to the specified condition is searched from the position indicated by the up cursor or the up temporary cursor in the execution transition diagram in the direction opposite to the time axis. The up temporary cursor in the execution transition diagram moves to the search result position.
–	Close	Closes this dialog box.
–	Help	Opens an explanation window for this dialog box.

[Error]

If no event meeting the set search condition exists in the AZ trace data, a warning sound is emitted.

Object Select Dialog Box [Function Level]

[Object Select]

[Outline]

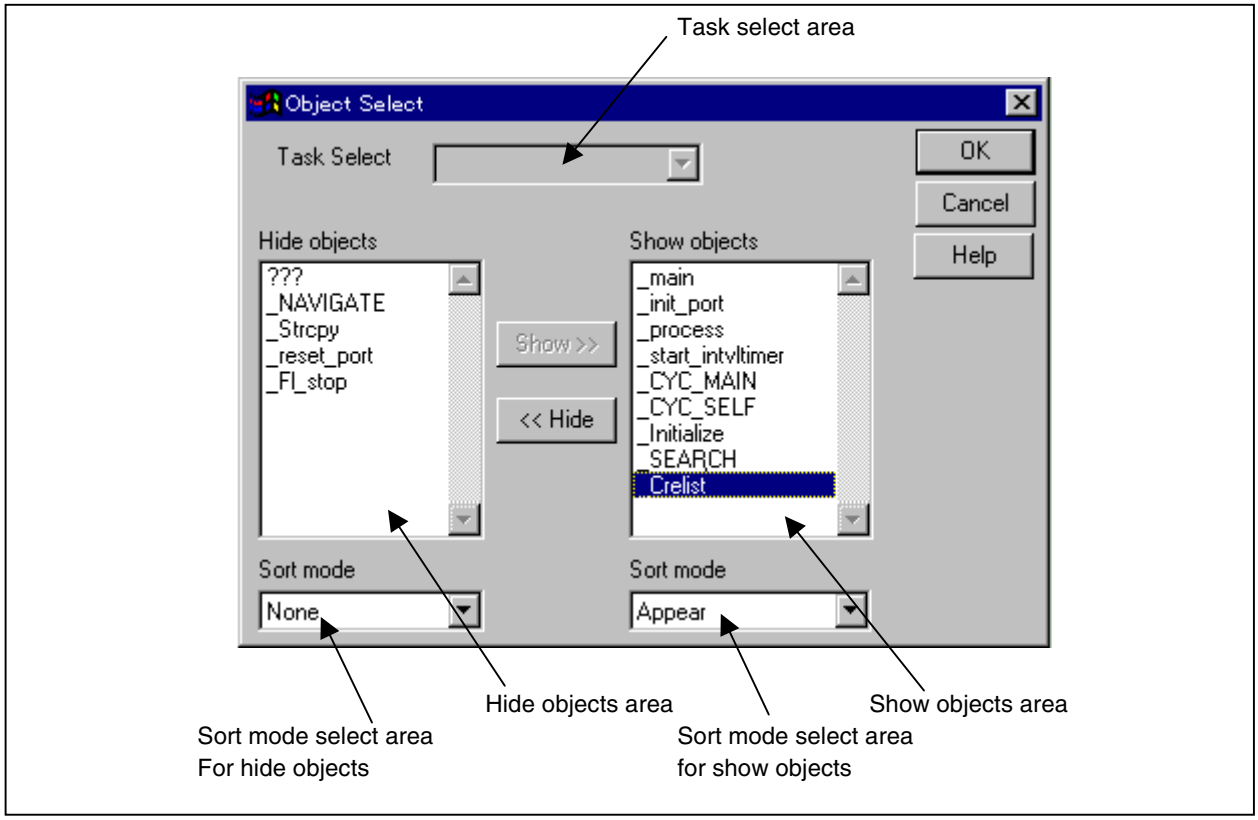
This dialog box is used to select objects to be displayed and to change their sequence in the execution transition diagram of the function-level <Analyze Window>.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [View (V)], then [Object Select (O)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + V, O keys in that order.

[Window]

Figure 6-27 Object Select Dialog Box (Function Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Shown object limitation method
(3) Shown object addition method
(4) Shown object sequence modification method

(1) Description of each area

(a) Task select area

This area selects the task to be displayed on the analyze window.

When a task name is selected, the execution transition diagram of the function level of the selected task is displayed. If “ALL” is selected, the execution transition diagrams of the function levels of all the tasks are displayed. Note, however, that a task can be selected only when an AZ trace has been executed at the task level/function level.

(b) Hide objects area

This area displays the list of objects among those included in AZ trace data that are not displayed in execution transition diagrams.

(c) Show objects area

This area displays the list of objects displayed in execution transition diagrams.

The default is to display all objects included in the AZ trace data.

The sequence in which objects are listed in this area is reflected in execution transition diagrams.

(d) Sort mode area

This area is used to select the display sequence used in the lists in the hide objects area and the show objects area.

(2) Shown object limitation method

The objects that are displayed in execution transition diagrams can be limited (deleted) by performing the following operation.

[Operation Method]

<1> Select objects that do not need to be displayed in execution transition diagrams from the list displayed in the Show object area.

<2> Click the <<Hide button. The selected objects are moved to the hide objects area. If, at this time, the destination is specified, the objects in question are inserted immediately before this specified destination, and if the destination is not specified, they are inserted at the very end of the list.

<3> Click the OK button to reflect these changes in the execution transition diagram.

Remark Hidden objects are grouped into the Etc. object and displayed in execution transition diagrams.

(3) Shown object addition method

Objects to be displayed in execution transition diagrams can be added by performing the following operation.

[Operation Method]

<1> Select the objects to be displayed in execution transition diagrams among those listed in the hide objects area.

<2> Click the Show>> button. The selected objects are moved to the show objects area. If, at this time, the destination is specified, the objects in question are inserted immediately before this specified destination, and if the destination is not specified, they are inserted at the very end of the list.

<3> Click the OK button to reflect these changes in the execution transition diagram.

(4) Shown object sequence modification method

Objects in the hide objects area and show objects area are displayed classified into interrupts, idle, event flags, semaphores, mailboxes, and memory pools (default).

To modify the display sequence, select a setting from the sort mode drop-down list in the sort mode area.

The display sequence in the show objects area is reflected to the execution transition diagram.

The following sort modes can be selected.

Sort Mode	Meaning
None	Unsorted mode (default)
Appear	Order of appearance in AZ trace data
Name	Name sequence for objects
Priority	Priority sequence (however, this setting is valid only for tasks.)

[Function Buttons]

Operation Target	Button	Function
Object	<< Hide	Moves objects selected in the show objects area to the hide objects area. If the destination is specified, the objects are inserted immediately this specified destination, and if the destination is not specified, they are inserted at the very end of the list.
Object	Show >>	Moves objects selected in the hide objects are to the show objects area. If the destination is specified, the objects are inserted immediately this specified destination, and if the destination is not specified, they are inserted at the very end of the list.
–	OK	Displays objects on execution transition diagram based on the objects displayed in the show objects area.
–	Cancel	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

CPU Window [Function Level]

[CPU Window]

[Outline]

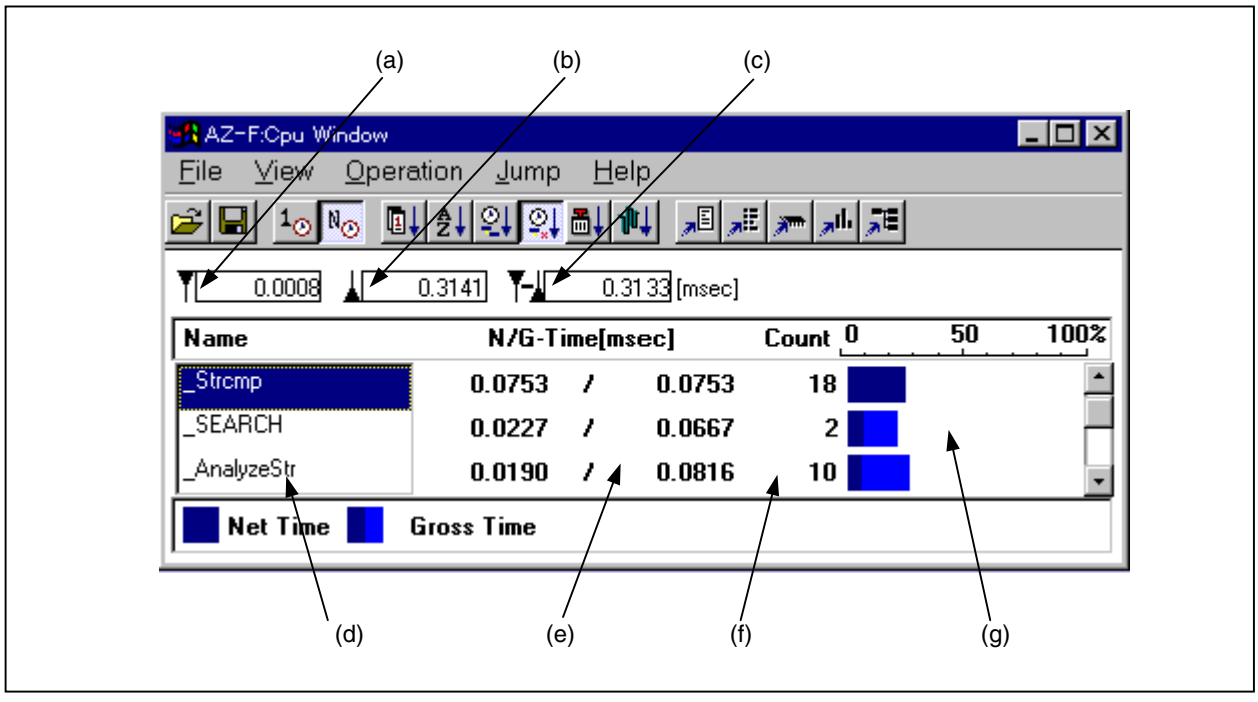
This window displays the CPU usage status in the time range between the up cursor and the down cursor in the execution transition diagram.

From this window, it is possible to check the execution time for specified tasks, interrupts, etc., and to evaluate the target data performance from the idle time and interrupt time. This window can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [Browse (B)], then [CPU Utilization Rate (C)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + B, C keys in that order.

[Window]

Figure 6-28 CPU Window (Function Level)



(a) Up cursor position time display
(b) Down cursor position time display
(c) Up/down cursor time display
(d) Object name
(e) Object execution time display (net time/gross time)
(f) Number of times of object execution
(g) CPU utilization rate graph display

[Function]

This section describes the following items.

(1) Description of each area
(2) CPU utilization rate display method
(3) Jump function in <CPU Window>

(1) Description of each area

(a) Up cursor position time display

Displays the time when CPU utilization rate calculation was started.
This is the relative time from the start of AZ trace data collection until the position of the up cursor in the execution transition diagram. The unit is milliseconds (msec).

(b) Down cursor position time display

Displays the time when CPU utilization rate calculation was ended.
This is the relative time from the start of AZ trace data collection until the position of the down cursor in the execution transition diagram. The unit is milliseconds (msec).

(c) Up/down cursor position time display

Displays the time interval during which CPU utilization rate data was calculated.
This is the time interval between the up cursor and the down cursor. The unit is milliseconds (msec).

(d) Object name

Displays list of object names that exist within calculation time interval.

(e) Object execution time display

Displays the execution time of the object (net time/gross time).
Net time: Execution time including child function
Gross time: Execution time excluding child function

(f) Number of times of object execution

Displays the number of times the object has been executed.

(g) CPU utilization rate graph display

Displays how much each object uses the CPU in percentages.

(2) CPU utilization rate display method

CPU utilization rate is calculated during the time interval between the up cursor and the down cursor in the execution transition diagram.

[Operation Method]

<1> Define the interval for which the CPU utilization rate is to be calculated by setting the up cursor and down cursor in the execution transition diagram.

<2> From the menu bar in the <Analyze Window>, select [Browse (B)], then [CPU Utilization Rate (C)] to open this window.

Remark When the <CPU Window> is open, moving the up cursor or the down cursor in the execution transition diagram causes automatic update of the CPU utilization rate.

(3) Jump function from <CPU Window>

After specifying an object in the list with the mouse, selecting [Jump (J)] in this window causes the next window to appear.

- **Source text**

  Source text corresponding to the specified object is displayed on the debugger.
  If the source text is already being displayed on an active window, the displayed contents on that window are updated.

- **Disassemble text**

  Displays disassemble text corresponding to the specified object on the debugger. If the disassemble text is already being displayed on an active window, the displayed contents on that window are updated.

- **Memory list**

  Displays a memory list corresponding to the specified object on the debugger.
  If the memory list is already being displayed on an active window, the displayed contents on that window are updated.

- **Pattern distribution**

  Opens the “Pattern Window” of the function level corresponding to the specified object. If an active “Pattern Window” is already being displayed, the displayed contents on that window are updated.

  The pattern displayed here is automatically set as follows.
  Start point: Task Switch [ANY] → [Specified task] ; [Valid]
  End point: Task Switch [Specified task] → [ANY] ; [Valid]

(Meaning: Pattern distribution of processing zone from switching location of [Any object] → [Specified object] to switching location of [Specified object] → [Any object])

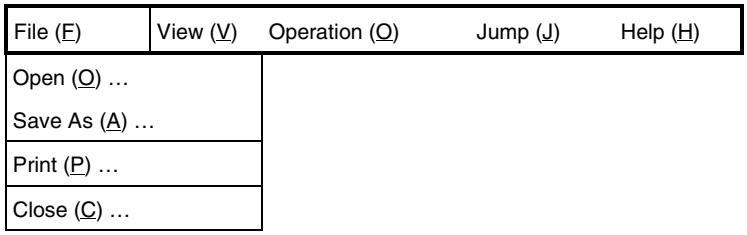
- **Call Graph**
  Displays the <Call Graph Window> corresponding the specified object. If an active <Call Graph Window> is already displayed, its contents are updated.

[Function Buttons]

Operation Target	Button	Function
–		Opens the <File Select> dialog box. The display data in the previously saved CPU Window is read and displayed.
–		Opens the <File Select> dialog box. The display data displayed in the current CPU Window is saved to a file.
–		Displays the graph per execution time.
–		Displays the graph per total execution time.
–		Changes the graph display sequence to order of appearance of trace data.
–		Changes the graph display sequence to object name sequence (alphabetical order).
–		Changes the graph display sequence to order of longest gross time (execution time including child functions).
–		Changes the graph display sequence to order of longest gross time (execution time excluding child functions).
–		Changes the graph display sequence to order of most times executed.
–		Changes the graph display sequence to order of appearance in <Analyze Window>.
Object		Displays the <Source Text Window> corresponding to the specified object. If an active <Source Text Window> is already being displayed, its contents are updated.
Object		Displays the < Disassemble Window> corresponding to the specified object. If an active <Disassemble Window> is already being displayed, its contents are updated.
Object		Displays the <Memory Window> corresponding to the specified object. If an active <Memory Window> is already being displayed, its contents are updated.
Object		Displays the <Pattern Window> corresponding to the specified object. If an active <Pattern Window> is already displayed, its contents are updated.
Object		Displays the <Call Graph Window> corresponding to the specified object. If an active <Call Graph Window> is already being displayed, its contents are updated.

[Menu Bar]

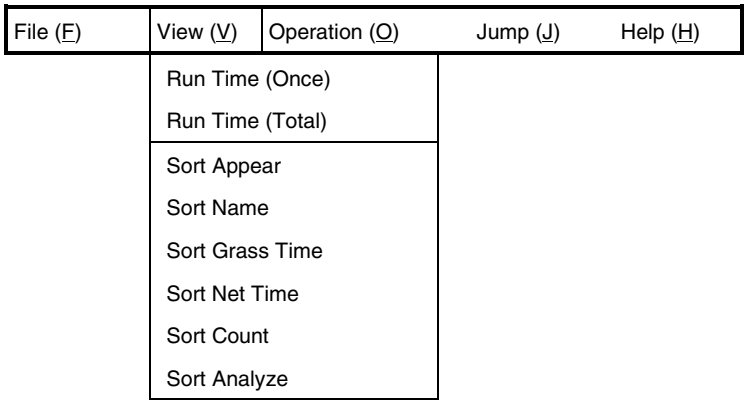
(1) [File (F)] menu



Open (O)	Opens the <File Select> dialog box. The previous saved display file in this window is read. The default extension of the display file for this window is .azc.
Save As (A)	Opens the <File Select> dialog box. Save the display file containing the information currently displayed in this window for the first time or with a new name. The default extension of the display file for this window is .azc.
Print (P)	This menu item is not supported in this version.
Close (C)	Closes this window.

Caution If the CPU utilization rate graph is not displayed, [Save As (A)] cannot be selected.

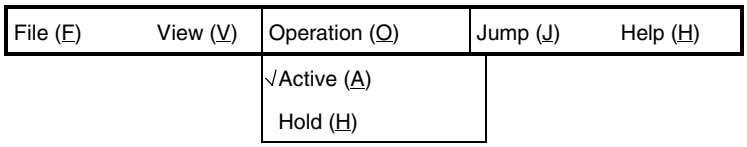
(2) [Display (V)] menu



Run Time (Once)	Displays a graph per individual execution time. This item has the same operation as the  button.
Run Time (Total)	Displays a graph per total execution time. This item has the same operation as the  button.
Sort Appear	Changes the graph display sequence to order of appearance of AZ trace data. This item has the same operation as the  button.
Sort Name	Changes the graph display sequence to name sequence (alphabetical order). This item has the same operation as the  button.

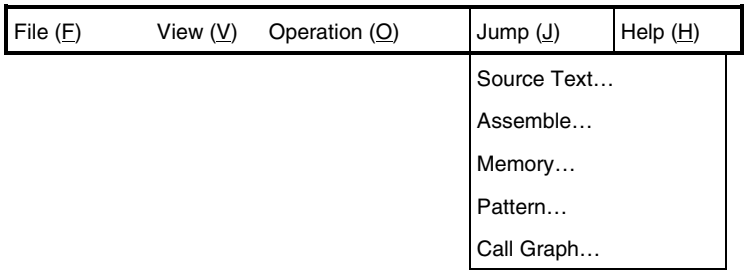
Sort Gross Time	Changes the graph display sequence to order of longest gross time (execution time including child functions). This item has the same operation as the  button.
Sort Net Time	Changes the graph display sequence to order of longest gross time (execution time excluding child functions). (Default) This item has the same operation as the  button.
Sort Count	Changes the graph display sequence to order of most times executed. This item has the same operation as the  button.
Sort Analyze	Changes the graph display sequence to object appearance sequence in execution transition diagram. This item has the same operation as the  button.

(3) [Operation (O)] menu



Active (A)	Switches this window from hold status to active status.
Hold (H)	Switches this window from active status to hold status.

(4) [Jump (J)] menu



Source Text...	Opens the <Source Text Window> corresponding to the specified object. If an active <Source Text Window> is already being displayed, its contents are updated. This item has the same operation as the  button.
Assemble...	Opens the <Disassemble Window> corresponding to the specified object. If an active < Disassemble Window> is already being displayed, its contents are updated. This item has the same operation as the  button.
Memory...	Opens the <Memory Window> corresponding to the specified object. If an active <Memory Window> is already being displayed, its contents are updated. This item has the same operation as the  button.

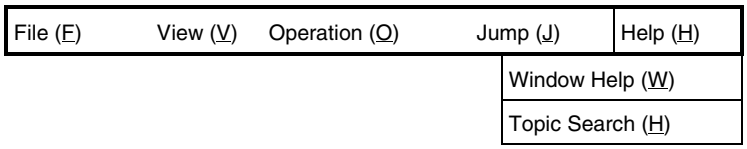
Pattern… Opens the function-level <Pattern Window> corresponding to the specified object. If an active <Pattern Window> is already being displayed, the contents of this window are updated.
The patterns displayed here is automatically set as follows.

Start point: Function Call [ANY] → [Specified Object] ; [Valid]
End point: Function Return [Specified Object] → [ANY] ; [Valid]

This item has the same operation as the  button.

Call Graph... Displays the <Call Graph Window> corresponding to the specified object. If an active <Call Graph Window> is already being displayed, its contents are updated.
This item has the same operation as the  button.

(5) [Help (H)] menu



Window Help (W) Displays the help topics for this window.
Topic Search (H) Displays the help <Topic Search> dialog box of the AZ850.

[Caution]

- This window closes when the function-level <Analyze Window> is closed.

[Error]

- When an active <CPU Window> already exists, trying to make a <CPU Window> in the hold status active causes an <Error> dialog box to appear.

Pattern Set Dialog Box [Function Level]

[Pattern Set]

[Outline]

This dialog box is used to set the pattern search mode and the search conditions as pattern settings for displaying the <Pattern Window>.

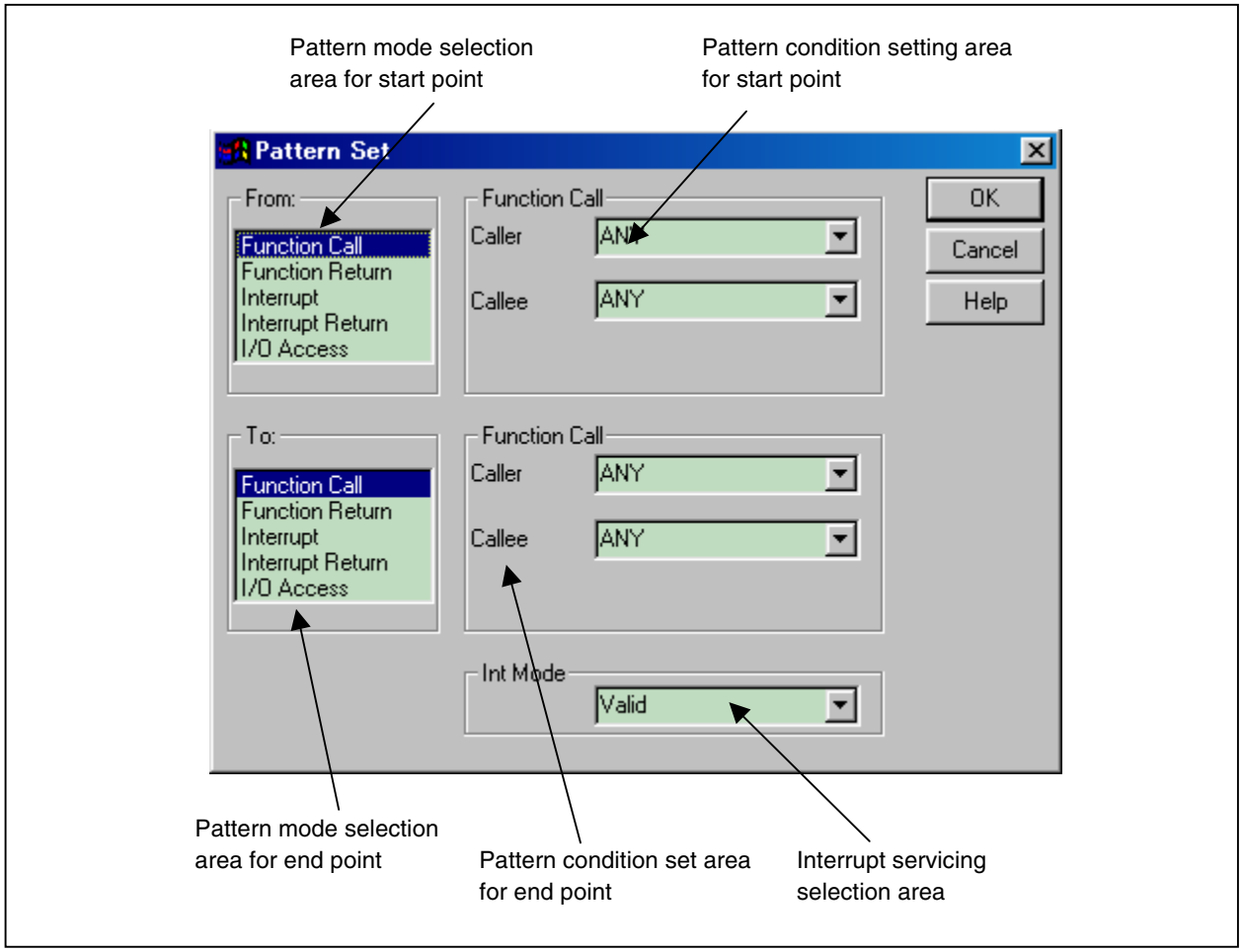
A pattern refers to the processing interval (CPU run interval) from the occurrence of a given event (task switching, interrupt occurrence, system call status, etc.) to the end of that event or the occurrence of a different event.

This dialog box can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [Browse (B)], then [Pattern Distribution (P)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + B, P keys in that order.
- From the menu bar in the <Pattern Window>, select [Browse (B)], then [Pattern Distribution (P)].
- In the <Pattern Window>, click the  button.
- In the <Pattern Window>, press the ALT + P, S keys in that order.

[Window]

Figure 6-29 Pattern Set Dialog Box (Function Level)



[Function]

This section describes the following.

(1) Description of each area
(2) Pattern search/calculation method

(1) Description of each area

(a) Pattern mode selection area

This area is used to select the pattern mode.

The pattern mode indicates the type of event used for the pattern start point (From:) to the end point (To:) to be calculated in the <Pattern Window>.

Table 6-18 lists the various pattern modes.

Table 6-18 Pattern Modes (Function Level)

Pattern Mode	Description
Function Call	Mode using location where a function was called as start/end points.
Function Return	Mode using location where a function was returned as start/end points.
Interrupt	Mode using location where an interrupt occurred as start/end points.
Interrupt Return	Mode using location where an interrupt handler was terminated as start/end points.
I/O Access	Mode using location where I/O was accessed as start/end points.

(b) Condition setting area

This area is used to set the pattern condition for the pattern mode for the pattern start/end points specified in (a).

The contents displayed in this area differ according to the specified pattern mode.

The pattern conditions set for each item can either be directly input from the keyboard or selected from the drop-down list.

- If “Function Call” is specified as the pattern mode
  - Caller: Specify a caller function. If any function will do, specify “ANY”.
  - Callee: Specify a callee function. If any function will do, specify “ANY”.

- If “Function Return” is specified as the pattern mode
  - Caller: Specify the name of a function from which execution is to return. If any function will do, specify “ANY”.
  - Callee: Specify the name of a function to which execution is to return. If any function will do, specify “ANY”.

- If “Interrupt” is specified as the pattern mode
  - Function: Specify the name of a function/interrupt at the interrupt source. If any function/interrupt will do, specify “ANY”.
  - Interrupt: Specify the name of an interrupt. If any interrupt will do, specify “ANY”.

- If “Interrupt Return” is specified as the pattern mode
  - Interrupt: Specify the name of an interrupt. If any interrupt will do, specify “ANY”.
  - Function: Specify the name of a function/interrupt to which execution is to return from an interrupt. If any function/interrupt will do, specify “ANY”.

- If “I/O Access” is specified as the pattern mode
  - Function: Specify the name of a function/interrupt for I/O access. If any function/interrupt will do, specify “ANY”.
  - I/O: Specify the name of an I/O to be accessed. If any I/O will do, specify “ANY”.
  - Access: Specify the access status of the I/O (Read, Write, or Read/Write).

(2) Pattern search/calculation method

The specified pattern is searched/calculated and the <Pattern Window> is opened by performing the following operation.

[Operation Method]

<1> Set the up cursor and the down cursor in the execution transition diagram in the interval for which the pattern distribution status is to be calculated, in order to open this dialog box.
<2> Select the pattern mode to be used as the start point of the pattern to be calculated from the “From:” item in this dialog box.
<3> Select the pattern mode to be used as the end point of the pattern to be calculated from the “To: item.
<4> In the search condition setting area, either input the pattern conditions for “From:” and “To:” directly from the keyboard, or select them from the drop-down list.
<5> Click the OK button.

[Function Buttons]

Operation Target	Button	Function
Pattern condition	OK	Searches/calculates the specified pattern in the time interval set with the up cursor and the down cursor in the execution transition diagram and opens the <Pattern Window>.
–	Cancel	Closes this dialog box.
–	Help	Opens an explanation window for this dialog box.

[Error]

- If no pattern satisfying the set search conditions exists in the AZ trace data, the <Error> dialog box appears.

Pattern Window [Function Level]

[Pattern Window]

[Outline]

The pattern set in the <Pattern Window> is searched in the time interval set with the up cursor and the down cursor in the execution transition diagram, and the a histogram of the frequency of occurrence of this pattern is displayed in this window.

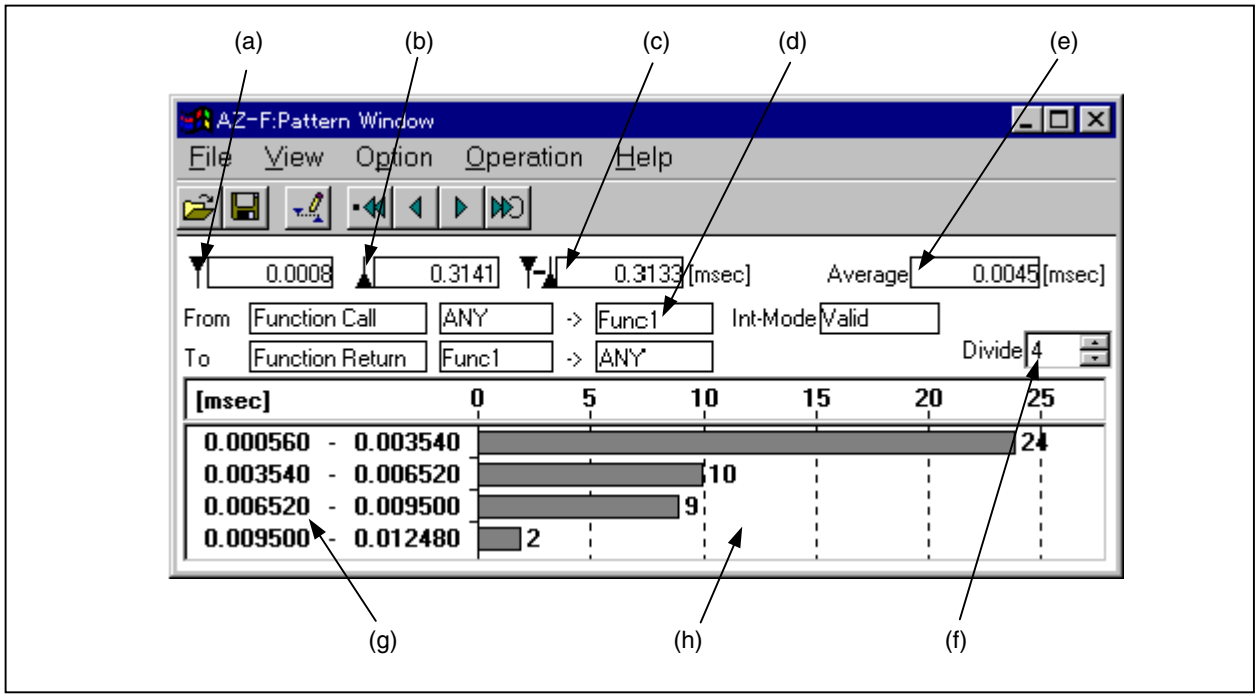
A pattern refers to the processing interval (CPU run interval) from the occurrence of a given event (task switching, interrupt occurrence, system call status, etc.) to the end of that event or the occurrence of a different event. The execution time worst value and average value for various processes of the user program can be obtained from this window.

This window can be opened with one of the following operations.

- From the menu bar in the <Analyze Window>, select [Browse (B)], then [Pattern Distribution (P)], and perform settings in the <Pattern Set> dialog box.
- In the <Analyze Window>, click the  button and set the condition in the <Pattern Set> dialog box.
- In the <Analyze Window>, press the ALT + B, P keys in that order and perform settings in the <Pattern Set> dialog box.
- From the menu in the CPU window, select [Jump (J)], then [Pattern Distribution (P)].
- In the <CPU Window>, click the  button.

[Window]

Figure 6-30 Pattern Window (Function Level)



(a) Up cursor position time display
(b) Down cursor position time display
(c) Up/down cursor time display
(d) Pattern set condition display
(e) Average value display
(f) Histogram split display
(g) Processing time display area
(h) Pattern distribution display area

[Function]

This section describes the following items.

(1) Description of each area
(2) Pattern distribution display method
(3) Pattern distribution viewing method
(4) Search from <Pattern Window>

(1) Description of each area

(a) Up cursor position time display

Displays the time when pattern distribution status calculation was started.

This is the relative time from the start of AZ trace data collection until the position of the up cursor in the execution transition diagram. The unit is milliseconds (msec).

(b) Down cursor position time display

Displays the time when pattern distribution status collection ended.

This is the relative time from the start of AZ trace data collection until the position of the down cursor in the execution transition diagram. The unit is milliseconds (msec).

(c) Up/down cursor position time display

Displays the time interval during which the pattern distribution status was calculated.

This is the time interval between the up cursor and the down cursor. The unit is milliseconds (msec).

(d) Pattern setting condition display

Displays the pattern conditions set in the <Pattern Set> dialog box.

(e) Average value display

Displays the average value for the set pattern execution time. The unit is milliseconds (msec).

(f) Histogram split number display

Displays the histogram split number. The split number can be freely changed from 1 to 100 by clicking the button on the right.

(g) Processing time display area

Displays the time interval during which the set pattern was processed.

(h) Pattern distribution display area

Displays in histogram form the processing time of the set pattern calculated during the time interval set with the up cursor and the down cursor in the execution transition diagram.

(2) Pattern distribution display method

Pattern distribution calculation is done during the time interval set with the up cursor and the down cursor in the execution transition diagram.

[Operation Method]

<1> Set the up cursor and the down cursor in the execution transition diagram to define the interval for which the pattern distribution status is to be calculated.

<2> From the menu bar in the <Analyze Window>, select [Browse (B)], then [Pattern Distribution (P)].

<3> In the <Pattern Set> dialog box that opens automatically, set the conditions of the pattern to be calculated and displayed, and then click the OK button.

Remark When the <Pattern Window> is open, moving the up cursor or the down cursor in the execution transition diagram causes automatic update of the pattern distribution contents.

(3) Search from <Pattern Window>

By using the function buttons in the <Pattern Window>, the pattern locations for which the execution time interval is minimum/maximum (or ascending/descending order of time interval) are searched, and the search results are displayed on an execution transition diagram.

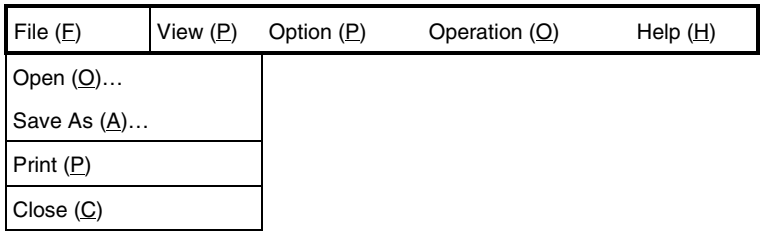
The up temporary cursor moves to the start position of the searched pattern, and the down temporary cursor moves to the end position.

[Function Buttons]

Operation Target	Button	Function
–		Opens the <File Select> dialog box. The previously saved <Pattern Window> contents are read and displayed.
–		Opens the <File Select> dialog box. The display data currently displayed in the <Pattern Window> is saved to a file.
–		Opens the <Pattern Set> dialog box.
–		Displays in the <Analyze Window> the location in the searched pattern where the execution time interval is minimum.
–		Searches the location with the next smaller execution time interval compared to the currently searched location.
–		Searches the location with the next larger execution time interval compared to the currently searched location.
–		Displays in the <Analyze Window> the location in the searched pattern where the execution time interval is maximum.

[Menu Bar]

(1) [File (F)] menu



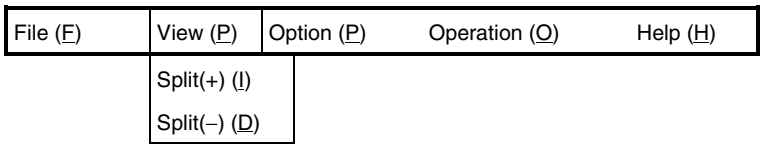
Open (O) — Opens the file select dialog box <Open>. The file containing the previously saved window contents is read.
The default extension of the display file of this window is .azp.

Save As (A) — Opens the file select dialog box <Open>. Saves the current display information in this window to a display file, either as a new file or as a file with a different name.
The default extension of the display file for this window is .azp.

Print (P) — This menu item is not supported in this version.

Close (C) — Closes this window.

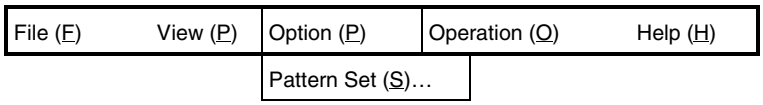
(2) [View (V)] menu



Split(+) (I) — Increases histogram split number by 1.

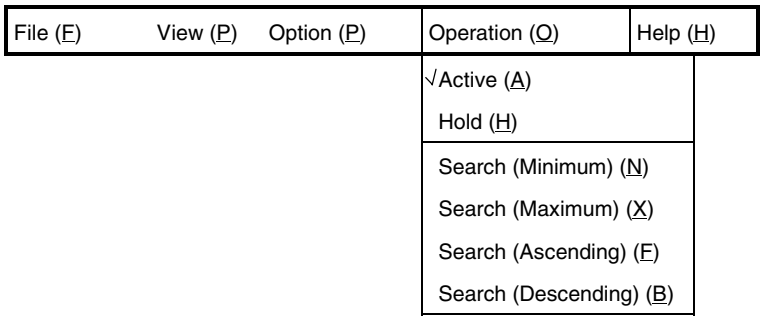
Split(-) (D) — Decreases histogram split number by 1.

(3) [Option (P)] menu



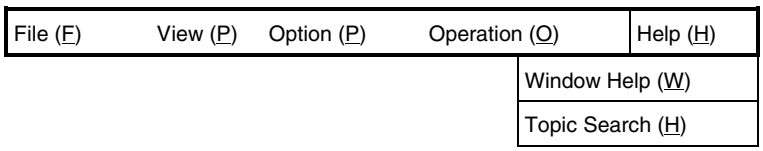
Pattern Set (S) — Opens the trace-level <Pattern Set> dialog box of this window.

(4) [Operation (O)] menu



Active (A)	Switches this window from hold status to active status.
Hold (H)	Switches this window from active status to hold status.
Search (Minimum) (N)	Displays the location with the minimum execution time in the calculated pattern. The up temporary cursor moves to the start position and the down temporary cursor moves to the end point of the searched pattern. This item has the same operation as the  button.
Search (Maximum) (X)	Displays the location with the maximum execution time in the calculated pattern. The up temporary cursor moves to the start position and the down temporary cursor moves to the end point of the searched pattern. This item has the same operation as the  button.
Search (Ascending Order) (F)	Searches the pattern with the next longer execution time compared to the currently searched pattern after the [Search (Minimum) (N)] item is selected or the  button is clicked. The up temporary cursor moves to the start position and the down temporary cursor moves to the end position of the searched pattern. This item has the same operation as the  button.
Search (Descending Order) (B)	Searches the pattern with the next shorter execution time compared to the currently searched pattern after the [Search (Minimum) (N)] item is selected or the  button is clicked. The up temporary cursor moves to the start position and the down temporary cursor moves to the end position of the searched pattern. This item has the same operation as the  button.

(5) [Help (H)] menu



Window Help (W)	Displays the help topics for this window.
Topic Search (H)	Displays the help <Topic Search> dialog box of the AZ850.

[Caution]

- The <Pattern Window> closes when the <Analyze Window> is closed.

[Error]

- When an active <Pattern Window> already exists, trying to make a window in the hold status active causes an <Error> dialog box to appear.
- If a split number over 100 is specified, a warning sound is emitted.

Trace View Window [Function Level]

[Trace View Window]

[Outline]

This window displays the AZ trace data displayed as an execution transition diagram.

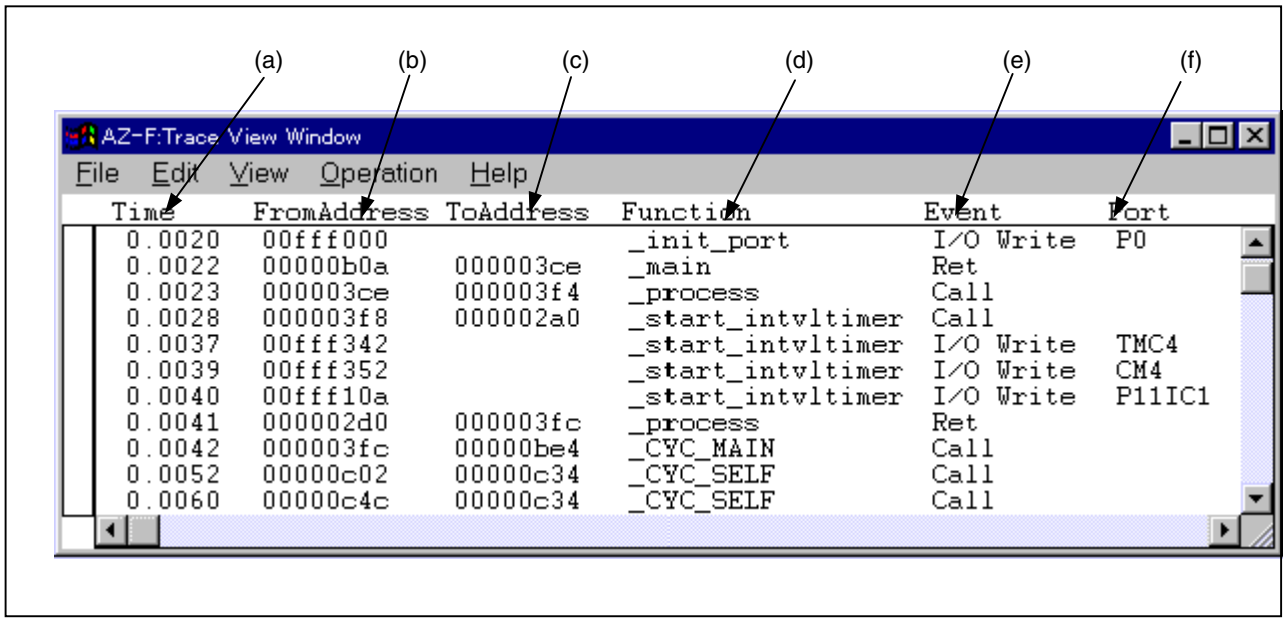
More detailed AZ trace data can be viewed by opening the <Trace View Window> from the <Analyze Window>.

This window can be opened with one of the following operations.

- From the main menu in the <Analyze Window>, select [Browse (B)], then [Trace View (T)].
- In the <Analyze Window>, click the  button.
- In the <Analyze Window>, press the ALT + B, T keys in that order.

[Window]

Figure 6-31 Trace View Window (Function Level)



(a) Time display area
(b) FromAddress display area
(c) ToTask display area
(d) Function display area
(e) Event display area
(f) Port display area

[Function]

This section describes the following items.

(1) Description of each area
(2) AZ trace data display method
(3) AZ trace viewing method
(4) AZ trace data search method

(1) Description of each area

(a) Time display area

Displays the relative time from the AZ trace start time. The unit is milliseconds (msec).

(b) FromAddress display area

Displays the execution address or I/O access address at the branch source.

(c) ToAddress display area

Displays the execution address at the branch destination.

(d) Function display area

Displays an execution function name.

(d) Event display area

Displays the type of trace data event.

The types of events that can be displayed are as follows.

- **Call**
  Means the start of function call.
- **Ret**
  Means the end of function return.
- **Int**
  Means the start of interrupt servicing.
- **Reti**
  Means the end of interrupt servicing.
- **I/O Read**
  Means I/O input.
- **I/O Write**
  Means I/O output.

(e) Port area

Displays the subject I/O name if “I/O Read” or “I/O Write” is displayed in the Event field.

(2) AZ trace data display method

AZ trace data is displayed from the location specified in the execution transition diagram.

[Operation Method]

<1> Indicate the AZ trace data display start position.
If the up temporary cursor is displayed in the execution transition diagram, it becomes the display start position, and if it is not displayed, the beginning of the trace data becomes the display start position.

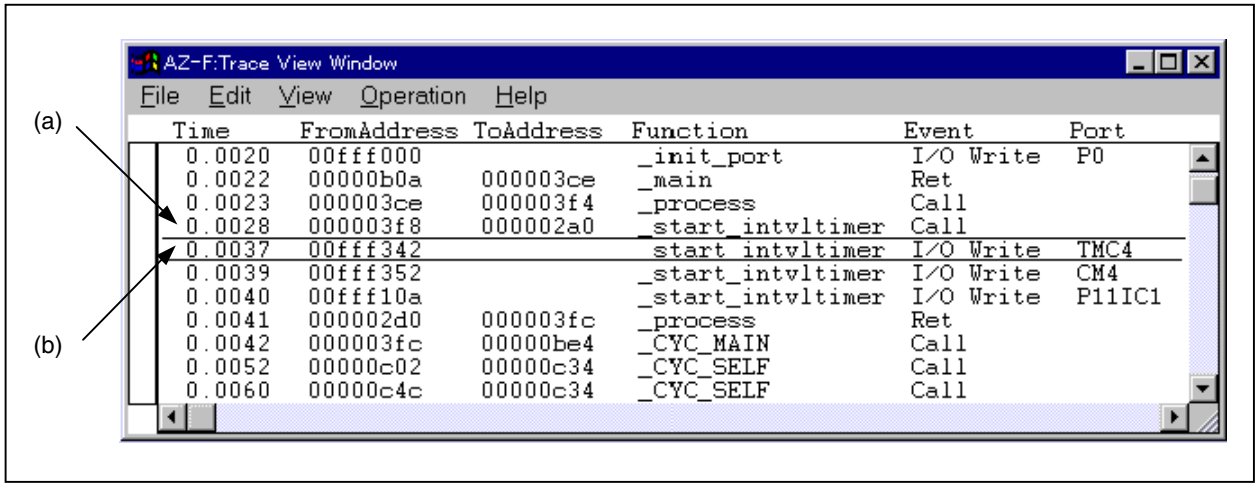
<2> From the menu bar on the <Analyze Window>, select [Browse (B)], then [Trace View (T)], to open this window.

Remark When the <Trace View Window> is open, moving the up temporary cursor in the execution transition diagram causes the AZ trace data display position to move automatically.

(3) AZ trace data viewing method

Figure 6-32 describes how to read the AZ trace data.

Figure 6-32 AZ Trace Data Viewing Method (Function Level)



(a) The function “-start-intvltime” is called at address 0x03f8 after the system has been started (0.0028 ms).

(b) The function “_start_intvtimer” executes I/O output to “TMC4” at address 0xfff342 after the system has been started (0.0037 ms).

(4) AZ trace data search method

When opened from the menu bar in this window, search using execution task/interrupt name, event type, system call arguments, etc., as conditions can be performed from the <Trace Search> dialog box.
For details about the search method, refer to the <Trace Search> dialog box section.

[Operation Method]

<1> From the menu bar in this window, select [View (V)], then [Search (S)].

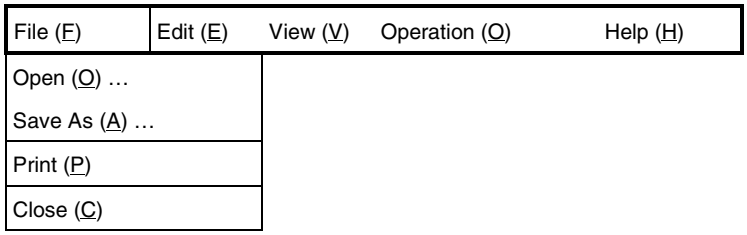
<2> Set the search conditions in the <Trace Search> dialog box that is automatically opened.

<3> The search in the new trace time direction is started by clicking the Search(Fore) button in the <Trace Search> dialog box, and the trace search in the old trace time direction is started by clicking the Search(Back) button.

<4> Update the AZ trace data display position with the search location as the beginning.

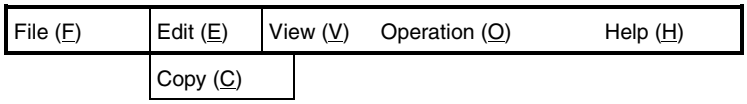
[Menu Bar]

(1) [File (F)] menu



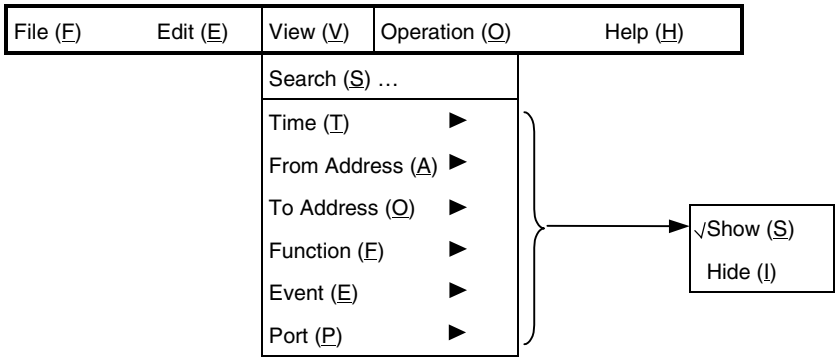
Open (O)	This menu item is not supported in this version.
Save As (A)	Opens the <File Select> dialog box. Saves the display information of the current window to a display file, either as a new file or as a file with a different name. The default extension of the display file for this window is .azt.
Print (P)	This menu item is not supported in this version.
Close (C)	Closes this window.

(2) [Edit (E)] menu



Copy (C)	This menu item is not supported in this version.

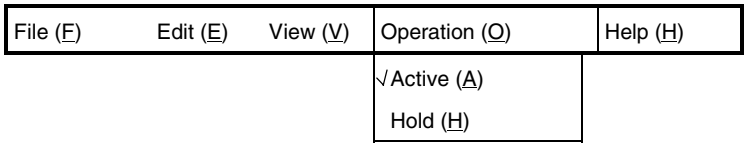
(3) [View (V)] menu



Search (S)	Opens the <Trace Search> dialog box.
Time (T)	Specifies Show/Hide for the “Time” item. Select either Show (S) or Hide (I) from the sub-menu.
From Address (A)	Specifies Show/Hide for the “From Address” item. Select either Show (S) or Hide (I) from the sub-menu.
To Address (O)	Specifies Show/Hide for the “To Address” item. Select either Show (S) or Hide (I) from the sub-menu.
Function (F)	Specifies Show/Hide for the “Function (F)” item. Select either Shows (S) or Hide (I) from the sub-menu.

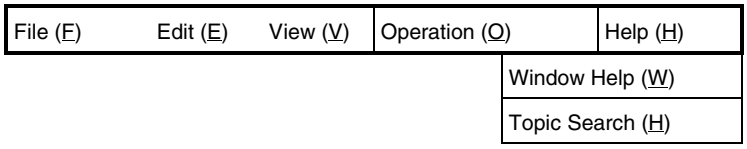
Event (E)	Specifies Show/Hide for the “Event” item. Select either Show (S) or Hide (I) from the sub-menu.
Port (P)	Specifies Show/Hide for the “I/O Port” item. Select either Show (S) or Hide (I) from the sub-menu.

(4) [Operation (O)] menu



Active (A)	Switches this window from hold status to active status.
Hold (H)	Switches this window from active status to hold status.

(5) [Help (H)] menu



Window Help (W)	Displays the help topics for this window.
Topic Search (H)	Displays the help <Topic Search> of the AZ850.

[Caution]

- This window closes when the <Analyze Window> is closed.

[Error]

- If an active <Trace View Window> exists, making a window in the hold status active causes the <Error> dialog box to appear.

Trace Search Dialog Box [Function Level]

[Trace Search]

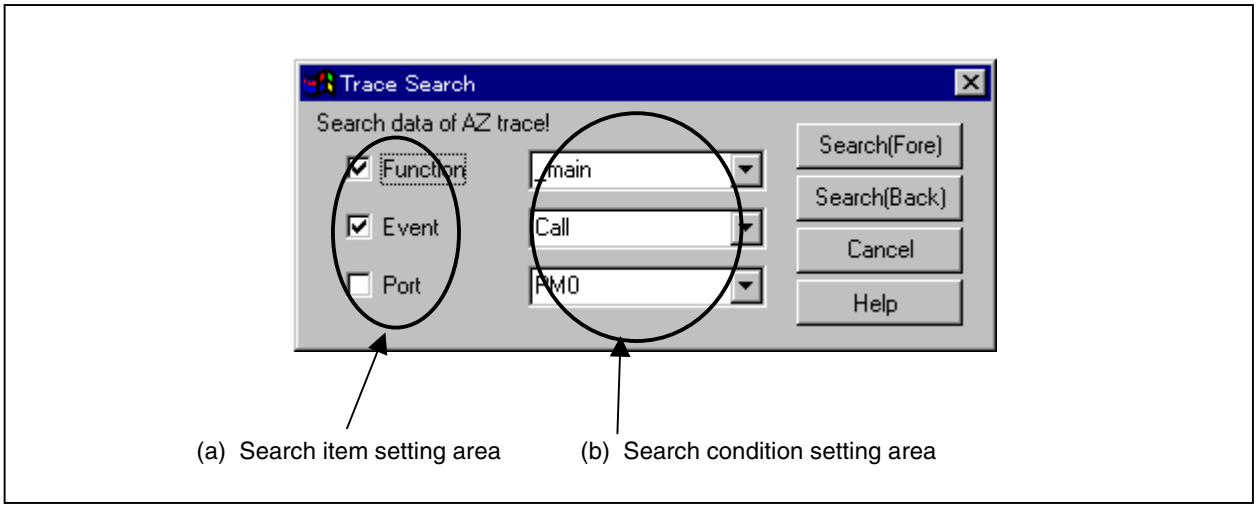
[Outline]

This dialog box is used to set search conditions used for searching AZ trace data in the <Trace View Window>.
Execution task name/interrupt name, event type, system call argument, etc., can be set as the search condition.
This dialog box can be opened with one of the following operations.

- In the menu bar in the <Trace View Window>, select [View (V)], then [Search (S)].
- In the <Trace View Window>, press the ALT + V, S keys in that order.

[Window]

Figure 6-33 Trace Search Dialog Box (Function Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Search method

(1) Description of each area

(a) Search item setting area

This area is used to specify the trace data search items in the <Trace View Window>.

Function Select this to perform search by function name/interrupt name.
Event Select this to perform search by event type.
Port Select this to perform search by I/O port name.

(b) Search condition setting area

This area is used to specify search conditions for each search item.

The drop-down list displays the function names/interrupt names, event types, and I/O port names that exist in the collected AZ trace data.

(2) Search method

[Operation Method]

<1> In the search item setting area, select the item to be searched.
Multiple items can be selected.

<2> In the search item setting area, either input the search condition directly from the keyboard, or select it from the drop-down list.

<3> Click the Search(Fore) button or the Search(Back) button.

The search is performed as follows.

- If Search(Fore) button is clicked
  Locations that match the set search condition are searched in the new trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.
- If Search(Back) button is clicked
  Locations that match the set search condition are searched in the old trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.

A trace condition setting example in the <Trace Search> dialog box is shown below.

Figure 6-34 When Searching Location Where Function "_main" Was Executed

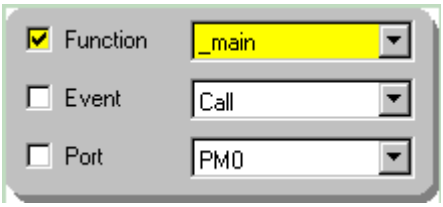


Figure 6-35 When Searching Location Where Function "_main" Was Called

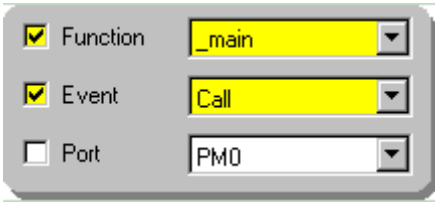
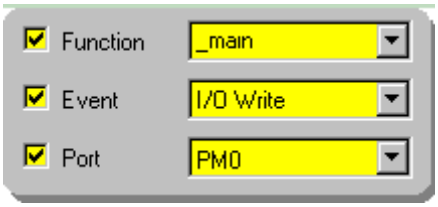


Figure 6-36 When Searching Location Where Function "_main" Executes I/O Output to "PM0"



[Function Buttons]

Operation Target	Button	Function
Search condition	Search(Fore)	Locations that match the set search condition are searched in the new trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.
Search condition	Search(Back)	Locations that match the set search condition are searched in the old trace time direction, and the <Trace View Window> is displayed with the search location as the beginning.
–	Cancel	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

[Error]

- If no location that matches the set search condition exists in the AZ trace data, a warning sound is emitted.
- A warning sound is emitted when the Search(Fore) button or the Search(Back) button is pressed without any item selected in the search item setting area.

Call Graph Window [Function Level]

[Call Graph Window]

[Outline]

This window displays a diagram indicating the relationship between caller functions and callee functions in a zone between the up cursor and down cursor on the execution transition diagram in the function-level <Call Graph Window>.

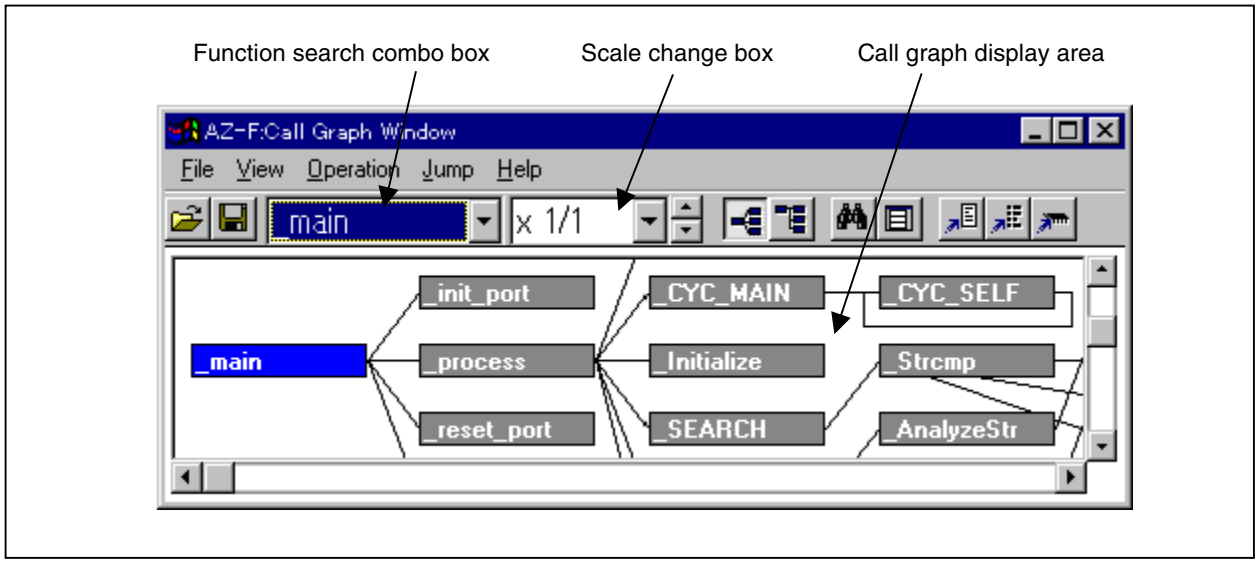
This window can be used to visually monitor the relationship between each function (parent function, source function, and child function).

This window can be opened as follows:

- Select [Browse (B)] → [Call Graph (G)] in the function-level <Analyze Window>.
- Press the ALT + B, G keys in that order in the function-level <Analyze Window>.
- Click the button in the function-level <Analyze Window>.
- Select [Jump (J)] → [Call Graph (G)] in the function-level <CPU Window>.
- Press the ALT + J, and G keys in that order in the function-level <Analyze Window>.
- Click the button in the function-level <CPU Window>.

[Window]

Figure 6-37 Call Graph Window (Function Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Searching method

(1) Description of each area

(a) Function search combo box

This box is used to specify the function name/interrupt name to be searched when searching a function/interrupt on the call graph. Searching is started as soon as the function name/interrupt name to be searched has been selected from the drop-down list, and the specified function/interrupt is displayed in reverse video.

(b) Scale change button

This button reduces the relational diagram in the window in a range of 1/1 to 1/8. If a value exceeding this range is specified, a warning sound is issued.

(c) Call graph display area

This area displays a diagram indicating the relationship between caller functions and callee functions in a zone between the up cursor and down cursor on the function-level execution transition diagram.

By double-clicking the specified function name/interrupt name, the <Function Detail Information> dialog box can be opened. This area can be displayed in two “display modes”.

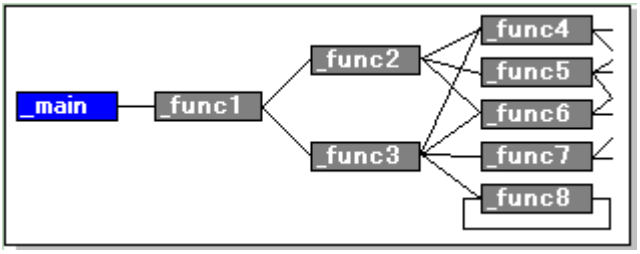
(2) Display modes of call graph

The call graph can be displayed in the following two modes:

(a) Standard mode

In this mode, function call relationships that have emerged in a specified range are displayed. As shown in Figure 6-38, one function (box) is displayed only once, and the relationship between functions is displayed by lines connecting each other. This mode is used to check call relationships in a wide range.

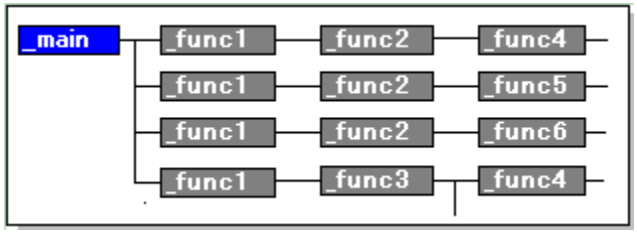
Figure 6-38 Standard Mode (Function Level)



(b) Total mode

In this mode, function call relationships that have appeared in a specified range as displayed. As shown in Figure 6-39, one function (box) is displayed as many times as it has been executed. This mode is used to check relationships of function calls as they have been executed.

Figure 6-39 Total Mode (Function Level)



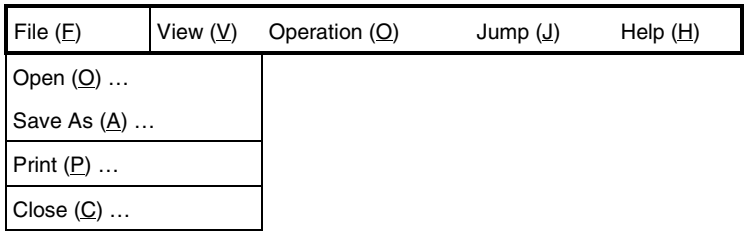
- "Recursive function" is displayed in a line that goes around the function name (in the above figure, "_Func8" is a recursive function).
- If a function/interrupt is specified by the mouse, the <Source Text Window>, <Disassemble Window> or <Memory Window> corresponding to the specified function/interrupt can be opened by selecting the [Jump (J)] menu in this window.
- By double-clicking any function/interrupt with the mouse, the <Function Detail Information> dialog box that is used to check the detailed information on the "parent function", "source function", or "child function" of the specified function/interrupt can be opened.
- Functions/interrupts can be searched in the <Function Search> dialog box that is opened by selecting [View (V)] → [Search (S)] on the menu bar in this window.

[Function Buttons]

Operation Target	Button	Function
–		Opens the <File Select> dialog box. Reads and displays the display data of the <Call Graph Window> previously saved.
–		Opens the <File Select> dialog box. Saves the display data currently displayed on the <Call Graph Window> to a file.
–		Changes the display mode to the standard mode.
–		Changes the display mode to the total mode.
–		Opens the <Function Search> dialog box.
–		Opens the <Function Detail Information> dialog box.
Object		Opens the <Source Text Window> corresponding to the specified object. If an active <Source Text Window> is already being displayed, its contents are updated.
Object		Opens the <Disassemble Window> corresponding to the specified object. If an active <Disassemble Window> is already being displayed, its contents are updated.
Object		Opens the <Memory Window> corresponding to the specified object. If an active <Memory Window> is already being displayed, its contents are updated.

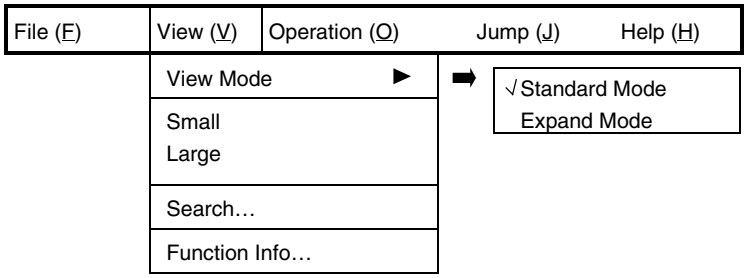
[Menu Bar]

(1) [File (F)] menu



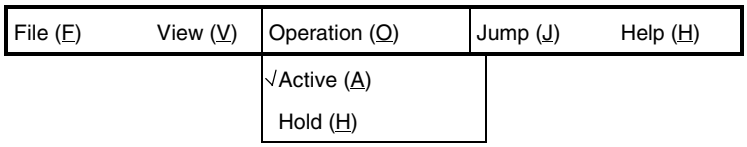
Open (O)	Opens the <File Select> dialog box and reads the previously saved display file of this window. The default extension of the display file of this window is .azc.
Save As (A)	Opens the <File Select> dialog box and saves the current display information of this window to a new file, or by changing the file name. The default extension of the display file of this window is .azc.
Print (P)	Not supported by this version.
Close (C)	Closes this window.

(2) [View (V)] menu



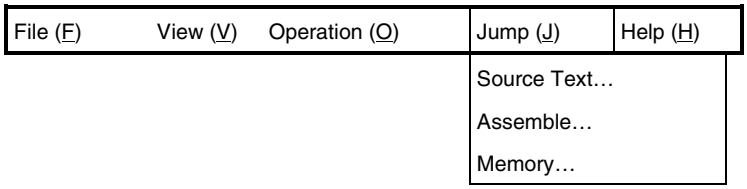
View Mode	Specifies the view mode of the call graph (standard mode or total mode). Performs the same operation as clicking the  button.
Small	Reduces the displayed call graph. Performs the same operation as using the scale change button.
Large	Expands the displayed call graph. Performs the same operation as using the scale change button.
Search...	Opens the <Function Search> dialog box. Performs the same operation as clicking the  button.
Function Info...	Opens the <Function Detail Information> dialog box. Performs the same operation as clicking the  button.

(3) [Operation (O)] menu



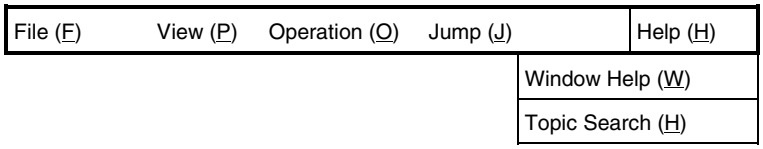
Active (A)	Switches this window from hold status to active status.
Hold (H)	Switches this window from active status to hold status.

(4) [Jump (J)] menu



Source Text…	Opens the <Source Text Window> corresponding to the specified object. If an active <Source Text Window> is already being displayed, its contents are updated. This item has the same operation as the  button.
Assemble…	Opens the <Disassemble Window> corresponding to the specified object. If an active <Disassemble Window> is already being displayed, its contents are updated. This item has the same operation as the  button.
Memory…	Opens the <Memory Window> corresponding to the specified object. If an active <Memory Window> is already being displayed, its contents are updated. This item has the same operation as the  button.

(5) [Help (H)] menu



Window Help (W)	Displays the help topic for this window.
Topic Search (H)	Displays the help <Topic Search > dialog box of the AZ850.

[Caution]

- This window is closed when the function-level <Analyze Window> is closed.

Function Search Dialog Box [Function Level]

[Function Search]

[Outline]

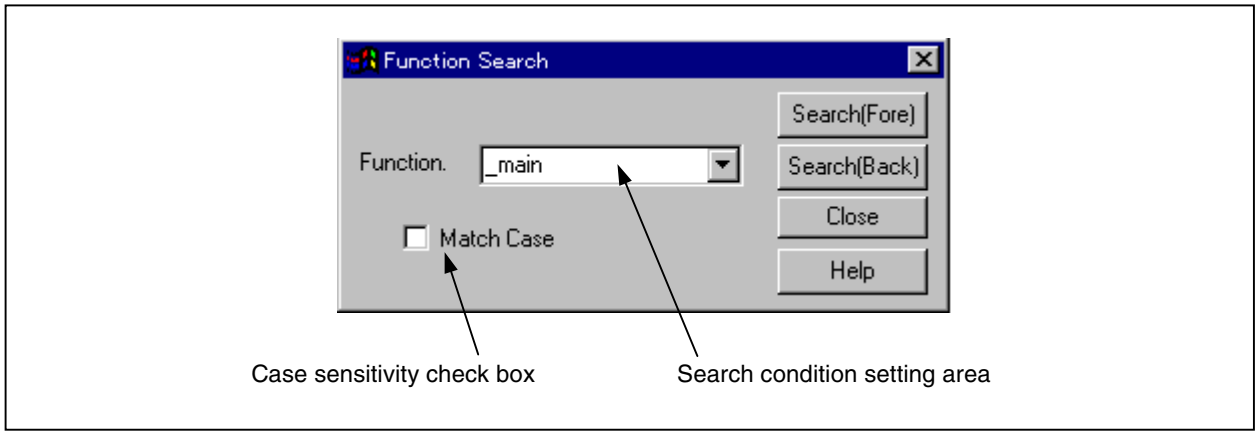
This dialog box is used to search a function/interrupt name in the <Call Graph Window>.

This dialog box can be opened as follows:

- Select [View (V)] → [Search (S)] in the function-level <Call Graph Window>.
- Click the  button in the function-level <Call Graph Window>.
- Press the ALT + V, and S keys, in that order, in the function-level <Call Graph Window>.

[Window]

Figure 6-40 Function Search Dialog Box (Function Level)



[Function]

This section describes the following items.

(1) Description of each area
(2) Searching method

(1) Description of each area

(a) Search condition setting area

This area is used to set the function/interrupt name to be searched.

The function/interrupt name can be directly input from the keyboard or selected from the drop-down list.

On the drop-down list, all the function/interrupt names that exist on the call graph are displayed.

(b) Case sensitivity check box

This check box is used to specify whether the uppercase and lowercase characters are distinguished when a function/interrupt name is searched.

By checking this box, the uppercase and lowercase characters are distinguished.

[Function Buttons]

Operation Target	Button	Function
Search condition	Search(Fore)	Searches the location that matches the specified “search condition” from the location of the up cursor or up temporary cursor on the execution transition diagram, in the time axis direction. The up temporary cursor on the execution transition diagram moves the position of the search result.
Search condition	Search(Back)	Searches the location that matches the specified “search condition” from the location of the up cursor or up temporary cursor on the execution transition diagram, in the direction opposite to the time axis direction. The up temporary cursor on the execution transition diagram moves the position of the search result.
–	Close	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

[Error]

- If the specified function/interrupt name does not exist on the call graph, a warning sound is issued.
- If a button is clicked when the function to be searched does not exist after the function is displayed in reverse video, or if a button is clicked when the function to be searched does not exist before the function displayed in reverse video, a warning sound is issued.

Function Detail Information Dialog Box [Function Level]

[Function Detail Information]

[Outline]

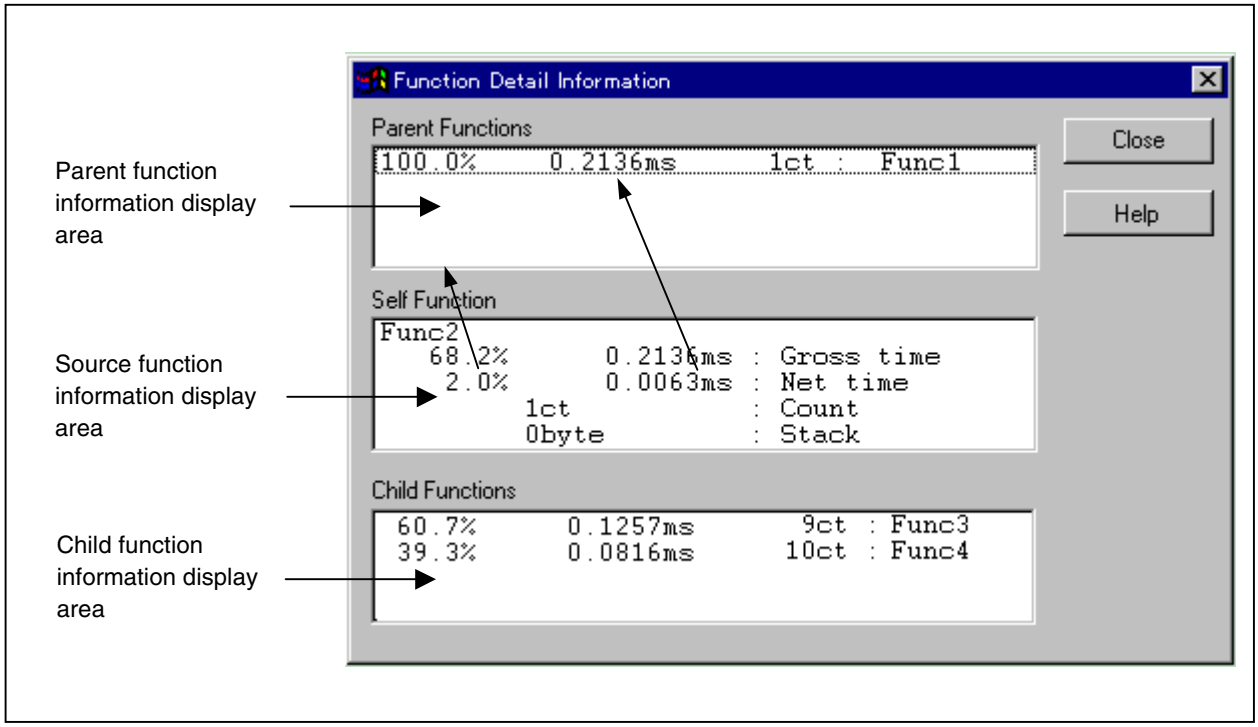
This dialog box displays detailed information on the parent function, source function, and child function displayed in the <Call Graph Window>.

This dialog box can be opened as follows:

- Select [View (V)] → [Function Detail Information (I)] in the function-level <Call Graph Window>.
- Click the  button in the function-level <Call Graph Window>.
- Press the ALT + V, and I keys in that order in the function-level <Call Graph Window>.

[Window]

Figure 6-41 Function Detail Information Dialog Box (Function Level)



[Function]

This section describes the following items.

(1) Description of each area

(1) Description of each area

(a) Parent function information display area

This area displays detailed information of a parent function, such as the function name, time, percentage, and the number of times of execution.

(b) Source function information display area

This area displays detailed information such as execution time including or excluding that of the child function of the source function, the number of times the source function has been called, time, percentage, and stack size.

(c) Child function information display area

This area displays the detailed information of a child function, such as the time, percentage, and the number of times of execution.

[Function Buttons]

Operation Target	Button	Function
–	Close	Closes this dialog box.
★ –	Help	Opens an explanation window for this dialog box.

[Error]

- If a function name on the list of the parent function information display area or child function information display area is double-clicked, the <Function Information> dialog box of the specified function as the source function is displayed.
- This dialog box is closed when the <Call Graph Window> is closed.

APPENDIX A DEBUGGING METHOD USING AZ850

This appendix describes the basic procedure for debugging using the AZ850.

(1) Debugger startup

Start the debugger to be used.

(2) AZ850 startup

Start the AZ850 and open the <AZ850> main window.

At this time, check if <<**Connected**>> is displayed in the status display area. If it is, the connection with the debugger was successful.

(3) Load module download

Download a load module prepared for the AZ850 to the debugger.

Check if <<RX+AZ Loaded>> is displayed on the status bar in the <AZ850> main window in the case of the soft trace form, or if <<RX Loaded>> is displayed in the case of the hardware trace form.

(4) Settings in <AZ Option> dialog box

Open the <AZ Option> dialog box, and set the following options in this dialog box.

★
- Address mask specification
  Specify the upper limit value of the physical address space on the chip in the <Address Mask> field.
- Real-time OS type selection
  Select the real-time OS type embedded in the user program with <<RTOS Select>>.
- Trace form selection
  Select the trace form to be used with <<Trace Form>>.
- Trace buffer type selection and trace buffer area setting
  If the software trace form has been selected as the trace form, after selecting the type of trace buffer to be used with <<Soft Form Buffer Type>>, set its area with <<Soft Form Buffer Region>>.
- Trace level selection
  Select the trace level of the AZ trace data to be collected with <<Trace Level>>.
  In this version, only “Task Level” can be selected as the task level. Download a load module prepared for the AZ850 to the debugger.

(5) AZ trace mode switching

Set the AZ850 trace function to “AZ Trace ON” to enable it.

Caution Do not perform the AZ Trace ON setting before downloading of the load module (loading of the real-time OS information) has been completed.

(6) User program execution

Execute the user program on the debugger.

The trace data for the AZ850 starts being collected into the trace buffer along with the user program execution.

(7) User program stop

Stop the user program on the debugger (if a break point has been set, wait until the break).
The AZ850 trace data collection stops at the same time as the user program execution.

(8) Trace data upload

Convert the trace data collected in the trace buffer to AZ trace data through uploading.

(9) Check using <Analyze Window>

Open the <Analyze Window>, and check the collected AZ trace data with execution transition diagrams for individual tasks.

- **To display execution transition diagram...**
  From the menu bar in the <AZ850> main window, select [Browse (B)], [Analyze (Z)], [Task Level (T)] or click the  button on the tool bar.
- **To check the operation of an object...**
  Check the operation of the specified object using the Simple search button displayed by clicking the object name.
- **To check the task/interrupt transition status...**
  From the <Pattern Search> dialog box displayed from this window, search the switching points of specific task, interrupt occurrence locations, the occurrence locations of specific system calls, etc.
  → The search results are displayed on the execution transition diagram.
- **To analyze the task/interrupt processing time...**
  Search/analyze the pattern (specific processing) set in the <Pattern Set> dialog box opened from this dialog box.
  → The search results are displayed in the execution transition diagram.
  → The distribution status caused by the set pattern processing time is displayed in the <Pattern Window>.

(10) Check using <CPU Window>

Check the CPU use status in the defined interval from the <CPU Window>.

- **To display the CPU utilization rate**
  In the execution transition diagram, set the up cursor and the down cursor in the interval for which the CPU utilization rate is to be collected.
  The CPU utilization rate is collected for the time interval delimited by the up cursor and the down cursor.
  After setting these cursors, open the <CPU Window>.

Remark If the <CPU Window> is active, moving the up cursor or the down cursor in the task level execution transition diagram causes automatic update of the CPU percentages.

(11) Check using <Pattern Window>

Check the execution time distribution status for the specified pattern from the <Pattern Window>.

- **To display pattern distributions...**

  [Pattern Display Method]

  <1> In the <Analyze Window>, set the up cursor and the down cursor in the interval for which the pattern distribution status is to be collected.

  <2> From the menu bar in the <Analyze Window>, select [Browse (B)], [Pattern Distribution (P)], or click the  button on the tool bar.

  <3> In the <Pattern Set> dialog box that opens automatically, set the conditions of the pattern to be calculated and displayed, and then click the OK button.

  [Pattern display method from <CPU Window>]

  <1> In the <Analyze Window>, define the interval for which the pattern distribution status is to be calculated by setting the up cursor and the down cursor.

  <2> In the <CPU Window>, after selecting an object in the list, select [Jump (J)], [Pattern Distribution (P)] from the menu bar, or click the  button on the tool bar.

The pattern distribution displayed using this method is data calculated in the processing interval of the specified object (mode in which switching of the specified object is used as the start/end point).

Remark When the <Pattern Window> is active, moving the up cursor or the down cursor in the task level execution transition diagram causes automatic update of the pattern distribution contents.

(12) Check using <Trace View Window>

Check in detail the collected AZ trace data using the <Trace View Window>.

- **To display AZ trace data...**

  In the execution transition diagram, move the up temporary cursor to the desired position.
  If the up temporary cursor is not displayed, the first trace data becomes the display start position.
  After setting the cursor, open the <Trace View Window>.

Remark If the <Trace View Window> is active, moving the up cursor in the task level execution transition diagram causes automatic update of the AZ trace data.

Repeat the steps from step (6) as required to continue debugging.

Remark If the soft trace form is used, the contents of the trace buffer are cleared by resetting AZ Trace ON.

★

APPENDIX B ERROR MESSAGE LIST

The error messages of the AZ850 are described using the following format.

Error No.	Error Message
	User handling

1000	Not enough memory.
	The memory in the machine is insufficient. After closing unneeded windows, perform the operation again.
1001	Internal error.
	An error that could not be anticipated has occurred. Perform the operation again from the beginning.
1010	Can't change to active mode.
	Since an active window already exists, the status of the window cannot be changed to active. Either change the status of the active window to hold or close the active window before making the desired window active.
1020	Illegal file name.
	An incorrect character(s) or character length, or an illegal format, was used in the file name. Check the file name and then perform the operation again.
1021	Not exist file.
	The specified file name does not exist. Specify the correct file name.
1022	Can't write file.
	Either there is not sufficient free disk space or the specified file is a read-only file, so that it cannot be written to. Specify a file in a separate disk, or a file that is not read-only.
1023	Illegal file format.
	The file cannot be read because its format is incorrect. Check if it is an AZ file or not.
1030	Not exist Function Information.
	No function information is included in the load module. Append the -g and -Xaz options and create the load module again.
1040	Nesting of function is too deep.
	The number of functions or nests (5000) that can be analyzed in the AZ850 has been exceeded or the AZ850 may not be able to detect a restore from an interrupt because the "option_az_info_ri" code has not been inserted in the program, and therefore the AZ850 judges that the interrupt is nested. Reduce the number of functions to be traced in the Measurement Select dialog box to reduce the number of nested functions, or confirm that the "option_az_info_ri" code that creates restore data from an interrupt is correctly inserted.
1100	Not implement AZ interface.
	Connection with the debugger is not possible because the AZ interface is not mounted on the debugger side. Check whether the debugger supports TIP.

1110	Can't switch trace mode.
	An error occurred during AZ trace ON/OFF switching. The address mask value may not be correct or communication between the debugger and the AZ850 may have failed. Check that the address mask value is set correctly in the <AZ Option> dialog box. Otherwise restart.
1118	Not specified trace buffer region.
	AZ Trace ON was set without a trace buffer area being specified. In the <AZ Option> dialog box, specify the trace buffer area, and then set AZ Trace ON.
1120	Can't upload.
	An error occurred during trace data uploading. The trace memory area settings may be incorrect. Check if correct addresses have been specified as the trace buffer area in the <AZ Option> dialog box.
1121	Not trace data.
	There is no trace data in the executed data. Execute the user program in the AZ trace mode and upload the trace data again.
1122	Illegal trace data.
	The time lag in the trace data may be incorrect. Check if the user own coding block is correctly coded.
1128	Not include task level trace data.
	Task-level trace data was not included in the collected trace data. Check if the task level has been selected in the <AZ Option> dialog box, or check the transition diagram in the <Analyze Window (function level)>.
1129	Not include func level trace data.
	The collected trace data did not contain function-level trace data. Check if the function level has been selected in the <AZ Option> dialog box, or check the transition diagram in the <Analyze Window (task level)>.
1130	Not Download Program.
	An attempt was made to set AZ Trace ON before downloading the program. Set AZ Trace ON after downloading the program.
1200	Not select trace level.
	No trace level has been specified in the <AZ Option> dialog box. Specify either one or both of Task Level / Func. Level in the <AZ Option> dialog box.
1210	Illegal trace buffer address.
	The address range specified for trace buffer area specification in the <AZ Option> dialog box is incorrect. Specify a correct address range for trace buffer area specification in the <AZ Option> dialog box.
1220	The address mask is illegal.
	An illegal value that cannot be handled as a mask value was input for the address mask specification in the <AZ Option> dialog box. Specify a hexadecimal number for the mask value in the <AZ Option> dialog box.
1300	No measurement select object.
	No trace target has been specified in the Measurement Target Select dialog box. Specify a trace target in the <Measurement Target Select> dialog box.
1400	Not exist pattern.
	The specified pattern does not exist in the trace data between the up cursor and the down cursor. Expand the interval between the up cursor and the down cursor, and perform the operation again. If this error occurs even with the maximum interval, the specified pattern does not exist in the trace data.

1500	Program running.
	Communication between the debugger and the AZ850 may have failed. Activate the debugger and the AZ850.
1700	The specified file has an invalid RX type.
	An attempt was made to read an AZ file whose RX differs from the RX specified in the <AZ Option> dialog box. Check if an appropriate RX is specified in the <AZ Option> dialog box.

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APPENDIX D REVISION HISTORY

Revisions up to this edition are shown below. The “Chapter” column indicates the chapter in each edition to which the revision was applied.

Edition	Description	Chapter
2nd	Newly created	–
3rd	Change of operating environment	CHAPTER 1 OUTLINE
	Addition of CPU type specification area	CHAPTER 3 OPERATION METHOD
	Addition of description on window reference	CHAPTER 6 WINDOW REFERENCE
★ 4th	Change of operating environment	CHAPTER 1 OUTLINE
	Modification of installation and uninstallation procedures Change of name of file for AZ monitor creation	CHAPTER 2 INSTALLATION
	Modification and addition of screen diagram and description for each window and dialog box	CHAPTER 3 OPERATION METHOD
	Modification of description on each window and dialog box	CHAPTER 6 WINDOW REFERENCE
	Addition, deletion and modification of error messages	APPENDIX B ERROR MESSAGE LIST

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