IAR C-SPY® Hardware Debugger Systems

User Guide

for Renesas

E8/E8a and E10A-USB Emulators

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TRADEMARKS

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This guide applies to IAR Embedded Workbench® for Renesas.

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Preface

Welcome to the *IAR C-SPY® Hardware Debugger Systems User Guide for* Renesas E8/E8a and E10A-USB Emulators. The purpose of this guide is to provide you with detailed reference information that can help you use the features in the IAR C-SPY® Hardware Debugger Systems.

Who should read this guide

You should read this guide if you want to get the most out of the features in the C-SPY hardware debugger systems. In addition, you should have working knowledge of:

- The C or C++ programming language
- Application development for embedded systems
- The architecture and instruction set of the Renesas microcontroller (refer to the chip manufacturer's documentation)
- The operating system of your host machine.

This guide also assumes that you already have working knowledge of the target system you are using, as well as some working knowledge of the IAR C-SPY Debugger. For a quick introduction to the IAR C-SPY Debugger, see the tutorials available in the *IAR Embedded Workbench® IDE User Guide*.

How to use this guide

This guide describes the C-SPY interface to the target system you are using; this guide does not describe the general features available in the IAR C-SPY debugger or the hardware target system. To take full advantage of the whole debugger system, you must read this guide in combination with:

- The *IAR Embedded Workbench® IDE User Guide* which describes the general features available in the C-SPY debugger
- The documentation supplied with the target system you are using.

Note that additional features might have been added to the software after the *IAR C-SPY® Hardware Debugger Systems User Guide* was printed. The file `readme.htm` contains the latest information. You can find the file via the **Help** menu in the IDE.

What this guide contains

Below is a brief outline and summary of the chapters in this guide.

- *Introduction to C-SPY® hardware debugger systems* introduces you to the available C-SPY drivers to be used for the target board. The chapter briefly shows the difference in functionality provided by the different C-SPY drivers.
- *Hardware-specific debugging* describes the additional options, menus, and features provided by these debugger systems.

Other documentation

The complete set of IAR development tools for the target processor are described in a series of guides. These guides can be found in the `install_dir\doc` directory or reached from the **Help** menu.

All of these guides are delivered in hypertext PDF or HTML format on the installation media. Some of them are also delivered as printed books.

Recommended web sites:

- The Renesas web site, **www.renesas.com**, contains information and news about the target processors.
- The IAR Systems web site, **www.iar.com**, holds application notes and other product information.

Document conventions

When, in this text, we refer to the programming language C, the text also applies to C++, unless otherwise stated.

When referring to a directory in your product installation, for example `install_dir\doc`, the full path to the location is assumed, for example `c:\Program Files\IAR Systems\Embedded Workbench 5.n\install_dir\doc`.

TYPOGRAPHIC CONVENTIONS

This guide uses the following typographic conventions:

Style	Used for
`computer`	• Source code examples and file paths. • Text on the command line. • Binary, hexadecimal, and octal numbers.

Table 1: Typographic conventions used in this guide

Style	Used for
parameter	A placeholder for an actual value used as a parameter, for example *filename*.h where *filename* represents the name of the file.
[option]	An optional part of a command.
{option}	A mandatory part of a command.
a|b|c	Alternatives in a command.
bold	Names of menus, menu commands, buttons, and dialog boxes that appear on the screen.
italic	• A cross-reference within this guide or to another guide. • Emphasis.
…	An ellipsis indicates that the previous item can be repeated an arbitrary number of times.
🛠	Identifies instructions specific to the IAR Embedded Workbench® IDE interface.
🖥	Identifies instructions specific to the command line interface.
💡	Identifies helpful tips and programming hints.
⚠	Identifies warnings.

Table 1: Typographic conventions used in this guide (Continued)

NAMING CONVENTIONS

The following naming conventions are used for the products and tools from IAR Systems® referred to in this guide:

Brand name	Generic term
IAR Embedded Workbench®	IAR Embedded Workbench®
IAR Embedded Workbench® IDE	the IDE
IAR C-SPY® Debugger	C-SPY, the debugger
IAR C/C++ Compiler™	the compiler
IAR Assembler™	the assembler
IAR XLINK™ Linker	XLINK, the linker
IAR XAR Library builder™	the library builder
IAR XLIB Librarian™	the librarian
IAR DLIB Library™	the DLIB library
IAR CLIB Library™	the CLIB library

Table 2: Naming conventions used in this guide

Introduction to C-SPY® hardware debugger systems

This chapter introduces you to the C-SPY drivers and to how they differ from the C-SPY Simulator.

The C-SPY emulator drivers

C-SPY consists of both a general part which provides a basic set of C-SPY features, and a driver. The C-SPY driver is the part that provides communication with and control of the target system. The driver also provides a user interface—special menus, windows, and dialog boxes—to the functions provided by the target system, for instance special breakpoints. This driver is automatically installed during the installation of IAR Embedded Workbench.

This guide describes the operation of the IAR C-SPY drivers for the following Renesas hardware debugger systems:

- E8/E8a Emulator
- E10A-USB Emulator.

For further details about the concepts that are related to C-SPY, see information about the general debugger features, see the *IAR Embedded Workbench® IDE User Guide*.

DIFFERENCES BETWEEN THE C-SPY DRIVERS

This table summarizes the key differences between the C-SPY drivers:

Feature	Simulator	E8/E8a Emulator	E10A-USB Emulator
Code breakpoints	x	x[1]	x[1]
Data breakpoints	x	--	x
Execution in real time	--	x	x
Zero memory footprint	x	--	x
Simulated interrupts	x	--	--
Real interrupts	--	x	x
Cycle counter	x	--	--

Table 3: Driver differences

Feature	Simulator	E8/E8a Emulator	E10A-USB Emulator
Code coverage	x	--	--
Data coverage	x	--	--
Profiling	x	x[2]	x[2]
Trace	x	--	--
Start/Stop	--	x[3]	--

Table 3: Driver differences (Continued)

[1] For detailed information about available breakpoints, see *Available breakpoints*, page 19.
[2] Cycle counter statistics are not available.
[3] Start/Stop is not available for all drivers.

General descriptions of the different drivers follow.

Installing the C-SPY emulator drivers

The C-SPY emulator drivers are automatically installed during the installation of IAR Embedded Workbench. Using the C-SPY emulator driver, C-SPY can connect to the emulator.

To use the hardware debugger, you also need a USB driver. The first time you connect an emulator to the USB port on the host computer, a USB setup wizard will help you locate and install the required USB driver. The driver is located in the `install_dir\drivers\renesas` directory of your IAR Systems product installation.

The C-SPY emulator driver communicates with the emulator via the USB driver. The emulator communicates with the emulator interface on the microcontroller.

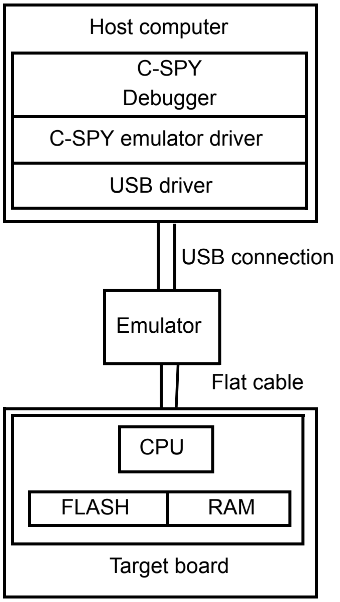


Figure 1: Emulator communication overview

For further information, refer to the Renesas documentation supplied with the emulator.

When a debugging session is started, your application is automatically downloaded and programmed into flash memory.

Programming the E10A-USB firmware

Before an E10A-USB emulator can be used for the first time, the emulator firmware must be programmed. To program or update the firmware, follow these steps:

1 Make sure the USB cable is not attached to the emulator. Then open the sliding switch cover and make sure that the mode selection switch (number 1) is set to 1.

Note: The USB cable must never be attached when you change the mode selection switch.

2 Attach the USB cable and connect the E10A-USB emulator to your host computer, and start the setup program found at `\`*`install_dir`*`\external\OCD\Platform\E10A-USB\`*`cpu_family`*`\`*`cpu_name`*`\SetupTool\E1setup.exe`. If you are asked to locate a `sys` file, this can be found on the CD that is supplied with the emulator.

3 A dialog box with information about device and firmware version is displayed. If the firmware information consists of dashes or an older version, this means that no firmware has been programmed. In that case, click **Setup** to display the next dialog box. Otherwise, click **Exit** and skip steps 4 through 8.

4 Follow the instructions in the dialog box; disconnect the USB cable and change the mode selection switch back to 0. Then re-attach the USB cable. Click **OK** to download the firmware update.

If a hardware wizard is launched and asks you to re-install the USB driver for **HMSE USB Direct**, select a driver for your operating system version from the CD—or from the `drivers\` subdirectory in the Embedded Workbench installation directory—and install it. The original driver is not corrupted or invalid, but the host computer treats the E10A-USB Emulator with the switch in a different position as a different device. When the installation of the driver is completed, click **OK**.

Note: Do not turn off the host computer or disconnect the USB cable any more until the download has been completed. This can damage the firmware permanently.

5 The firmware download might take some time. When it has been completed successfully, click **OK** in the dialog box that is displayed.

6 Follow the instructions in the new dialog box; disconnect the USB cable and change the mode selection switch back to 1 once more and then re-attach the USB cable again. Click **OK**.

7 The dialog box with information about device and firmware version will now show device group and version information for the firmware.

8 Click **Exit**. The E10A-USB emulator is now ready to be used.

Note: This setup procedure does not apply to the Renesas E8/E8a Emulator. For the E8/E8a emulator, the firmware is programmed automatically.

Connecting to the target board, E8/E8a

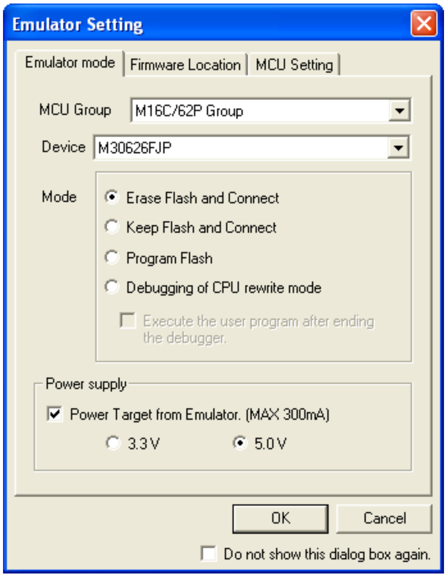
To establish a connection to the target board, you must follow this procedure:

1 To select the device that matches your target system, choose **Project>Options>General Options>Target**.

2 Select the driver that matches your emulator on the **Project>Options>Debugger>Setup** page.

3 Build the project if it has not been built and choose **Project>Debug** to start C-SPY.

4 The **Emulator Setting** dialog box is displayed.



MCU Group: M16C/62P Group

Device: M30626FJP

Mode:
- ● Erase Flash and Connect
- ○ Keep Flash and Connect
- ○ Program Flash
- ○ Debugging of CPU rewrite mode
- □ Execute the user program after ending the debugger.

Power supply:
- ☑ Power Target from Emulator. (MAX 300mA)
- ○ 3.3 V ● 5.0 V

□ Do not show this dialog box again.

Figure 2: The Emulator Setting dialog box for the E8a emulator

Select your MCU group and device from the drop-down lists. The following items can also be selected on the **Emulator Mode** page:

E8/E8a Emulator option	Description
Erase Flash and Connect	Erases the flash memory data for the MCUs and simultaneously writes the E8/E8a emulator firmware.
Keep Flash and Connect	Retains the flash memory data for the MCUs. **Note:** The area for the E8/E8a emulator firmware and the vector area used by the E8/E8a emulator will change.
Program Flash	Writes your application to the flash memory. Debugging of the application is disabled. Select this mode when using the E8/E8a emulator as a flash memory programmer. **Note:** It is necessary to input the ID code of the flash memory to the target device.

Table 4: The E8/E8a emulator mode options

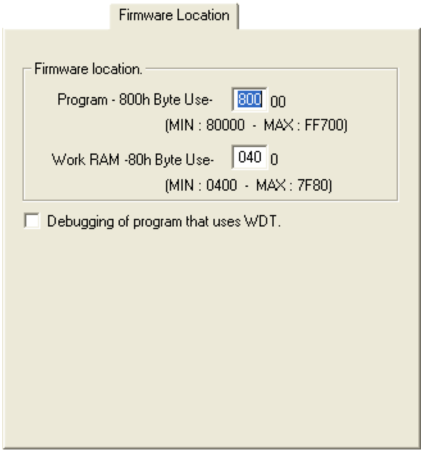
E8/E8a Emulator option	Description
Debugging of CPU rewrite mode	Erases the flash memory data for the MCUs and simultaneously writes the E8/E8a emulator program, when starting the debugger. Select this setting when debugging the program which rewrites the CPU. **Note:** In this mode, it is not possible to set PC breakpoints or to change the contents of the flash memory.
Execute the user program after ending the debugger	Executes your application when you stop the debugger. This option requires external power supply. **Note:** This option is available only for the E8a emulator and only when **Program Flash** has been selected.
Power target from Emulator	Select this option if the target board is not connected to any power supply.
Do not show this dialog box again	If you select this option, the dialog box will not be displayed the next time the debugger is launched. This option is mirrored in the E8/E8a Emulator menu command **Show Emulator Setting**. Use the menu command to display the dialog box again. See also *Maintaining the connection to the hardware*, page 8.

Table 4: The E8/E8a emulator mode options (Continued)

5 If the **Firmware Location & WDT** dialog box is displayed, you must confirm the placement of code and data on the target microcontroller. If your application uses a watchdog timer, select the **Debugging of program that uses WDT** option to cause the watchdog timer to be refreshed when your application is running.

If you use the default device-specific XLINK linker command file, you do not need to change any settings.

Note: Make sure that your application is not downloaded to the firmware location.


Firmware Location

Firmware location.

Program - 800h Byte Use- 800 00
(MIN : 80000 - MAX : FF700)

Work RAM -80h Byte Use- 040 0
(MIN : 0400 - MAX : 7F80)

□ Debugging of program that uses WDT.

Figure 3: The Firmware Location page for the E8/E8a emulator

If this dialog box is not displayed, skip this step.

Click **OK** in the **Emulator Setting** dialog box to save your settings.

6 The **Connecting** dialog box is displayed and the emulator connection is started.

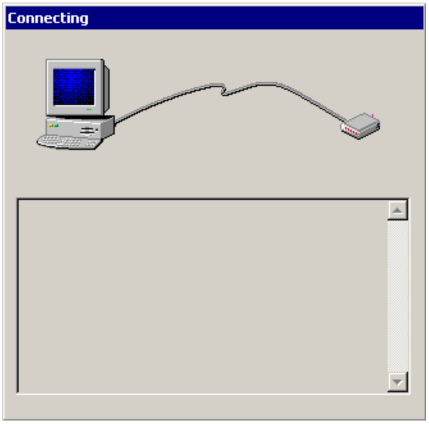
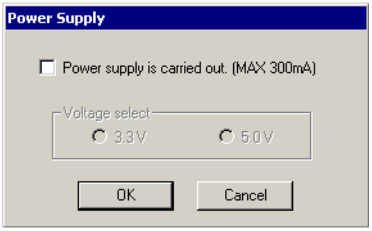


Figure 4: The Connecting dialog box

7 If a dialog box asks you to confirm that the target board is supplied with power, select the check box and the correct voltage.



Power Supply

□ Power supply is carried out. (MAX 300mA)

Voltage select

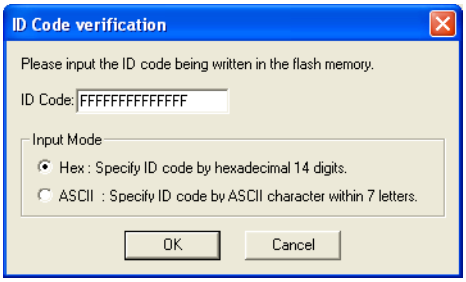
○ 3.3V ○ 5.0V

Figure 5: The Power Supply dialog box for the E8/E8a emulator

If this dialog box is not displayed, skip this step.

Note: Before you connect the target board to a power supply, check the power specifications and that there are no short circuits. Incorrect operation might damage the board and the emulator.

8 If the **ID Code verification** dialog box is displayed, enter the hexadecimal ID security code for the flash memory.



ID Code verification

Please input the ID code being written in the flash memory.

ID Code: FFFFFFFFFFFFFF

Input Mode

● Hex : Specify ID code by hexadecimal 14 digits.

○ ASCII : Specify ID code by ASCII character within 7 letters.

Figure 6: The ID Code verification dialog box for the E8/E8a emulator

When the emulator is ready to be used, `Connected` will be printed in the IAR Embedded Workbench Debug Log window together with the number of available hardware and software breakpoints.

MAINTAINING THE CONNECTION TO THE HARDWARE

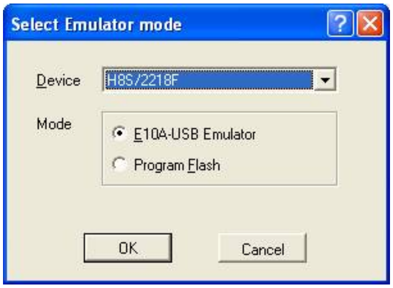
When a debug session is started, a connection to the hardware is established and an initialization routine is executed. The initialization sets the emulator options for your target system.

When you start a debug session with the same hardware as the previous session and without closing the IDE between the debug sessions, C-SPY can skip the initialization to save time. For information on how to set this behavior in C-SPY, see the option *Do not show this dialog box again*, page 6. If you set this option, the connection to the hardware is maintained and the initialization is not repeated. This option is mirrored in the menu command **Show Emulator Setting**, see the *The Emulator menu*, page 17.

Connecting to the target board, E10A-USB

To establish a connection to the target board, follow this procedure:

1. To select the device that matches your target system, choose **Project>Options>General Options>Target** in IAR Embedded Workbench.
2. Select the driver that matches your emulator on the **Project>Options>Debugger>Setup** page.
3. Build the project if it has not been built and choose **Project>Debug** to start C-SPY.
4. The **Select Emulator mode** dialog box is displayed.



Device: H8S/2218F

Mode:
- ● E10A-USB Emulator
- ○ Program Flash

Figure 7: The Select Emulator mode dialog box for the E10A-USB emulator

Select the device name in use from the **Device** drop-down list. The following items can be selected in the **Mode** group box.

E10A-USB Emulator	Description
E10A-USB Emulator	The E10A-USB emulator for the specified device is activated. Debugging the program is enabled.
Program Flash	Your application is programmed to the internal flash memory. Debugging the program is disabled.

Table 5: The E10A-USB emulator mode options

5 The **Connecting** dialog box is displayed and the emulator connection is started.

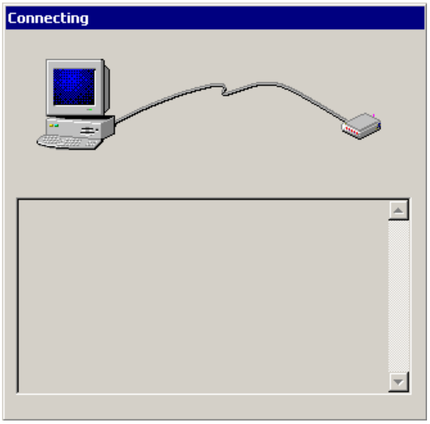


Figure 8: The Connecting dialog box

6 If you are asked to update the emulator firmware, click **OK** and see *Programming the E10A-USB firmware*, page 3.

7 If a dialog box asks you to confirm that the target board is supplied with power, select the check box and the correct voltage.

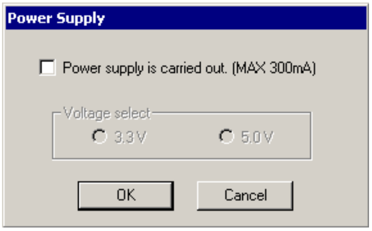


Figure 9: The Power Supply dialog box for the E10A-USB emulator

If this dialog box is not displayed, skip this step.

Note: Before you connect the target board to a power supply, check the power specifications and that there are no short circuits. Incorrect operation might damage the board and the emulator.

8 If the **System Clock** dialog box is displayed, specify the system clock frequency.

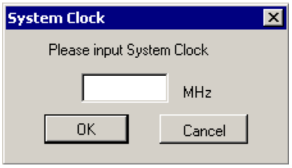
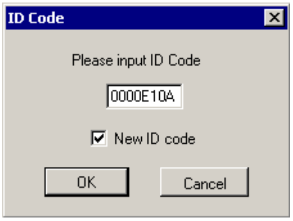


Figure 10: The System Clock dialog box for the E10A-USB emulator

If this dialog box is not displayed, skip this step.

9 If the **ID Code** dialog box is displayed, enter the hexadecimal ID security code for the flash memory. For some devices, the flash memory contents are erased if the ID code does not match.



0000E10A

☑ New ID code

Figure 11: The ID Code dialog box for the E10A-USB emulator

If the **New ID code** option is available and selected, the flash memory contents are erased.

When the emulator is ready to be used, `Connected` will be printed in the IAR Embedded Workbench Debug Log window together with the number of available hardware and software breakpoints.

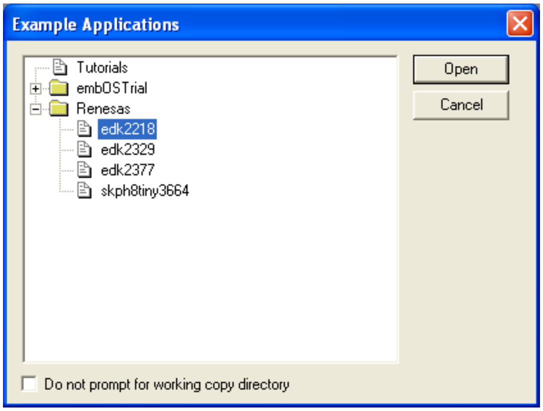
Getting started

IAR Embedded Workbench comes with example applications. You can use these examples to get started using the development tools from IAR Systems or simply to verify that contact has been established with your target board. You can also use the examples as a starting point for your application project.

You can find the examples in the *`install_dir`*`\examples` directory. The examples are ready to be used as is. They are supplied with ready-made workspace files, together with source code files.

RUNNING THE DEMO PROGRAM

1 To use an example application, choose **Help>Startup Screen** and click **Example workspaces**. In the **Example Applications** dialog box that appears, choose the specific evaluation board or starter kit that you are using. The examples listed below are supplied with IAR Embedded Workbench for H8.



□ Do not prompt for working copy directory

Figure 12: Example application

Click **Open**.

2 In the dialog box that appears, choose a destination folder for your project location. Click **Select** to confirm your choice.

3 The available example projects are displayed in the workspace window. Select one of the projects, and if it is not the active project (highlighted in bold), right-click it and choose **Set As Active** from the context menu.

4 To view the project settings, select the project and choose **Options** from the context menu. Verify the settings of the options **Device** and **Debugger>Driver**. As for other settings, the project is set up to suit the target system you selected.

For further details about the C-SPY options for the hardware target system and how to configure C-SPY to interact with the target board, see *Hardware-specific debugging*, page 15.

Click **OK** to close the **Options** dialog box.

5 To compile and link the application program, choose **Project>Make** or click the **Make** button.

6 To start C-SPY, choose **Project>Debug** or click the **Debug** button. If C-SPY fails to establish contact with the target system, see *Resolving problems*, page 24.

7 Choose **Execute>Go** or click the **Go** button to start the program.

Click the **Stop** button to stop execution.

Hardware-specific debugging

This chapter describes the additional options, menus, and features provided by the C-SPY® hardware debugger systems. The chapter contains the following sections:

- Debugger options for debugging using hardware systems
- Target-dependent settings
- Using breakpoints
- Resolving problems.

Debugger options for debugging using hardware systems

Before you start any C-SPY hardware debugger you must set some options for the debugger system—both C-SPY generic options and options required for the hardware system (C-SPY driver-specific options). Follow this procedure:

1. To open the **Options** dialog box, choose **Project>Options**.
2. To set C-SPY generic options and select a C-SPY driver:
   - Select **Debugger** from the **Category** list
   - On the **Setup** page, select the appropriate C-SPY driver from the **Driver** list.

   For information about the settings **Setup macros**, **Run to**, and **Device descriptions**, as well as for information about the pages **Extra Options** and **Plugins**, see the *IAR Embedded Workbench® IDE User Guide*.

   Note that a default device description file and linker command file is automatically selected depending on your selection of a device on the **General Options>Target** page.
3. To set the driver-specific options, select the appropriate driver from the **Category** list. Depending on which C-SPY driver you are using, different sets of available option pages appears.

   For details about each page, see:
   - *The Setup page*, page 16

- *The Download page*, page 16
- *The Extra Options page*, page 17.

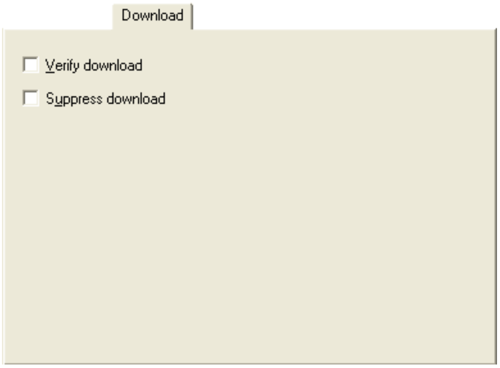
4 When you have set all the required options, click **OK** in the **Options** dialog box.

THE SETUP PAGE

There are no driver-specific options to be set before the debugging starts. Refer to the user documentation supplied with the target system for information about the required settings.

THE DOWNLOAD PAGE

By default, C-SPY downloads the application into RAM or flash memory when a debug session starts. The **Download** options lets you modify the behavior of the download.



□ Verify download

□ Suppress download

Figure 13: The C-SPY Download options

Verify download

Use this option to verify that the downloaded code image can be read back from target memory with the correct contents.

Suppress download

Use this option to debug an application that already resides in target memory. When this option is selected, the code download is disabled, while preserving the present content of the flash. Use this option together with the option *Keep Flash and Connect*, page 5.

If this option is combined with the **Verify download** option, the debugger will read back the code image from non-volatile memory and verify that it is identical to the debugged program.

Note: It is important that the image that resides in target memory is linked consistently with how you use C-SPY for debugging. For example, you might first link your application using an output format without debug information, such as Intel-hex, and then load the application separately from C-SPY. If you then use C-SPY only for debugging, you cannot build the debugged application with the linker option **With runtime control modules** as that would add extra code, resulting in two different code images.

THE EXTRA OPTIONS PAGE

The **Extra Options** page provides you with a command line interface to C-SPY.

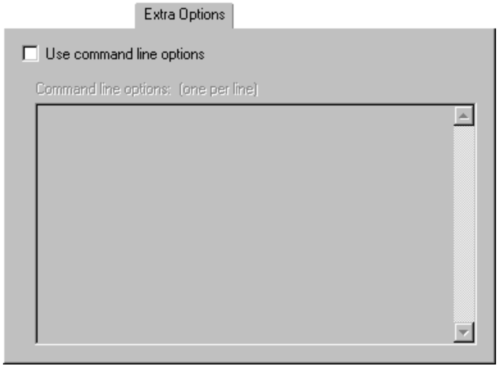

Extra Options
□ Use command line options
Command line options: (one per line)

Figure 14: The Extra Options page for C-SPY command line options

Use command line options

Additional command line arguments (not supported by the GUI) for C-SPY can be specified here.

Target-dependent settings

In this section you can read about the emulator-specific features.

THE EMULATOR MENU

When you are using an emulator driver, a driver-specific menu appears in C-SPY:

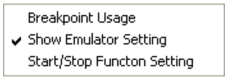


Figure 15: The E8a Emulator menu

These commands are available on the emulator menu:

Menu command	Description
Breakpoint Usage	Displays the **Breakpoint Usage** dialog box, see the *The Breakpoint Usage dialog box*, page 23.
Show Emulator Setting[1]	Displays the **Emulator Setting** dialog box, see the *Maintaining the connection to the hardware*, page 8.
Start/Stop Function Setting[1]	Lets you execute specified routines of your application immediately before starting and immediately after halting the application execution. The specified routines are executed when the operations Go and Step are performed. A dialog box where you can specify start and stop as labels or addresses is displayed. See also *Restrictions for the Start/Stop Function*, page 18.

Table 6: Commands on the E8a Emulator menu

1 Not available for all targets

Restrictions for the Start/Stop Function

The Start/Stop function has the following restrictions:

- Do not set any breakpoints in the specified routine.
- Do not step into the specified routine.
- When a stack is used, make sure it is the user stack and not the interrupt stack.
- Disable interrupts during the execution of the specified routine.

Using breakpoints

This section provides an overview of the available breakpoints for the C-SPY hardware debugger systems. The following is described:

- *Available breakpoints*, page 19
- *Code breakpoints*, page 20
- *The Execution Address Breakpoint dialog box*, page 20
- *The Software breakpoint dialog box*, page 21
- Log breakpoints, see the *IAR Embedded Workbench® IDE User Guide*.
- *The Break Condition dialog box*, page 22
- *The Breakpoint Usage dialog box*, page 23
- *C-SPY use of breakpoints*, page 24.

For information about the various methods for setting breakpoints, the facilities for monitoring breakpoints, and the various breakpoint consumers, see the chapter *Using breakpoints*, page 18 in this guide.

AVAILABLE BREAKPOINTS

Using the C-SPY drivers for hardware debugger systems you can set *code breakpoints* and for some drivers you can also set *data breakpoints*. Code breakpoints are implemented as software breakpoints or hardware breakpoints. Hardware breakpoints are also referred to as *execution address breakpoints*. Data breakpoints are referred to as *break conditions*.

The type of breakpoints you can set in C-SPY depends on the target system you are using.

The table below summarizes the characteristics of breakpoints for the E8/E8a Emulator:

Breakpoint type	M16C/R8C	M32C	R32C	H8
Hardware breakpoints	x	x	x	--
Software breakpoints	x	x	x	x
Data breakpoints	--	--	--	--

Table 7: Available breakpoints for the E8/E8a Emulator

For the E10A-USB Emulator, these are the available breakpoints:

Breakpoint type	H8
Hardware breakpoints	--
Software breakpoints	x
Data breakpoints	x[1]

Table 8: Available breakpoints for the E10A-USB Emulator

[1] For the E10A-USB Emulator, data breakpoints are referred to as break conditions. See *The Break Condition dialog box*, page 22 for more information.

Determining which breakpoint type is set

In the IDE, there are two ways to see which type of breakpoint is set. One way is to open the **Breakpoint Usage** dialog box. An other way is to move your mouse over the breakpoint symbol in the editor window. Then a tooltip appears and informs you of the breakpoint type.

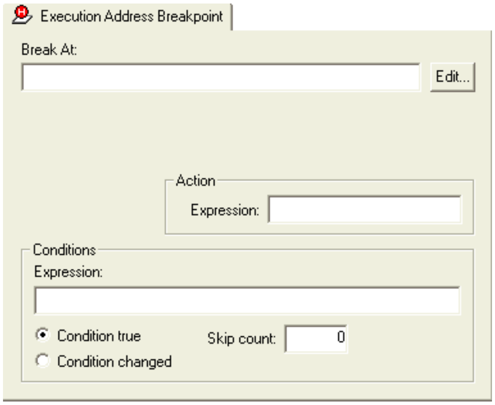
CODE BREAKPOINTS

If you set a code breakpoint, a default breakpoint will be set. If your driver supports hardware breakpoints, the debugger will first use any available hardware breakpoints before using software breakpoints.

THE EXECUTION ADDRESS BREAKPOINT DIALOG BOX

To set a hardware breakpoint, right-click in the Breakpoints window and choose **New Breakpoint>Address** on the context menu. To modify an existing breakpoint, select it in the Breakpoints window and choose **Edit** on the context menu.

The **Execution Address Breakpoint** dialog box appears.



● Condition true

○ Condition changed

Skip count: 0

Figure 16: The Execution Address Breakpoint dialog box

Break At

Specify the location of the breakpoint in the **Break At** text box. Alternatively, click the **Edit** browse button to open the **Enter Location** dialog box; see the *IAR Embedded Workbench® IDE User Guide*.

Action

You can optionally connect an action to a breakpoint. Specify an expression, for instance a C-SPY macro function, which is evaluated when the breakpoint is triggered and the condition is true.

Conditions

You can specify simple and complex conditions.

Conditions	Description
Expression	A valid expression conforming to the C-SPY expression syntax.
Condition true	The breakpoint is triggered if the value of the expression is true.
Condition changed	The breakpoint is triggered if the value of the expression has changed since it was last evaluated.
Skip count	The number of times that the breakpoint must be fulfilled before a break occurs (integer).

Table 9: Execution address breakpoint conditions

When an execution address breakpoint is triggered, there is no need for instruction rewrite/write back processing, which makes it fast. The execution address breakpoints share events with data breaks, trace, the RAM monitor, and time measurement.

THE SOFTWARE BREAKPOINT DIALOG BOX

To set a software code breakpoint, right-click in the Breakpoints window and choose **New Breakpoint>Software** on the context menu. To modify an existing breakpoint, select it in the Breakpoints window and choose **Edit** on the context menu.

The Software Breakpoint dialog box appears.

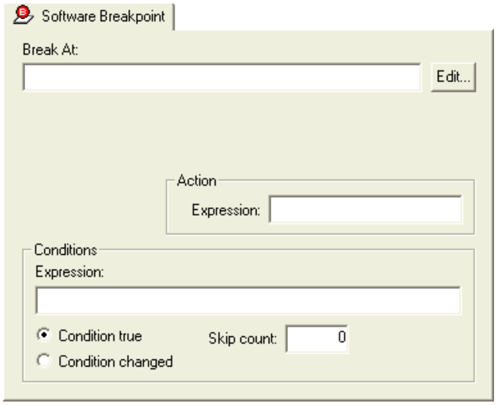


Figure 17: The Software Breakpoint dialog box

Break At

Specify the location of the breakpoint in the **Break At** text box. Alternatively, click the **Edit** browse button to open the **Enter Location** dialog box; see the *IAR Embedded Workbench® IDE User Guide*.

Action

You can optionally connect an action to a breakpoint. Specify an expression, for instance a C-SPY macro function, which is evaluated when the breakpoint is triggered and the condition is true.

Conditions

You can specify simple and complex conditions.

Conditions	Description
Expression	A valid expression conforming to the C-SPY expression syntax.
Condition true	The breakpoint is triggered if the value of the expression is true.
Condition changed	The breakpoint is triggered if the value of the expression has changed since it was last evaluated.
Skip count	The number of times that the breakpoint must be fulfilled before a break occurs (integer).

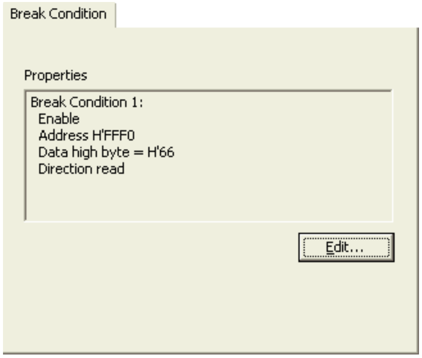
Table 10: Software breakpoint conditions

When a software code breakpoint is set in the internal flash ROM of the target microcomputer, a number of instructions must be rewritten and processed every time it is triggered, which makes software code breakpoints slow.

THE BREAK CONDITION DIALOG BOX

To set a data breakpoint, right-click in the **View>Breakpoints** window. On the context menu, choose **New Breakpoint>Break Condition** to set a new break condition. Alternatively, to modify an existing break condition, select one in the Breakpoint window and choose **Edit** on the context menu.

The **Break Condition** dialog box appears.



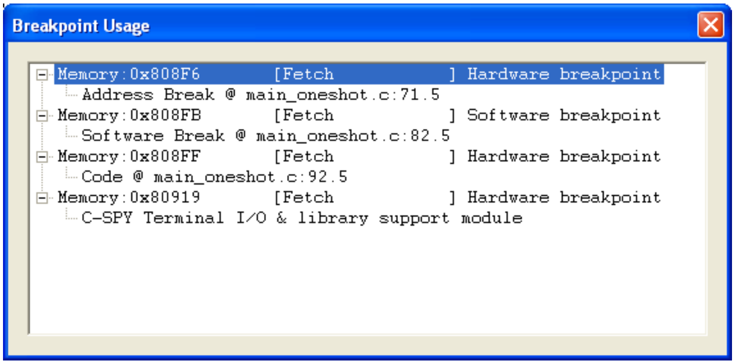
Break Condition 1:
Enable
Address H'FFF0
Data high byte = H'66
Direction read

Figure 18: The Break Condition dialog box

Press the **Edit** button to specify the break conditions. Refer to the user documentation supplied with the target system for information about the break condition settings.

THE BREAKPOINT USAGE DIALOG BOX

The **Breakpoint Usage** dialog box—available from the driver-specific menu—lists all active breakpoints.



```
Memory:0x808F6       [Fetch           ] Hardware breakpoint
  Address Break @ main_oneshot.c:71.5
Memory:0x808FB       [Fetch           ] Software breakpoint
  Software Break @ main_oneshot.c:82.5
Memory:0x808FF       [Fetch           ] Hardware breakpoint
  Code @ main_oneshot.c:92.5
Memory:0x80919       [Fetch           ] Hardware breakpoint
  C-SPY Terminal I/O & library support module
```

Figure 19: The Breakpoint Usage dialog box

In addition to listing all breakpoints that you have defined, this dialog box also lists the internal breakpoints that the debugger is using.

For each breakpoint in the list the address and access type are shown. Each breakpoint in the list can also be expanded to show its originator.

For more information, see the *IAR Embedded Workbench® IDE User Guide*.

C-SPY USE OF BREAKPOINTS

When you set a breakpoint, C-SPY sets a breakpoint for internal use. To do this, the breakpoints in the emulator are used. The fact that C-SPY uses breakpoints is normally not a problem. However, one exception is C-SPY profiling, which requires many breakpoints.

C-SPY will set a breakpoint if:

- the C-SPY option **Run to** has been selected (one breakpoint is set temporarily after each reset)
- the stack plugin is being used (if the C-SPY option **Run to** has been selected, the breakpoint needed for that will be used also by the stack plugin)
- the linker option **With runtime control modules** has been selected (debug support for program termination and optionally file I/O).

Exceeding the number of available breakpoints will cause the debugger to single step. This will significantly reduce the execution speed. For this reason you must be aware of the different breakpoint consumers; see the *IAR Embedded Workbench® IDE User Guide*.

You can prevent the debugger from using breakpoints in these situations by deselecting these options.

Resolving problems

Debugging using the C-SPY hardware debugger systems requires interaction between many systems, independent from each other. For this reason, setting up this debug system can be a complex task. If something goes wrong, it might at first be difficult to locate the cause of the problem.

This section includes suggestions for resolving the most common problems that can occur when debugging with the C-SPY hardware debugger systems.

For problems concerning the operation of the evaluation board, refer to the documentation supplied with it, or contact your hardware distributor.

WRITE FAILURE DURING LOAD

There are several possible reasons for write failure during load. The most common is that your application has been incorrectly linked:

- Check the contents of your linker command file and make sure that your application has not been linked to the wrong address

- Check that you are using correct linker command file.

If you are using the IAR Embedded Workbench, the linker command file is automatically selected based on your choice of device:

- Choose **Project>Options**
- Select the **General Options** category
- Click the **Target** tab
- Choose the appropriate device from the **Device** drop-down menu.

To override the default linker command file:

- Choose **Project>Options**
- Select the **Linker** category
- Click the **Config** tab
- Choose the appropriate linker command file in the **Linker command file** area.

NO CONTACT WITH THE TARGET HARDWARE

There are several possible reasons for C-SPY to fail to establish contact with the target hardware.

- Check the communication devices on your host computer
- Verify that the cable is properly plugged in and not damaged or of the wrong type
- Verify that the target chip is properly mounted on the evaluation board
- Make sure that the evaluation board is supplied with sufficient power
- Check that the correct options for communication have been specified in the IAR Embedded Workbench; see the documentation provided with the target system.

Examine the linker command file to make sure that your application has not been linked to the wrong address.