# RealView™ Debugger

## Version 1.6

# Essentials Guide

ARM®

ARM DUI 0181B

# RealView Debugger
## Essentials Guide

### Release Information

The following changes have been made to this document.

**Change History**

| Date | Issue | Change |
|---|---|---|
| April 2002 | A | RealView Debugger 1.5 release. |
| September 2002 | B | RealView Debugger v1.6 release. |

### Proprietary Notice

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# Preface

This preface introduces the RealView Debugger Essentials Guide. This guide shows you how to start using RealView Debugger to manage software projects and to debug your application programs. It contains the following sections:

- *About this book* on page vi
- *Feedback* on page xi.

## About this book

RealView Debugger provides a powerful tool for debugging and managing software projects. This book contains:

- an introduction to the software components that make up RealView Debugger
- a tutorial to create a project and build an executable image
- a step-by-step guide to getting started, making a connection to a target, and loading an image to start a debugging session
- details about ending a debugging session
- a description of the RealView Debugger desktop
- a glossary of terms for users new to RealView Debugger.

### Intended audience

This book is written for developers who are using RealView Debugger to manage ARM-targeted development projects. It assumes that you are an experienced software developer, and that you are familiar with the ARM development tools. It does not assume that you are familiar with RealView Debugger.

### Using this book

This book is organized into the following chapters:

**Chapter 1** ***About RealView Debugger***

Read this chapter for an introduction to RealView Debugger. This chapter describes the underlying debugger concepts and explains terminology used in the rest of this book and the documentation suite.

**Chapter 2** ***Features of RealView Debugger***

Read this chapter for a description of the features of RealView Debugger, including details about those that are new in RealView Debugger v1.6.

**Chapter 3** ***Getting Started with RealView Debugger***

This chapter explains how to begin using RealView Debugger for the first time. This describes how to start RealView Debugger, make a connection, and load an image ready to start debugging.

**Chapter 4** ***Quick-start Tutorial***

Read this chapter when you have access to a workstation. Follow the step-by-step instructions to gain some experience of using RealView Debugger to manage a project and to debug software.

**Chapter 5** ***Ending your RealView Debugger Session***

This chapter describes how to end your RealView Debugger session and exit the debugger.

**Chapter 6** ***RealView Debugger Desktop***

Read this chapter for a detailed description of the contents of the RealView Debugger desktop.

***Glossary*** An alphabetically arranged glossary defines the special terms used.

## Typographical conventions

The following typographical conventions are used in this book:

*italic* Highlights important notes, introduces special terminology, denotes internal cross-references, and citations.

**bold** Highlights interface elements, such as menu names. Denotes ARM processor signal names. Also used for terms in descriptive lists, where appropriate.

`monospace` Denotes text that can be entered at the keyboard, such as commands, file and program names, and source code.

`monospace` Denotes a permitted abbreviation for a command or option. The underlined text can be entered instead of the full command or option name.

*`monospace italic`* Denotes arguments to commands and functions where the argument is to be replaced by a specific value.

**`monospace bold`** Denotes language keywords when used outside example code.

## Further reading

This section lists publications from both ARM Limited and third parties that provide additional information.

ARM periodically provides updates and corrections to its documentation. See `http://www.arm.com` for current errata, addenda, and Frequently Asked Questions.

## ARM publications

This book is part of the RealView Debugger documentation suite. Other books in this suite include:

- *RealView Debugger v1.6 User Guide* (ARM DUI 0153)
- *RealView Debugger v1.6 Target Configuration Guide* (ARM DUI 0182)
- *RealView Debugger v1.6 Command Line Reference Guide* (ARM DUI 0175)
- *RealView Debugger v1.6 Extensions User Guide* (ARM DUI 0174).

If you are using RealView Debugger with the *ARM Developer Suite* (ADS) v1.2, refer to the following books in the ADS document suite for more information:

- *Getting Started* (ARM DUI 0064)
- *ADS Compilers and Libraries Guide* (ARM DUI 0067)
- *ADS Linker and Utilities Guide* (ARM DUI 0151)
- *CodeWarrior IDE Guide* (ARM DUI 0065)
- *AXD and armsd Debuggers Guide* (ARM DUI 0066)
- *ADS Assembler Guide* (ARM DUI 0068)
- *ADS Debug Target Guide* (ARM DUI 0058)
- *ADS Developer Guide* (ARM DUI 0056).

If you are using RealView Debugger with the *RealView Compilation Tools* (RVCT) v1.2, refer to the following books in the RVCT document suite for more information:

- *RealView Compilation Tools v1.2 Getting Started Guide* (ARM DUI 0202)
- *RealView Compilation Tools v1.2 Compilers and Libraries Guide* (ARM DUI 0205)
- *RealView Compilation Tools v1.2 Linker and Utilities Guide* (ARM DUI 0206)
- *RealView Compilation Tools v1.2 Assembler Guide* (ARM DUI 0204)
- *RealView Compilation Tools v1.2 Developer Guide* (ARM DUI 0203).

The following documentation provides general information on the ARM architecture, processors, associated devices, and software interfaces:

- *ARM Architecture Reference Manual* (ARM DUI 0100). This is provided in electronic form with ADS and is also available as a printed book:

  David Seal, *ARM Architecture Reference Manual, Second Edition*, 2001, Addison Wesley. ISBN 0-201-73719-1

- *ARM Reference Peripheral Specification* (ARM DDI 0062)

- *ARM-Thumb® Procedure Call Standard (ATPCS) Specification* (SWS ESPC 0002).

Refer to the following documentation for information relating to the ARM debug interfaces suitable for use with RealView Debugger:

- *ARM Agilent Debug Interface v1.0 User Guide* (ARM DUI 0158)
- *Multi-ICE version 2.2.2 User Guide* (ARM DUI 0048).

Refer to the following documentation for information relating to specific ARM Limited processors:

- *ARM7TDMI (Rev 4) Technical Reference Manual* (ARM DDI 0210)
- *ARM7EJ-S (Rev 1) Technical Reference Manual* (ARM DDI 0214)
- *ARM9TDMI (Rev 3) Technical Reference Manual* (ARM DDI 0180)
- *ARM920T (Rev 1) Technical Reference Manual* (ARM DDI 0151)
- *ARM922T (Rev 0) Technical Reference Manual* (ARM DDI 0184)
- *ARM9EJ-S (Rev 1) Technical Reference Manual* (ARM DDI 0222)
- *ARM926EJ-S (Rev 0) Technical Reference Manual* (ARM DDI 0198)
- *ARM940T (Rev 2) Technical Reference Manual* (ARM DDI 0144)
- *ARM946E-S (Rev 1) Technical Reference Manual* (ARM DDI 0201)
- *ARM966E-S (Rev 2) Technical Reference Manual* (ARM DDI 0213)
- *ARM1020E Technical Reference Manual* (ARM DDI 0177)
- *ARM1022E Technical Reference Manual* (ARM DDI 0237).

Refer to the following documentation for details on the FLEX*lm*® license management system, supplied by GLOBEtrotter Inc., that controls the use of ARM applications:

- *ARM FLEXlm License Management Guide* (ARM DUI 0209).

### Other publications

For a comprehensive introduction to ARM architecture see:

Steve Furber, *ARM system-on-chip architecture* (2nd edition, 2000). Addison Wesley, ISBN 0-201-67519-6.

For the definitive guide to the C programming language, on which the RealView Debugger macro and expression language is based, see:

Brian W. Kernighan, Dennis M. Ritchie, *The C Programming Language* (2nd edition, 1989). Prentice-Hall, ISBN 0-13-110362-8.

For more information about Oak and TeakLite processors from the DSP Group see:

`http://www.dspg.com.`

Contact information for MaxCore from AXYS is available at:

`http://www.axysdesign.com.`

# Feedback

ARM Limited welcomes feedback on both RealView Debugger and its documentation.

## Feedback on RealView Debugger

If you have any problems with RealView Debugger, please submit a Software Problem Report:

1. Select **Help** → **Send a Problem Report...** from the RealView Debugger main menu.
2. Complete all sections of the Software Problem Report.
3. To get a rapid and useful response, please give:
   - a small standalone sample of code that reproduces the problem, if applicable
   - a clear explanation of what you expected to happen, and what actually happened
   - the commands you used, including any command-line options
   - sample output illustrating the problem.
4. Email the report to your supplier.

## Feedback on this book

If you have any comments on this book, please send email to `errata@arm.com` giving:

- the document title
- the document number
- the page number(s) to which your comments apply
- a concise explanation of your comments.

General suggestions for additions and improvements are also welcome.

# Chapter 1
# About RealView Debugger

This chapter introduces RealView Debugger. It explains how the debugger provides a development environment for embedded systems applications using the ARM family of processors.

This chapter contains the following sections:

## 1.1 RealView Debugger

RealView Debugger enables you to debug your embedded application programs and have complete control over the flow of the program execution so that you can quickly isolate and correct errors.

### 1.1.1 RealView Debugger concepts and terminology

The following terminology is used throughout the RealView Debugger documentation suite to describe debugging concepts:

**Debug target**

A piece of hardware or simulator that runs your application program. A hardware debug target might be a single processor, or a development board containing a number of processors.

**Connection** The link between the debugger program and the debug target.

**Single connection access**

The base installation of RealView Debugger enables you to carry out debugging tasks in single-processor debugging mode, that is where there is only one target connection.

**Multiprocessor access**

RealView Debugger has been developed as a fully-featured debugger for working with multiprocessor debug target systems. Multiprocessor access enables you to maintain one or more connections to debug targets. Multiprocessor access is a separately licensed feature of RealView Debugger.

**DSP** RealView Debugger has been developed to provide full debugging functions when working with a range of debug target systems including *Digital Signal Processors* (DSPs). DSP-based debugging is a separately licensed feature of RealView Debugger.

**RTOS** Operating systems provide software support for application programs running on a target. *Real Time Operating Systems* (RTOSs) are operating systems that are designed for systems that interact with real-world activities where time is critical.

### Multithreaded operation

RTOS processes can share the memory of the processor so that each can share all the data and code of the others. These are called *threads*. RealView Debugger enables you to:

- attach Code windows to threads to monitor one or more threads
- select individual threads to display the registers, variables, and code related to that thread
- change the register and variable values for individual threads.

## 1.2 About the debugging environment

RealView Debugger uses a three-tier environment to debug application programs:

- the debugger software
- the debug interface layer, incorporating the *execution vehicles*
- the debug target.

RealView Debugger uses connection information to describe:

- how the debugger connects to the debug target
- information required to use that connection
- what kind of processor the target is using.

It might also include cached copies of processor registers or memory.

This approach means that you can switch between debug targets without having to start a second or third instance of the debugger program.

This section describes the RealView Debugger debugging environment:

- *Components of RealView Debugger*
- *Debug target interface* on page 1-5
- *Persistence information* on page 1-5.

### 1.2.1 Components of RealView Debugger

RealView Debugger comprises:

**GUI** The *Graphical User Interface* (GUI) gives access to the main features of the debugger, command processing, and the Code windows.

**Target Vehicle Server (TVS)**

RealView Debugger maintains connections through the TVS and plugins that support each combination of target processor and execution vehicle. Using plugins, for example a board file (`*.brd`), and board-chip definition files (`*.bcd`), enables RealView Debugger to enumerate advanced information about your target hardware or processor.

The TVS contains the basic debugging functionality and forms most of the software making up RealView Debugger. If you have the appropriate licenses, the TVS provides multiprocessor debugging, supports multithreaded operation under an RTOS, and enables tracing and performance profiling.

**RealView Connection Broker**

RealView Connection Broker operates in two modes:

**Local** Operating as RealView Connection Broker, this runs on your local workstation and enables you to access local targets.

**Remote** Operating as RealView Network Broker, this runs on a remote workstation and makes specified targets on that workstation available to other workstations connected to the same network.

### 1.2.2 Debug target interface

RealView Debugger works with either a hardware or a software debug target. An ARM development board communicating through Multi-ICE® is an example of a hardware debug target system. ARMulator is an example of a software debug target system.

The debug target interface contains the execution vehicles that process requests from the client tools to the target. A debug interface might be a JTAG interface unit such as Multi-ICE, a simulator, or a ROM monitor.

### 1.2.3 Persistence information

RealView Debugger maintains persistence information to enable you to halt a debugging session and resume at a later date. This means that RealView Debugger can remember your working environment including:

- current target connections
- loaded images
- open projects
- desktop settings, for example pane selections and window positions.

## 1.3 Debugging mode

The base installation of RealView Debugger enables you to debug your images in single connection mode, that is, where there is only one connection.

If you have the appropriate license, you can also debug multiprocessor applications. RealView Debugger supports such multiprocessor debugging by maintaining connections to multiple debug targets through one or more Code windows. When working in multiprocessor debugging mode, you can use one Code window to cycle through the connected targets, or multiple Code windows to view different targets.

Multiprocessor debugging mode is a separately licensed feature of RealView Debugger and is described in detail in *RealView Debugger v1.6 Extensions User Guide*.

## 1.4 Using the documentation suite

The RealView Debugger documentation suite consists of five books:

- *RealView Debugger v1.6 Essentials Guide*
- *RealView Debugger v1.6 User Guide*
- *RealView Debugger v1.6 Target Configuration Guide*
- *RealView Debugger v1.6 Command Line Reference Guide*
- *RealView Debugger v1.6 Extensions User Guide*.

At the front of each book is a Preface describing how the contents are organized and how information is presented in the chapters. The following description explains how you might use the books:

1. You are recommended to read the chapters in this book, *RealView Debugger v1.6 Essentials Guide*, to start debugging your images and to learn how to use RealView Debugger quickly. This book describes the minimum needed for the new user.

2. For a comprehensive description of the features available in RealView Debugger, see *RealView Debugger v1.6 User Guide*. This describes, in detail, how to debug your images, how to work with projects, and how to configure RealView Debugger to customize your working environment. This book also contains examples of debugging software and details shortcuts, and tips, for the developer.

3. *RealView Debugger v1.6 Target Configuration Guide* describes how to connect to targets, how to amend existing targets that are set up in the base installation, and how to customize your own targets.

4. If you want to use the RealView Debugger *Command Line Interface* (CLI) to control your debugging tasks, *RealView Debugger v1.6 Command Line Reference Guide* provides a detailed description of every CLI command and includes examples of their use.

5. If you have the appropriate licenses, you can access RealView Debugger extensions, for example multiprocessor debugging mode and Trace. These features are described in *RealView Debugger v1.6 Extensions User Guide*.

Refer to *ARM FLEXlm License Management Guide* for details on the license management system that controls the use of ARM applications.

See the installation notes delivered with your product for details on installing RealView Debugger.

# Chapter 2
# Features of RealView Debugger

This chapter describes the features of RealView Debugger and highlights new functionality in RealView Debugger v1.6. It contains the following sections:

## 2.1 RealView Debugger v1.6

RealView Debugger v1.6 provides a range of features for the developer:

- *Multi-core debugging*
- *OS awareness*
- *Extended Target Visibility (ETV)*
- *Advanced debugging facilities*
- *Trace, Analysis, and Profiling* on page 2-3
- *Project manager* on page 2-4
- *RealView Debugger downloads* on page 2-4.

### 2.1.1 Multi-core debugging

RealView Debugger v1.6 provides a single debug kernel for mixed ARM and DSP debugging. The debugger provides full support for synchronized start and stop, stepping, and cross triggering of breakpoints.

### 2.1.2 OS awareness

RealView Debugger v1.6 enables you to:

- use RTOS debug including *Halted System Debug* (HSD)
- interrogate and display resources after execution has halted
- access semaphores and queues
- view the status of the current thread or other threads
- customize views of application threads.

### 2.1.3 Extended Target Visibility (ETV)

RealView Debugger v1.6 provides visibility of targets such as boards and SoC. Users can configure targets using board-chip definition files and preconfigured files are available:

- ARM family files provided as part of the installation
- customer/partner board files provided through ARM DevZone®.

### 2.1.4 Advanced debugging facilities

RealView Debugger v1.6 provides standard debug views and advanced debugging features:

- RealView Debugger supports variables of 64-bit type ‘long long’ throughout the user interface (new in v1.6).

- There is now support for module statics, that is static variables of non-local scope, in the Call Stack pane (new in v1.6).
- RealView Debugger offers a powerful command-line interface and scripting capability that includes macros support, conversion from ARM AXD and armsd, and history lists to record previous actions.
- Users can access a console (headless debugger) driven from the command line or from scripts (new in v1.6).
- RealView Debugger includes an editing control called **Tooltip Evaluation** that provides hover-style evaluation in different code views (new in v1.6).
- RealView Debugger enables you to position a Memory pane to display a memory region based on the contents of a variable or register in the Register or Watch panes, or in the **Src** tab (new in v1.6).
- Users now have greater control over panes in the Code window and the debug views displayed. RealView Debugger provides the option of using a single Code window to display a wide range of data views during debugging (new in v1.6).
- Programming Flash modules are available as standard.
- Memory mapping is enabled if required.
- Colored memory views indicate the type of memory according to memory map settings.

### 2.1.5 Trace, Analysis, and Profiling

New in RealView Debugger v1.6, Trace, Analysis, and Profiling is enabled by a Trace debug license. Trace support is available for:

- ARM ETM v1.0 (ETM7 and ETM9), including On-Chip Trace
- ARM ETM v2.0 (ETM10) (beta)
- ARMulator ETM simulator
- AXYS Oak and TeakLite MaxSim simulators
- DSP Group On-Chip Trace (Oak and TeakLite)
- Motorola 56600 On-Chip Trace
- Intel XScale On-Chip Trace.

Trace and Profiling provides full trace support including simple and complex tracepoints and data filtering:

- viewing raw trace
- viewing code trace
- viewing data trace

- viewing disassembly trace
- tracing of function calls
- the profiling of time spent in each function
- the ability to filter captured trace data by field
- the ability to sort captured trace data by field.

You can set tracepoints directly in the source-level view and/or the disassembly-level view. The same functionality is available in the Memory pane so that you can select regions in memory to trace, or trace a specific memory value when it changes.

### 2.1.6 Project manager

RealView Debugger v1.6 is a fully-featured *Integrated Development Environment* (IDE) including a project manager and build system.

New in v1.6, the project manager includes a Configuration Summary window to display the switch string passed to the compiler tools for build target configurations in the current project.

### 2.1.7 RealView Debugger downloads

ARM provides a range of services to support developers using RealView Debugger. Among the downloads available are OS awareness modules to support RTOS developers and enhanced support for different hardware platforms through technical information and board description files. See `http://www.arm.com` to access these resources from ARM DevZone.

## 2.2 Getting more information online

The full documentation suite is available online as DynaText, XML, and PDF files.

Select **Start** → **Programs** → **RealView Debugger v1.6** from the Windows **Start** menu. From here:

- select **Online Books** to view the DynaText files
- select **XML Documentation** to see the XML version.

You can also access the DynaText files from the **Help** menu when RealView Debugger is running.

For a Typical installation, the DynaText and XML files are installed in:

```
C:\Program Files\ARM\Documentation
```

To access the XML documentation, you must use either:

- Netscape 6.2
- Mozilla 1.0.

The PDF files are installed, as part of the base installation, in `install_directory\PDF`.

**Note**

The DynaText, XML, and PDF files contain the same information.

# Chapter 3
# Getting Started with RealView Debugger

This chapter gives step-by-step instructions to get started with RealView Debugger, including making a connection and loading an image for debugging. It also covers the main tasks that you might carry out in a debugging session.

It contains the following sections:

## 3.1 Starting RealView Debugger

To start your debugging session, you must complete the following steps:

1. Start RealView Debugger.
2. Connect to your chosen debug target.
3. Load an image for debugging.

This section describes how to start RealView Debugger and display the default Code window. It contains the following sections:

- *Starting RealView Debugger*
- *The Code window*.

### 3.1.1 Starting RealView Debugger

To start RealView Debugger:

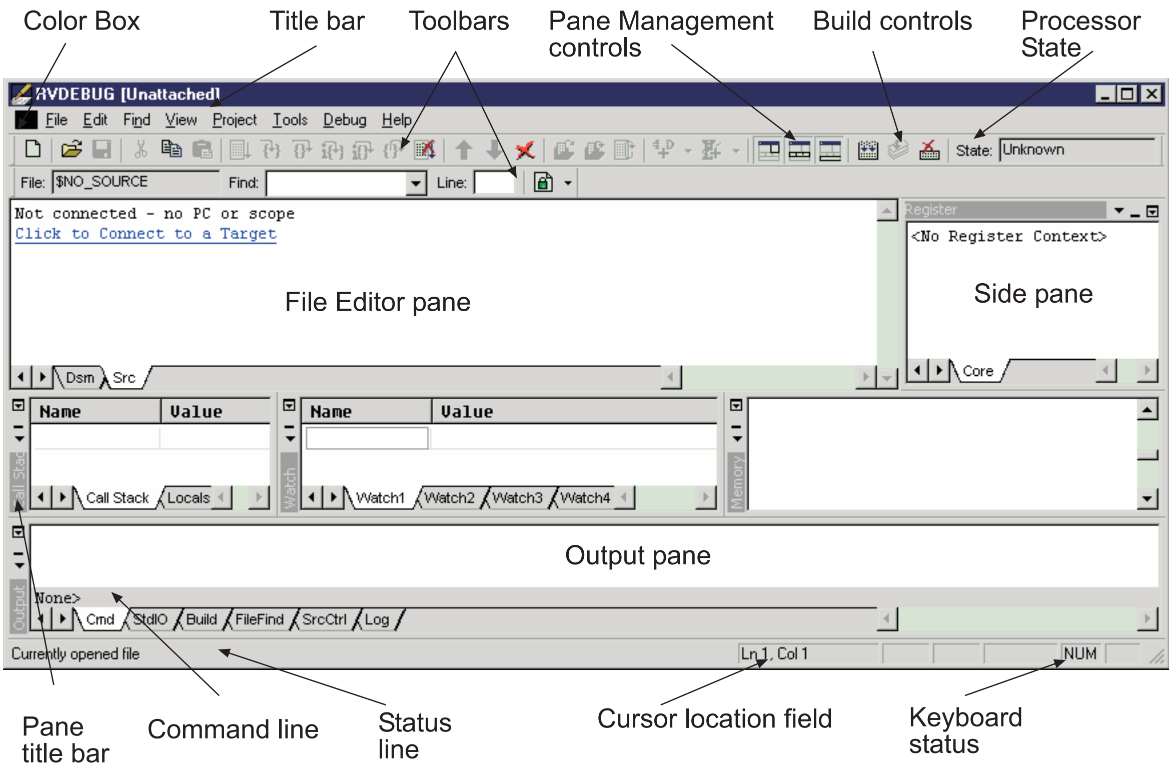
1. Select **Start** → **Programs** → **RealView Debugger v1.6** from the Windows **Start** menu.
2. Select **RealView Debugger** from the menu.

The first time you run RealView Debugger after installation, it creates a unique working directory, in your RealView Debugger home directory, for you to store your personal files, debugger settings, and target configuration files. RealView Debugger then creates or copies files into this directory ready for your first debugging session.

If a user ID is not specified then RealView Debugger creates a general-purpose working directory called `*install_directory*\home\owner`.

### 3.1.2 The Code window

Starting RealView Debugger immediately after installation displays the default Code window to provide a starting point for all debugging tasks. The Code window is your main debugging and editing window. This is shown in Figure 3-1 on page 3-3.



RVDEBUG [Unattached]

File: $NO_SOURCE

State: Unknown

Not connected - no PC or scope

Click to Connect to a Target

<No Register Context>

<None>

Currently opened file

Ln 1, Col 1

**Figure 3-1 Code window**

The appearance of the Code window depends on your licenses. For example, the base installation enables you to debug your images in single connection mode, that is where there is only one connection. If you are working in this mode, the title bar does not show `[Unattached]`.

For a full description of the contents of this window, see Chapter 6 *RealView Debugger Desktop*.

## 3.2 Connecting to a target

The next stage in your debugging session is to connect to your debug target. The base installation of RealView Debugger includes built-in configuration files to enable you to make a connection without having to modify any configuration details.

This section introduces target configuration and how to make a connection:

- *Target configuration*
- *Working with connections*
- *Making a connection* on page 3-5
- *Setting connect mode* on page 3-6.

### 3.2.1 Target configuration

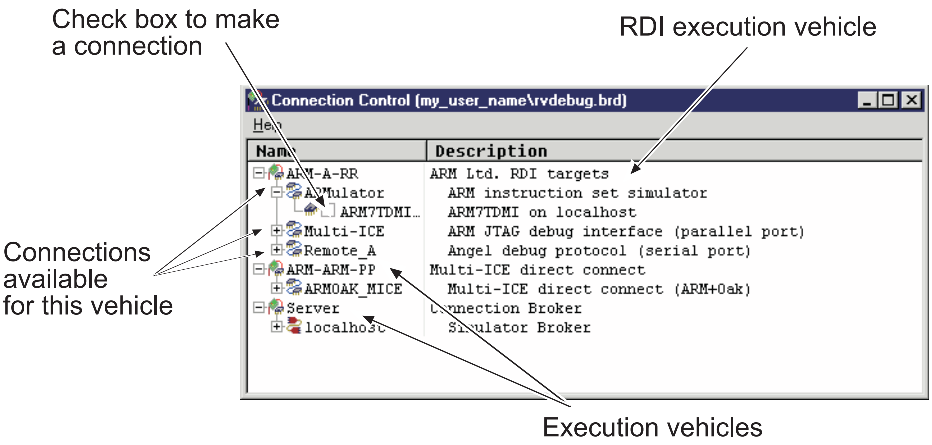
RealView Debugger uses a board file to access information about the debugging environment and the debug targets available to you, for example how memory is mapped. See *RealView Debugger v1.6 Target Configuration Guide* for details of how to customize your targets.

You can start to use RealView Debugger with the default board file installed as part of the base installation without making any further changes.

### 3.2.2 Working with connections

RealView Debugger makes a distinction between target *configuration*, and how a target is accessed, that is the *connection*.

Select **File** → **Connection** → **Connect to Target...** from the main menu to display the Connection Control window ready to make your first connection. This is shown in Figure 3-2 on page 3-5.


Check box to make a connection
RDI execution vehicle
Connection Control (my_user_name\rvdebug.brd)
Help
Connections available for this vehicle
Execution vehicles

| Name | Description |
|---|---|
| ARM-A-RR | ARM Ltd. RDI targets |
| ARMulator | ARM instruction set simulator |
| ARM7TDMI… | ARM7TDMI on localhost |
| Multi-ICE | ARM JTAG debug interface (parallel port) |
| Remote_A | Angel debug protocol (serial port) |
| ARM-ARM-PP | Multi-ICE direct connect |
| ARMOAK_MICE | Multi-ICE direct connect (ARM+Oak) |
| Server | Connection Broker |
| localhost | Simulator Broker |

**Figure 3-2 Connection Control window**

This window dynamically details all your connections during a debugging session.

——— **Note** ———

If you are licensed to use RealView Debugger extensions, the Connection Control window includes tabs, not shown here. For example, in multiprocessor debugging mode, the window includes a **Connect** tab and a **Synch** tab.

---

### 3.2.3 Making a connection

If you have ADS 1.2 or RVCT 1.2 installed the top-level entry `ARM-A-RR` is the execution vehicle that supports connections to ARM RDI targets, as shown in Figure 3-2. Expand this to show the `ARMulator` connection that uses the ARMulator instruction set simulator.

The default configuration files installed as part of the base installation enable you to connect to an `ARM7TDMI` core using ARMulator on your local workstation. The Connection Control window shows this default target connection.

Select the `ARM7TDMI` check box so that it is checked to make the connection.

With the connection established, your Code window is updated:

- the Code window title bar is updated with the name of the current connection
- the hyperlink in the File Editor pane changes to enable you to load an image
- the Output pane displays details of the connection

- panes are updated with debug information, for example the Register pane shows the core registers for the connected target.

Where you are always debugging code on the same target you can configure RealView Debugger to make the same connection automatically each time it starts. See the chapter describing connecting to targets in *RealView Debugger v1.6 Target Configuration Guide* for details of how to set this option.

### RDI connection details

RealView Debugger displays RDI connection details in different tabs depending on the startup conditions and the Code windows you are using. Because this is the first time you connected to an RDI target from the default Code window, the startup connection details are displayed in the **Log** tab and the **Cmd** tab of the Output pane. In future debugging sessions, this information is displayed in the **Cmd** tab.

## 3.2.4 Setting connect mode

You can control the way a target processor starts when you connect. This is particularly useful when debugging multiprocessor debug targets and working with multiple threads. In single processor debugging mode, you might want to leave an image executing while RealView Debugger closes down and then restart at a later date.

If you are not connected, you can set connect mode when you make a new connection:

1. Select **File** → **Connection** → **Connect to Target...** to display the Connection Control window.

2. Right-click on the connection entry and select **Connect (Defining Mode)...** from the **Connection** context menu.

3. Select the required state from the selection box.

   The options listed depend on your execution vehicle.

4. Click **OK** to make the connection with the processor in the required state.

If you set connect mode from the Connection Control window, this temporarily overrides any setting in your target configuration file. See the chapter describing connecting in *RealView Debugger v1.6 Target Configuration Guide* for full details on setting connect mode for your debug target.

## 3.3 Working with memory

Before you load an image, you might have to define memory settings. This depends on the debug target you are using to run your image. For example, if you are using the default ARMulator to simulate an ARM processor, setting the value of top of memory is not appropriate.

Where appropriate, defining memory gives you full access to all the memory on your debug target. RealView Debugger enables you to do this in different ways, for example using an include file, or defining the memory map as part of your target configuration settings. These options are described in detail in *RealView Debugger v1.6 User Guide*.

**Note**

In the example in this section, you set up memory manually for the current session. Target memory settings defined in this way are only temporary and are lost when you exit RealView Debugger.

This section describes how to set up memory:

- *Setting top of memory and stack values*
- *Setting top of memory for a session* on page 3-8.

### 3.3.1 Setting top of memory and stack values

The top of memory variable is used to enable the semihosting mechanism to return the top of stack and heap. If you are not using an ARM-based target, or if your target does not use semihosting, this is ignored.

If you do not set these values, RealView Debugger uses default settings that are dependent on the debug target. For ARM processors the default value used for top of memory is `0x20000`.

When you first connect to an ARM-based target, RealView Debugger displays a warning message in the **Cmd** tab:

```
Warning: No stack/heap or top of memory defined - using defaults.
```

You can set permanent values for top of memory, stack, and heap, using the Connection Properties window. Configure your debug target and define these settings so that they are used whenever you connect. See the chapter describing configuring custom targets in *RealView Debugger v1.6 Target Configuration Guide* for an example of how to do this.

### 3.3.2 Setting top of memory for a session

If you are working with an appropriate debug target, you can set the value of top of memory on a temporary basis, that is for the current session, using the `@top_of_memory` register.

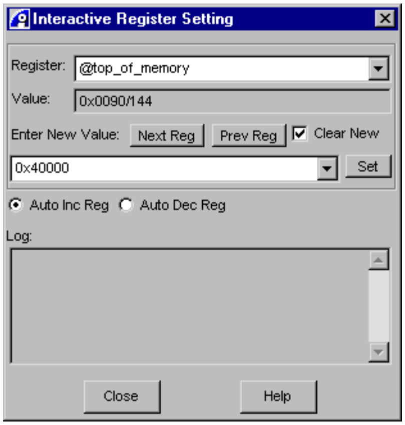
—— **Note** ——

If you are using the default ARMulator to simulate an ARM processor, this is not a suitable target for setting top of memory in this way because top of memory is set from an ARMulator configuration file rather than from within RealView Debugger.

To set the value of top of memory for an ARM Integrator/AP board and `ARM940T` core, using Multi-ICE:

1. Select **Debug** → **Memory/Register Operations** → **Set Register...** to display the Interactive Register Setting dialog box.

2. Specify the register to be changed, `@top_of_memory`, and enter the required value, for example `0x40000`, as shown in Figure 3-3.



Interactive Register Setting

Register: @top_of_memory

Value: 0x00907144

Enter New Value: 0x40000

☑ Clear New

● Auto Inc Reg ○ Auto Dec Reg

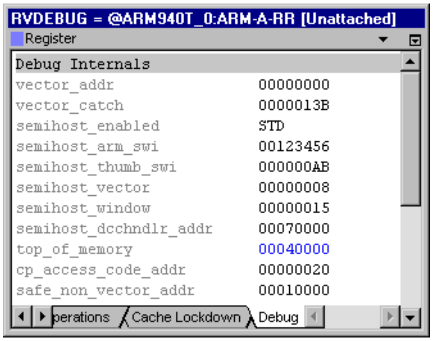
Log:

**Figure 3-3 Setting top of memory for session**

3. Click **Set** to update the register contents. The Log display is updated to record the change.

4. Click **Close** to close the dialog box.

The **Debug** tab, in the Register pane, displays the updated value, as shown in the example in Figure 3-4 on page 3-9.



RVDEBUG = @ARM940T_0:ARM-A-RR [Unattached]

Register

```
Debug Internals
vector_addr                00000000
vector_catch               0000013B
semihost_enabled           STD
semihost_arm_swi           00123456
semihost_thumb_swi         000000AB
semihost_vector            00000008
semihost_window            00000015
semihost_dcchndlr_addr     00070000
top_of_memory              00040000
cp_access_code_addr        00000020
safe_non_vector_addr       00010000
```

**Figure 3-4 Changed settings in the Register pane**

The value of top of memory might be displayed in dark blue to show that it has changed since the last update.

If you set this value too low, loading an image to your target might generate a warning message in the **Cmd** tab:

```
Warning: No room for heap - could cause unpredictable behavior.
```

For full details on setting top of memory for an ARM-based target, see the chapter describing memory mapping in *RealView Debugger v1.6 User Guide.*

## 3.4 Loading an image

When you have connected to a suitably configured debug target you are ready to load your image for debugging:

- *Loading an image*
- *What is shown in the title bar?* on page 3-12
- *Reloading an image* on page 3-12
- *Unloading an image* on page 3-13.

### 3.4.1 Loading an image

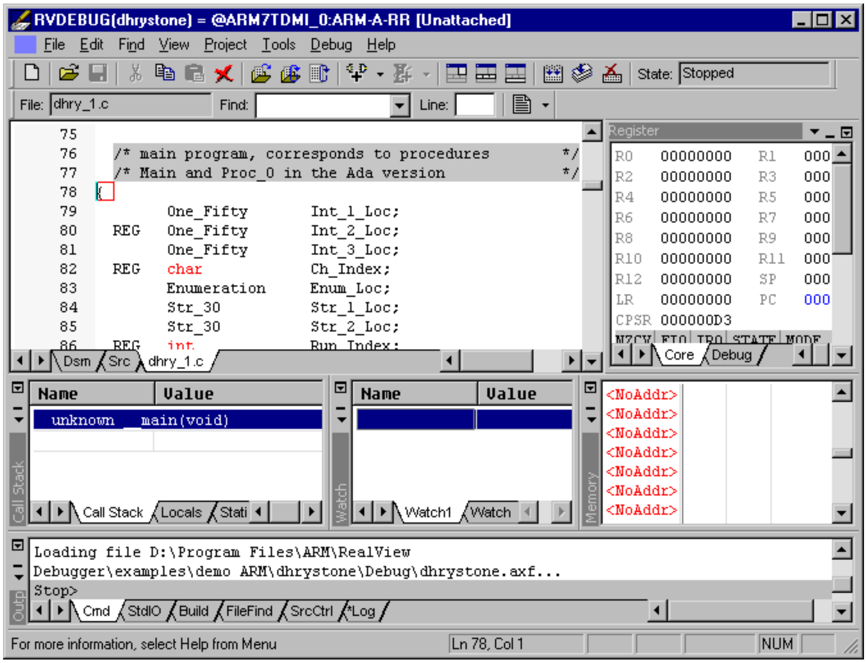
In this example, you load the image `dhrystone.axf` installed as part of the base installation. By default this is located in the ARM examples directory in `install_directory\examples\demo_ARM\dhrystone\Debug`.

Select **File → Load Image...** to load your image. This displays the Load File to Target dialog box where you can locate the required image and specify the way in which it is loaded.

**Note**

Do not change any default settings in the Load File to Target dialog box.

Your Code window looks like Figure 3-5 on page 3-11.



State: Stopped

File: dhry_1.c

```
/* main program, corresponds to procedures        */
/* Main and Proc_0 in the Ada version             */
{
        One_Fifty       Int_1_Loc;
  REG   One_Fifty       Int_2_Loc;
        One_Fifty       Int_3_Loc;
  REG   char            Ch_Index;
        Enumeration     Enum_Loc;
        Str_30          Str_1_Loc;
        Str_30          Str_2_Loc;
  REG   int             Run_Index;
```

```
R0   00000000   R1   000
R2   00000000   R3   000
R4   00000000   R5   000
R6   00000000   R7   000
R8   00000000   R9   000
R10  00000000   R11  000
R12  00000000   SP   000
LR   00000000   PC   000
CPSR 000000D3
NZCV FIQ IRQ STATE MODE
```

| Name | Value |
|---|---|
| unknown | __main(void) |

```
<NoAddr>
<NoAddr>
<NoAddr>
<NoAddr>
<NoAddr>
<NoAddr>
<NoAddr>
```

```
Loading file D:\Program Files\ARM\RealView
Debugger\examples\demo ARM\dhrystone\Debug\dhrystone.axf...
Stop>
```

For more information, select Help from Menu   Ln 78, Col 1   NUM

**Figure 3-5 Code window with an image loaded**

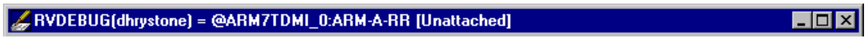
In this Code window **Text Coloring** is enabled by default and line numbering is turned on by selecting **Edit** → **Editing Controls** → **Show Line Numbers**.

When you load an image, the debugger:

- inserts the source filename, for the current context, in the File field at the top of the File Editor pane
- highlights the location of the *Program Counter* (PC) at the entry point with a red box
- moves the text insertion point to the current location of the PC
- updates the Code window panes as appropriate
- updates the Code window title bar to show the name of the project associated with the image
- displays the load line in the **Cmd** tab in the Output pane.

### 3.4.2 What is shown in the title bar?

The Code window title bar gives details of the connection and any processes running on your debug target. If you connect to a target and load an image, your title bar looks like the one shown in Figure 3-6.



RVDEBUG(dhrystone) = @ARM7TDMI_0:ARM-A-RR [Unattached]

**Figure 3-6 Code window title bar**

In addition to the application icon, you can see (from left to right):

**RVDEBUG** Identifies the Code window. This changes to identify each new Code window that you open, for example `RVDEBUG_1`, or `RVDEBUG_2`.

**(dhrystone)** The project associated with the loaded image.

**@ARM...** The connection, including the target processor, the connection number, and the execution vehicle.

**[Unattached]**

If you are working in multiprocessor debugging mode, this shows the attachment of the window to a specified connection. A Code window is unattached by default, shown by `[Unattached]`.

If you float a pane, the pane title bar reflects the title bar of the calling Code window.

**Note**

The contents of your title bar might be different from the one shown in Figure 3-6 depending on your licenses, the current connection (if any), open projects and windows attachment. For a full description of the contents, see Chapter 6 *RealView Debugger Desktop*.

### 3.4.3 Reloading an image

During your debugging session you might have to amend your source code and then recompile. Select **File** → **Reload Image to Target** from the Code window to reload an image following these changes.

Reloading an image refreshes any window displays and updates debugger resources.

### 3.4.4 Unloading an image

You do not have to unload an image from a debug target before loading a new image for execution. Display the Load File to Target dialog box and ensure that the **Replace Existing File(s)** check box is selected ready to load the next image.

However, you might want to unload an image explicitly as part of your debugging session, for example if you correct coding errors and then rebuild outside RealView Debugger. You can do this using the Process Control pane:

1. Select **View** → **Pane Views** → **Process Control Pane** from the default Code window main menu.
2. Right-click on the `Image` entry, for example `dhrystone.axf`, or on the `Load` entry, `Image+Symbols`, to display the **Image** context menu.
3. Select **Unload**.

You can also unload an image by clicking on the check box associated with the `Load` entry so that it is unselected.

Unloading an image does not affect target memory. It unloads the symbols and removes most of the image details from RealView Debugger. However, the image name is retained.

——— **Note** ———

To remove image details completely, right-click on the `Image` entry in the Process Control pane and select **Delete Entry**.

## 3.5 Debugging an image

Chapter 4 *Quick-start Tutorial* provides details on using the features of RealView Debugger with your images. This section summarizes how to start debugging with RealView Debugger:

- *Getting started*
- *Code views* on page 3-15
- *Viewing target status* on page 3-15.

### 3.5.1 Getting started

You can start debugging your image when you have completed the following steps:

1. Start RealView Debugger, see *Starting RealView Debugger* on page 3-2.
2. Connect to your target, see *Making a connection* on page 3-5.
3. Set top of memory, if appropriate, see *Setting top of memory for a session* on page 3-8.
4. Load your image, see *Loading an image* on page 3-10.

To start your debugging session:

1. Select **Edit** → **Editing Controls** → **Show Line Numbers** to display line numbers.

   This is not necessary but might help you to follow the examples.
2. Right-click in the first entry in the Memory pane, `<NoAddr>`, and select **Set New Start Address...** from the context menu.
3. Enter a value as the start address for the area of interest, for example `0x8008`.
4. Click **Set** to confirm the setting and close the dialog box.
5. Click on the **Src** tab in the File Editor pane.
6. Set a simple, unconditional breakpoint at line 149 in `dhry_1.c`, `Proc_5();`, by double-clicking on the line number.

   If the line number is not visible, then double-click inside the gray area at the left of the required statement in the File Editor pane to set the breakpoint.
7. Set a watch by right-clicking on the variable `Int_1_Loc` at line 152 in `dhry_1.c` so that it is underlined in red. Select **Watch** from the context menu.

8. To start execution either:
   - Select **Debug** → **Execution Control** → **Go (Start Execution)** from the main menu.
   - Click the **Go** button on the Actions toolbar.
9. Enter the required number of runs, for example `50000`.
10. Monitor execution until the breakpoint is reached.
11. Click **Go** again and monitor the programas execution continues.

### 3.5.2 Code views

Use the File Editor pane to view source code during your debugging session. In the example shown in Figure 3-5 on page 3-11, the File Editor pane contains three tabs:

- the **Dsm** tab enables you to track program execution in the disassembly-level view
- the **Src** tab enables you to track program execution in the source-level view
- the file tab `dhry_1.c` shows the name of the current source file in the editing, or non-execution, view.

Click on the relevant tab to toggle between the different code views.

### 3.5.3 Viewing target status

The State group, on the Actions toolbar, shown in Figure 3-5 on page 3-11, enables you to see the current state of your debug target:

**Unknown** Shows that the current state of the target is unknown to the debugger. For example it might have been running when the connection was established or it might be disconnected.

**Stopped** Shows that the target is connected but any image loaded is not executing.

**Running** Shows that an image is executing. In this case, a running progress indicator is also included.

Chapter 4
# Quick-start Tutorial

This chapter provides a step-by-step tutorial using RealView Debugger to debug your images. All the tasks introduced in this chapter, and the RealView Debugger options used, are described in full in *RealView Debugger v1.6 User Guide*.

This tutorial contains the following sections:

- *How to use the tutorial* on page 4-2
- *Setting up your first project* on page 4-3
- *Debugging with RealView Debugger* on page 4-13
- *Working with custom panes* on page 4-27
- *More about projects* on page 4-29
- *Completing the tutorial* on page 4-35.

## 4.1 How to use the tutorial

The tutorial starts by setting up a user-defined project to build an image for debugging. A user-defined project in RealView Debugger is not required for debugging, but it can provide a powerful aid to development. A project enables RealView Debugger to save your list of files, understand your build model, and maintain a record of your project-level preferences. In this tutorial, you build source files installed as part of the base installation and then debug the executable.

If you do not set up your own project, you can follow the tutorial using the supplied project, named `dhrystone.prj`, installed in the ARM examples directory. This sample project comes with a ready-built image, named `dhrystone.axf`, installed in the directory *`install_directory`*`\examples\demo_ARM\dhrystone\Debug`.

### 4.1.1 Getting started

Begin by making a copy of the source files provided so that the tutorial is self-contained and the installed example files are untouched:

1. Create a new directory called *`install_directory`*`\Tutorial`. This is the tutorial project *base directory*.
2. Copy the required files, `dhry.h`, `dhry_1.c`, and `dhry_2.c`, from the examples directory, that is *`install_directory`*`\examples\demo_ARM\dhrystone`, into the new tutorial directory.

Start your session so that you can follow the tutorial:

1. Start RealView Debugger, as described in *Starting RealView Debugger* on page 3-2.
2. Connect to the `ARM7TDMI` core processor using ARMulator, as described in *Making a connection* on page 3-5.

You can complete the tutorial using the default files provided in the base installation. It is not necessary to change any of these files or to amend any configuration files.

## 4.2 Setting up your first project

RealView Debugger enables you to set up different types of user-defined projects:

- Standard project, including Compile/Assemble/Link
- Library project, including Compile/Assemble/Add to library
- Custom project, using your makefile or defining a no-build project to hold only image and properties
- Container project, composed of existing projects
- Copy, created by copying existing projects.

When you create a new project, you can also merge a saved *auto-project* to create a user-defined project.

For full details on creating different types of project, merging project settings, and accessing the project management features of RealView Debugger, see the chapter describing managing projects in *RealView Debugger v1.6 User Guide*.

This section takes you through the basic steps to set up a Standard user-defined project based on a set of example source files in the base installation. Follow this section to specify the default behavior for your C, C++, or assembly language programs, and build an image. This section describes:

- *Defining your build tools* on page 4-4
- *Creating a new project* on page 4-5
- *Defining a Standard Project* on page 4-5
- *Viewing the project settings* on page 4-7
- *Setting up compiler options* on page 4-7
- *Project base directory* on page 4-9
- *Building the application* on page 4-9
- *Project files* on page 4-10
- *Closing the project* on page 4-11.

**Note**

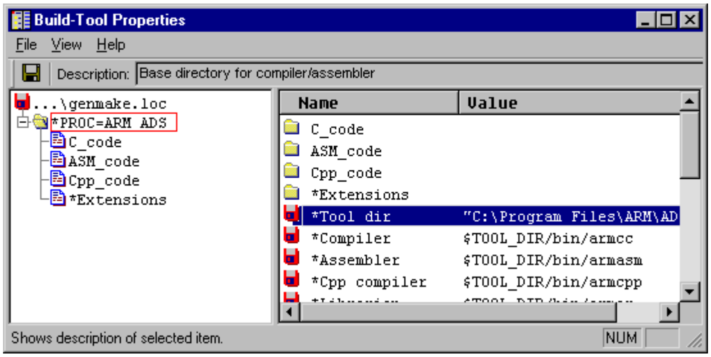
This section introduces the Build-Tool Properties window and the Project Properties window to set up your first development project. There are full descriptions of the general layout and controls of these Settings windows in the RealView Debugger online help topic *Changing Settings*.

### 4.2.1 Defining your build tools

RealView Debugger provides support for multiple toolchains. The debugger can locate your build tools automatically based on your environment variables or Registry entries. You can use the default build tools in every project you create or to build source files outside a project. However, you can override these settings for specific projects if required.

To see the default toolchain:

1. Select **Project** → **Build-Tool Properties...** from the Code window main menu. This displays the Build-Tool Properties window shown in Figure 4-1.



Description: Base directory for compiler/assembler

```
...\genmake.loc
*PROC=ARM_ADS
  C_code
  ASM_code
  Cpp_code
  *Extensions
```

| Name | Value |
|---|---|
| C_code | |
| ASM_code | |
| Cpp_code | |
| *Extensions | |
| *Tool dir | "C:\Program Files\ARM\AD |
| *Compiler | $TOOL_DIR/bin/armcc |
| *Assembler | $TOOL_DIR/bin/armasm |
| *Cpp compiler | $TOOL_DIR/bin/armcpp |

Shows description of selected item.

**Figure 4-1 Build-Tool Properties for a Typical installation**

This shows a Typical installation where the ADS 1.2 toolchain is installed. If you have installed a Custom configuration your window looks different.

When you are working with the Build-Tool Properties window, click on an entry in the left or right pane to see a one-line text explanation in the Description field at the top of the window. Right-click on an entry and select **Detailed Description...** to see extended online help.

2. Select **File** → **Close window** to close the Build-Tool Properties window.

The first time you open the Build-Tool Properties window, RealView Debugger copies the file `*install_directory*\etc\genmake.loc` into your home directory ready for building operations during your debugging sessions. This is updated each time you amend your Build-Tool Properties window settings. You are warned before changes are saved in this file, but you can restore all entries to the installation defaults if required.

This is all that is required to start your first project.

**Note**

For details on how to change your build tools see *Changing build tools* on page 4-29.

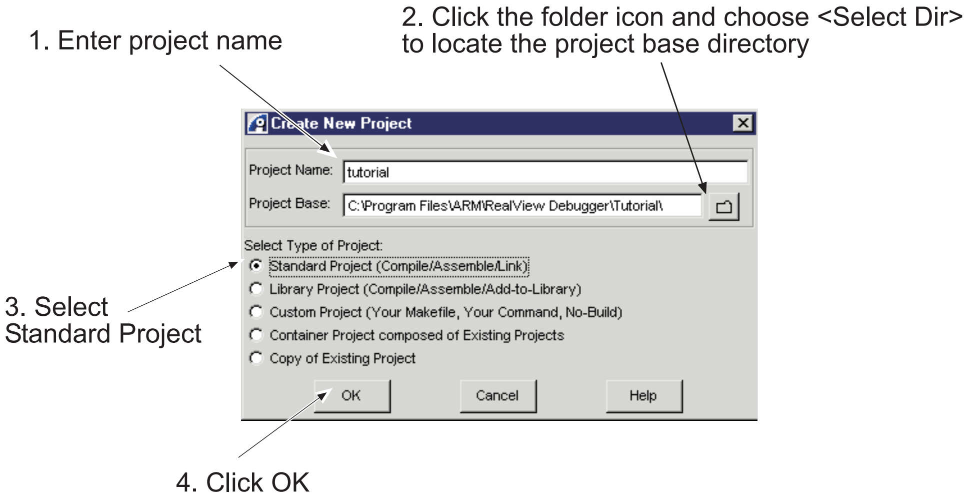
### 4.2.2 Creating a new project

To set up the new project:

1. Select **Project** → **New Project...** from the default Code window main menu.

   This displays the Create New Project dialog box. The Project Base field might be prefilled with your RealView Debugger installation directory name as defined by your environment variable. You can override this.

2. Enter the project details as shown in Figure 4-2.



1. Enter project name

2. Click the folder icon and choose <Select Dir> to locate the project base directory

3. Select Standard Project

4. Click OK

Create New Project

Project Name: tutorial

Project Base: C:\Program Files\ARM\RealView Debugger\Tutorial\

Select Type of Project:

● Standard Project (Compile/Assemble/Link)

○ Library Project (Compile/Assemble/Add-to-Library)

○ Custom Project (Your Makefile, Your Command, No-Build)

○ Container Project composed of Existing Projects

○ Copy of Existing Project

**Figure 4-2 Creating a new project**

RealView Debugger confirms that the specified project base directory exists. If the directory does not exist, you are given the option to create the directory ready for your project files.

### 4.2.3 Defining a Standard Project

When you close the Create New Project dialog box, RealView Debugger displays the Create Standard Project dialog box where you specify the:

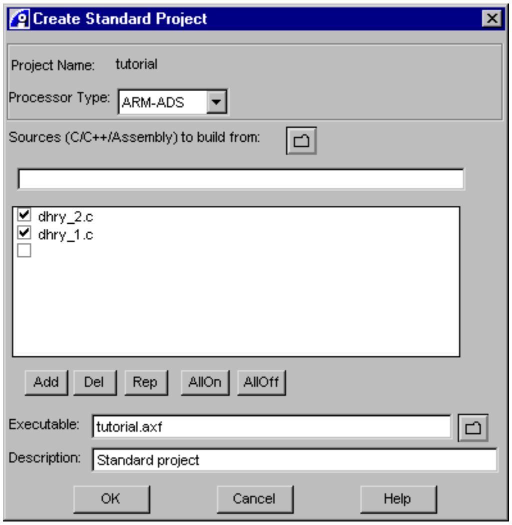
- processor family and toolchain you are using
- source files to include in the build process

- image name.

To define the project:

1. Click on the down arrow to specify the Processor Type that you are using to run your images and the toolchain. In this example, that is `ARM-ADS`.
2. Click the folder icon to open the project base directory, defined previously, and specify the source files to use in the build process. This displays the Select source files for Project dialog box where you can highlight one or more files. Use the Shift or Ctrl keys to select the files `dhry_1.c` and `dhry_2.c`.
3. Click **Open** and add the required source files to your project.

   The Create Standard Project dialog box looks like Figure 4-3.



Create Standard Project

Project Name: tutorial

Processor Type: ARM-ADS

Sources (C/C++/Assembly) to build from:

☑ dhry_2.c
☑ dhry_1.c
□

Executable: tutorial.axf

Description: Standard project

**Figure 4-3 Create Standard Project dialog box**

   The Executable field contains the image name, that is `tutorial.axf`. Do not change this so that you can follow the rest of the tutorial.

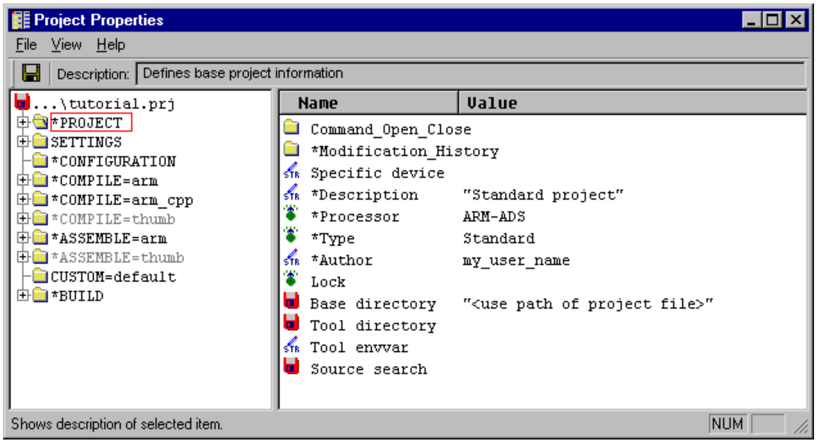
   You do not have to change the project Description field.

4. Click **OK** to confirm your entries and close the Create Standard Project dialog box.

Closing the dialog box creates the project settings file in the project base directory and opens the project into the debugger, shown in the Code window title bar.

### 4.2.4 Viewing the project settings

When you close the Create Standard Project dialog box, RealView Debugger displays the Project Properties window, shown in Figure 4-4.



Description: Defines base project information

```
...\tutorial.prj
 *PROJECT
 SETTINGS
 *CONFIGURATION
 *COMPILE=arm
 *COMPILE=arm_cpp
 *COMPILE=thumb
 *ASSEMBLE=arm
 *ASSEMBLE=thumb
 CUSTOM=default
 *BUILD
```

| Name | Value |
|---|---|
| Command_Open_Close | |
| *Modification_History | |
| Specific device | |
| *Description | "Standard project" |
| *Processor | ARM-ADS |
| *Type | Standard |
| *Author | my_user_name |
| Lock | |
| Base directory | "<use path of project file>" |
| Tool directory | |
| Tool envvar | |
| Source search | |

Shows description of selected item.

**Figure 4-4 Project Properties window**

The Project Properties window enables you to view project settings as defined in the project file. Click on the entry `...\tutorial.prj` at the top of the list of entries in the left pane of the window. This displays the full path of the project settings file in the Description field at the top of the window. In this new standard project this is identified as *`install_directory`*`\Tutorial\tutorial.prj`.

Most entries in the Project Properties window are filled automatically from the Create Standard Project dialog box. You do not have to change any entries. Select **File** → **Close Window** from the menu to close the Project Properties window.

When you examine your project settings and then close the Project Properties window, RealView Debugger regenerates the makefiles. The **Build** tab in the Output pane displays information about the generation process. You must wait for this to complete before making the next change. See *Generated makefiles* on page 4-32 for more details.

### 4.2.5 Setting up compiler options

For this tutorial, you must specify a preprocessor macro that is included as part of the build model. You have to set the `-D` compiler switch to specify how the compiler processes `#if` directives. You must set this to `MSC_CLOCK` to specify the C function library to control how timing measurements are made.

To do this you must change a project setting:

1. Select **Project** → **Project Properties...** from the default Code window main menu to display the Project Properties window.

2. Click on `*COMPILE=arm` in the left pane to see the contents.

3. Double-click on `Preprocessor` in the right pane to see the contents.

4. Right-click on `Define` in the right pane and select **Edit Value** from the context menu.

5. Type `MSC_CLOCK` and press Enter.

   An asterisk is placed at the front of the setting to show that it has changed from the default.

6. Select **File** → **Save and Close** from the menu to close the Project Properties window.

RealView Debugger regenerates the makefiles, as shown in the **Build** tab in the Output pane. You must wait for this to complete before making more changes.

### Customizing your project

You can also make other changes to the project to specify the build model, for example to suppress compiler warning messages. To do this you must change a project setting:

1. Select **Project** → **Project Properties...** from the default Code window main menu to display the Project Properties window.

2. Click on `*COMPILE=arm` in the left pane to see the contents.

3. Double-click on `Messages` in the right pane to see the contents.

4. Double-click on `Warning` in the right pane to see the contents.

5. Right-click on `Suppress_warnings` in the right pane and select **enabled** from the context menu.

6. Select **File** → **Save and Close** from the menu to close the Project Properties window.

RealView Debugger regenerates the makefiles, as shown in the **Build** tab in the Output pane. You must wait for this to complete before making more changes.

### 4.2.6 Project base directory

When the new project setup is complete, your project base directory is updated with the files required to manage your new project. These are the:

- project file `tutorial.prj`
- build target configuration directories `Debug`, `Release`, and `DebugRel`
- generated makefiles for each build target configuration, for example `tutorial_Debug.mk`.

**Note**

The project source files do not have to be in the project base directory, although this is recommended for single-user, self-contained projects.

### 4.2.7 Building the application

If you have the ARM C compiler installed on your workstation, you can now build the application defined by the example project `tutorial.prj`. If you do not have the compiler installed, you can follow the steps to complete the tutorial but you cannot build an executable.

To build the executable for the example project:

1. Select **Tools** → **Build...** from the default Code window main menu.
2. If you have made any changes to the Project Properties, or to the Build-Tool Properties, you are prompted to rebuild all project files.

   Click **Yes** to confirm the rebuild.

The build, or rebuild, completes and RealView Debugger displays the **Build** tab, in the Output pane, to report successful completion. The **Build** tab also displays any errors or warnings generated during the build.

### 4.2.8 Project files

The project you have just created is a single-user, self-contained project. This means that the project base directory now contains all the files associated with the tutorial project, as described in Table 4-1.

**Table 4-1 Tutorial project files**

| Project contains | Directory/filename | Description |
|---|---|---|
| Debug directory | `Debug` | This area contains the object files and the executable ready for debugging or execution.<br>By default, `Debug` is specified as the active configuration for this project. This means that this is the build target configuration that is built and loaded. Change this using the Project Properties window to view, and amend, the `CONFIGURATION` group, shown in Figure 4-4 on page 4-7. |
| DebugRel directory | `DebugRel` | This area is empty. |
| Release directory | `Release` | This area is empty. |
| Source files | `dhry_1.c`<br>`dhry_2.c`<br>`dhry.h` | The original source files and headers for the project. If any files have been edited, this area also includes the backup files (see *Backup files* on page 4-11). |
| Project file | `tutorial.prj` | The project settings file, using the project name specified when the project was created. This is identified as the first entry in the project settings, shown in Figure 4-4 on page 4-7.<br>If the project settings have been edited, this area also includes the backup file (see *Backup files* on page 4-11). |
| makefiles | `tutorial_Debug.mk`<br>`tutorial_DebugRel.mk`<br>`tutorial_Release.mk` | The makefiles generated by RealView Debugger for each build target configuration (see *Generated makefiles* on page 4-32).<br>The filenames and the rules can be changed in the project settings using the Project Properties window to view, and amend, the `BUILD` group, shown in Figure 4-4 on page 4-7. |

### Executable files

By default, the executable image created in this project is saved in `install_directory\Tutorial\Debug\tutorial.axf`. You can copy this file to another location or share it with others in your development team. You can load the image to a target processor without opening the project first. However, where you have created a user-defined project, it is recommended that you open the project first to load and debug the associated image. Opening the project enables you to access the project properties, save new settings, or make changes to the build model.

### Backup files

If you make any changes to the project during your current session, a backup file is automatically created to enable you to recover from any accidental editing or to restore previous settings. Similarly, changing a source file in the File Editor pane also creates a backup file for safety. These files are given the `.bak` extension by default, for example `dhry_1.c.bak`, and `tutorial.prj.bak`, and are located in the project base directory.

## 4.2.9 Closing the project

The default Code window title bar shows the name of your new project:

```
RVDEBUG(tutorial) = @ARM7TDMI_0:ARM-A-RR [Unattached]
```

The project is automatically associated with the connection. This is called project *binding*. The project name, `tutorial`, is enclosed in round brackets to show that it is bound to the connection.

**Note**

If several projects are open, the title bar shows the name of the *active* project. See the chapter describing managing projects in *RealView Debugger v1.6 User Guide* for details on controlling projects.

You can keep projects open while you are debugging. This might be useful to add new files to the project or if source files change. It is not necessary to keep the project open to debug the executable you just created.

To close the project, select **Project** → **Close Project...** from the Code window main menu. Because there is only one open project, it closes immediately.

——— **Note** ———

If you have loaded the image created by your project, RealView Debugger gives you the option to unload the image. Unload the image associated with the project to avoid the creation of an auto-project (see *Working with images* on page 4-16 for more details).

———

The Code window title bar shows that the project is no longer open.

Any files displayed in the File Editor pane remain after the parent project closes. To close the file shown on the top tab, either:

- select **File** → **Close** from the Code window main menu
- right-click on the file tab and select **Close** from the context menu.

If any file has been edited, you are warned and given the option to save the file before it closes. A backup copy of the previous version is saved by default, unless you have changed this in your workspace.

If you have several files displayed in the File Editor pane, the next tab is brought to the top and you can then close this one in the same way.

In the next part of the tutorial you use the debugging features of RealView Debugger to load an executable image and monitor execution. It is not necessary to exit RealView Debugger at this stage.

## 4.3 Debugging with RealView Debugger

This section gives you step-by-step instructions to carry out some basic debugging tasks. These examples use the sample project `dhrystone.prj`, supplied as part of the RealView Debugger base installation. If you prefer, you can use the executable built in *Setting up your first project* on page 4-3 and saved in the tutorial project, `tutorial.prj`.

If you are not licensed to use RealView Debugger extensions, your Code window might look different to the one shown in the rest of this tutorial. This does not affect the tutorial.

This section contains the following subsections:

- *Getting started*
- *Basic debugging tasks* on page 4-14
- *Using breakpoints* on page 4-22.

### 4.3.1 Getting started

Complete these steps so that you can follow the rest of the tutorial:

1. Start RealView Debugger, as described in *Starting RealView Debugger* on page 3-2.
2. Connect to the `ARM7TDMI` core processor using ARMulator, as described in *Making a connection* on page 3-5.
3. Select **Project → Open Project...** to open the required project, for example *`install_directory`*`\examples\demo_ARM\dhrystone\dhrystone.prj`.
4. Click on the hyperlink in the File Editor pane to load the associated image, for example *`install_directory`*`\examples\demo_ARM\dhrystone\Debug\dhrystone.axf`.

   This location has been derived automatically from the project information.

The default Code window title bar shows the name of your open project:

```
RVDEBUG(dhrystone) = @ARM7TDMI_0:ARM-A-RR [Unattached]
```

**Note**

If you are using the supplied source files, RealView Debugger might warn that the source is more recent than the executable. This message can be ignored.

### 4.3.2 Basic debugging tasks

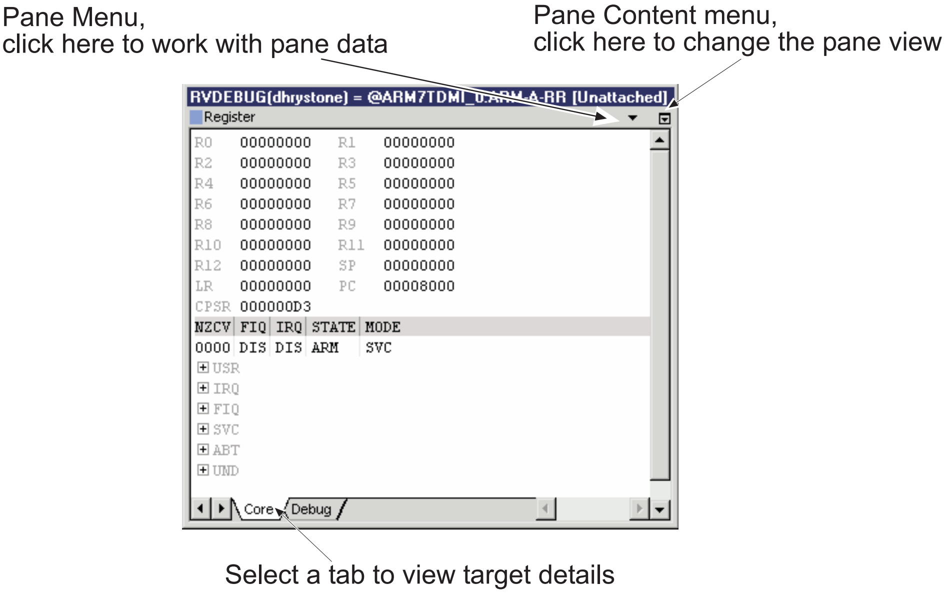
In your debugging session RealView Debugger enables you to examine registers, memory contents, and variables:

- *Displaying register contents*
- *Changing register contents* on page 4-15
- *Process control* on page 4-16
- *Displaying memory contents* on page 4-17
- *Displaying variables* on page 4-19
- *Tooltip evaluation* on page 4-19
- *Using the call stack* on page 4-20
- *Using browsers and lists* on page 4-21
- *Setting watches* on page 4-21.

#### Displaying register contents

To display register contents for the loaded image:

1. Select **View** → **Pane Views** → **Registers** from the default Code window to display the Register pane. It looks like the example in Figure 4-5.



Pane Menu,
click here to work with pane data
Pane Content menu,
click here to change the pane view
RVDEBUG(dhrystone) = @ARM7TDMI_0:ARM-A-RR [Unattached]
Register
Core
Debug
Select a tab to view target details

```
R0   00000000   R1   00000000
R2   00000000   R3   00000000
R4   00000000   R5   00000000
R6   00000000   R7   00000000
R8   00000000   R9   00000000
R10  00000000   R11  00000000
R12  00000000   SP   00000000
LR   00000000   PC   00008000
CPSR 000000D3
NZCV FIQ IRQ STATE MODE
0000 DIS DIS ARM   SVC
⊞USR
⊞IRQ
⊞FIQ
⊞SVC
⊞ABT
⊞UND
```

**Figure 4-5 Register pane**

The Register pane displays tabs appropriate to the target processor running your image and the target vehicle used to make the connection. For the ARM7TDMI core using ARMulator, the pane includes the **Core** tab, showing the base registers for the connected target processor, and the **Debug** tab, showing internal debugger variables. For full details on the contents of this tab see the chapter describing monitoring execution in *RealView Debugger v1.6 User Guide*.

2. Click the **Pane** menu and select **Show Enumerations as Values** from the available options. This displays the register contents as values rather than enumerated strings. The Register pane is refreshed.

3. Click the **Pane** menu and unselect **Show Enumerations as Values**.

### Changing register contents

To change the contents of registers:

1. Click on the **Core** tab in the Register pane.

2. Right-click in the Mode field of the *Current Program Status Register* (CPSR) register (SVC) to display the context menu shown in Figure 4-6.

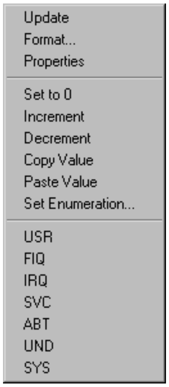


**Figure 4-6 Changing register contents**

3. Select **Set Enumeration...**. This opens a selection box where you can specify the context-sensitive value to modify the selected register entry.

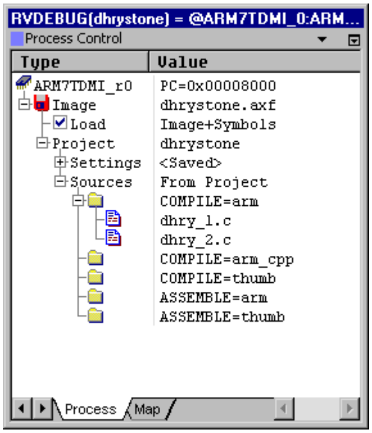
4. Select FIQ from the list of available options and click **OK** to change the Mode field of the CPSR from SVC (0013) to FIQ (0011). This updates the contents of the ARM banked registers, R8 to R14, shown in the pane. Similarly, if you are in SVC mode and you change the contents of R13 in the SVC bank (SP), the contents of R13 (SP) change to match.

In this example, the value can also be changed by selecting **FIQ** from the list of values from the context menu shown in Figure 4-6 on page 4-15.

### Process control

To display the Process Control pane:

1. Select **View** → **Pane Views** → **Process Control Pane** from the default Code window. It looks like the example in Figure 4-7.



| Type | Value |
|---|---|
| ARM7TDMI_r0 | PC=0x00008000 |
| Image | dhrystone.axf |
| ☑ Load | Image+Symbols |
| Project | dhrystone |
| Settings | <Saved> |
| Sources | From Project |
| | COMPILE=arm |
| | dhry_1.c |
| | dhry_2.c |
| | COMPILE=arm_cpp |
| | COMPILE=thumb |
| | ASSEMBLE=arm |
| | ASSEMBLE=thumb |

**Figure 4-7 Process Control pane**

The **Process** tab shows details about your current process. If you are debugging a single process application, this is the same as viewing the processor details. In this example, you can identify the target processor and see details about your project and the loaded image.

2. Right-click on an entry in this pane, for example `dhrystone.axf`, and select **Properties** from the context menu. This displays a text box giving more information on the chosen item.

#### *Working with images*

Where you have created a user-defined project, it is recommended that you open this first to load and debug the associated image, or images. This enables you to access the project properties, save new settings, or make changes to the build model. In this example, the user-defined project is open so project settings have been used to populate entries in the **Process** tab.

When an image is loaded directly to a debug target, RealView Debugger checks to see if an auto-project exists for that image in the same location. Where no auto-project exists, RealView Debugger creates an in-memory project to use in the current session.

An auto-project is a custom, image control, project that holds project settings where the build model is unknown. You can view these settings using the Project Properties window. Using an auto-project enables you to amend and save image load parameters where you do not have a user-defined project or where you have no control over the build model. You also have the option to use the saved auto-project as the basis of a user-defined project.

**Note**

If you load an image built as part of a user-defined project without opening the project you cannot access all the project properties because these are unknown to RealView Debugger. In this case, RealView Debugger creates an in-memory project, or uses the saved auto-project file.

See the chapter on working with images in *RealView Debugger v1.6 User Guide* for details on using auto-projects in RealView Debugger.

### Displaying memory contents

To display an area of memory:

1. Select **View** → **Pane Views** → **Memory** from the default Code window to display the Memory pane.
2. Right-click on an entry `<NoAddr>` to display the context menu shown in Figure 4-8.

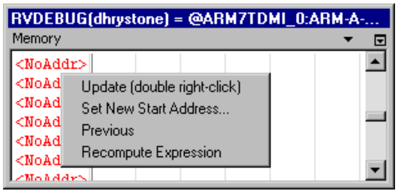
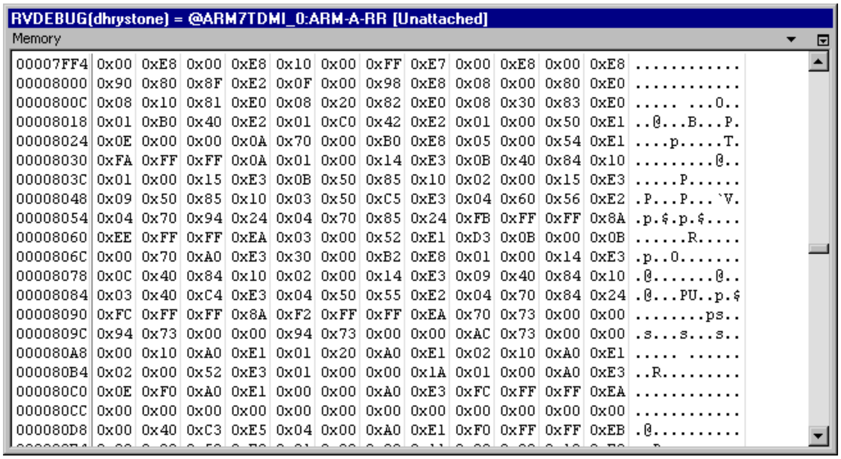


**Figure 4-8 Memory address menu**

3. Select **Set New Start Address...** to display the address prompt box.
4. Enter `0x8000` as the new start address and click **Set** to confirm your choice and close the prompt.
5. ▼ Click on the Memory pane **Pane** menu and select **Show ASCII** to display the updated memory contents, shown in Figure 4-9 on page 4-18.



```
00007FF4 0x00 0xE8 0x00 0xE8 0x10 0x00 0xFF 0xE7 0x00 0xE8 0x00 0xE8 ............
00008000 0x90 0x80 0x8F 0xE2 0x0F 0x00 0x98 0xE8 0x08 0x00 0x80 0xE0 ............
0000800C 0x08 0x10 0x81 0xE0 0x08 0x20 0x82 0xE0 0x08 0x30 0x83 0xE0 ..... ...0..
00008018 0x01 0xB0 0x40 0xE2 0x01 0xC0 0x42 0xE2 0x01 0x00 0x50 0xE1 ..@...B...P.
00008024 0x0E 0x00 0x00 0x0A 0x70 0x00 0xB0 0xE8 0x05 0x00 0x54 0xE1 ....p.....T.
00008030 0xFA 0xFF 0xFF 0x0A 0x01 0x00 0x14 0xE3 0x0B 0x40 0x84 0x10 .........@..
0000803C 0x01 0x00 0x15 0xE3 0x0B 0x50 0x85 0x10 0x02 0x00 0x15 0xE3 .....P......
00008048 0x09 0x50 0x85 0x10 0x03 0x50 0xC5 0xE3 0x04 0x60 0x56 0xE2 .P...P...`V.
00008054 0x04 0x70 0x94 0x24 0x04 0x70 0x85 0x24 0xFB 0xFF 0xFF 0x8A .p.$.p.$....
00008060 0xEE 0xFF 0xFF 0xEA 0x03 0x00 0x52 0xE1 0xD3 0x0B 0x00 0x0B ......R.....
0000806C 0x00 0x70 0xA0 0xE3 0x30 0x00 0xB2 0xE8 0x01 0x00 0x14 0xE3 .p..0.......
00008078 0x0C 0x40 0x84 0x10 0x02 0x00 0x14 0xE3 0x09 0x40 0x84 0x10 .@.......@..
00008084 0x03 0x40 0xC4 0xE3 0x04 0x50 0x55 0xE2 0x04 0x70 0x84 0x24 .@...PU..p.$
00008090 0xFC 0xFF 0xFF 0x8A 0xF2 0xFF 0xFF 0xEA 0x70 0x73 0x00 0x00 ........ps..
0000809C 0x94 0x73 0x00 0x00 0x94 0x73 0x00 0x00 0xAC 0x73 0x00 0x00 .s...s...s..
000080A8 0x00 0x10 0xA0 0xE1 0x01 0x20 0xA0 0xE1 0x02 0x10 0xA0 0xE1 ..... ......
000080B4 0x02 0x00 0x52 0xE3 0x01 0x00 0x00 0x1A 0x01 0x00 0xA0 0xE3 ..R.........
000080C0 0x0E 0xF0 0xA0 0xE1 0x00 0x00 0xA0 0xE3 0xFC 0xFF 0xFF 0xEA ............
000080CC 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ............
000080D8 0x00 0x40 0xC3 0xE5 0x04 0x00 0xA0 0xE1 0xF0 0xFF 0xFF 0xEB .@..........
```

**Figure 4-9 Updated memory contents**

Click on the **Pane** menu again and select **Set Number of Columns to show...** to choose how many columns are used in the memory display, for example `12`. If you do not specify the number used (or specify zero), RealView Debugger displays as many columns as it can fit into the pane.

6. Click the **Go** button on the Actions toolbar to execute the image. Enter a large number of runs, for example `50000`.

7. Click **Stop Execution** to stop the program before it finishes and view the updated memory contents, shown in dark blue in the Memory pane.

   At the next update, memory contents might be colored light blue. This shows that they changed at the previous update. Seeing the update depends on the memory contents that you can see and where execution stops.

8. Click on the file tab for the source file `dhry_1.c` and locate `scanf` at line 124.

9. Double-click on `scanf` so that it is highlighted and then drag it to the Memory pane where you can drop it into the display. This is a quick way to display a chosen location in the Memory pane,

   Use the **Pane** menu, or right-click in an address entry in the Memory pane, to select the display format and modify the address range of the memory area that you want to see.

You can change memory contents displayed in the Memory pane using in-place editing.

### Displaying variables

To display the value of a variable from your source code:

1. Select **File** → **Reload Image to Target** to reload the image.
2. Click the **Go** button on the toolbar to execute the image for a number of runs, for example `5000`.
3. Select the required variable in the current context, for example click on the file tab for the source file `dhry_1.c` and move to line 301. Highlight the variable `Ptr_Glob` in the expression:

   ```
   structassign (*Ptr_Val_Par->Ptr_Comp, *Ptr_Glob);
   ```

4. Right-click to display the **Source Variable Name** menu, shown in Figure 4-10.

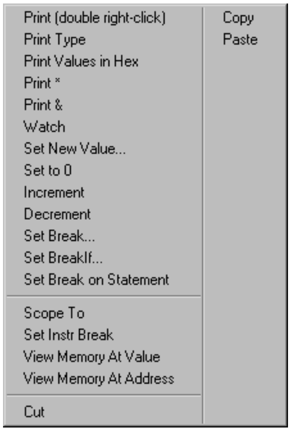


**Figure 4-10 Source Variable Name menu**

5. Select **Print** to view the value of the chosen variable in the current context. This is displayed in the **Cmd** tab of the Output pane.
6. Select **View Memory At Value** to display the memory view at this location.

### Tooltip evaluation

Use **Tooltip Evaluation** to see hover-style evaluation when you hold your mouse pointer, for two seconds, over a variable in the **Src** tab, or a register in the **Dsm** tab.

This option is enabled by default. Select **Edit** → **Editing Controls** → **Tooltip Evaluation** to disable this for the current Code window.

### Using the call stack

The Call Stack pane enables you to follow the flow of your program by examining the current status of functions and variables. This pane shows you the path that leads from the main entry point to the currently executing function.

To monitor your execution path:

1. Select **View** → **Pane Views** → **Call Stack** from the default Code window to display the Call Stack pane.

2. Select **File** → **Reload Image to Target** to reload the image.

3. Click the **Go** button on the Actions toolbar to execute the image. Enter a large number of runs, for example `50000`.

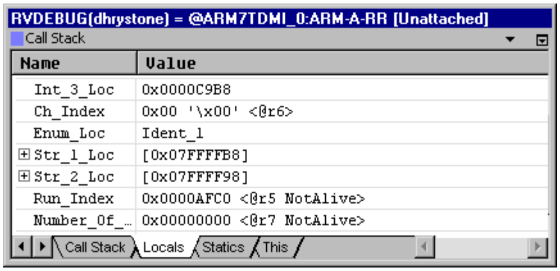
4. Click **Stop Execution** to stop the program before it finishes.

   The **Call Stack** tab, in the Call Stack pane, displays details of the functions currently on the stack and awaiting execution.

5. Right-click on an entry in the Call Stack pane, to see the **Function** context menu.

   This menu enables you to carry out operations on the chosen function in the stack, for example to scope to that function.

6. Click on the **Locals** tab in the Call Stack pane. This displays a list of the variables that are local to the current function, shown in the example in Figure 4-11.



RVDEBUG(dhrystone) = @ARM7TDMI_0:ARM-A-RR [Unattached]

Call Stack

| Name | Value |
|---|---|
| Int_3_Loc | 0x0000C9B8 |
| Ch_Index | 0x00 '\x00' <@r6> |
| Enum_Loc | Ident_1 |
| ⊞ Str_1_Loc | [0x07FFFFB8] |
| ⊞ Str_2_Loc | [0x07FFFF98] |
| Run_Index | 0x0000AFC0 <@r5 NotAlive> |
| Number_Of_… | 0x00000000 <@r7 NotAlive> |

**Figure 4-11 Local variables in the Call Stack pane**

   If a variable is a structure or an array, a plus sign is added to the entry in the Call Stack pane. You can click on this to expand the variable to see all elements of the structure or array.

7. Right-click on an entry in the **Locals** tab, to see the **Variables** context menu.

8. Click on the **Statics** tab, to see non-local variables, that is module statics.

### Using browsers and lists

RealView Debugger provides lists browsers and lists to help with debugging tasks. These enable you to search through your source files to look for specific structures and to monitor their status during program execution. Browsers are available for:

- project modules and files
- functions
- variables
- C++ classes.

To access the browsers:

1. Select **Find** from the default Code window main menu to display the **Find** menu.

   The list of available lists is at the bottom of the menu.

2. Select **Function List...** to display the Function List.

3. Highlight the required function in the list.

4. Use the controls in the dialog box to:
   - view details about the function
   - perform actions, for example scoping to the function or setting a breakpoint
   - display the source-level view or the disassembly-level view.

5. Click **Close** to close the Function List.

See the chapter describing working with browsers in *RealView Debugger v1.6 User Guide* for full details on using browsers and lists.

### Setting watches

Watches monitor variables during execution of your image.

To set a series of watches and to monitor their value during execution of the image:

1. Select **File** → **Reload Image to Target** to reload the image.

2. Click the **Go** button on the Actions toolbar to execute the image. Enter a large number of runs, for example `50000`.

3. Click **Stop Execution** to stop the program before it finishes.

4. Select **View** → **Pane Views** → **Watch** from the default Code window to display the Watch pane.

5. Highlight the required variable in the current context.

6. Right-click to display the **Source Variable Name** menu, shown in Figure 4-10 on page 4-19.

7. Select **Watch** from the menu. This adds the chosen variable to the Watch pane and displays the current value, if known.

8. Click the **Go** button on the toolbar to execute the image.

9. Click the **Stop Execution** button to stop the program before it finishes.

   With the processor halted, monitor changes in the variables in the Watch pane. Depending on where you halted execution, values that changed at the last pane update are displayed in dark blue. Values that changed at a previous pane update are displayed in light blue.

   You can remove variables from the Watch pane. Highlight the entry and press Delete. The values list is refreshed after the entry has been removed.

### 4.3.3 Using breakpoints

Breakpoints are specified locations where execution should stop. The breakpoint is triggered either by:

- execution reaching the specified address
- data values at the specified location, in the current context, changing or becoming equal to a particular value.

Breakpoints let you suspend program execution when the program accesses specific memory locations, variables, or functions. You can define conditions that are tested or qualify the breakpoint to define when execution stops. This section describes:

- *Breakpoint types*
- *Actions and qualifiers* on page 4-23
- *Managing breakpoints* on page 4-25.

#### Breakpoint types

RealView Debugger enables you to use different types of breakpoint when you are debugging your image. Breakpoint types are dependent on the hardware support provided by your debug target:

**Simple** These breakpoints enable you to test address-specific data values. These breakpoints can be either hardware or software breakpoints.

Simple breakpoints are supported by all ARM processors.

**Complex** These breakpoints use advanced hardware support on your target processor, or as implemented by your simulator software.

Check your hardware characteristics, and your vendor-supplied documentation, to determine the level of support for complex breakpoints.

RealView Debugger provides the Set Address/Data Break/Tracepoint dialog box that enables you to specify your breakpoint details and to define how execution continues after the breakpoint triggers. This is described in full in the chapter describing working with breakpoints in *RealView Debugger v1.6 User Guide*.

#### *Viewing your hardware characteristics*

To see your hardware support for complex breakpoints select **Debug** → **Complex Breakpoints** → **Show Break Capabilities of HW...** from the default Code window main menu. This displays an information box describing the support available for your target processor.

**Note**

If you are using the default ARMulator to simulate an ARM processor, this does not support the use of complex breakpoints.

### Actions and qualifiers

Breakpoints are also classified depending on the action taken by RealView Debugger to trigger the breakpoint:

**Unconditional**

The program stops if execution reaches the specified location.

**Conditional** The program stops if execution reaches the specified location and one or more predefined conditions are met. The conditions that must be satisfied can be defined based on data values or on counters.

#### *Setting conditional breakpoints*

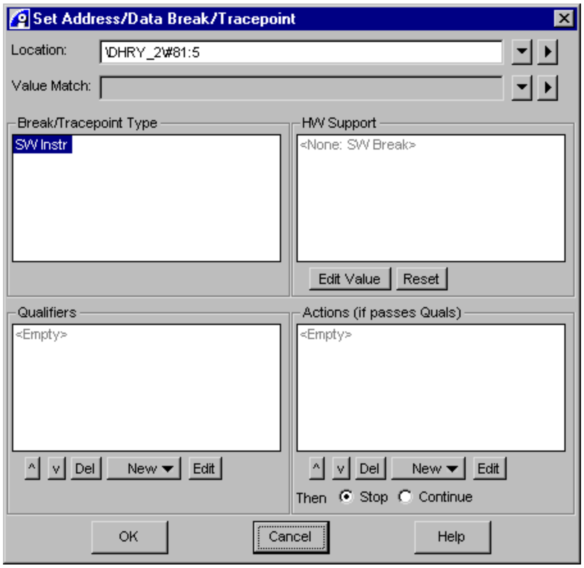
Use the Set Address/Data Break/Tracepoint dialog box to set a simple, conditional breakpoint:

1. Select **File** → **Reload Image to Target** to reload the image.
2. Select **File** → **Open...** and open the source file `dhry_2.c` so that it is displayed in the File Editor pane.
3. Scroll through the source file `dhry_2.c` and locate the line:

```
81 }/* Proc_7 */
```

4. Right-click on the line number and select **Set Break...** from the context menu to display the Set Address/Data Break/Tracepoint dialog box shown in Figure 4-12.

   If the line number is not visible, then right-click inside the gray area at the left of the required statement or on the line of code to display the context menu.



Set Address/Data Break/Tracepoint

Location: \DHRY_2#81:5

Value Match:

Break/Tracepoint Type: SW Instr

HW Support: <None: SW Break>

Qualifiers: <Empty>

Actions (if passes Quals): <Empty>

Then ● Stop ○ Continue

**Figure 4-12 Set Address/Data Break/Tracepoint dialog box**

Because you are using ARMulator to simulate an `ARM7TDMI` processor, the breakpoint types available are limited. A software instruction breakpoint is highlighted and the Location field is prefilled.

Depending on the Break/Tracepoint Type you select, the Location or the Value Match field might be unavailable. In this case, the field is grayed out.

5. Click **New** to specify the Qualifiers or conditions for the new breakpoint. This displays the **New Qualifiers** menu.

6. Select **When Expression True...** from the menu.

7. Enter the condition `Int_Glob==5` in the prompt.

8. Click **Set** to confirm the entry and close the prompt box.

   The breakpoint condition is shown in the Qualifiers group display.

9. Click **OK** to close the Set Address/Data Break/Tracepoint dialog box. The code view is updated and a yellow disc appears to show that a conditional breakpoint has been set. The **Cmd** tab, in the Output pane, shows the RealView Debugger command used to set the breakpoint.

10. Click the **Go** button on the toolbar to execute the image. When the breakpoint is reached, execution stops and RealView Debugger displays a message in the **Cmd** tab of the Output pane to identify the point in the source code where the program stopped.

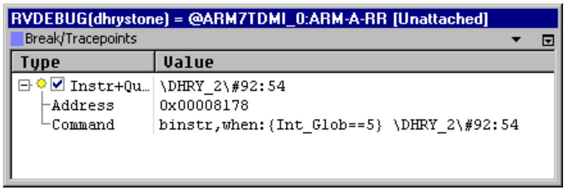
11. Click **Go** again to complete execution.

If you try to set a breakpoint on a non-executable line, RealView Debugger looks for the first executable line immediately following and places the breakpoint there. If the lines preceding the breakpointed instruction are comments, declarations, or other non-executable code, they are marked with black, downward pointing arrows. Lines marked in this way are regarded as part of the breakpoint. You cannot place two unconditional breakpoints on the same line, or on lines marked by the downward pointing arrows.

### Managing breakpoints

To display the current breakpoint details:

1. Select **View** → **Pane Views** → **Break/Tracepoints Pane** from the default Code window to display the Break/Tracepoints pane, shown in Figure 4-13.



RVDEBUG(dhrystone) = @ARM7TDMI_0:ARM-A-RR [Unattached]

Break/Tracepoints

| Type | Value |
|---|---|
| ⊟ ● ☑ Instr+Qu… | \DHRY_2\#92:54 |
| Address | 0x00008178 |
| Command | binstr,when:{Int_Glob==5} \DHRY_2\#92:54 |

**Figure 4-13 Break/Tracepoints pane**

This shows the conditional breakpoint you set previously, the address, and the RealView Debugger command used to create it. The check box is selected to show that the breakpoint is enabled.

2. Right-click anywhere on the breakpoint entry, in the Break/Tracepoints pane, to display the **Break/Tracepoints** menu.

   From here, you can examine the breakpoint, edit or copy it, or disable it so that it is ignored the next time the program runs.

You can remove entries from the Break/Tracepoints pane. Highlight the entry and select **Clear** from the **Break/Tracepoint** menu. The breakpoints list is refreshed after the entry has been removed.

## 4.4 Working with custom panes

If you are working in single-processor debugging mode, the default Code window gives you full access to your code views and all debugging operations. However, you might want to display multiple memory views for your debug target, or to view multiple panes at the same time. You can customize your desktop to get the views you want.

See Chapter 6 *RealView Debugger Desktop* for:

- details on the contents of the Code window
- full details on working with panes
- a description of the controls used in the rest of this section.

This section describes:

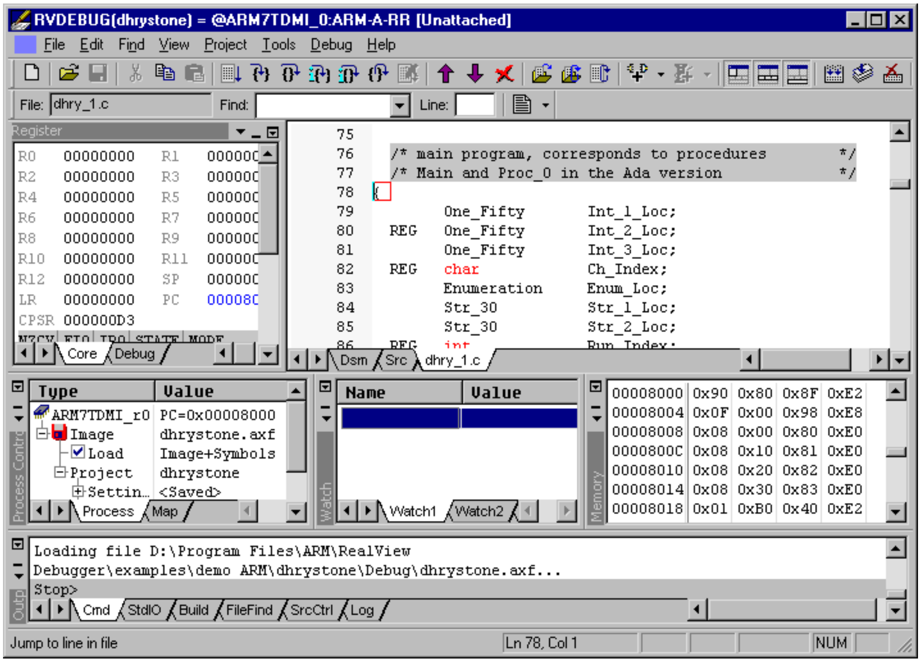
- *Customizing your debug views*
- *Hiding panes* on page 4-28.

### 4.4.1 Customizing your debug views

To set up the default Code window and customize the panes:

1. Select **View** → **Pane Views** → **Registers** to view the Register pane, **Core** tab.
2. Click the **Pane Content** menu in the Register pane and select **Switch Side** to reposition the pane.
3. Select **View** → **Pane Views** → **Call Stack** to view the Call Stack pane, **Call Stack** tab.
4. Click the **Pane Content** menu in the Call Stack pane and select **Process Control** to change the debug view.

Your default Code window looks like the example shown in Figure 4-14 on page 4-28.



```
R0   00000000   R1   00000C
R2   00000000   R3   00000C
R4   00000000   R5   00000C
R6   00000000   R7   00000C
R8   00000000   R9   00000C
R10  00000000   R11  00000C
R12  00000000   SP   00000C
LR   00000000   PC   00008C
CPSR 000000D3
NZCV FIQ IRQ STATE MODE
```

```
  /* main program, corresponds to procedures        */
  /* Main and Proc_0 in the Ada version             */
{
        One_Fifty       Int_1_Loc;
  REG   One_Fifty       Int_2_Loc;
        One_Fifty       Int_3_Loc;
  REG   char            Ch_Index;
        Enumeration     Enum_Loc;
        Str_30          Str_1_Loc;
        Str_30          Str_2_Loc;
  REG   int             Run_Index;
```

```
Type                Value
ARM7TDMI_r0         PC=0x00008000
  Image             dhrystone.axf
    ☑ Load          Image+Symbols
  Project           dhrystone
    Settin...       <Saved>
```

```
Name        Value
```

```
00008000 0x90 0x80 0x8F 0xE2
00008004 0x0F 0x00 0x98 0xE8
00008008 0x08 0x00 0x80 0xE0
0000800C 0x08 0x10 0x81 0xE0
00008010 0x08 0x20 0x82 0xE0
00008014 0x08 0x30 0x83 0xE0
00008018 0x01 0xB0 0x40 0xE2
```

```
Loading file D:\Program Files\ARM\RealView
Debugger\examples\demo ARM\dhrystone\Debug\dhrystone.axf...
Stop>
```

Jump to line in file        Ln 78, Col 1

**Figure 4-14 Example Code window**

In Figure 4-14, line numbering is turned on by selecting **Edit** → **Editing Controls** → **Show Line Numbers**.

## 4.4.2 Hiding panes

You can use the Pane Management controls, on the Actions toolbar, to define which panes are visible in your Code windows, for example click **Hide Bottom Pane** from the Pane Management controls to hide the Output pane in the Code window shown in Figure 4-14.

## 4.5 More about projects

This section gives more detail on how to manage your projects in RealView Debugger and enables you to make more changes to the tutorial project, if required. It contains the following sections:

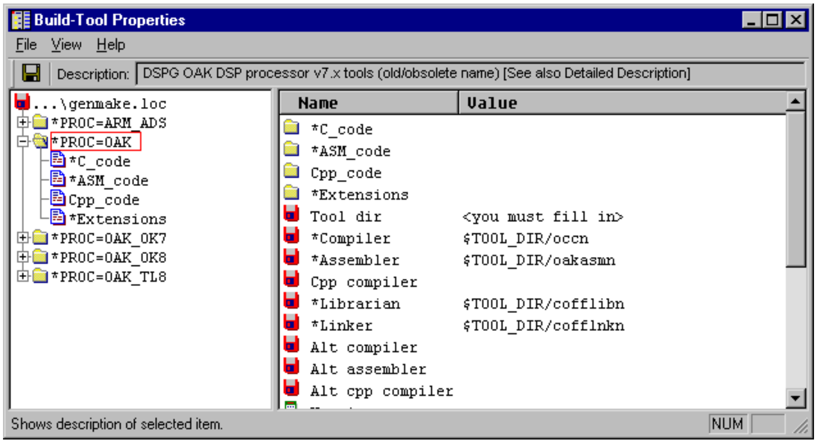
- *Changing build tools*
- *Viewing build settings* on page 4-30
- *Adding files to your project* on page 4-31
- *Generated makefiles* on page 4-32
- *Building an application* on page 4-33
- *Finding build errors* on page 4-33.

### 4.5.1 Changing build tools

You can specify the location of a default toolchain to use when building applications and images. You can set up a tools location at any time but it is recommended that you do this before creating your first project.

To set up a different build tools location:

1. Select **Project → Build-Tool Properties...** from the Code window main menu. This displays the Build-Tool Properties window shown in Figure 4-15.



Description: DSPG OAK DSP processor v7.x tools (old/obsolete name) [See also Detailed Description]

```
...\genmake.loc
+ *PROC=ARM_ADS
- *PROC=OAK
    *C_code
    *ASM_code
    Cpp_code
    *Extensions
+ *PROC=OAK_OK7
+ *PROC=OAK_OK8
+ *PROC=OAK_TL8
```

| Name | Value |
|---|---|
| *C_code | |
| *ASM_code | |
| Cpp_code | |
| *Extensions | |
| Tool dir | <you must fill in> |
| *Compiler | $TOOL_DIR/occn |
| *Assembler | $TOOL_DIR/oakasmn |
| Cpp compiler | |
| *Librarian | $TOOL_DIR/cofflibn |
| *Linker | $TOOL_DIR/cofflnkn |
| Alt compiler | |
| Alt assembler | |
| Alt cpp compiler | |

Shows description of selected item.

**Figure 4-15 Setting the build tools location for a Custom installation**

2. Double-click on a group, in the left pane, to specify the toolchain to use. This displays the contents in the right pane. This is shown in the example in Figure 4-15.

3. Right-click on the `Tool_dir` entry and select **Edit as Directory Name** from the context menu. This displays the Enter New Directory dialog box where you can specify the location of the toolchain you want to use. This forms the base directory for the executable tools for this family of processors.

4. Select **File** → **Save and Close** to save your changes and close the Build-Tool Properties window.

If you have a common linker command file or your own runtime libraries, for example kernel, ASIC (*Application Specific Integrated Circuit*), and peripheral drivers, you can specify them for all projects at this stage. To make the changes:

1. Select **Project** → **Build-Tool Properties...** from the Code window main menu.

2. Double-click on the `*PROC=ARM_ADS` group in the left pane to expand the tree.

3. Double-click on `C_code` in the right pane.

4. Right-click on `Def_cmd_file` and select **Edit as Filename** from the context menu. This displays the Enter New Filename dialog box where you can specify the location of the linker command file.

5. Right-click on `Def_lib_cmd_file` and select **Edit as Filename** from the context menu. This displays the Enter New Filename dialog box where you can specify the location of the librarian command file.

6. Select **File** → **Save and Close** to save your changes and close the Build-Tool Properties window.

### 4.5.2 Viewing build settings

The Project Properties window includes another window that enables you to see a summary of the compiler, assembler, and linker command lines generated by the current project settings. This window provides a read-only display of the command-line switches for each of the current build target configurations.

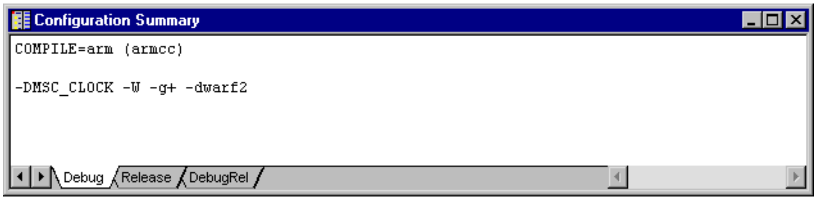
To view your current compiler settings:

1. Select **Project** → **Open Project...** to open the required project, for example `*install_directory*\examples\demo_ARM\dhrystone\dhrystone.prj`.

2. Select **Project** → **Project Properties...** to display the Project Properties window.

3. Click on `*COMPILE=arm` in the left pane of the Project Properties window to see the ARM C compiler (`armcc`) command line.

4. Select **View** → **Configuration Summary** to display the Configuration Summary window, shown in Figure 4-16 on page 4-31.



Configuration Summary

```
COMPILE=arm (armcc)

-DMSC_CLOCK -W -g+ -dwarf2
```

**Figure 4-16 Configuration Summary window**

This window contains one tab for each of the build target configurations specified for the chosen group, that is `Debug`, `Release`, and `DebugRel`.

If you change a compiler setting, the Configuration Summary window updates automatically.

5. Click on `*ASSEMBLE=arm` in the left pane of the Project Properties window to see the ARM assembler (`armasm`) command line in the Configuration Summary window.

6. Select **File** → **Close Window** from the menu to close the Project Properties window without making any changes.

If you select an entry in the left pane that does not contain compiler, assembler, or linker settings, for example `*CONFIGURATION`, the Configuration Summary window displays the message:

```
NO COMPILE, ASSEMBLE or BUILD group is selected.
```

If you close the Project Properties window without closing the Configuration Summary window first, RealView Debugger displays both windows automatically when you next open the Project Properties window in this session.

## 4.5.3 Adding files to your project

You can change your project properties at any time after creation, for example you can add source files, add object files, delete files, or exclude files from the build.

### Adding source files to a project

With a project open, you can add source files and so update the project properties automatically. There are two ways to do this, depending on the location of the file you want to add:

- Select **Project** → **Add This File to Project** to add the file currently displayed in the topmost tab in the File Editor pane to the list of project sources.

- Select **Project** → **Add Files to Project...** to display the Select File(s) to Add dialog box where one or more files can be added to the project.

**Note**

Make sure that the Project Properties window is not open when adding source files from the **Project** menu. Also ensure that any rebuild is complete.

### Adding object files to a project

If you want to add object files to your project you must use the Project Properties window, shown in Figure 4-4 on page 4-7. For full details of how to do this, see the chapter describing managing projects in *RealView Debugger v1.6 User Guide*.

## 4.5.4 Generated makefiles

RealView Debugger uses the template `gen_***.mk` to generate makefiles for all projects. The `***` is replaced depending on your default processor family and toolchain. In this tutorial project, RealView Debugger uses the template `gen_arx.mk` located in the directory *`install_directory`*`\etc`.

The makefiles are generated when you do any of the following:

- create a new project
- edit and save an existing project
- edit and close the Build-Tool Properties window
- update the Project Properties window, for example doing an edit and save.

Details about the makefile generation process are given in the **Build** tab of the Output pane.

**Note**

You can also force the makefiles to be regenerated if necessary. This is explained in the chapter describing managing projects in *RealView Debugger v1.6 User Guide*.

### Viewing the makefile

You can view the makefile that is generated using RealView Debugger, for example either:

- Select **File** → **Open...** from the default Code window main menu to display the Select File to Open dialog box where you can locate the makefile and open it in the File Editor pane for viewing.
- Open Windows Explorer and navigate to the project base directory. Drag the makefile and drop it into the File Editor pane where it opens for viewing.

Do not make any changes to the generated makefiles as these are overridden when the files are next generated. It is recommended that you always use the Project Properties window to set up your preferences.

### 4.5.5 Building an application

To build the executable for a project:

1. Select **Project** → **Open Project...** to open the required project.
2. Select **Tools** → **Build...** from the default Code window main menu.
3. If you have made any changes to the Project Properties, or to the Build-Tool Properties, you are prompted to rebuild all project files.

   Click **Yes** to confirm the rebuild.

The build, or rebuild, completes and RealView Debugger displays the **Build** tab, in the Output pane, to report successful completion. If the build process fails, the **Build** tab reports any errors.

In the build process:

- RealView Debugger builds the executable as a background task. This is shown by an exclamation mark in the **Build** tab. You can still submit commands or use RealView Debugger during the build.
- The `Debug` build target configuration is built by default.
- The `-f` flag forces the `make` utility to read the specified file, `tutorial_Debug.mk`, as a makefile.
- The `all` flag forces a rebuild of all project files.

You can click the **Stop Build** button on the Actions toolbar to halt a build.

### 4.5.6 Finding build errors

Errors in your source code always result in a failed build and the executable is not built. In these cases, you must locate and correct these errors. RealView Debugger includes features to help locate errors in the source files when the build process fails.

#### Build error reporting

The error reporting system:

- highlights the error text in the Output pane **Build** tab
- scrolls the file in the File Editor pane to the location of the error

- places a blue pointer at the error
- places the flashing text cursor in the source file after the error.

If RealView Debugger finds more than one error, it highlights the first error. Select **Tools** → **Next Line/Error** to move through the error list after correcting an error. Alternatively, you can go directly to an error by double-clicking on the line number, shown in the Output pane **Build** tab.

## 4.6 Completing the tutorial

Because the tutorial project is self-contained, follow these steps if you want to tidy up the *install_directory*\Tutorial directory after you close down RealView Debugger.

### 4.6.1 Removing tutorial project files

To remove the files associated with the project:

1. Delete the project file *install_directory*\Tutorial\tutorial.prj.
2. Delete the build target configuration directories, for example:

   *install_directory*\Tutorial\Debug
3. Delete the target generated makefiles, for example:

   *install_directory*\Tutorial\tutorial_Debug.mk
4. Delete any backup files with the .bak extension.

The project is now deleted from your workstation.

### 4.6.2 Removing the tutorial project

If you do not want to keep the files copied at the start, or the executable image, you can delete the entire tutorial project base directory, that is *install_directory*\Tutorial.

# Chapter 5
# Ending your RealView Debugger Session

This chapter describes how to end your debugging session and how to exit RealView Debugger. It contains the following sections:

- *Saving the session* on page 5-2
- *Disconnecting from a target* on page 5-5
- *Exiting RealView Debugger* on page 5-7.

## 5.1 Saving the session

RealView Debugger stores session details by default when you end your debugging session. Saving the session enables you to start your next session using the same working environment, connecting automatically to a specified target, and opening projects.

RealView Debugger stores session details using your:

- *Workspace*
- *Startup file* on page 5-3
- *History file* on page 5-3
- *Settings options* on page 5-4.

### 5.1.1 Workspace

The RealView Debugger workspace is used for visualization and control of default values, and storing persistence information. It includes:

- user-defined options and settings
- connection details
- details about open windows and, in some cases, their contents
- user-defined projects or auto-projects to open on startup.

The first time that you run RealView Debugger, the default workspace settings file `rvdebug.aws` is created in your home directory. Each time you start RealView Debugger after this, it loads this workspace automatically, but you can change the defaults or create a new workspace of your own.

To change your workspace, select **File** → **Workspace** from the main menu to display the **Workspace** menu shown in Figure 5-1.

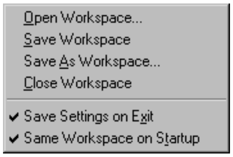


**Figure 5-1 Workspace menu**

Alternatively, you can run RealView Debugger from the command line without loading a workspace, for example:

```
"C:\Program Files\ARM\RealView Debugger v1_6\bin\rvdebug.exe" -aws=-
```

For full details on amending your workspace settings to define how session details are saved and where, see the chapter describing configuring workspaces in *RealView Debugger v1.6 User Guide*.

### 5.1.2 Startup file

The startup file contains a record of your last debugging session including:

- images and files loaded into RealView Debugger
- the list of all recently loaded files, for example source files
- the recent workspaces list
- the workspace to be used on startup, if specified
- workspace save and restart settings
- user-defined menu settings, for example pane format options
- the recent projects list.

By default, this file is called `rvdebug.sav`. The first time you close down RealView Debugger after performing an operation in the default Code window a startup file is created in your home directory. From this point on, every time you close down RealView Debugger and exit, this startup file is updated. You can specify a different startup file, or none at all, by changing your workspace settings.

### 5.1.3 History file

The history file contains a record of:

- commands submitted during a debugging session, for example, changing directory, loading source files, loading an image for execution, or setting breakpoints
- data entries examined in the Code window during debugging
- the Set Directory and Set File lists used in Open dialog boxes, for example Select File to Open, or Select File to Include Commands from
- personal favorites such as variables, data values, watches, and breakpoints.

The first time you run RealView Debugger, carry out an operation, and then exit, a history file is created in your home directory. By default, this is called `exphist.sav` and is updated at the end of all subsequent debugging sessions.

### 5.1.4 Settings options

By default, RealView Debugger writes your current settings to your startup file ready for re-use, saves your current workspace, and reloads this workspace at the next start-up.

To change these defaults, select **File** → **Workspace** from the main menu to display the **Workspace** menu shown in Figure 5-1 on page 5-2.

At the bottom of this menu are your current settings options. Enable or disable the required options to decide how your next RealView Debugger session starts. For example, if **Same Workspace on Startup** is unselected, RealView Debugger does not use the current workspace at the next start-up. This means that, unless another workspace is specified on the command line, RealView Debugger opens the default workspace.

These options are saved in your startup file when you exit RealView Debugger.

## 5.2 Disconnecting from a target

You can disconnect from the current target quickly, depending on your current debugging mode. Either:

- Select **File** → **Connection** → **Disconnect** from the Code window main menu.

  This immediately disconnects the connection.

- Select **File** → **Connection** → **Connect to Target...** from the Code window main menu to display the Connection Control window, and unselect the check box to disconnect the connection.

RealView Debugger Code windows do not close when you disconnect from a target. However, if you have an image loaded, disconnecting removes all the debug information from RealView Debugger and this clears pane contents.

Disconnecting does not close any open projects.

**Note**

It is not necessary to disconnect from a target before you close down RealView Debugger, see *Exiting RealView Debugger* on page 5-7 for more details.

### 5.2.1 Setting disconnect mode

You can control the way a target processor is left after you disconnect. This is particularly useful when debugging multiprocessor debug targets and working with multiple threads. In single processor debugging mode, you might want to leave an image executing but close down RealView Debugger.

If you are connected, you can set disconnect mode:

1. Select **File** → **Connection** → **Connect to Target...** to display the Connection Control window.
2. Right-click on the connection entry and select **Disconnect (Defining Mode)...** from the **Connection** context menu.
3. Select the required state from the selection box.

   The options listed depend on your execution vehicle.
4. Click **OK** to disconnect and leave the processor in the required state.

If you set disconnect mode from the Connection Control window, this temporarily overrides any setting in your target configuration file. See the chapter describing connecting (and disconnecting) in *RealView Debugger v1.6 Target Configuration Guide* for full details on setting disconnect mode for your debug target.

## 5.3 Exiting RealView Debugger

This section describes the options available when you exit RealView Debugger:

- *Closing down without a connection*
- *Closing down with a connection*
- *Reconnecting to a target* on page 5-8.

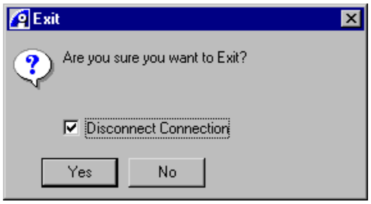
### 5.3.1 Closing down without a connection

Disconnect from your target, as described in *Disconnecting from a target* on page 5-5, and select **File** → **Exit** to display the Exit dialog box.

Click **Yes** to close the Exit dialog box and close down RealView Debugger.

### 5.3.2 Closing down with a connection

If you are connected to your target and you select **File** → **Exit**, the Exit dialog box includes the **Disconnect Connection** check box, shown in Figure 5-2.



Exit

Are you sure you want to Exit?

☑ Disconnect Connection

**Figure 5-2 Exit dialog box, connected**

Use the check box to specify your disconnect options:

- *Maintaining the connection*
- *Terminating the connection* on page 5-8.

#### Maintaining the connection

To close down and maintain the connection:

1. Unselect the **Disconnect Connection** check box shown in Figure 5-2.

2. Click **Yes** to close the Exit dialog box and close down RealView Debugger.

RealView Debugger exits but the connection is maintained for future sessions, that is the *Target Vehicle Server* (TVS) is left running. If you are connected to a remote debug target and you close down this way, the remote RealView Debugger Connection Broker is also left running.

### Terminating the connection

To close down and terminate the connection:

1. Leave the **Disconnect Connection** check box, shown in Figure 5-2 on page 5-7, so that it is selected.
2. Click **Yes** to close the Exit dialog box and close down RealView Debugger.

RealView Debugger exits and terminates any connections to debug targets, that is TVS stops. If you are connected to a remote debug target and you close down this way, you must stop the remote RealView Debugger Connection Broker manually.

——— **Note** ———

See *Components of RealView Debugger* on page 1-4 for details on TVS and RealView Debugger Connection Broker.

## 5.3.3 Reconnecting to a target

RealView Debugger saves all open connections in the current workspace if you close down without disconnecting first. This default behavior is independent of the status of the **Disconnect Connection** check box shown in Figure 5-2 on page 5-7.

If you exit a session when still connected to a debug target, RealView Debugger tries to reconnect when you next open the workspace. However, this might fail if the connection or vehicle status has changed, for example if your Multi-ICE server has stopped.

If RealView Debugger reconnects successfully, the connection mode specified in the target configuration file is used by default. See the chapter describing connecting in *RealView Debugger v1.6 Target Configuration Guide* for full details on defining the connect mode for your debug target.

——— **Note** ———

Use your settings options to change the way RealView Debugger closes down, see *Settings options* on page 5-4 for details.

# Chapter 6
# RealView Debugger Desktop

This chapter describes, in detail, the RealView Debugger desktop. It describes the contents of the default Code window, and explains how to change them. This chapter describes items and options available from the main menu and the toolbars.

It contains the following sections:

## 6.1 About the desktop

This section describes the default Windows desktop that you see when you run RealView Debugger for the first time after installation and highlights any key features that might be different. It contains the following sections:

- *Splash screen*
- *Code window*
- *Default windows and panes* on page 6-5
- *Pane controls* on page 6-8
- *Button toolbars* on page 6-8
- *Color Box* on page 6-9
- *Other window elements* on page 6-10.

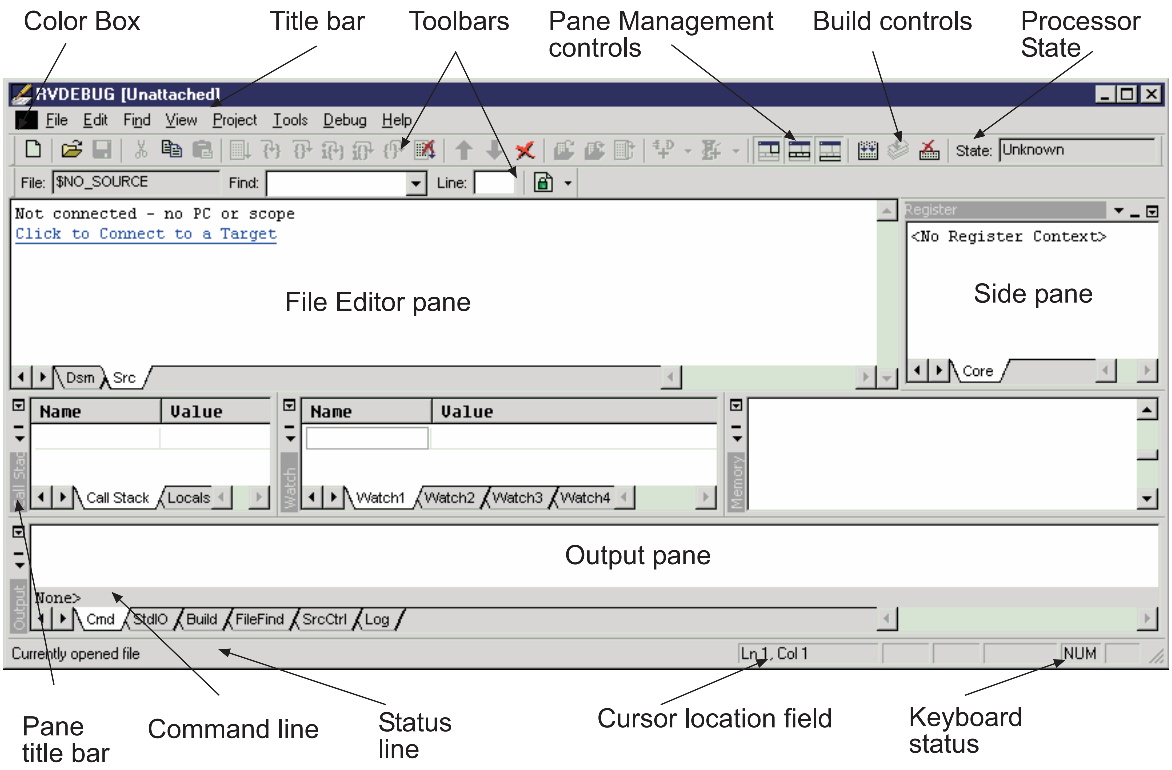
### 6.1.1 Splash screen

Run the debugger from the Windows **Start** menu to display the RealView Debugger splash screen. During this time, the debugger is checking your environment and creating (or updating) configuration files and a working directory.

Use the `-nologo` flag to run RealView Debugger from the command line without a splash screen.

### 6.1.2 Code window

The Windows splash screen is replaced by the default Code window when you run RealView Debugger for the first time after installation, shown in Figure 6-1 on page 6-3.



RVDEBUG [Unattached]

File: $NO_SOURCE

State: Unknown

Not connected - no PC or scope
Click to Connect to a Target

<No Register Context>

Ln 1, Col 1

**Figure 6-1 Default Code window**

The Code window is your main debugging and editing window. The contents of this window change as you:

- connect to targets
- load and unload application programs or files
- configure and customize your working environment.

The toolbar buttons displayed, and the options available from window and pane menus also change depending on the licenses you have.

### Title bar

The Code window title bar gives details of the connection and any processes running on your debug target. If you connect to a target and load an image, your title bar looks like the one shown in Figure 6-2 on page 6-4.

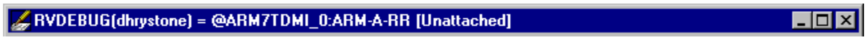

RVDEBUG(dhrystone) = @ARM7TDMI_0:ARM-A-RR [Unattached]

**Figure 6-2 Title bar**

In addition to the application icon, the title bar contains (from left to right):

**RVDEBUG** Identifies the Code window. This changes as you open new windows, for example `RVDEBUG_1`, or `RVDEBUG_2`.

**(dhrystone)** The project associated with the image that you loaded.

In RealView Debugger, a project can be associated with a connection, that is it is *bound* to that connection, shown in Figure 6-2.

Where a project is not associated with a particular connection, it is *unbound*. In this case, the project name is enclosed in angled brackets, for example `<my_project>`.

See the chapter describing managing projects in *RealView Debugger v1.6 User Guide* for details on project binding.

**@ARM...** The connection, including the target processor, the connection number, and the execution vehicle.

**[Unattached]**

The attachment of the window to a specified connection.

If you are working in multiprocessor mode, the default Code window is unattached. You can attach a Code window to a specified connection, shown by `[Board]`. See the chapter describing working with multiple targets in *RealView Debugger v1.6 Extensions User Guide* for details.

If you are using an RTOS, you can attach a Code window to a thread to display debug information for that thread. This is shown by `[Thread]`. See the chapter describing RTOS support in *RealView Debugger v1.6 Extensions User Guide* for details.

If you are working in single processor debugging mode, the option to attach windows to your connection is not available.

If you float a pane, the pane title bar reflects the title bar of the calling Code window.

**——— Note ———**

The contents of your title bar might be different from the one shown in Figure 6-2 depending on your connection (if any), open projects, and windows attachment.

### 6.1.3 Default windows and panes

RealView Debugger provides a range of debug views:

- Registers
- Stack
- Process Control
- Symbol Browser
- Watch
- Call Stack and Locals
- Memory and Memory Map
- Threads (with the appropriate RTOS support package)
- Break/Tracepoints.

The default Code window, shown in Figure 6-1 on page 6-3, contains:

**File Editor pane**

The File Editor pane is always visible when working with RealView Debugger.

Use this area of the Code window to:

- use a shortcut to connect to a target or load an image
- enter text to create project files
- open source files for editing and resaving
- view disassembly
- set breakpoints to control execution
- use the available menu options to search for specific text as part of debugging
- follow execution through a sequence of source-level and disassembly-level views.

The File Editor pane contains a hyperlink to make your first connection to a debug target. When a connection is made, this link changes to give you a quick way to load an image.

When RealView Debugger first starts, the File Editor pane contains tabs to track program execution:

- the **Src** tab shows the current context in the source view
- the **Dsm** tab displays disassembled code with intermixed C/C++ source lines.

If you load an image, or when you are working with source files, more tabs are displayed, for example `dhry_1.c`. In this case, click on the **Src** tab to see the location of the PC.

**Side pane** By default, this contains the Register pane view that displays grouped processor registers for the current target processor. When you first run RealView Debugger, this pane is positioned to the right of the File Editor pane but you can switch this pane to the left, using the **Switch Side** option from the **Pane Content** menu.

The Register pane displays different tabs depending on the target processor and the connection mechanism. For example, if you are using ARMulator to simulate an ARM processor, the **Debug** tab displays debugger internals. However, if the target processor is a DSP, a **Status** tab is available displaying details of the status flags.

**Middle pane row**

The middle pane row can contain one, two, or three pane views, but you can specify which panes are visible. By default this row contains:

**Call Stack pane**

Use this pane to:

- display the procedure calling chain from the entry point to the current procedure
- monitor local variables.

The Call Stack pane contains tabs:

**Call Stack**

Displays the stack functions call chain.

**Locals** Shows variables local to the current function.

**Statics** Displays a list of static variables local to the current module.

**This** Shows objects located by the C++ specific `this` pointer.

**Watch pane**

Use this pane to:

- set up variables or expressions to watch
- display current watches
- modify watches already set
- delete existing watches.

The Watch pane contains tabs to display sets of watched values. The first tab, **Watch1**, is selected by default.

**Memory pane**

Use this pane to:

- display the contents of a range of memory locations on the target
- edit the values stored by the application.

**Bottom pane**

The bottom pane of the Code window always contains the Output pane. Select the different tabs to:

- enter commands during a debugging session (**Cmd**)
- handle I/O with your application (**StdIO**)
- see the progress of builds (**Build)**
- see the results of Find in Files operations (**FileFind**)
- see the results of operations using your version control tool (**SrcCtrl**)
- view the results of commands and track events during debugging (**Log**).

The command line is located at the bottom of the Output pane. This shows the status of the current process, for example, `Stop`, `Run`, or `None` (no process). You can also enter debugger commands at the `>` prompt.

During your debugging session, you can use the **Pane Content** menu to define which view is displayed in a chosen pane (see *Pane controls* on page 6-8 for details). At the end of your first session, you can configure RealView Debugger to start next time with a different set of panes or views if required by saving the customized setup in your workspace.

### Changing panes

Select **View** → **Pane Views** to change what is displayed in a pane view or to restore the default views. You can also use this menu to display any window or pane that is hidden, without changing the view it displays. If a pane is hidden and you use the **Pane Views** menu to change the pane contents, it is automatically displayed to show the new view.

### Formatting pane views

The contents of the File Editor pane and the Output pane cannot be changed. However, you can define how the view is formatted, for example change the size of text displayed in the File Editor pane or the number of lines displayed in the Output pane. See the chapter describing configuring workspaces in *RealView Debugger v1.6 User Guide* for details of how to do this.

### 6.1.4 Pane controls

Each configurable pane in the Code window, shown in Figure 6-1 on page 6-3, includes a title bar and pane controls. In the side pane, the pane title bar is displayed horizontally at the top of the pane. In the middle and bottom panes, the title bar is displayed vertically at the left side of the pane.

If you float a pane, the title bar is displayed horizontally at the top of the window.

A pane contains the controls:

**Pane Content**

Click this button to display the **Pane Content** menu where you can change the debug view in the pane.

The selected option in the menu indicates the current view.

**Visual controls**

The visual controls are at the bottom of the **Pane Content** menu. Use these to float or hide the pane.

In the side pane, use the option **Switch Side** to move the pane from the right side of the Code window so that it is positioned to the left of the code view.

**Expand/Collapse Pane**

Click this button to collapse the currently selected view. Other panes are expanded to fill the empty area.

Click the **Expand Pane** button to restore the view.

There is no option to collapse, or expand, a floating pane.

**Pane Menu** Click this button to display the **Pane** menu.

Use this to:

- change the display format
- change how pane contents are updated
- extract data from the pane.

The options available from this menu depend on the pane.

### 6.1.5 Button toolbars

There are two toolbars, below the Code window main menu, that provide quick access to many of the features available from menu options:

- Actions toolbar, shown in Figure 6-3 on page 6-9
- Editing toolbar, shown in Figure 6-4 on page 6-9.

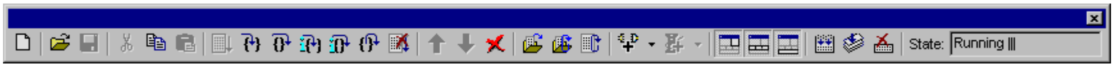


**Figure 6-3 Actions toolbar**

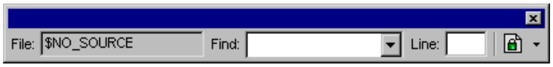


**Figure 6-4 Editing toolbar**

To disable a toolbar, select **View** → **Toolbars** from the main menu. This displays the **Toolbars** menu where you can specify which toolbars are visible.

You can move a toolbar from the default position in the Code window so that it floats on your desktop. To restore the floating toolbar, double-click anywhere on the toolbar title bar.

——— **Note** ———

Repositioning a toolbar in this way applies only to the calling Code window. If you create a new Code window the toolbars are in the default positions on opening.

See *Working with button toolbars* on page 6-15 for details on the buttons available from the Actions toolbar and the Editing toolbar, and how to customize toolbar groups.

### 6.1.6 Color Box

Code windows in RealView Debugger are color-coded to help with navigation. This is particularly useful when debugging multiprocessor debug targets and working with multiple threads.

When connected to a single target processor, the Color Box identifies the connection associated with the window. This is located on the main menu toolbar next to **File**, shown in Figure 6-5.

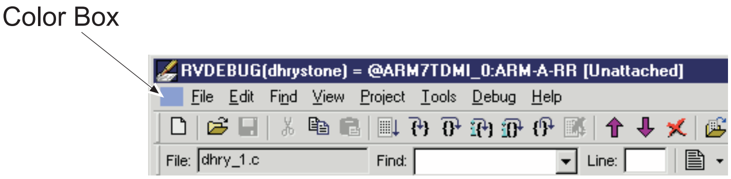


**Figure 6-5 Color Box**

When you first start RealView Debugger the Code window is not associated with any target or process. The Color Box changes when you make your first connection. As you create new Code windows, these are also color-coded. Closing your connection changes the Color Box to show that there is no connection associated with the window. Any other Code windows attached to that connection are also updated to match. Notice that:

- connection-independent windows, or controls, do not contain a Color Box
- floating panes contain a Color Box that matches the calling window.

### 6.1.7 Other window elements

There are status display areas at the bottom of the Code window:

**Status line** As you move through menu options, or when you view button tooltips, this line shows a more detailed explanation of the option or button under the cursor.

**Cursor location field**

As you move through files within the File Editor pane, the current location of the text insertion point is displayed in the Cursor location field at the bottom right of the Code window.

**LOG** Shows that output is being written to a log file.

**JOU** Shows that output is being written to a journal file.

**STDIOlog** Shows that output is being written to an STDIOlog file.

**NUM** Shows that you can use the numeric keypad to enter numbers.

**CAP** Shows that Caps Lock is selected.

## 6.2 Finding options on the main menu

This section provides a summary of the main menu options available from the Code window that enable you to:

- open and close files within the File Editor pane
- manage target images, projects, and workspaces
- navigate, search, and edit source files
- manage new windows and change pane contents
- work with projects and build images
- debug your images
- access the online help system.

The submenus available from the main menu bar are:

**File** Displays the **File** menu shown in Figure 6-6.

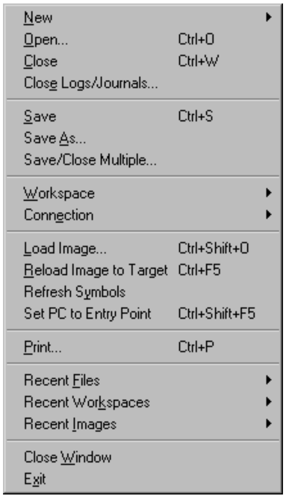


**Figure 6-6 File menu**

——— **Note** ———

The menu option **Close Window** is not enabled when the default Code window is the only window. This is the main debugging and editing window, and it must be open throughout your debugging session. Close the Code window to close down RealView Debugger.

**Edit** Displays the **Edit** menu shown in Figure 6-7. This menu enables you to work with source files as you develop your application. It includes options to define how source code is displayed in the File Editor pane.

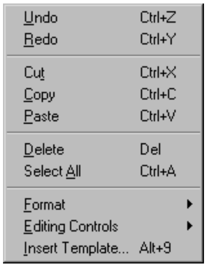


**Figure 6-7 Edit menu**

**Find** Displays the **Find** menu shown in Figure 6-8. This menu enables you to work with source files and to perform searches on those files as you debug your image. This also gives access to the browsers in RealView Debugger.

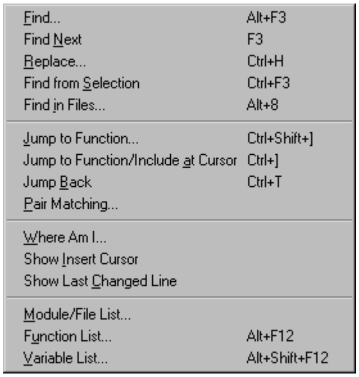


**Figure 6-8 Find menu**

**View** Displays the **View** menu shown in Figure 6-9. This menu enables you to set up new windows and panes as you are working with target connections. It also includes options to customize toolbar groups.

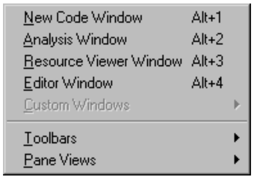


**Figure 6-9 View menu**

**Note**

Custom windows are not available in this release.

**Project** Displays the **Project** menu shown in Figure 6-10. This menu enables you to work with projects so that you can organize your source files, model your build process, and share files with other developers. This can be used in conjunction with the **Tools** menu to rebuild images.

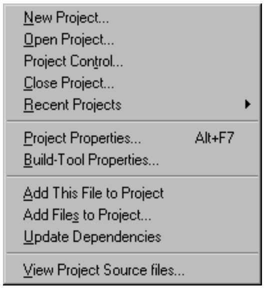


**Figure 6-10 Project menu**

**Tools** Displays the **Tools** menu shown in Figure 6-11.

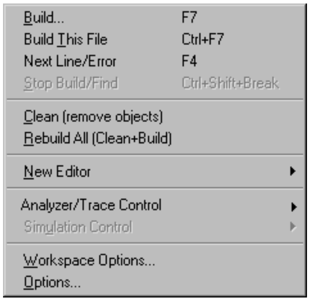


**Figure 6-11 Tools menu**

This menu enables you to build files, or groups of files, to create your image ready for loading to a target. It also enables you to examine, and change, your workspace settings and global configuration options.

If you have the appropriate licenses, you can access RealView Debugger extensions for Trace, Analysis, and Profiling. These features are described fully in *RealView Debugger v1.6 Extensions User Guide*.

**Note**

Supported by selected simulators from the DSP Group, the **Simulation Control** option is not available in this release.

**Debug** Displays the **Debug** menu shown in Figure 6-12.

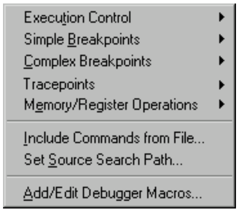

Execution Control
Simple Breakpoints
Complex Breakpoints
Tracepoints
Memory/Register Operations
Include Commands from File...
Set Source Search Path...
Add/Edit Debugger Macros...

**Figure 6-12 Debug menu**

This menu includes the main facilities you use during a debugging session.

**Help** Displays the **Help** menu shown in Figure 6-13.

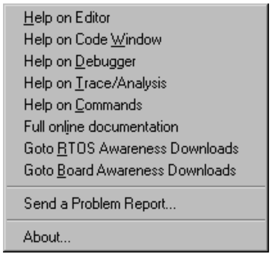


**Figure 6-13 Help menu**

This menu gives you access to the RealView Debugger online help, to web downloads pages, and displays details of your version of RealView Debugger. You can also use this menu to create and submit a *Software Problem Report* (SPR).

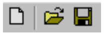
## 6.3 Working with button toolbars

The Code window toolbars give access to many of the features available from the main menu and to additional debugging controls. By default, the Code window shows both toolbars but you can customize which controls are available. This section describes:

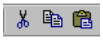
- *Actions toolbar*
- *Editing toolbar* on page 6-16
- *Customizing the Actions toolbar* on page 6-17.

### 6.3.1 Actions toolbar

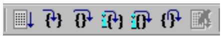
The Actions toolbar, see Figure 6-3 on page 6-9, contains buttons used during debugging sessions and when working with source code:



**File group** Use these buttons when developing applications to open files and to save changed files in the File Editor pane. They replicate selected options from the **File** menu.



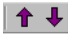
**Edit group** Use these buttons to edit source files in the File Editor pane. They replicate selected options from the **Edit** menu.



**Execution group**

Use these buttons to control program execution, for example starting and stopping execution, and stepping.

These buttons are enabled when an image has been loaded. They replicate selected options from the **Debug** menu.



**Context controls**

Use these buttons to move up and down the stack levels during program execution. These buttons are enabled when an image has been loaded.

**Command cancel**

Commands submitted to RealView Debugger are queued for execution. Click this button to cancel the last command entered onto the queue.

This does not take effect until the previous command has completed.

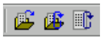
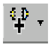


**Image load group**

Use these buttons to control images. They replicate selected options from the **File** menu.

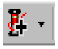


**Connection button**

This button is disabled unless you have the appropriate license.

Used during a multiprocessor debugging session, click this button to connect to the next available active connection. Click on the drop-down arrow to display the list of active connections with the current connection marked with an asterisk.

The list also shows if the Code window is attached by adding a check mark.



**Threads button**

Used during a multithreading debugging session, click this button to change to the next active thread. Click on the drop-down arrow to display the list of active threads where you can identify the current thread.

This button is only enabled when an underlying operating system is supported.

**Pane Management controls**

Use these buttons to control the panes displayed in the Code window.

**Build group** Use these buttons to control the build process during your debugging session. They replicate selected options from the **Tools** menu.

State: Running

**Processor State group**

This field indicates the runtime state of the debug target. This contains:

**Unknown**

Shows that the target state is not known to the debugger.

**Stopped** Shows that the target is connected but not active.

**Running** Shows that an image is currently running. In this case, a running progress indicator is also included.

### 6.3.2 Editing toolbar

The Editing toolbar, see Figure 6-4 on page 6-9, contains:

**File:** This read-only field shows the name of the file currently displayed in the File Editor pane. If you have changed the file since loading or saving, an asterisk, * , is appended to the end of the filename. Hold your mouse pointer over the field to see the full pathname.

If you are working on several files in the File Editor pane, the File field shows the name displayed on the topmost file tab.

**Find:** This field enables you to perform a quick text search on the file currently displayed in the File Editor pane. Type the required string into the Find field and then press Enter. If you are working on several files in the File Editor pane, the search examines only the file in the topmost file tab.

Click on the drop-down arrow to display a list of recently-used search strings.

**Line:** Use the Line number field to enter the number of the line where the text insertion point is to be moved.

If the Line number field is empty, click inside this field and press Enter to display the line number where the text insertion point is currently located. Click inside the field again and press Enter to scroll to this location.

**Source control button**

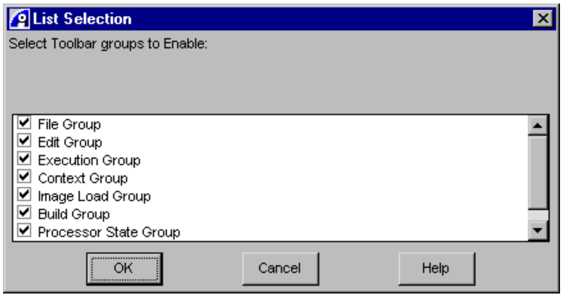
This button indicates the read/write status of the current file. Click this button to change the status of a file.

You can edit a file only if the Read-Write icon is displayed.

Click on the drop-down arrow to access the source control commands (if enabled).

### 6.3.3 Customizing the Actions toolbar

To customize your Actions toolbar, select **View** → **Toolbars** → **Customize...** from the Code window main menu to display the selection box shown in Figure 6-14.



List Selection

Select Toolbar groups to Enable:

☑ File Group
☑ Edit Group
☑ Execution Group
☑ Context Group
☑ Image Load Group
☑ Build Group
☑ Processor State Group

**Figure 6-14 Toolbar groups selection box**

Check boxes show which toolbar groups are currently enabled on the Actions toolbar. Click a selected check box to disable the associated group. Click **OK** to close the selection box and return to the Code window where the disabled groups have been removed from the button toolbar. To re-enable button groups, display the selection box and click on the check boxes so that they are selected.

If you customize a toolbar, this persists to any new Code windows that you open from this calling window. However, you cannot customize the toolbars shown in a standalone Editor window (see *Editor window* on page 6-22).

**Note**

Custom toolbar groups are not available in this release.

## 6.4 Working in the Code window

This section describes how to work with the Code window:

- *Floating, docking, and resizing windows and panes*
- *Changing the focus*
- *In-place editing* on page 6-20
- *Working with tabs* on page 6-21.

### 6.4.1 Floating, docking, and resizing windows and panes

Panes are docked to default positions in the Code window when RealView Debugger starts in the default state. You can resize the middle pane row by dragging the upper boundary to the required height. Similarly, drag the left boundary to a new position to enlarge the side pane. You can enlarge the Output pane by dragging the upper boundary.

A pane is floating when it is displayed separately from the calling window and can be moved around the desktop. To float a pane either:

- select **Float** from the **Pane Content** menu
- double-click on the pane title bar.

A floating pane is still tied to the calling window. If, for example, you float a pane from the middle pane row and then click the **Show/Hide Middle Pane** control in the Code window, the floating pane is also hidden. To restore the pane, click the **Show/Hide Middle Pane** control again.

To dock a floating pane, select **Dock** from the **Pane Content** menu or double-click on the pane title bar.

### 6.4.2 Changing the focus

In RealView Debugger, the focus indicates the window, or pane, where the next keyboard input takes effect. Use a single left-click on the title bar to move the focus to the Code window, or the pane, where you want to work. You can also move between the File Editor pane and the Output pane using Ctrl+Tab or Shift+Ctrl+Tab.

When working with several Code windows, left-click inside a pane entry to change the focus. The pane title bar changes color to show that it now has the focus, and the title bar of the calling Code window is also highlighted.

If you switch to another Code window by clicking on the title bar, the focus moves to that window and the text insertion point is located inside the File Editor pane. If the context of the Code window is unknown, the text insertion point is located at the command-line prompt.

If you double left-click in a pane entry, for example on the contents of a register in the Register pane, this moves the focus to this pane and highlights the entry ready for editing.

If you right-click in a pane that does not have the focus, the focus does not move to this pane. This action does, however, highlight the chosen entry in the new pane. In this case, use the Code window title bar to see where the focus is currently located.

### 6.4.3 In-place editing

In-place editing enables you to change a stored value and to see the results of that change instantly. RealView Debugger offers in-pace editing whenever possible. For example, if you are displaying the contents of memory or registers, and you want to change a stored value:

1. Double-click in the value you want to change, or press Enter if the item is already selected. The value is enclosed in a box with the characters highlighted to show they are selected (pending deletion).
2. Either:
   - enter data to overwrite the highlighted content
   - press the left or right arrow keys to deselect the existing data and position the insertion point where you want to make a change.
3. Press Enter to store the new value in the selected location.

If you press Escape before you press Enter, any changes you have made in the highlighted field are ignored.

In-place editing is not suitable for:

- editing complex data where some prompting is helpful
- editing groups of related items
- selecting values from predefined lists.

In these cases, an appropriate dialog box is displayed.

**Note**

When using in-place editing, you must either complete the entry and press Enter, or press Escape to cancel the operation. If you move the focus to another pane, RealView Debugger suspends the current editing operation so that you can complete it when focus returns. Similarly, if you click inside another pane, or change the current view, RealView Debugger cancels the current editing operation.

### 6.4.4 Working with tabs

You can access RealView Debugger debugging features using tabbed pages or *tabs*. In the Watch pane, for example, there are multiple tabs and each shows a different set of watched variables. The Output pane contains tabs enabling you to select the view that suits your debugging task.

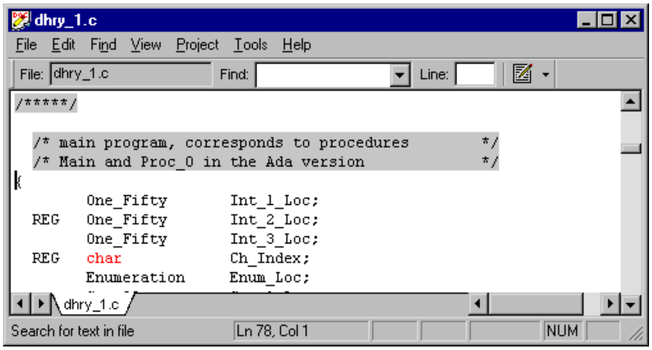
Right-click on a tab to display text that explains the function of the tab or the content. If you are using the default Windows display settings and you right-click on a tab that is not at the front, the tab name being referenced is colored red for easy identification.

If you right-click over a blank area of the tab bar at the bottom of a window or pane, a context menu enables you to select a tab from a list. You can also display this menu by right-clicking on the left, or right, scroll arrow on the left-hand side of the tab bar.

## 6.5 Editor window

RealView Debugger includes a range of editing features to help you work with source code and projects. Use a standalone Editor window to access these editing features so that you can edit files independently of the debugging session or to include these files within your project.

To display a standalone Editor window, select **View** → **Editor Window** from the Code window main menu. This displays a floating Editor window shown in Figure 6-15.



File: dhry_1.c

```
/*****/

  /* main program, corresponds to procedures          */
  /* Main and Proc_0 in the Ada version               */
{

        One_Fifty       Int_1_Loc;
  REG   One_Fifty       Int_2_Loc;
        One_Fifty       Int_3_Loc;
  REG   char            Ch_Index;
        Enumeration     Enum_Loc;
```

Search for text in file

Ln 78, Col 1

NUM

**Figure 6-15 Editor Window**

In this example, the window is already loaded with the file displayed in the topmost tab in the parent File Editor pane.

A quick way to display an empty Editor window is to click on the **Dsm** tab and then select **View** → **Editor Window** from the Code window main menu.

——— **Note** ———

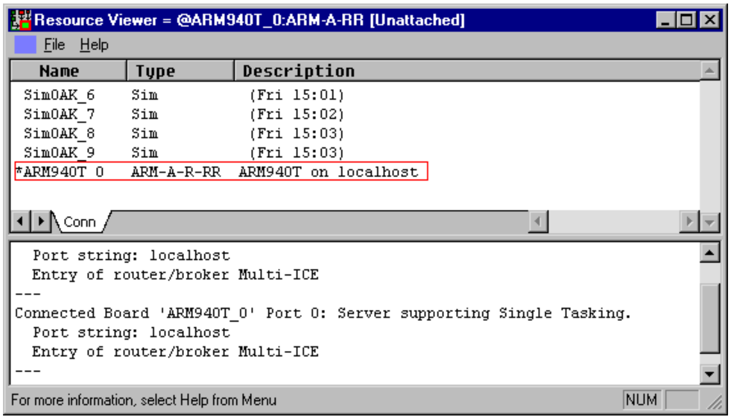
You can also display standalone Editor windows from the **Tools** menu.

———————————

## 6.6 Resource Viewer window

The Resource Viewer gives access to all the debugger resources as your debugging session progresses. With the appropriate OS support package, the Resource Viewer window also gives access to RTOS resources including lists of timers, threads, queues, event flags, and memory in byte and block pools. In this mode, additional tabs are displayed.

To display the Resource Viewer window shown in Figure 6-16, start RealView Debugger in the usual way and select **View** → **Resource Viewer Window** from the Code window main menu.



| Name | Type | Description |
|---|---|---|
| SimOAK_6 | Sim | (Fri 15:01) |
| SimOAK_7 | Sim | (Fri 15:02) |
| SimOAK_8 | Sim | (Fri 15:03) |
| SimOAK_9 | Sim | (Fri 15:03) |
| *ARM940T_0 | ARM-A-R-RR | ARM940T on localhost |

```
  Port string: localhost
  Entry of router/broker Multi-ICE
---
Connected Board 'ARM940T_0' Port 0: Server supporting Single Tasking.
  Port string: localhost
  Entry of router/broker Multi-ICE
---
```

For more information, select Help from Menu

**Figure 6-16 Resource Viewer window**

Because RealView Debugger is running, this window displays the starting state of the debugger. The contents of this window change as you establish new target connections, start applications, and debug your images.

The title bar shows the connection, and the Color Box at the left of the window menu bar shows the attachment status of the calling window.

The Resource Viewer window includes:

- *File menu* on page 6-24
- *Help menu* on page 6-24
- *Resources list* on page 6-25
- *Details area* on page 6-25.

### 6.6.1 File menu

This menu contains:

**Update List** Rereads the board file and updates the items displayed in the Resources list. This might be necessary if you change your connection without closing the Resource Viewer window.

**Display Details**

Displays details about a selected entry in the Resources list. A short description is shown in the Details area in the window. You can also display details about an item by double-clicking on the entry in the Resources list.

This is the default display format when you open the Resource Viewer window.

**Display Details as Property**

Select this option to display details information in a properties box.

Select this option to change the default display format while the window is open. Close the Resource Viewer window to restore the default, that is a description is shown in the Details area.

**Clear Log** Clears messages and information displayed in the Details area.

**Auto Update Details on Stop**

Automatically updates the Details area when any image running on the connection stops. This gives you information about the state of the connection when the process terminated. In multiprocessor debugging mode, this applies across all connections.

**Auto Update** Automatically updates the Resources list as you change debugger resources. Selected by default.

**Close Window**

Closes the Resource Viewer window.

### 6.6.2 Help menu

Select **Help** from the Resource Viewer window menu bar to display the **Help** menu.

This menu gives you access to the RealView Debugger online help and displays details of your version of RealView Debugger. You can also use this menu to create and submit a problem report.

### 6.6.3 Resources list

The Resources list box displays all the resources available to RealView Debugger. In single-processor debugging mode, it contains only the **Conn** tab showing the connection.

In multiprocessor debugging mode, the **Conn** tab shows all active connections. An asterisk (*) indicates the current connection.

If you are debugging a multithreaded application, the Resources list box displays a series of tabs, see the chapter describing RTOS support in *RealView Debugger v1.6 Extensions User Guide* for details.

### 6.6.4 Details area

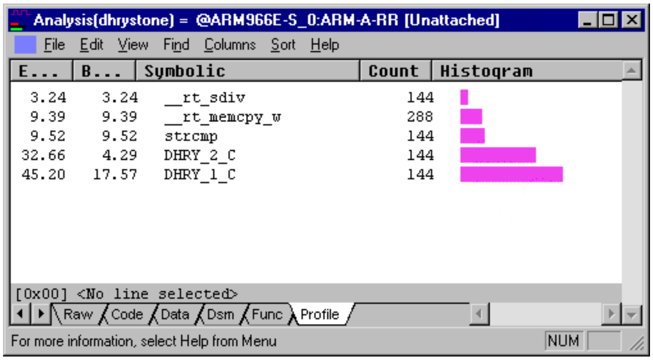
The bottom half of the Resource Viewer window displays information about a chosen entry.

## 6.7 Analysis window

RealView Debugger includes Trace, Analysis and Profiling for use when debugging either single targets or multiple processes. If you have a Trace license, the Analysis window gives you access to these features.

You can set tracepoints for a trace capture from the Code window and then use the Analysis window to view and analyze the results of the capture. The Analysis window provides access to most of the tracing functionality and enables you to view the captured trace information using the available tabs.

If you are connected to an appropriate debug target, for example an ETM-enabled `ARM966` core, select **View** → **Analysis Window** from the Code window main menu. This displays the Analysis window shown in Figure 6-17.



| E... | B... | Symbolic | Count | Histogram |
|---|---|---|---|---|
| 3.24 | 3.24 | __rt_sdiv | 144 | |
| 9.39 | 9.39 | __rt_memcpy_w | 288 | |
| 9.52 | 9.52 | strcmp | 144 | |
| 32.66 | 4.29 | DHRY_2_C | 144 | |
| 45.20 | 17.57 | DHRY_1_C | 144 | |

[0x00] <No line selected>

For more information, select Help from Menu

**Figure 6-17 Analysis window**

This example shows the results of a trace capture between two tracepoints during execution of the `dhrystone.axf` image. The **Profile** tab shows execution times for functions along with a graphical representation in the `Histogram` column.

To see this display, you must first configure the ETM, set up your trace options and then execute your image. For full details on accessing Trace, Analysis and Profiling options, and using the Analysis window, see the chapter describing tracing in *RealView Debugger v1.6 Extensions User Guide*.

# Appendix A
# Configuration Files Reference

This appendix describes the files set up for a new installation of RealView Debugger v1.6, where they are stored, and what information each file holds. This appendix assumes that you have chosen a Typical installation. It contains the following sections:

- *Overview* on page A-2
- *Files in the etc directory* on page A-3
- *Files in the home directory* on page A-5.

## A.1 Overview

RealView Debugger v1.6 creates files containing default settings and target configuration information when you first install. The files created (or modified) depend on whether you have chosen a Typical installation or a Custom installation. If you are upgrading from an earlier version of RealView Debugger, some files are modified so that previous configuration information is not lost.

When you run the debugger for the first time, some of this information is copied into the RealView Debugger v1.6 default home directory. This is an empty directory created by the installation process. If you are upgrading from an earlier version of RealView Debugger, the installer creates the home directory and copies your existing configuration details into it. This means that this area is not empty when you run the debugger for the first time.

## A.2 Files in the etc directory

When you install RealView Debugger v1.6, files containing default settings and target configuration details are installed in *`install_directory`*`\etc`. What files are installed, and their contents, depend on what other software is detected during the installation, for example ADS 1.2:

`armul.var` A list of ARMulator variants used by RealView Debugger.

You can edit this file to add hand-made variants.

`arm.brd` Processor-specific target configuration settings used in the default board file.

Do not edit this file manually.

`genmake.loc` Specifies the location of the development toolchain used when working with projects. RealView Debugger copies this file into the default home directory (when you first create a project) or merges project details (when you first work with an existing project).

Do not edit this file manually.

`gen_arx.mk` Toolchain-specific template used by the `genmake` program to generate makefiles.

You can edit this file to modify the input/output of the `genmake` program.

`genmake_ARM_ADS.loc`

Toolchain-specific makefile template used to define the location of development tools.

Do not edit these files manually.

`pARM.prc` Processor-specific information files used to define support for emulators and simulators, and for project information.

Do not edit these files manually.

`rvdebug.brd` The default board file containing target configuration settings. This file references `.bcd` and `.jtg` files.

`rvdebug.tpl` Template file containing standard templates for editing and using in source files.

`startup.mk` MSDOS `DMAKE` startup file.

You can edit this file if required.

`targ_ARM.aco` Processor-specific instruction format files used by RealView Debugger to color assembler code in the File Editor.

Do not edit this file manually.

`template.spr` SPR template used by RealView Debugger.

Do not edit this file manually.

`*.bcd` Board/chip definition files supplied by hardware manufacturers.

If you want to make changes to these files, copy them into your default home directory and edit them using the Connection Properties window.

`*.jtg` JTAG configuration files for non-RDI targets.

`*.stp` RealView Debugger internal template files containing debugger defaults. These are used as internal support files or as template files for settings. For example, to support project properties and define options such as workspace settings.

Do not edit these files manually.

For a new installation, some of these files are copied into your RealView Debugger default home directory when the debugger runs for the first time.

## A.3 Files in the home directory

When you install and run RealView Debugger v1.6 for the first time, files containing default settings and target configuration details are copied into your RealView Debugger default home directory where they can be maintained.

If you are upgrading from an earlier version of RealView Debugger, the installer creates the home directory and copies your existing configuration details into it. This means that this area is not empty when you run the debugger for the first time:

`armreg.sig` An internal settings file that is created or updated each time you run RealView Debugger.

Do not edit this file manually.

`exphist.sav` Your personal history file. This file keeps a record of each session and stores your personal favorites, for example breakpoints. This file is updated at the end of each debugging session.

`genmake.loc` Specifies the location of the development toolchain used when working with projects. RealView Debugger copies this file into the default home directory when you first create a project.

`rvdebug.aws` Your default workspace settings file. For a new installation, RealView Debugger creates this file when it runs for the first time. By default, this file is updated at the end of each debugging session.

`rvdebug.brd` Your board file containing target configuration settings. For a new installation, this is a duplicate of the file installed in *`install_directory`*`\etc`.

This file references `.rbe` files and `.bcd` files.

`rvdebug.ini` Specifies global configuration settings used across all workspaces or when working without a workspace. For a new installation, RealView Debugger creates this file when it runs for the first time.

`rvdebug.sav` This file specifies how each RealView Debugger session starts. For a new installation, RealView Debugger creates this file the first time you close down after performing an operation. By default, this file is updated at the end of each debugging session.

`*.auc` These are default target configuration settings files that are created when you first run RealView Debugger, for example `default.auc`.

These files are referenced by the `.rbe` files.

*.bcd Board/chip definition files that you might have copied into your home directory, from *install_directory*\etc, to make changes. Making copies means that the installation files are not changed.

*.cnf These are default target configuration settings files that are created when you first run RealView Debugger, for example armulator.cnf.

These files are referenced by the .rbe files.

*.rbe There is one .rbe configuration file for each available RDI target, for example armulator.rbe. This file is updated when you make changes to the RDI settings.

### A.3.1 Backup files

When you change a configuration file, RealView Debugger makes a backup copy of the current version to enable you to restore your previous settings, for example rvdebug.aws.bak and rvdebug.brd.bak. By default, backup files are given the .bak extension and are stored in the same location as the original file. You can change this behavior in your workspace.

# Glossary

The items in this glossary are listed in alphabetical order, with any symbols and numerics appearing at the end.

**Address breakpoint** A type of breakpoint.

*See also* Breakpoint.

**ADS** *See* ARM Developer Suite.

**Angel** Angel is a software debug monitor that runs on the target and enables you to debug applications running on ARM-based hardware. Angel is commonly used where a JTAG emulator is not available.

**ARM Developer Suite (ADS)**

A suite of software development applications, together with supporting documentation and examples, that enable you to write and debug applications for the ARM family of *RISC* processors.

**ARMulator** ARMulator is an instruction set simulator. It is a collection of modules that simulate the instruction sets and architecture of various ARM processors.

**ATPCS** ARM-Thumb Procedure Call Standard.

**AXYS Oak simulator** The AXYS Oak MaxSim simulator provides a high-end hardware/software model for the Oak DSP Core from the DSP Group Inc. It is available from the RealView Debugger Connection Control window if an Oak DSP license has been obtained.

**Backtracing** *See* Stack Traceback.

**Big-endian** Memory organization where the least significant byte of a word is at the highest address and the most significant byte is at the lowest address in the word.

*See also* Little-endian.

**Board** RealView Debugger uses the term *board* to refer to a target processor, memory, peripherals, and debugger connection method.

**Board file** The *board file* is the top-level configuration file, normally called `rvdebug.brd`, that references one or more other files.

**Breakpoint** A user defined point at which execution stops in order that a debugger can examine the state of memory and registers.

*See also* Hardware breakpoint and Software breakpoint.

**Conditional breakpoint**

A breakpoint that halts execution when a particular condition becomes true. The condition normally references the values of program variables that are in scope at the breakpoint location.

**Context menu** *See* Pop-up menu.

**Core module** In the context of Integrator, an add-on development board that contains an ARM processor and local memory. Core modules can run stand-alone, or can be stacked onto Integrator motherboards.

*See also* Integrator.

**Deprecated** A deprecated option or feature is one that you are strongly discouraged from using. Deprecated options and features will not be supported in future versions of the product.

**Doubleword** A 64-bit unit of information.

**Embedded Trace Macrocell (ETM)**

A block of logic, embedded in the hardware, that is connected to the address, data, and status signals of the processor. It broadcasts branch addresses, and data and status information in a compressed protocol through the trace port. It contains the resources used to trigger and filter the trace output.

**ETM** *See* Embedded Trace Macrocell.

**Halfword** A 16-bit unit of information.

**Hardware breakpoint**

A breakpoint that is implemented using non-intrusive additional hardware. Hardware breakpoints are the only method of halting execution when the location is in *Read Only Memory* (ROM). Using a hardware breakpoint often results in the processor halting completely. This is usually undesirable for a real-time system.

*See also* Breakpoint and Software breakpoint.

**IEEE 1149.1** The IEEE Standard that defines TAP. Commonly (but incorrectly) referred to as JTAG.

*See also* Test Access Port

**Integrator** A range of ARM hardware development platforms. *Core modules* are available that contain the processor and local memory.

**Joint Test Action Group (JTAG)**

An IEEE group focussed on silicon chip testing methods. Many debug and programming tools use a *Joint Test Action Group* (JTAG) interface port to communicate with processors. For further information refer to IEEE Standard, Test Access Port and Boundary-Scan Architecture specification 1149.1 (JTAG).

**JTAG** *See* Joint Test Action Group.

**JTAG interface unit** A protocol converter that converts low-level commands from RealView Debugger into JTAG signals to the EmbeddedICE logic and the ETM.

**Little-endian** Memory organization where the least significant byte of a word is at the lowest address and the most significant byte is at the highest address of the word.

*See also* Big-endian.

**Multi-ICE** A JTAG-based tool for debugging embedded systems.

**Pop-up menu** Also known as *Context menu*. A menu that is displayed temporarily, offering options relevant to your current situation. Obtainable in most RealView Debugger windows or panes by right-clicking with the mouse pointer inside the window. In some windows the pop-up menu can vary according to the line the mouse pointer is on and the tabbed page that is currently selected.

**Processor core** The part of a microprocessor that reads instructions from memory and executes them, including the instruction fetch unit, arithmetic and logic unit and the register bank. It excludes optional coprocessors, caches, and the memory management unit.

**Profiling** Accumulation of statistics during execution of a program being debugged, to measure performance or to determine critical areas of code.

**RDI** *See* Remote Debug Interface.

**RealView Compilation Tools**

*RealView Compilation Tools* is a suite of tools, together with supporting documentation and examples, that enables you to write and build applications for the ARM family of RISC processors.

**RealView Debugger Trace**

A software product add-on to RealView Debugger that extends the debugging capability with the addition of real-time program and data tracing.

**Remote Debug Interface (RDI)**

The *Remote Debug Interface* (RDI) is an ARM standard procedural interface between a debugger and the debug agent. RDI gives the debugger a uniform way to communicate with:

- a simulator running on the host (for example, ARMulator)
- a debug monitor running on ARM-based hardware accessed through a communication link (for example, Angel)
- a debug agent controlling an ARM processor through hardware debug support (for example, Multi-ICE).

**Remote_A** Remote_A is a software protocol converter and configuration interface. It converts between the RDI 1.5 software interface of a debugger and the Angel Debug Protocol used by Angel targets. It can communicate over a serial or Ethernet interface.

**RTOS** Real Time Operating System.

**RVCT** *See* RealView Compilation Tools.

**Scan chain** A scan chain is made up of serially-connected devices that implement boundary-scan technology using a standard JTAG TAP interface. Each device contains at least one TAP controller containing shift registers that form the chain. Processors might contain several shift registers to enable you to access selected parts of the device.

**Scope** The range within which it is valid to access such items as a variable or a function.

**Semihosting** A mechanism whereby I/O requests made in the application code are communicated to the host system, rather than being executed on the target.

**Simulator** A simulator executes non-native instructions in software (simulating a core).

**Software breakpoint** A *breakpoint* that is implemented by replacing an instruction in memory with one that causes the processor to take exceptional action. Because instruction memory must be altered software breakpoints cannot be used where instructions are stored in read-only memory. Using software breakpoints can enable interrupt processing to continue during the breakpoint, making them more suitable for use in real-time systems.

*See also* Breakpoint and Hardware breakpoint.

**Software Interrupt (SWI)**

An instruction that causes the processor to call a programmer-specified subroutine. Used by the ARM standard C library to handle semihosting.

**Stack traceback**

Also called a stack backtrace, this a list of procedure or function call instances on the current program stack. It might also include information about call parameters and local variables for each instance.

**SWI**

*See* Software Interrupt.

**TAP**

*See* Test Access Port.

**TAP Controller**

Logic on a device which enables access to some or all of that device for test purposes. The circuit functionality is defined in IEEE1149.1.

*See also* Test Access Port and IEEE1149.1.

**Target**

The target hardware, including processor, memory, and peripherals, real or simulated, on which the target application is running.

**Target Vehicle Server (TVS)**

Essentially the debugger itself, this contains the basic debugging functionality. TVS contains the run control, base multitasking support, much of the command handling, target knowledge, such as memory mapping, lists, rule processing, board-files and `.bcd` files, and data structures to track the target environment.

**Test Access Port (TAP)**

The port used to access the TAP Controller for a given device. Comprises **TCK**, **TMS**, **TDI**, **TDO**, and **nTRST** (optional).

**Tracepoint**

A tracepoint can be a line of source code, a line of assembly code, or a memory address. In RealView Debugger, you can set a variety of tracepoints to determine exactly what program information is traced.

**Tracing**

The real-time recording of processor activity (including instructions and data accesses) that occurs during program execution. Trace information can be stored either in a trace buffer of a processor, or in an external trace hardware unit. Captured trace information is returned to the Analysis window in RealView Debugger where it can be analyzed to help identify a defect in program code.

**Trigger**

In the context of breakpoints, a trigger is the action of noticing that the breakpoint has been reached by the target and that any associated conditions are met.

In the context of tracing, a trigger is an event that instructs the debugger to stop collecting trace and display the trace information around the trigger position, without halting the processor. The exact information that is displayed depends on the position of the trigger within the buffer.

**TVS** *See* Target Vehicle Server.

**Watch** A watch is a variable or expression that you require the debugger to display at every step or breakpoint so that you can see how its value changes. The Watch pane is part of the RealView Debugger Code window that displays the watches you have defined.

**Word** A 32-bit unit of information.

# Index

The items in this index are listed in alphabetical order, with symbols and numerics appearing at the end. The references given are to page numbers.