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**STR71x SOFTWARE DEVELOPMENT  
GETTING STARTED**

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## **INTRODUCTION**

This document provides an introduction to the STR71x product family. It describes the software environment required to develop an STR71x application from scratch. It summarizes the different steps needed to configure the development toolset and to use the template software library to build and to debug a sample STR71x application on the target hardware.

Two software examples are supplied with this application note. Both are intended for users new to STR71x microcontrollers. The first one is a standard application demonstrating an input/output pin toggling function. The required steps to create this example project, to build and debug the image are described in the first chapter. The second one illustrates an advanced example showing the use of interrupts. Both examples are loaded and executed from the STR71x embedded RAM, and then the target hardware has to be configured consequently (BOOTEN/1/0="110").

The application source files are provided within the package '**AN1774.zip**'. This file should be unpacked into any directory.

This document assumes that the reader is familiar with ARM cores. For more details on the ARM core architecture, refer to the ARM Developer Suite Guide and the ARM Technical Reference Manual. These documents are available from ARM website.

## 1 SOFTWARE SETTINGS

This chapter describes the different steps needed to creating and configuring an STR71x project. Neither the toolset installation nor the licence management are described in this application note. This document assumes that the toolset is already installed on the development host. For more details on RealView toolset installation and licences' management, refer to the RealView Debugger Installation Guide for Windows.

For more details on creating and running applications, refer to the RealView Debugger Essentials Guide. RealView Debugger documents are available from the ARM website.

The ARM RealView provides a graphical user interface tool for managing your software development projects.

This section describes the steps required for creating, building and debugging an STR71x standard application using the RealView toolset. This application consists of toggling the I/O port 0 peripheral pins. The I/Os, configured as push-pull outputs, are toggled in an endless loop every 130 ms (the external clock operates at a frequency of 16 MHz).

The application source code files are located in the example 1 of '**AN1774.zip**' file and are made of, besides the standard files described in [Section 2.1](#), the '*main.c*' file containing the main routine.

### 1.1 STARTING REALVIEW DEBUGGER

To start the RealView Debugger:

- Select **Start->Programs->ARM->ARM RealView Developer Kit for ST** from the Windows **Start** menu,
- Select **RealView Debugger** from the menu.

RealView Debugger starts and the default Code window is displayed. This window is your debugging and editing window.

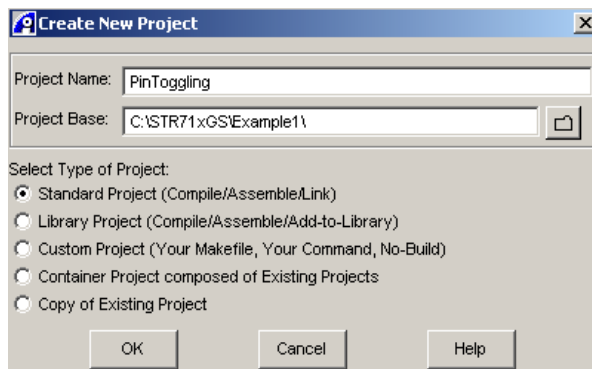
The appearance of the Code window depends on your licenses. For further information about this window contents, refer to the RealView Debugger Essentials Guide.

### 1.2 CREATING A NEW PROJECT

The following steps describe how to create a new project.

- Select **Project->New project...** from the default Code window main menu. A **Create New project** dialog box is displayed (see the figure below),
- Enter '*PinToggling*' as the project name in the **Project Name** field,
- Click the folder icon and choose **<Select Dir...>** to locate the project base directory,

- Select **Standard project (Compile/Assemble/Link)** as project type,

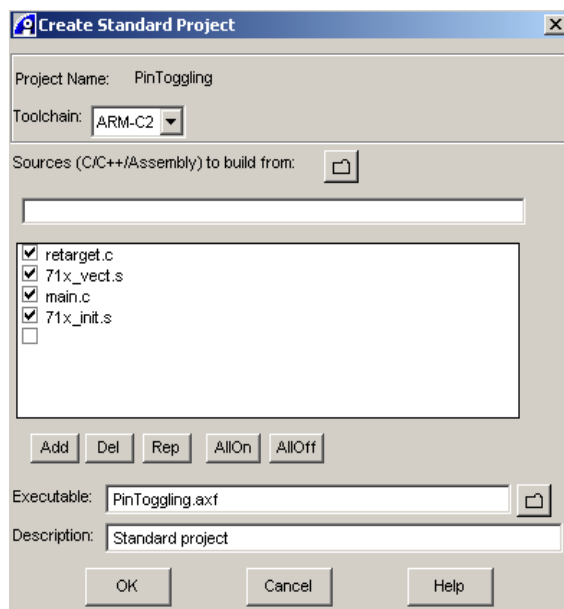


- Click **OK** to confirm your entries and close the **Create New Project** window.

### 1.3 DEFINING A STANDARD PROJECT

Once the Create New Project window is closed the **Create Standard project** dialog box is displayed (See the figure below).

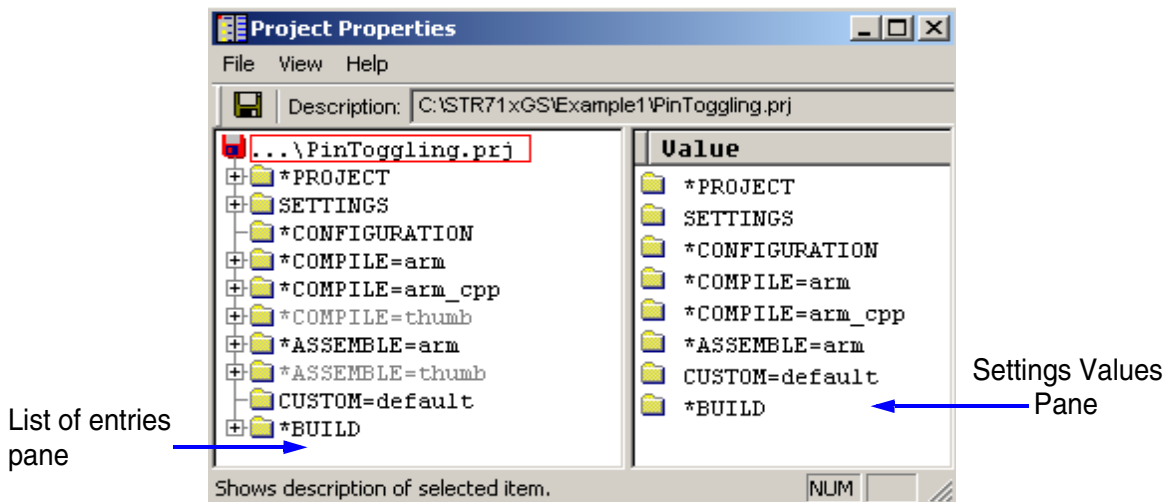
- Select **"ARM-C2"** in the **Toolchain** field.
- Specify the **Sources (C/C++/Assembly) to build from** by clicking the directory icon. The project base directory, defined previously, is opened. Select the source files to be added to the source list box: use Shift or Ctrl keys. The files: *retarget.c*, *71x\_vect.s*, *main.c* and *71x\_init.s* must be selected to be included in the build process.



The Real View Debugger completes the **Executable** field with the project name (*PinToggling.axf*) and the **Description** field as *Standard project*. Then click **OK** to create the project.

## 1.4 PROJECT SETTINGS

RealView Debugger displays the **Project Properties** window, shown in the figure below, to allow you to customize the project. This window contains all the project details such as source file, project path and compilation parameters.



- Double-Click on **\*COMPILE=arm** group in the List of Entries pane and choose **Preprocessor**. Right-click on the **Include** setting in the Settings Values pane, and select *Edit as Directory name* from the context menu. Use the *Enter New Directory* Dialog box to locate the path of the include directories. Set the include directory to `..\STR71xGS\Example1` and click **Select** to confirm your choice.
- Double-Click on **\*BUILD** group in the List of Entries pane and choose **Link Advanced**. Right-click on the **Scatter file** setting in the Settings Values pane, and select *Edit as file name* from the context menu. Use the **Enter New filename** Dialog box to locate the scatter file `'scat.scf'` under `..\STR71xGS\Example1`.
- Right-click on the **Entry** setting in the Settings Values pane, and select *Edit value* from the context menu. Then enter the name of the entry point in the corresponding field. In our case the entry point is `'Reset_Handler'`.
- Select **File->Save and Close** to regenerate the makefiles for the project, and close the Project Properties window.

## 1.5 BUILDING THE PROJECT

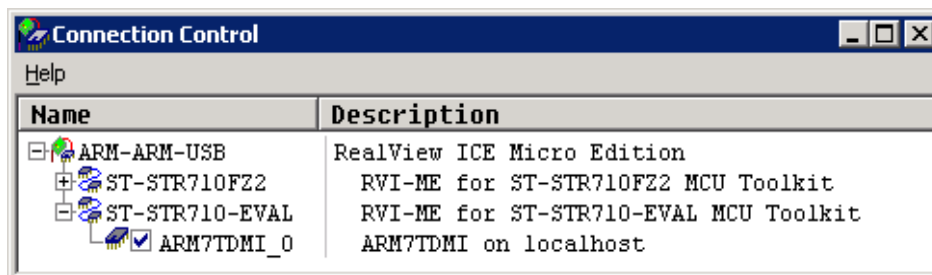
The project has been configured. You can now build it. Select **Tools->Rebuild all (clean+build)** from the Code Window main menu. The build completes and the RealView Debugger displays the **Build** tab, in the output pane, to report successful completion. The application image `'PinToggling.axf'` is generated.

## 1.6 CONNECTING TO TARGET

The next stage in your debugging session is to connect to your debug target, which is the STR71x core on your application board. This step assumes that you have already compiled and built your STR71x image.

If you choose hardware debugging, the MICRO-ICE debugging tool should be plugged in to both the host and to the target which must be powered on. Ensure that the ICE software is installed and setup as described in the next section MICRO-ICE SETUP.

- Select **File->Connection->Connect to target...** from the Code window main menu to display the **Connection Control** window, shown in the figure below. Use this window to connect to your target.



- The Connection Control window shows all the connections available. In our case, you can specify one of these connections: ST-STR710-EVAL. Select the check-box or double-click on the connection entry in the Name pane.
- Now, you can load the built image '*PinToggling.axf*', under '*..\STR71xGS\Example1\Debug*', on the target by selecting **File->Load Image**. You can also click the blue hyperlink **Click to Load Image to Target** in the File Editor pane.

## 1.7 DEBUGGING THE APPLICATION

Once the image has been loaded on the target you can debug it. To execute the image click the **Go** button on the Actions toolbar.



You can use breakpoints to run the application step by step. A simple double-click on a line sets a breakpoint on that location. You can display memory and register contents. Select **View->Pane Views->Memory** from the Code window to display the Memory pane or **View->Pane View->Registers** to display the Register pane. By means of these panes you can view and set the content of a register and a memory location. You can also display variables.

Use an oscilloscope to monitor the GPIO0 pin state.

For more details on RealView debugging features, refer to the *RealView Debugger essentials guide* document.

### 1.8 DISCONNECTING FROM THE TARGET

To disconnect from a target select **File->Connection->Disconnect** from the Code Window main menu or double-click the connect entry in the **Connection Control** window.

For more details on Micro-ICE configuration, refer to RealView ICE user guide.

## 2 SOFTWARE EXAMPLE

This chapter describes an STR71x software example. The first part enumerates the standard files required to build an application. The second part describes an application example.

This chapter assumes that both the hardware and the software environments are setup as described previously.

### 2.1 GENERIC CONFIGURATION FILES

This section describes the standard files required by any STR71x application. These files are mandatory for building a project for STR71x cores.

The table below enumerates and explains the use of each file.

File	Description
71x_vect.s	This file contains exception vectors and exception handlers. For this example RAM is fixed at address 0x0.
71x_map.h	This file contains the memory mapping and physical registers address definitions.
71x_init.s	This file performs initialization of stack pointers for each mode, Enhanced Interrupt Controller initialization, and branches to <code>__main</code> in the C library.
retarget.c	This file provides a retarget layer for low-level Input/Output. Typically, this contains your own target-dependent implementations of <code>fputc()</code> , <code>ferror()</code> ,....Semi-hosting SWIs are used to display text on the console of the host debugger.
scat.scf	An image is made up of regions and output sections. Every region in the image can have a different load and execution address. The scatter-loading mechanism enables you to specify the memory map of an image to armlink. For more information on the scatter file, load and execution regions, refer to the 'ARM Linker and Utilities Guide'.

## 2.2 APPLICATION EXAMPLE: INTERRUPT HANDLING

This section implements an application with interrupt handling. The *main()* function initializes and starts two timer overflow interrupts.

When a timer expires, an interrupt, handled in *71x\_it.c*, is generated. Timer0 generates an interrupt every 130 ms which toggles the GPIO0 pin. However Timer1 is configured to generate an interrupt every 4.2 s and to set GPIO1 pin to high level for 5 s. These timing suppose that the chip is clocked by an external oscillator operating at a frequency of 16 MHz.

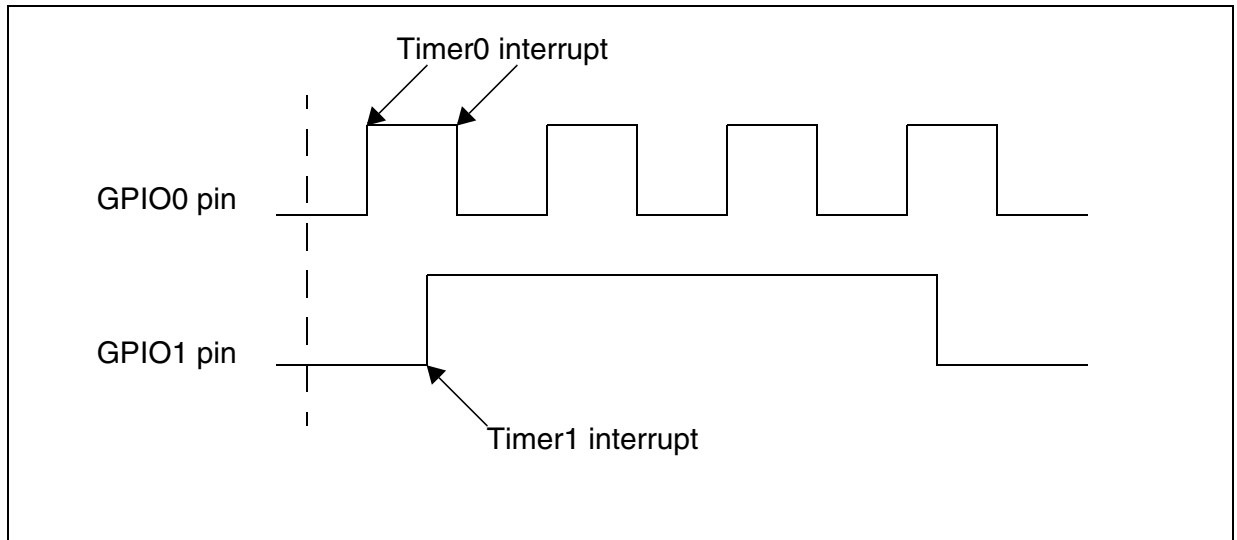
The Timer0 interrupt priority has been set to be higher than the Timer1 priority to allow the Timer0 *T0TIMI\_IRQHandler* interrupt routine to be served during the execution of the Timer1 *T1TIMI\_IRQHandler* interrupt routine. Figure 1. shows the behaviour of GPIO0 and GPIO1 pins and the Timer0 and Timer1 interrupts.

The example source code is located in the `..\STR71xGS\Example2` directory and it contains, besides the standard files and *main.c*, the makefiles for the project, the project file *InterruptHandling.prj*, the interrupt handler file *71x\_it.c* and the interrupt header file *71x\_it.h*.

This example has already been built for you. So there is no need to recompile it. You have, simply, to open the project file **Example2.prj** in the RealView Debugger, to load the image *Example2.axf* into the target and debug it.

For more details on STR71x interrupts' handling, refer to the Interrupt Handling application note, supplied within this package, or to the STR71x datasheet.

**Figure 1. Timer0 and Timer1 Interrupts handling**





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