Linear Technology DC934A Linux Application User's Guide for use with the Altera Cyclone V SoC Development Kit

Revision 1.0

Table of Contents

List of Figures

Introduction

The DC934A Linux application demonstrates access to the Linear Technology DC934A demonstration circuit, featuring the LTC2607 dual 16-bit DAC, from the Altera Cyclone V SoC evaluation board. The DC934A Linux application allows the user to configure the LTC2607 to output different voltage levels and to read back these levels using the on-board LTC2422 dual-channel ADC.

Board Connections

The following picture illustrates the hardware connections for the DC934A and the Altera Cyclone V Evaluation Board. The DC934A is connected to the Altera Cyclone V SoC Evaluation board using the QuikEval header, J32.

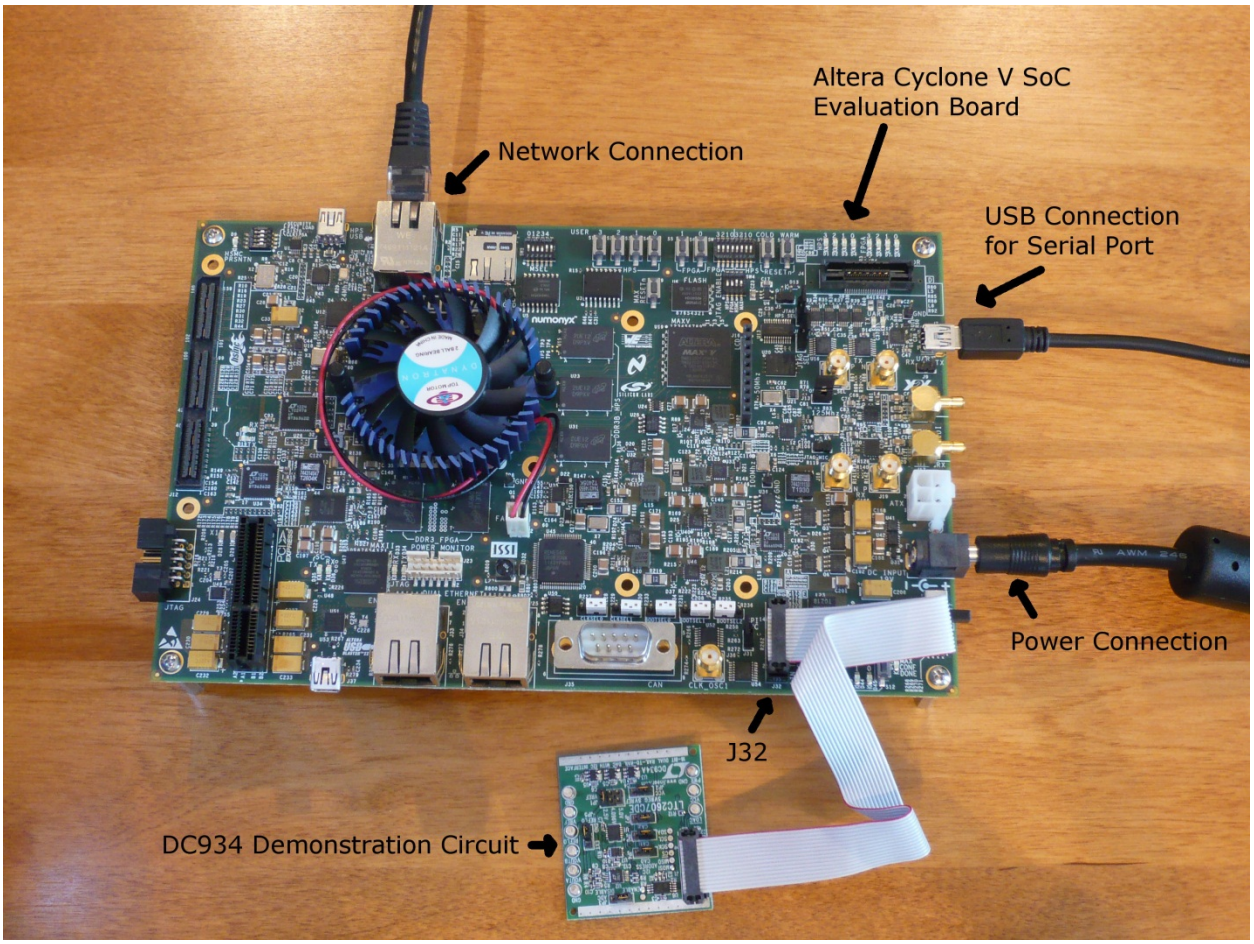

Figure 1. Hardware Connections

Jumper Settings

Configure the jumper settings of the Altera Cyclone V SoC evaluation board as per *Appendix A. Board Setup* of the *Altera SoC EDS User Guide*.

Installing Linux

Configure the Altera Cyclone V SoC evaluation board to run Linux as per *Appendix B. Running Linux* of the *Altera SoC EDS User Guide*.

Install the GPIO Kernel Modules

Install the Linux kernel modules necessary for controlling the GPIO. This will need to be performed after every boot. From the Linux console of the development board, run the following commands:

```
% cd /lib/modules/3.7.0/kernel/drivers/gpio
% insmod gpio-generic.ko
% insmod gpio-dw.ko
```

DC934A – Linux Application Debugging

This section presents how to debug the DC934 Linux application using ARM DS-5 Altera Edition and the provided DC934A Linux application.

Importing the DC934A Application

1. Start Eclipse for DS-5
2. Go to **File->Import…**
3. In the Import window, select **General -> Existing Project into Workspace** and press **Next**
4. Choose **Select Archive File** option and browse to the directory containing **Linear-DC934-Linux.tar.gz** and select it.
5. Press **Finish** to complete importing the DC934A application.

At the end of the import process Eclipse will show the project files:

- DC934.c – DC934 application source code
- LTC2422.c – LTC2422 ADC related source code
- LTC2422.h – LTC2422 ADC header file
- LTC2607.c – LTC2607 DAC related source code
- LTC2607.h – LTC2607 DAC header file
- UserInterface.c – Helper code for the user interface
- UserInterface.h – Header file for the user interface
- Makefile - Makefile used to compile the DC934 application

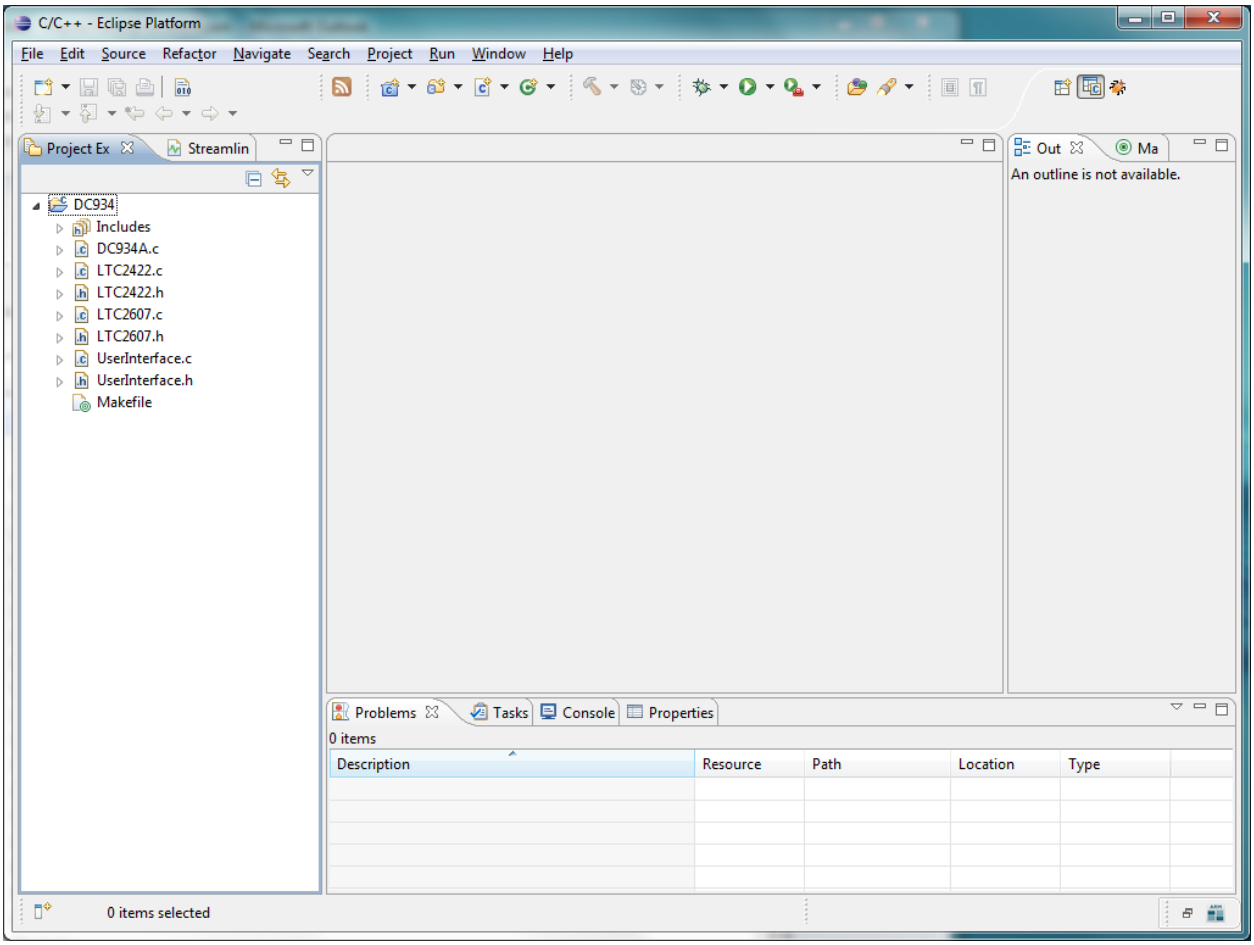

Figure 2. Linux DC934 Application Files

Compiling DC934A Application

The DC934A application is compiled in Eclipse by going to **Project -> Build Project**. This will compile the project using the Linaro gcc suite for Linux, which is part of the SoC EDS.

After a successful compilation, the following files will be created:

- DC934.o – object file
- LTC2422.o – object file
- LTC2607.o – object file
- UserInterface.o – object file
- dc934 – executable file
- dc934.map – linker output map file

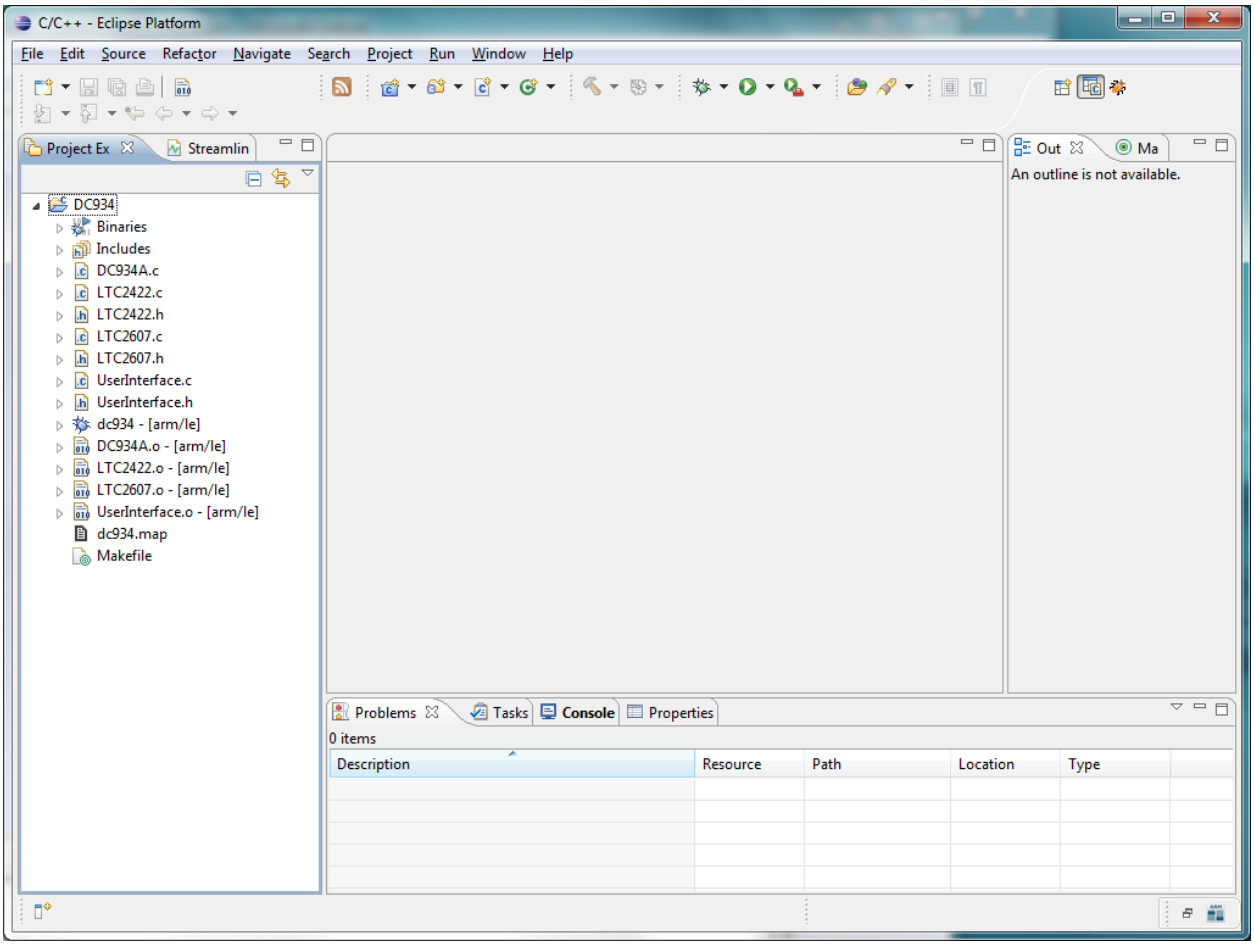

Figure 3. Compiled Project

Setting up Remote System Explorer

The ARM DS-5 AE can run and debug programs directly on the target with the help of the RSE (Remote System Explorer). Before this feature can be used, the RSE needs to be configured to connect to the target board running Linux.

Before doing the steps presented in this section, the board must be connected to the network and have an assigned IP address. Also there has to be a valid username with a password on the Linux board. This can be achieved by assigning a password to the root account, which does not have a password set up by default.

1. Within the desired Eclipse workspace, go to **Window -> Open Perspective -> Other**

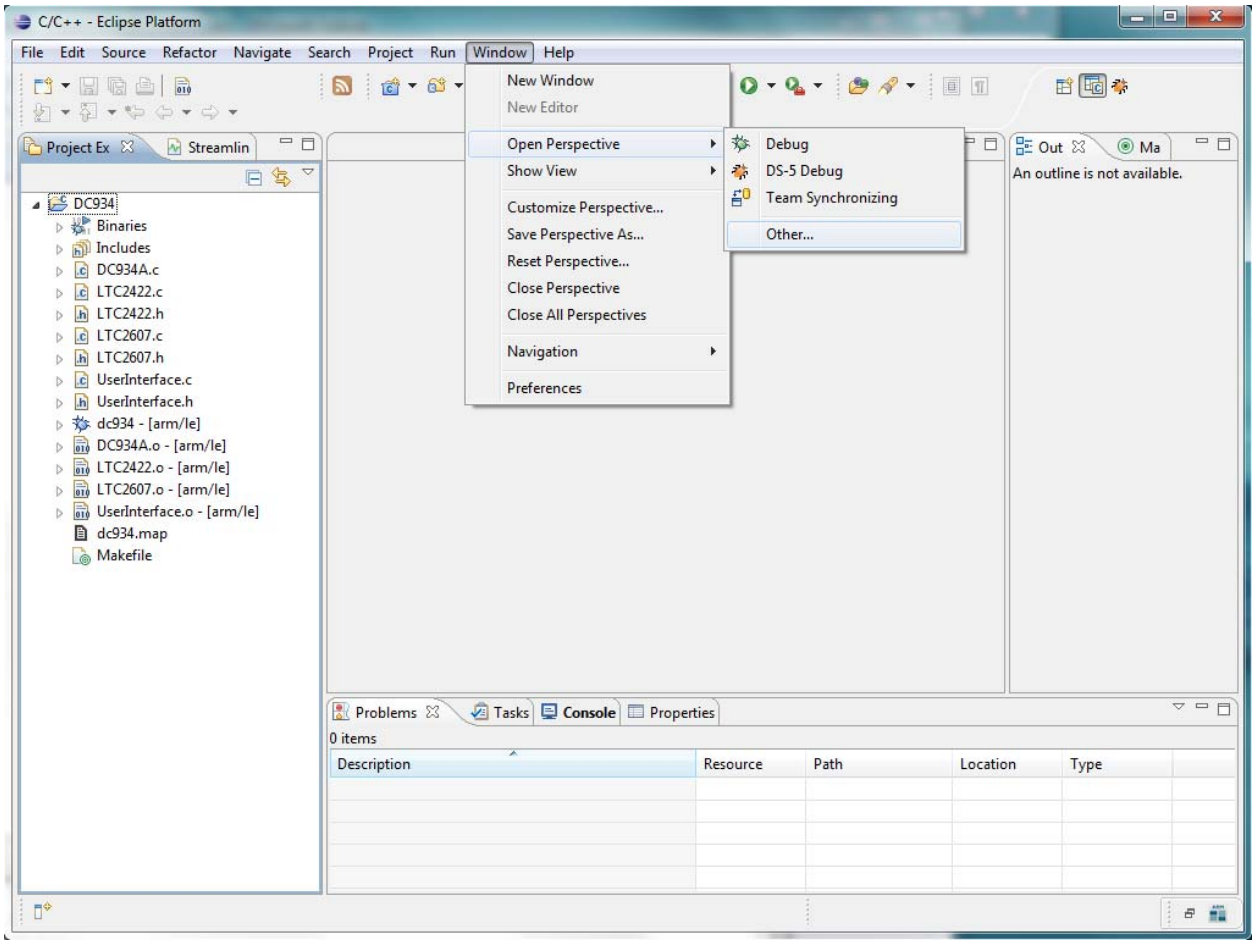

Figure 4. Other Perspective

2. In the Open Perspective window, select the **Remote System Explorer** and click **OK**.

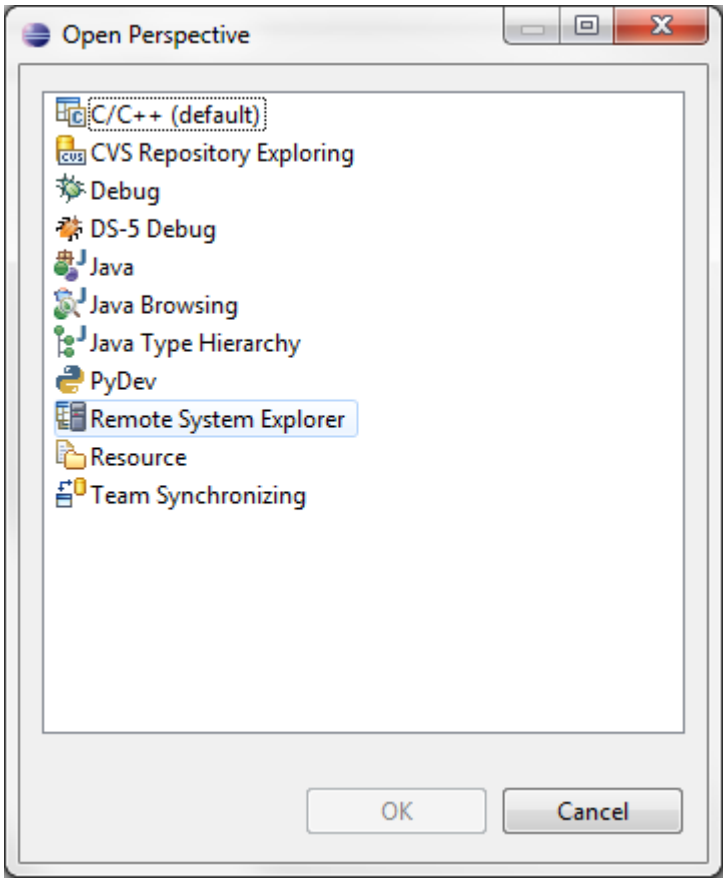

Figure 5. RSE Perspective

3. Within the RSE view, right click **Local** and select **New- > Connection …**

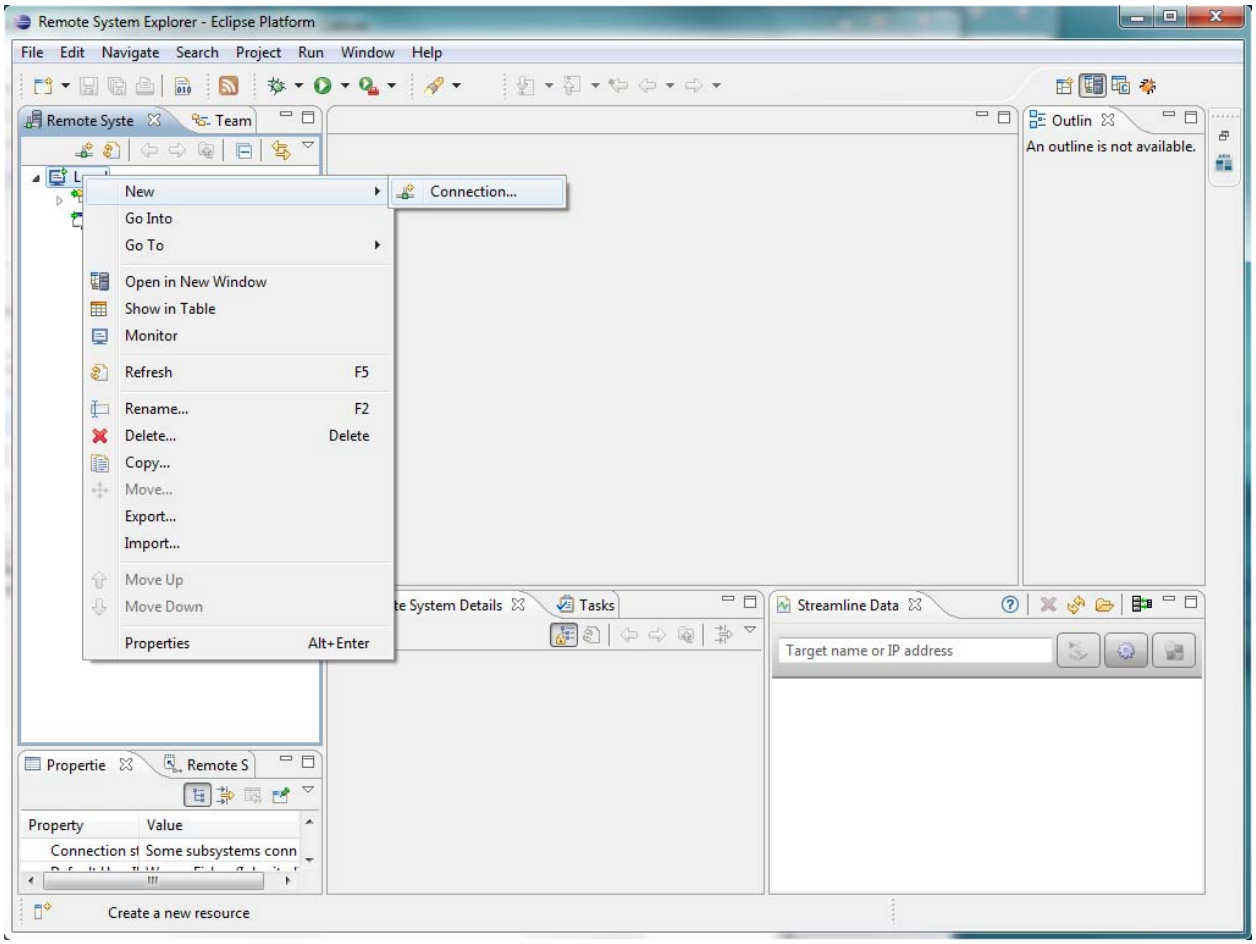

Figure 6. New Connection

4. Select Remote System Type to be **SSH Only** and click **Next**

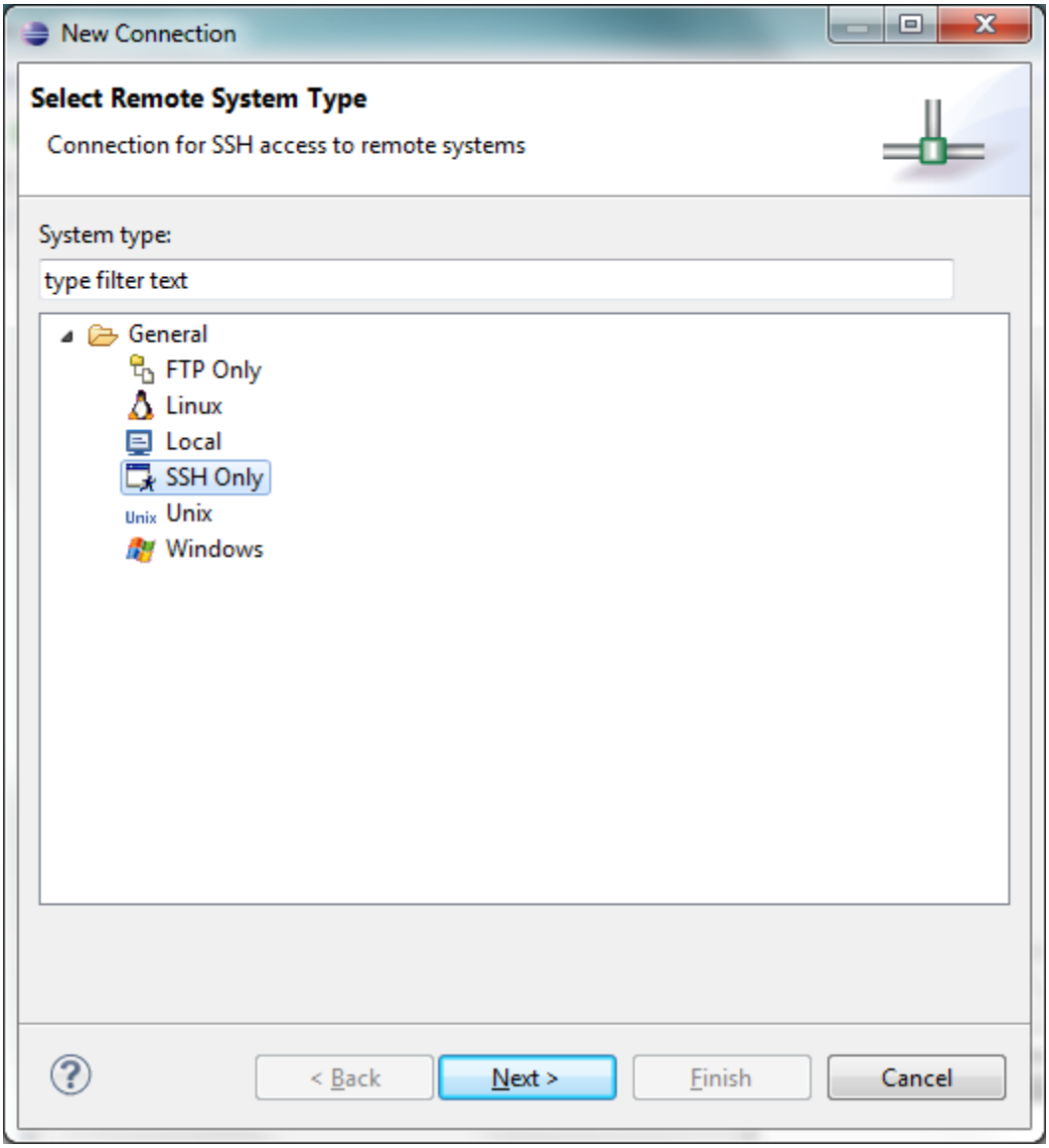

Figure 7. Remote System Type

5. Enter the IP address of the board in the **Host Name** field, and also give the connection a name and a description. Click the **Finish** button to have the connection created.

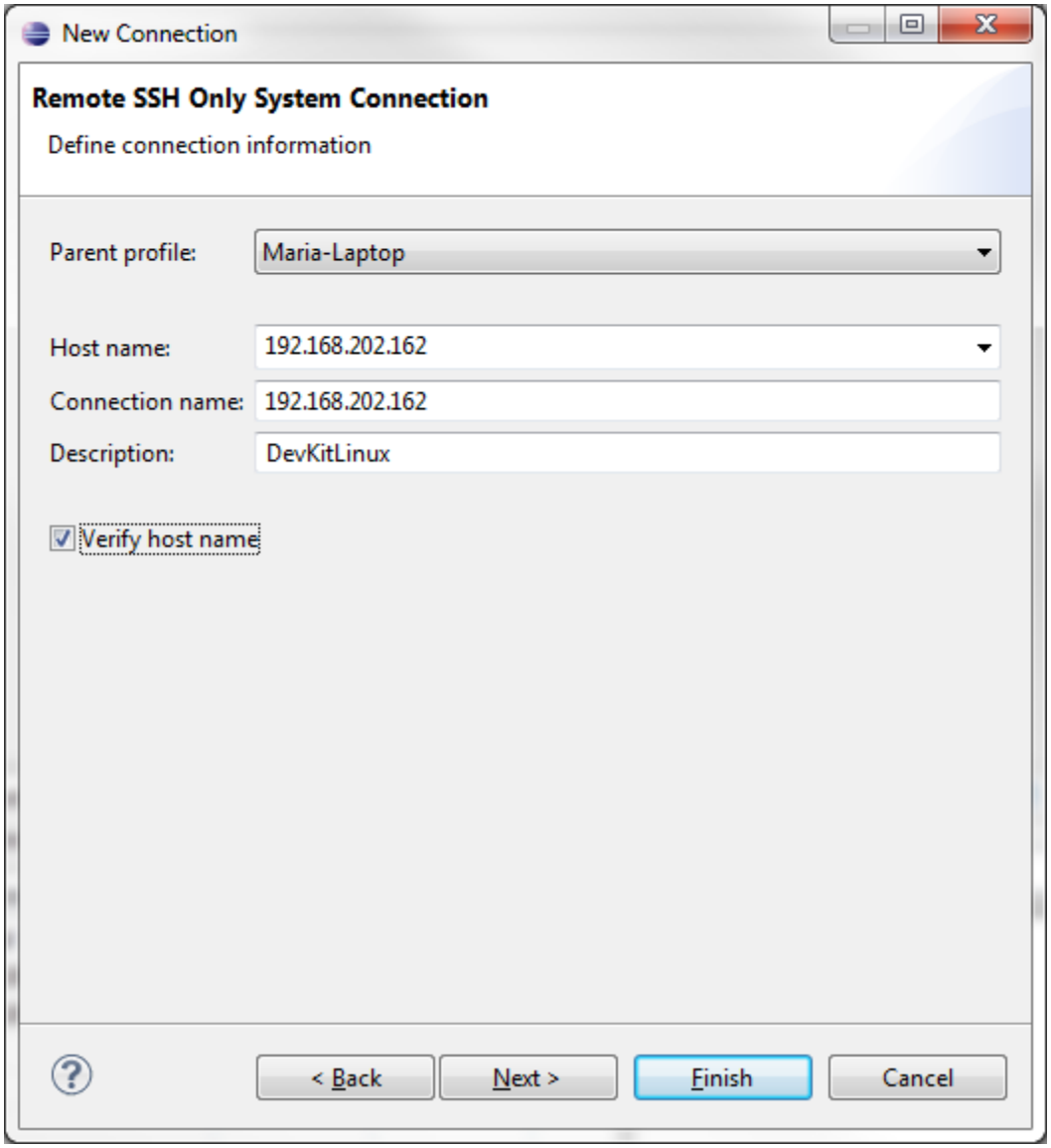

Figure 8. Connection Parameters

6. Click the **DevKitLinux -> Sftp Files -> Root**. This will open up a window to enter the username and password. Use root for username and the password you have set up for it.

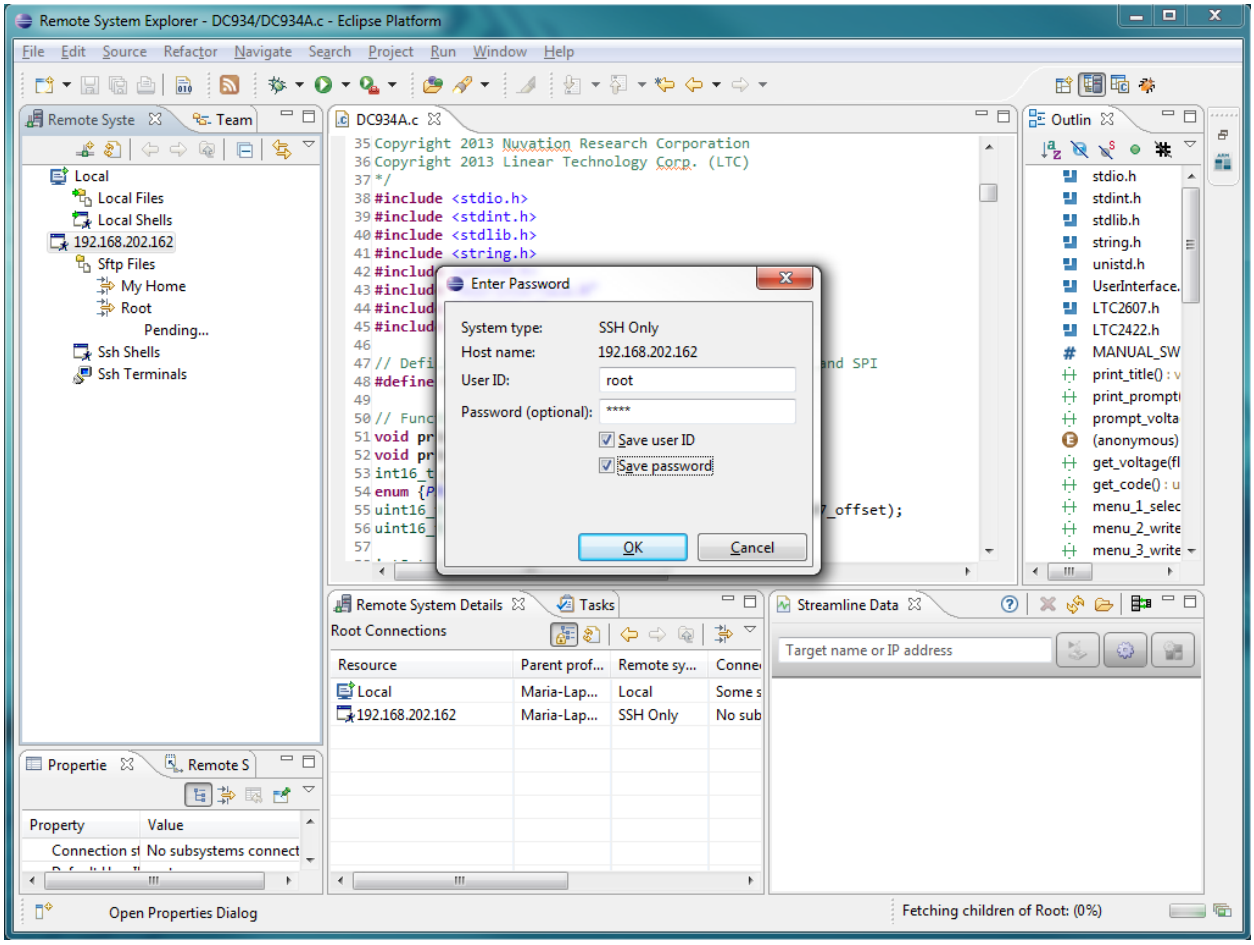

Figure 9. Enter Password

7. Eclipse will ask for confirmation of authenticity of the board. Press **Yes**.

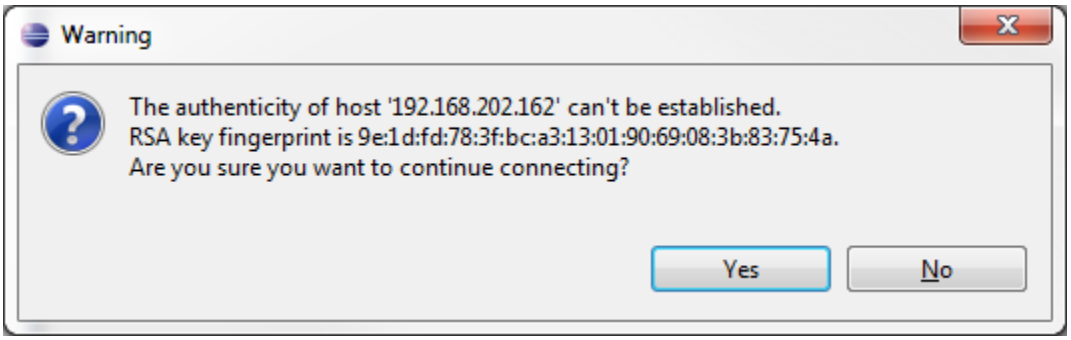

Figure 10. Board Authenticity Confirmation

8. RSE will then show the files currently on the DevKit board on the left panel.

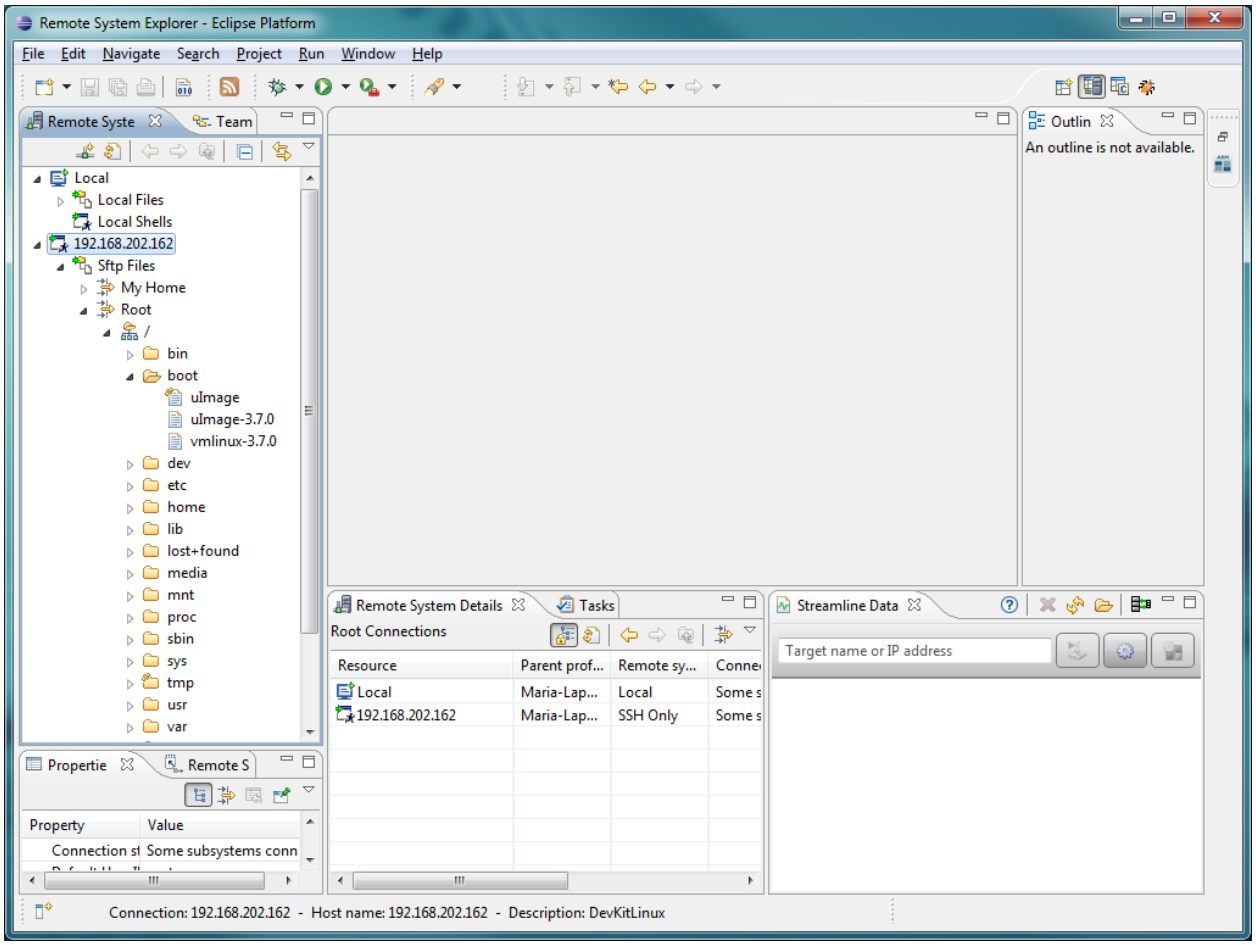

Figure 11. Target Files Visible

Debugging DC934A Linux Application

At this stage we have a compiled DC934A Linux application and a properly configured Remote System Explorer. This section will show how to create a Debugger Configuration and use it to run and debug the application.

1. Go to **Run->Debug Configurations**
2. Right-click the **DS-5 Debugger** and click **New**
3. Name the new Debugger Configuration **DevKitLinux-DC934**
4. In the **Connection** Panel
    - Select the target to be **Altera -> Cyclone 5 -> Linux Application Debug -> Download and Debug Application**.
    - Select the newly created RSE connection and keep the default values.

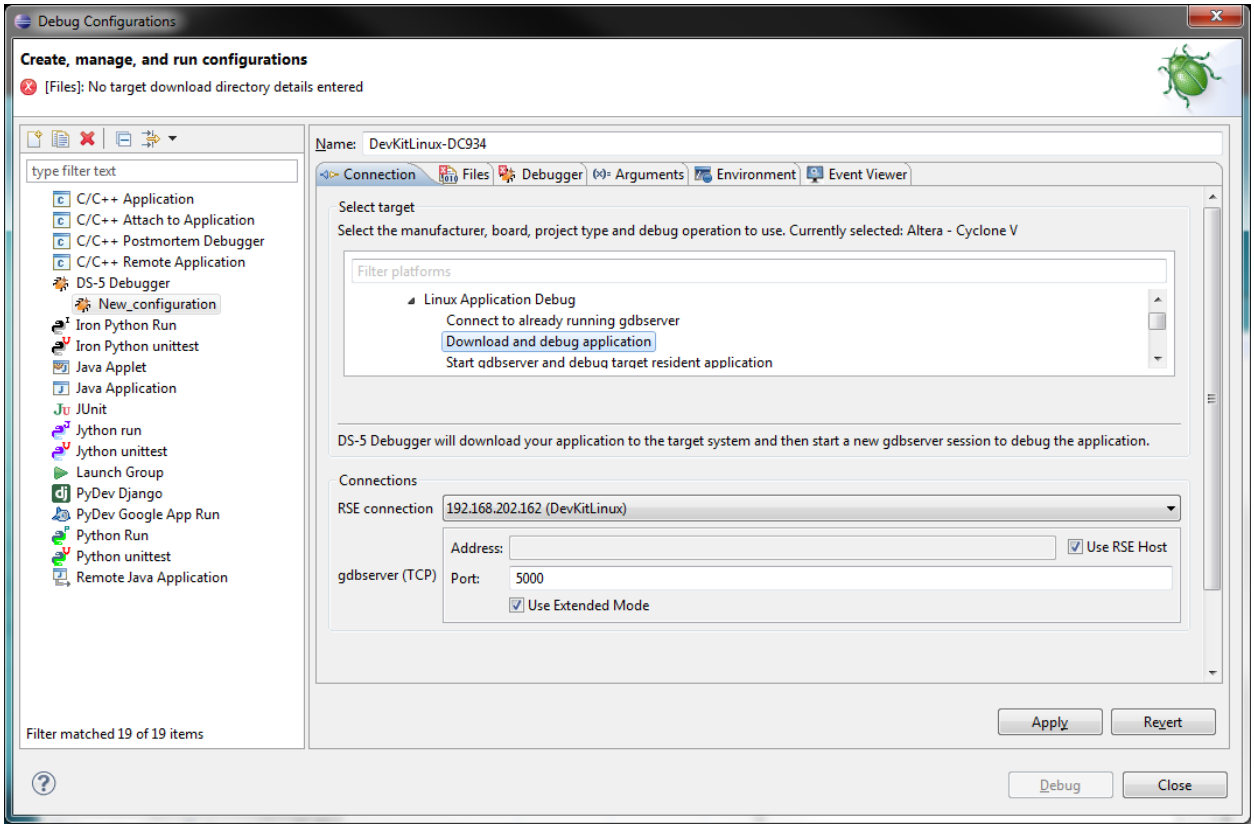

Figure 12. Debugger Connection Settings

5. Go to Files tab, and
   - Select the Application on host to download to be the **dc934** executable file. Use the **Workspace …** button to browse for the application.
   - Select the target download directory
   - Select the target working directory

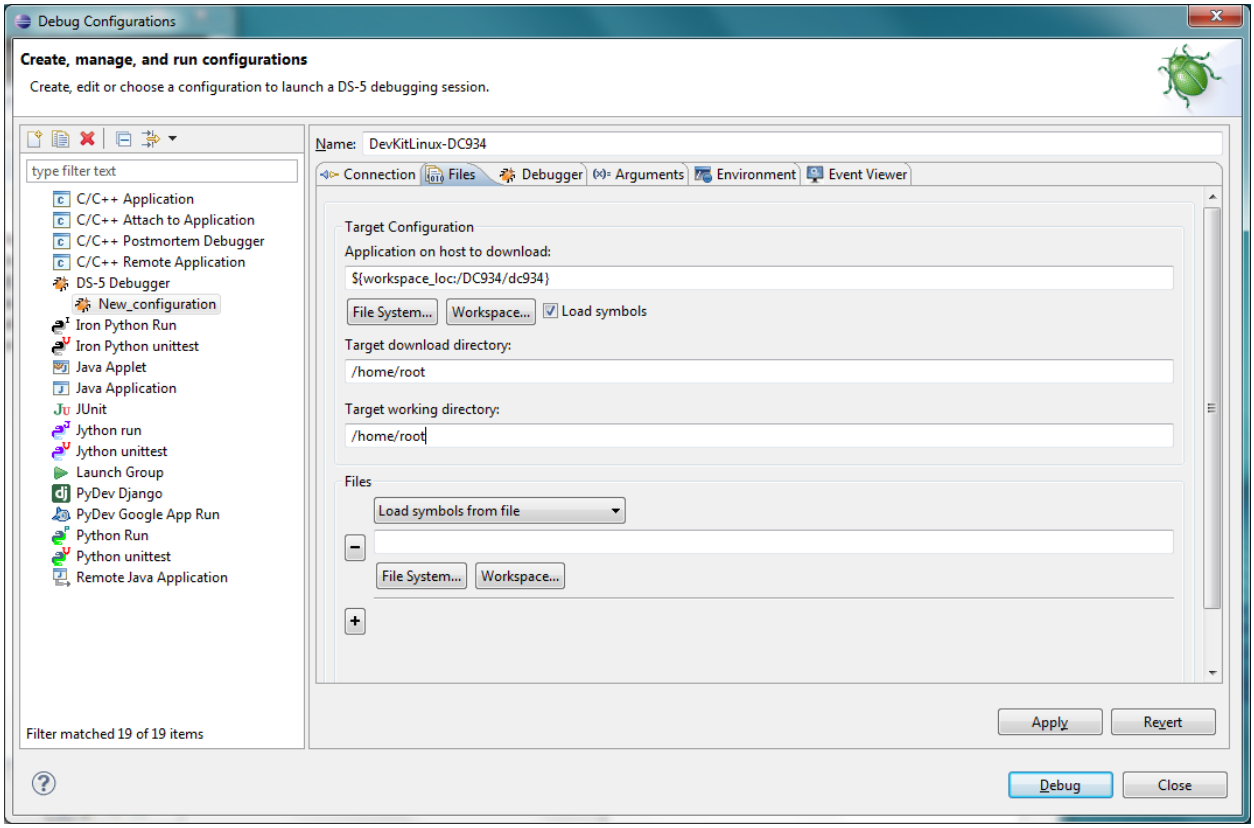

Figure 13. Debugger Files Settings

6. On the Debugger tab, make sure the **Debug from symbol** is selected and the symbol name is **main**.

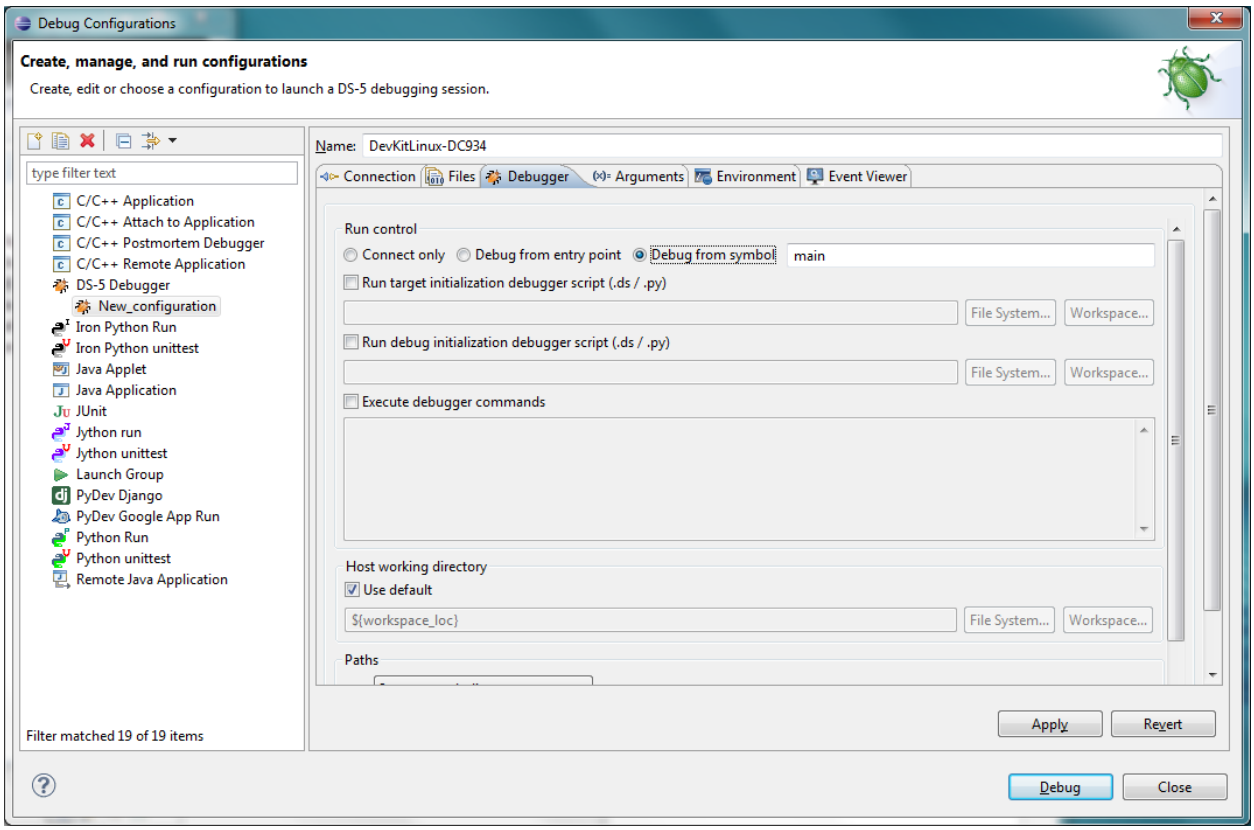

Figure 14. Stop At main

7. Click the Debug button. Eclipse will ask to switch to Debug perspective. Press Yes.

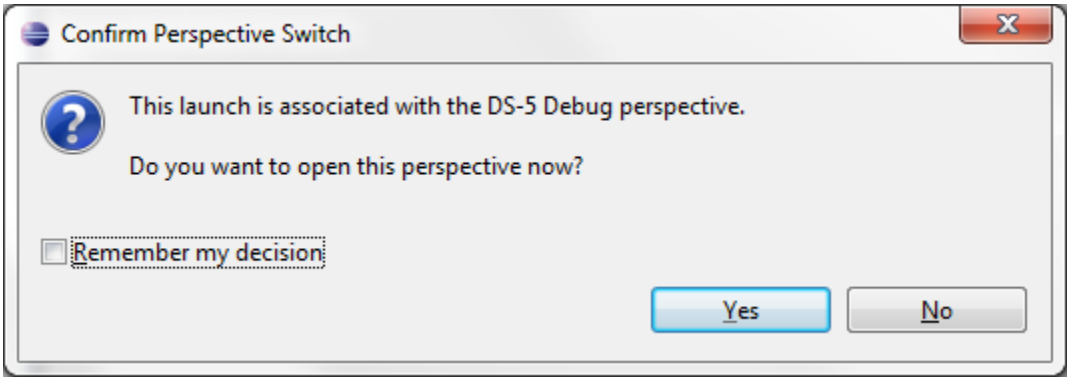

Figure 15. Switch to Debug Perspective

8. Eclipse will download the application to the board and stop at main, as instructed.

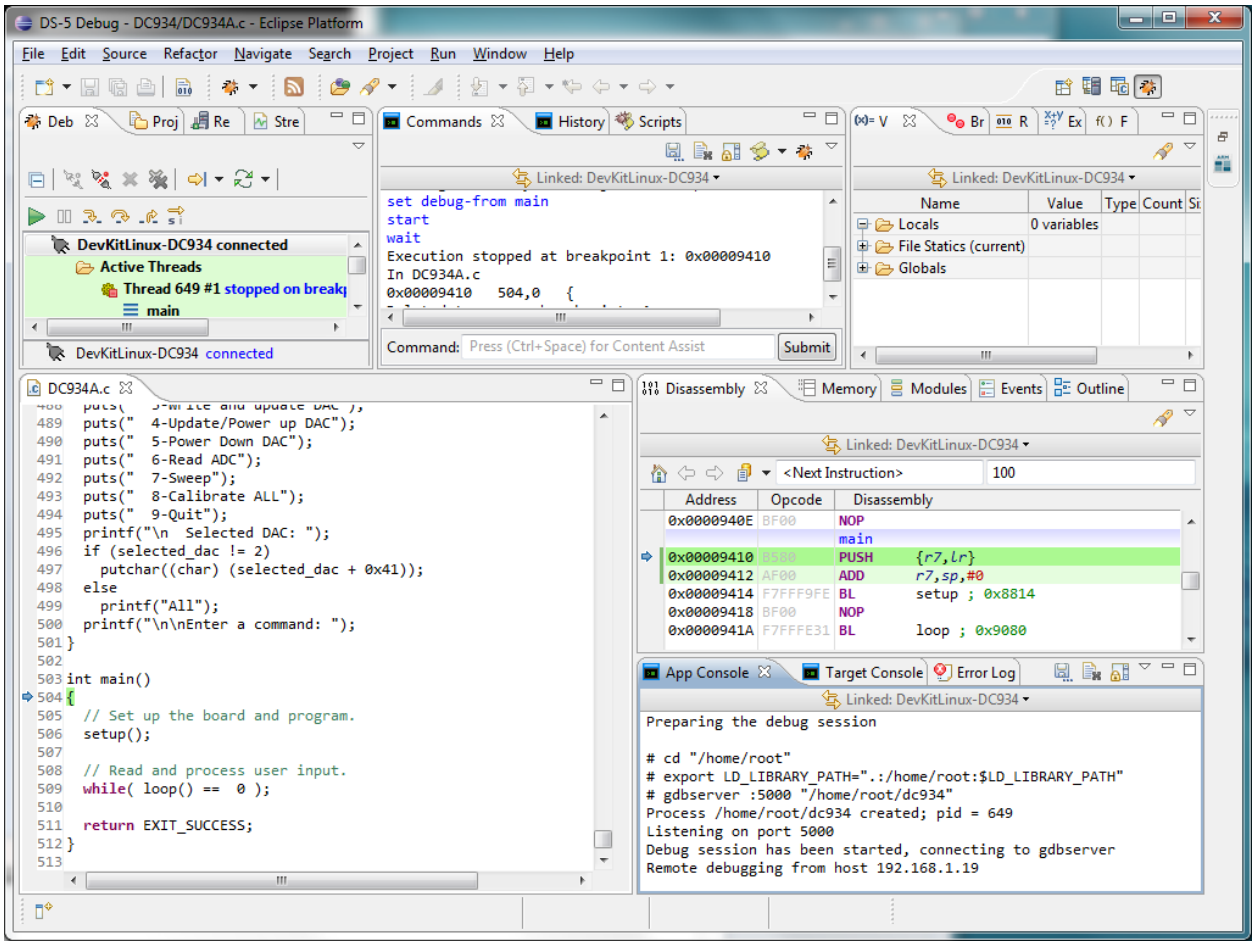

Figure 16. Application Downloaded

9. At this stage all the usual debugging features of DS-5 can be used: breakpoints, view variables, registers, tracing, etc. Click the **Continue** green button or press **F8** to run the application. The DC934A application's menu will be printed on the App Console in the lower right portion of the screen.

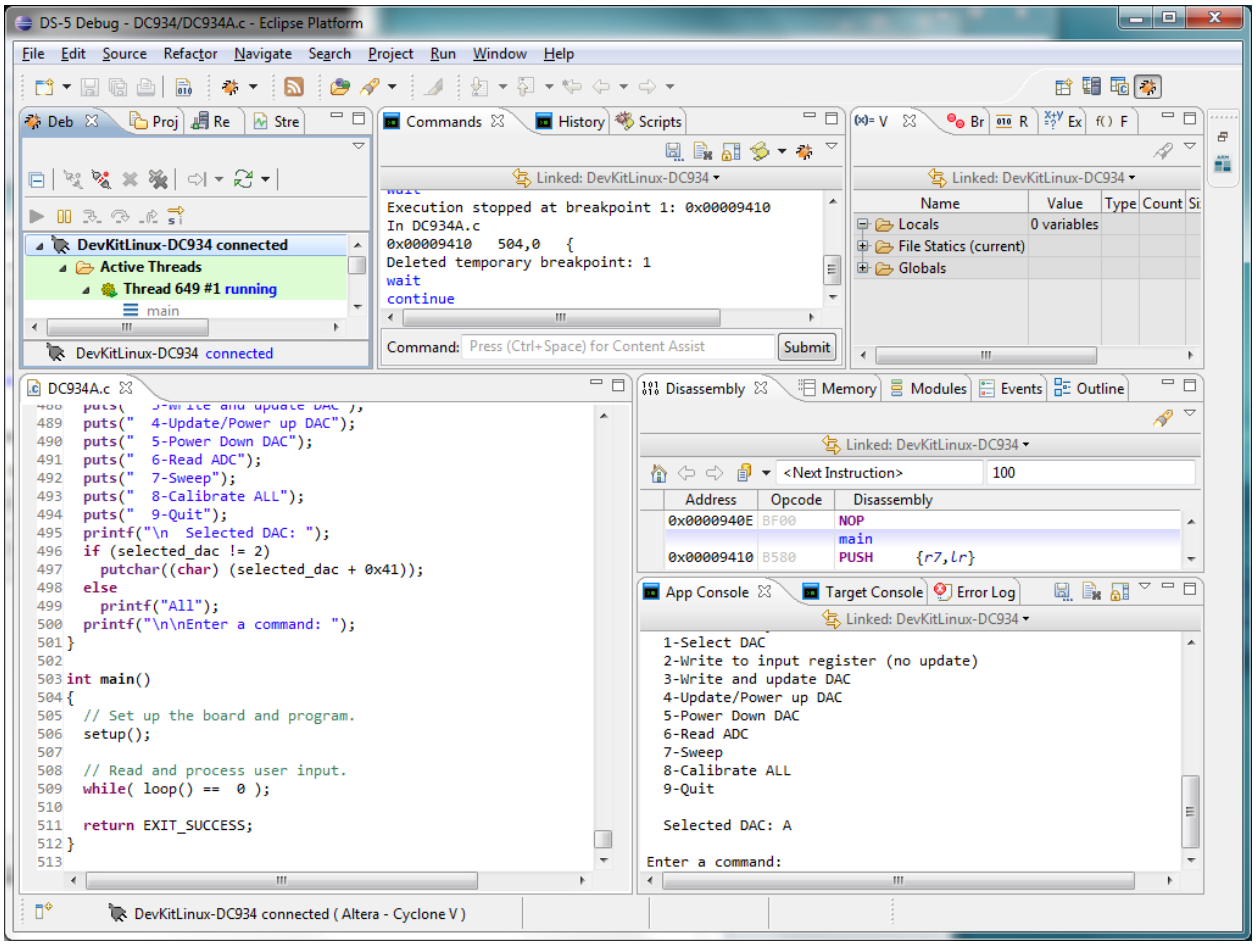

Figure 17. Application Running

10. To set a DAC value, activate the App Console by clicking on it and enter a **3** for the *"Write and update DAC"* command. Then enter a **1** to specify a voltage level and then **2.5** for 2.5V.

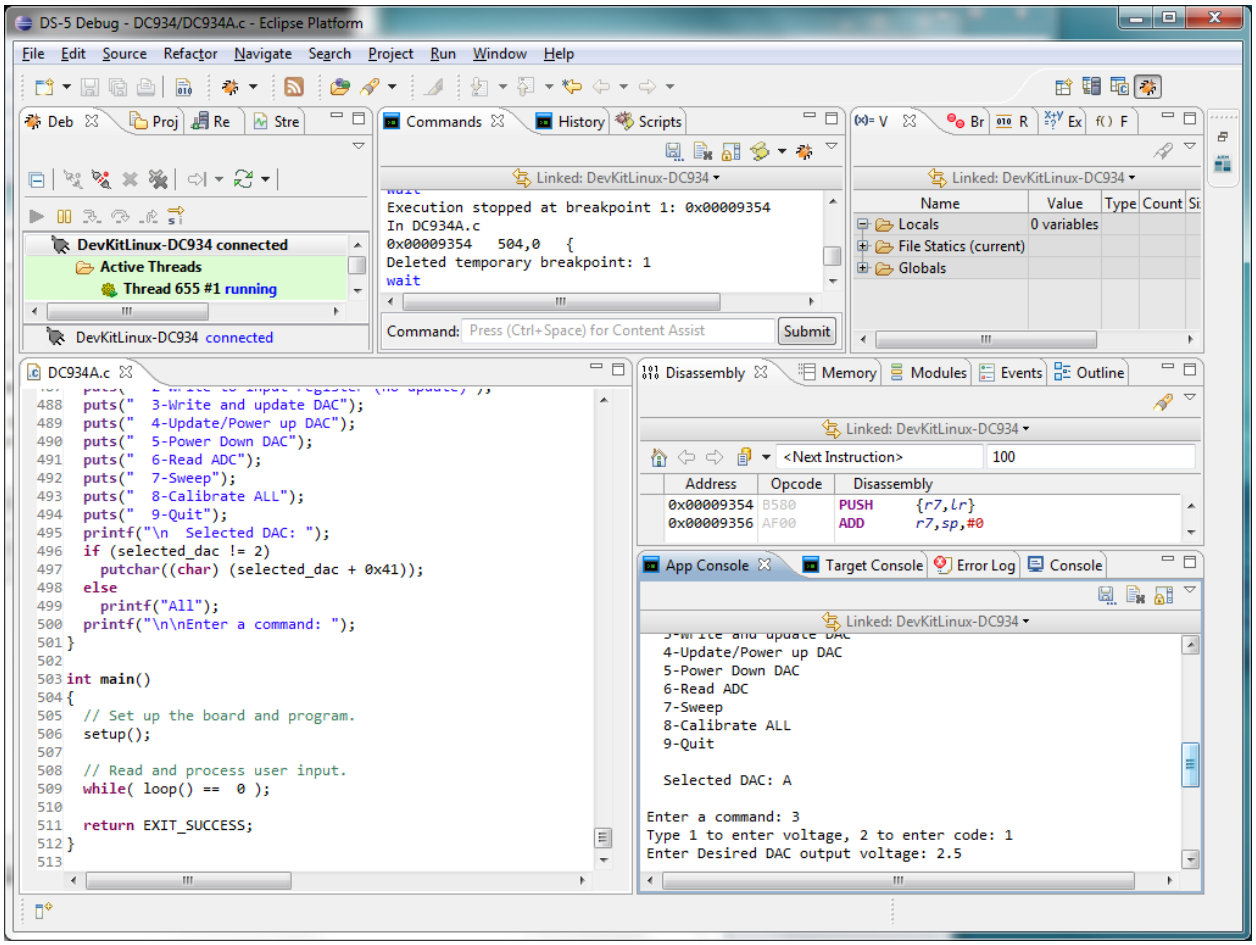

Figure 18. Setting a DAC Value

11. The, output voltage level of the DAC can be read using the ADC. Enter a **6** for the *"Read ADC"* command and the application will read and display the voltage levels for both channels. You may have to scroll back in the App Console window to see the output values.

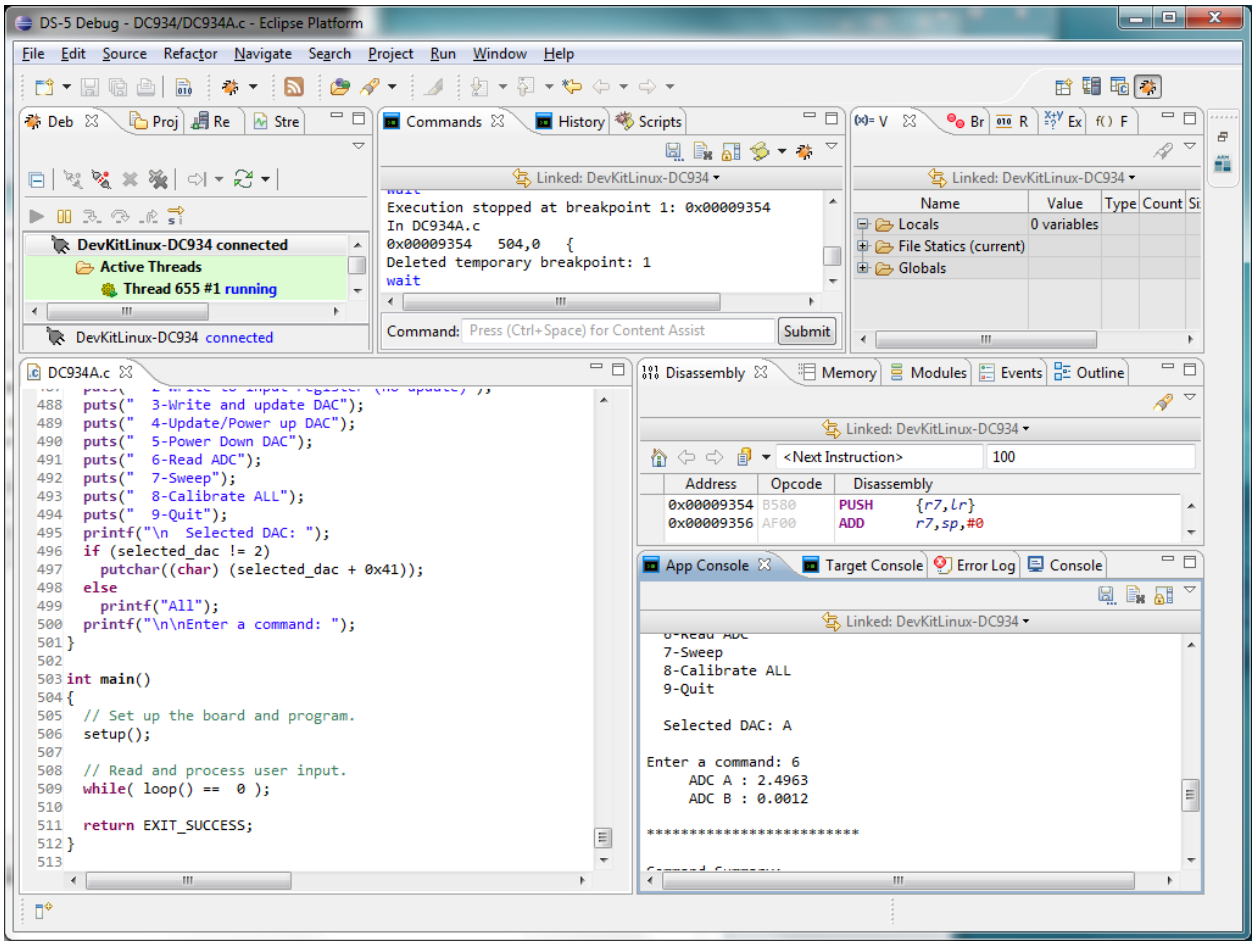

Figure 19. Reading a ADC Value