PANTECH SOLUTIONS®
Technology Beyond the Dreams

DSP/DSC BOARDS

Software User Manual for BF532 Audio Development Boards

USER MANUAL

Contents

1. Installation and Update VisualDSP++

1.1 Install VisualDSP++ Software

VisualDSP is an integrated development and debugging environment from Analog Devices.

1. Push the power button of the PC
2. Login as a user with administrator rights
3. Copy the setup files that as shown in figure 1.1 to the PC and double clicks over the icon,

The Install Shield Wizard screen appears

We can download this setup file from Analog Devices Website from the Address

http://www.analog.com/en/embedded-processing-dsp/software-and-reference-designs/content/visualdsp_software_test_drive/fca.html

We have to register for 90-days test drive, and then we can download the setup file. During the registration They will ask us to give the email-address to which they will send the Test Drive License.

Fig 1.1 Setup file

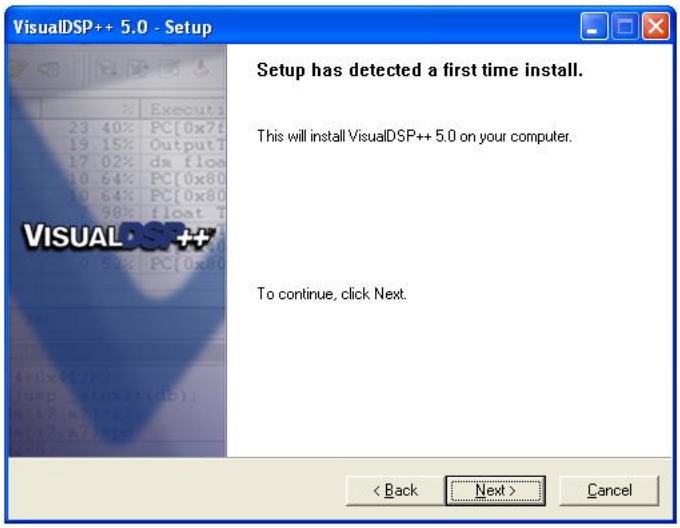


Fig.1-2 the InstallShield Wizard screen

4. Click Next. The **License Agreement** screen appears. (Fig.1-3)

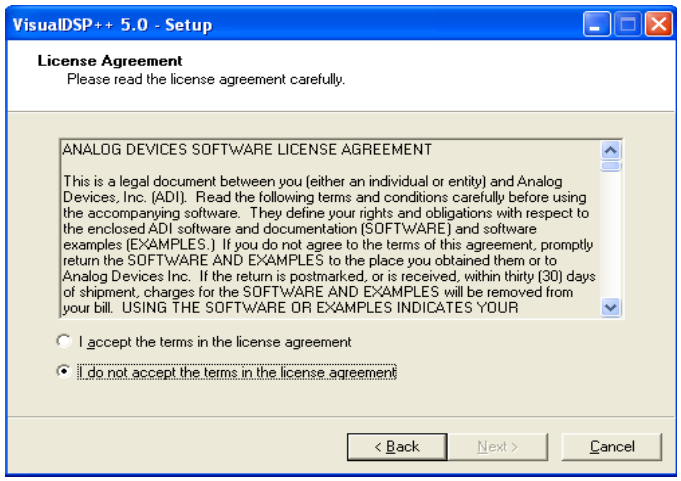


Fig.1-3 the License agreement screen

5. Read the license agreement, then select “I accept the terms in the license

Agreement” and click **next**. The **Customer Information** screen appears. (Fig.1-4)

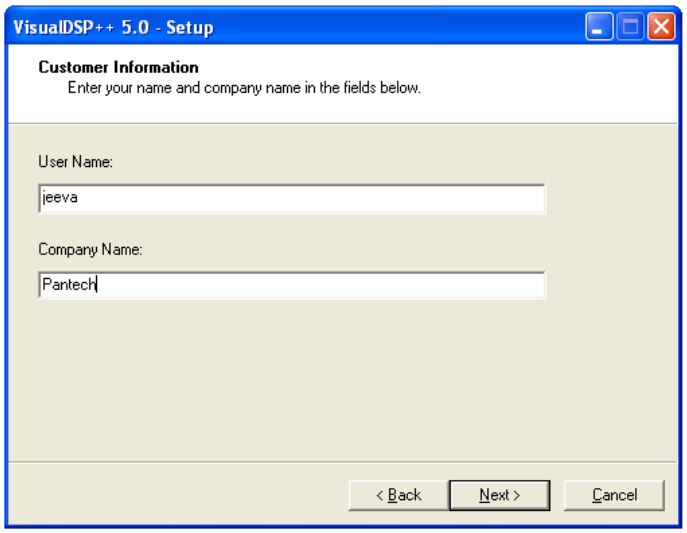


Fig.1-4 the Customer Information screen

6. Fill in the user information. Click **Next**. The **install path** appears. (fig1.5)

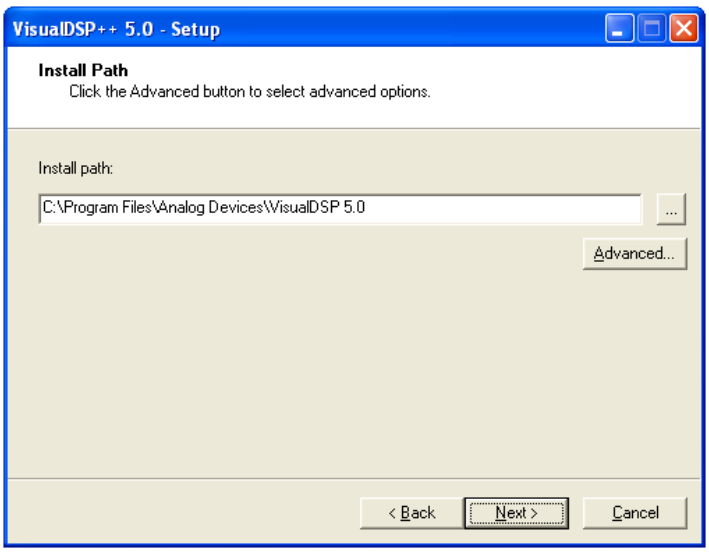


Fig.1-5 the install path screen

7. Click **Next**. The **Install** screen appears. (Fig.1-6)

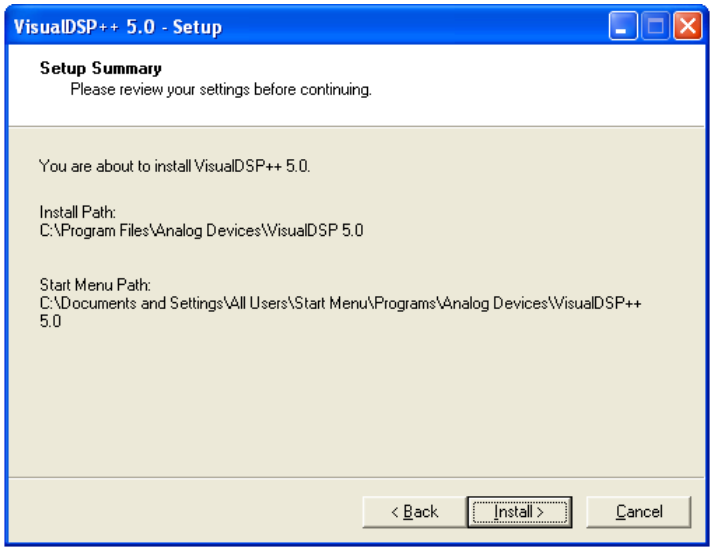


Fig.1-6 the Install screen

8. Click **Install** and wait until the install process is done. The Setup completed

Successfully message box and **Installation Completed** screen appears.(fig.1-8)

Click **Finish** to finish install.

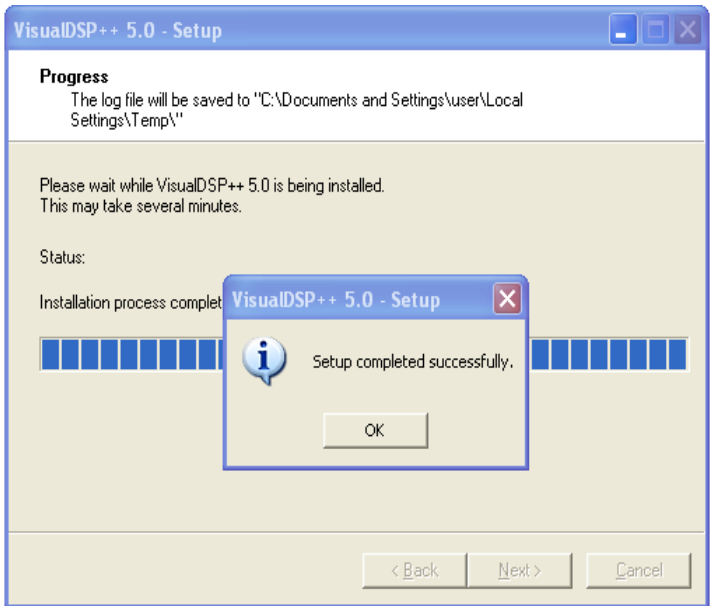


Fig.1-7 Setup completed successfully message box

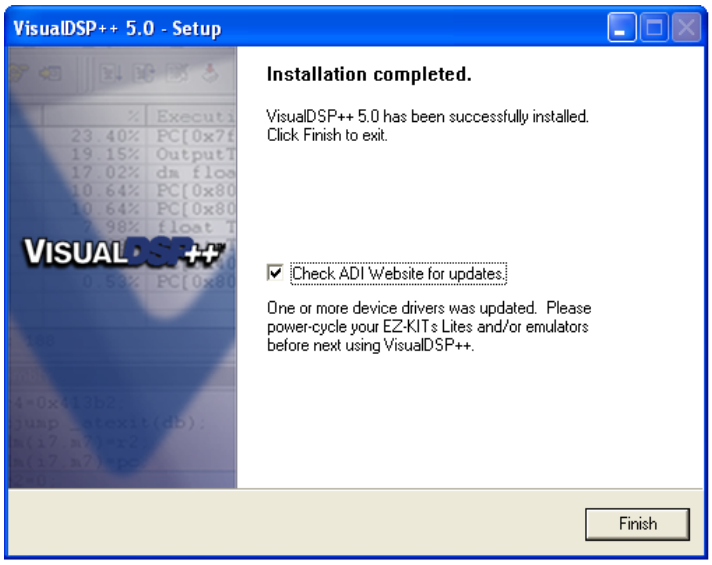


Fig.1-8 the Installation Completed screen

1.2 Install License and Register VisualDSP++

You must register your VisualDSP++ installation on-line to get a validation code. The Validation code is used to create the permanent license.

1. From the Start menu, choose **Start->Programs (All Programs) ->Analog Devices> VisualDSP++ 5.0 >VisualDSP++ Environment.**

2. An information screen asks if you would like to install a license. Click **Yes**. (Fig.1-7)

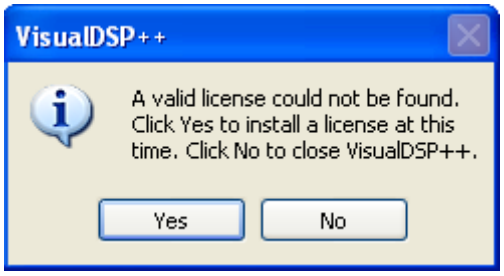


Fig.1-9 information screen

3. The about VisualDSP++ dialog appears. (fig.1-9) Select **Licenses** and click **New**.

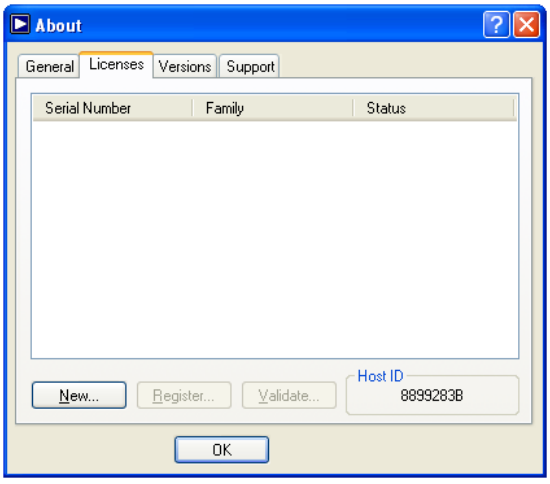


Fig.1-9 about VisualDSP++ Licenses

4. Install New License screen appears. (fig.1-10) Select Node – locked license or Test

Drive license and fill in the tools Serial number in the field exactly as it appears on

your CD sleeve. Click **Next**.

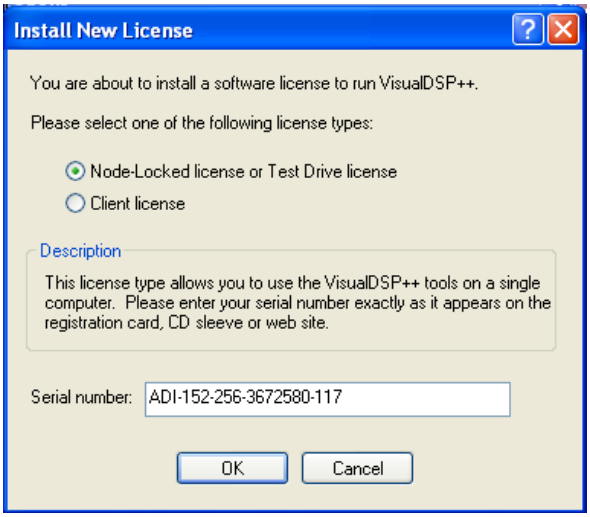


Fig.1-10 Install New License screen

5. An information window notifies of successful license installation.(fig.1-11) Click **OK**.

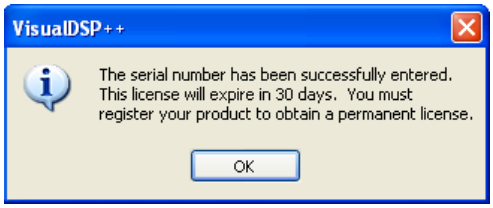


Fig.1-11 License installs successful notice

6. Select the serial number (KIT-###-###-######-##) and click **Validate**. (Fig.1-11)

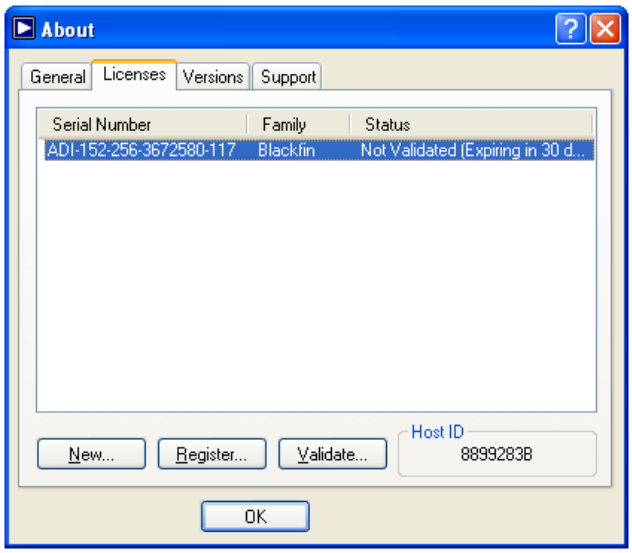
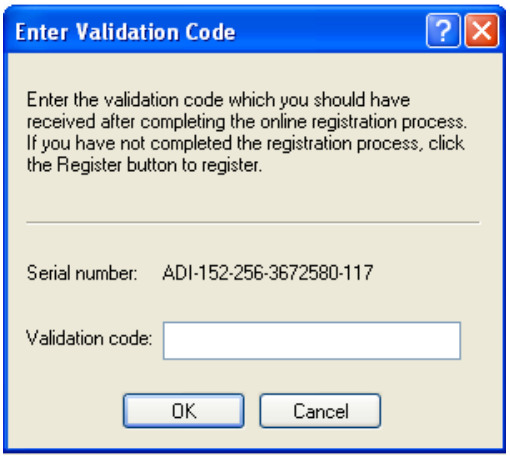


Fig.1-11 about VisualDSP++ Licenses

7. **Enter Validation Code** dialog appears. (fig.1-12) Enter your validation code in the field

And click **OK**. An information window notifies you of a successful validation. Click **OK**. (Fig.1-12). Validation Code screen.



1.3 Update VisualDSP++

1. Visit Analog Devices Tools website at http://www.analog.com/en/embedded-processing-dsp/software-and-reference-designs/content/visualdsp_tools_upgrades/fca.html to get the latest software updates and patches.

2. Download "*VisualDSP++ Release 5.0* - **Update 4 - September 2008** *Update*" or latest one.

3. From the Start menu, choose **Start->Programs** (**All Programs**) ->**Analog Devices-VisualDSP++ 5.0 >maintain this installation. Note the figure 1.13**

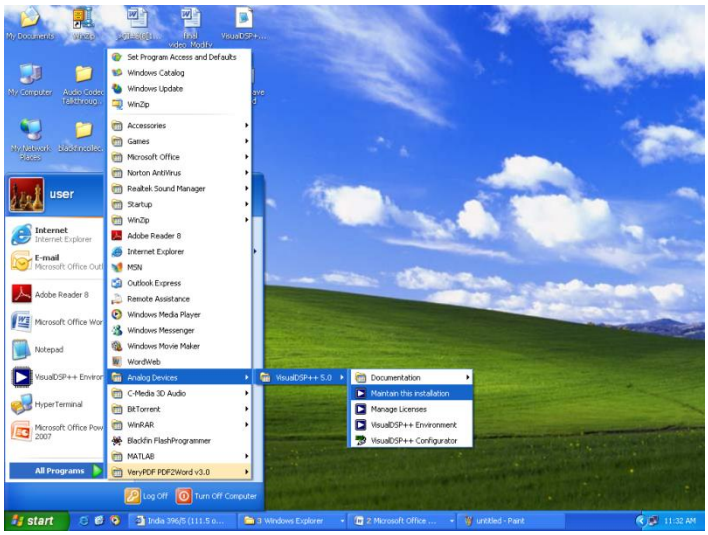


Figure 1.13 maintain this installation screen

4. The program maintenance screen Select “Apply a download Update” push button as shown in figure 1.14 , and click next

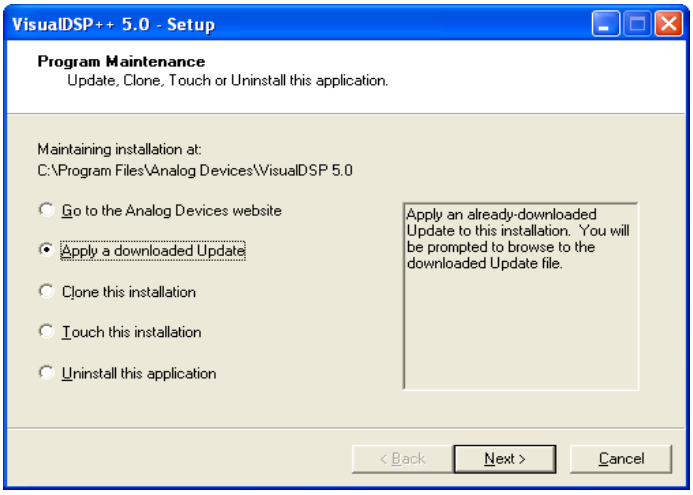


Figure 1.14 program maintenances screen

5. As shown in figure 1.15 browse the location of update software Wait until the update

Process is finished. Then the **Wizard Completed** screen appears. (fig.1-16) Click **Finish**

finishing update.

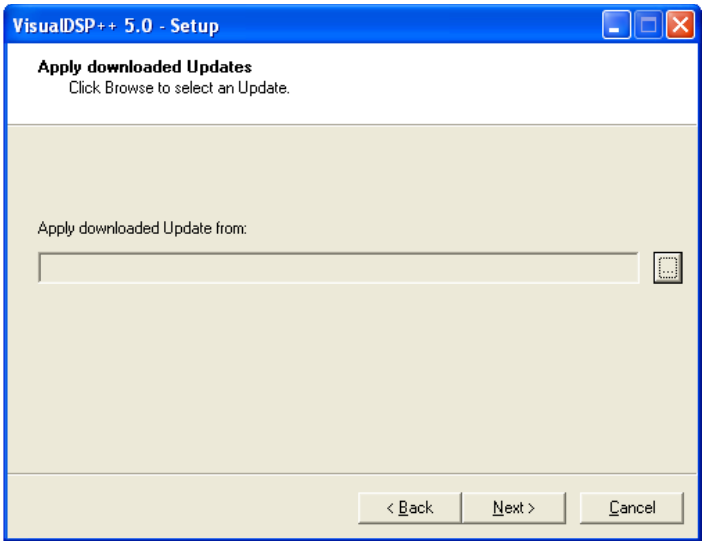


Figure 1.15 downloaded Updates Screen

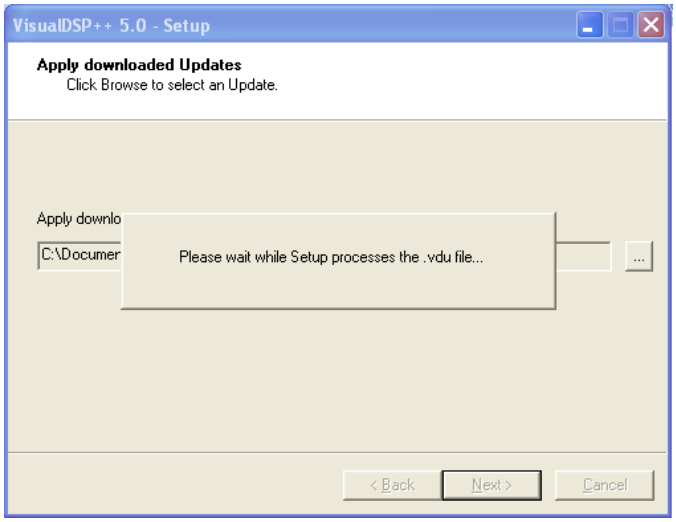


Figure.1-16 Wizard Completed

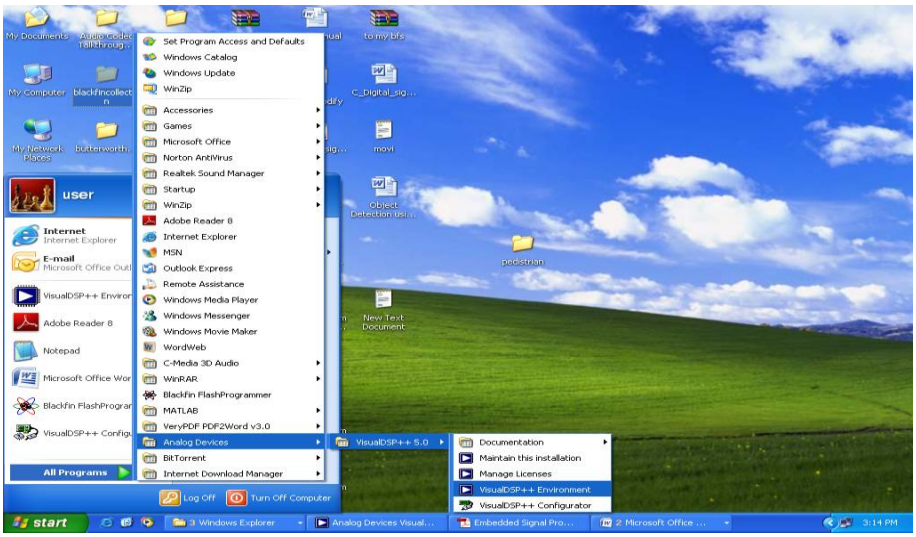
2. INSTALLATION and SESSION STARTUP

1. Plug the provided power supply into the Evaluation board. Visually verify that the green Power LED (D1) is on.
2. Connect one end of the UART cable to an available COM port on your PC and the Other End to the DB9 Connector

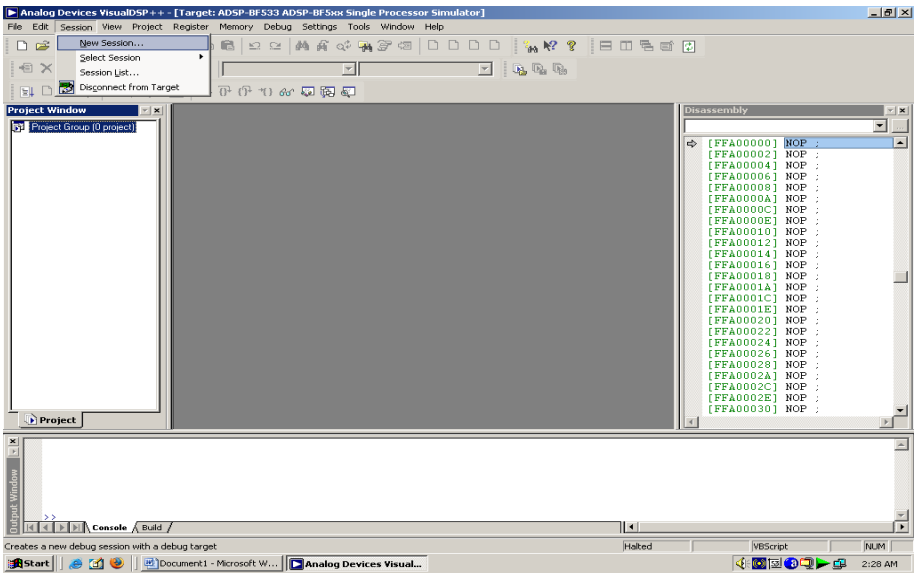
2.1 Start VisualDSP++

To start VisualDSP++ and creating a session following these steps,

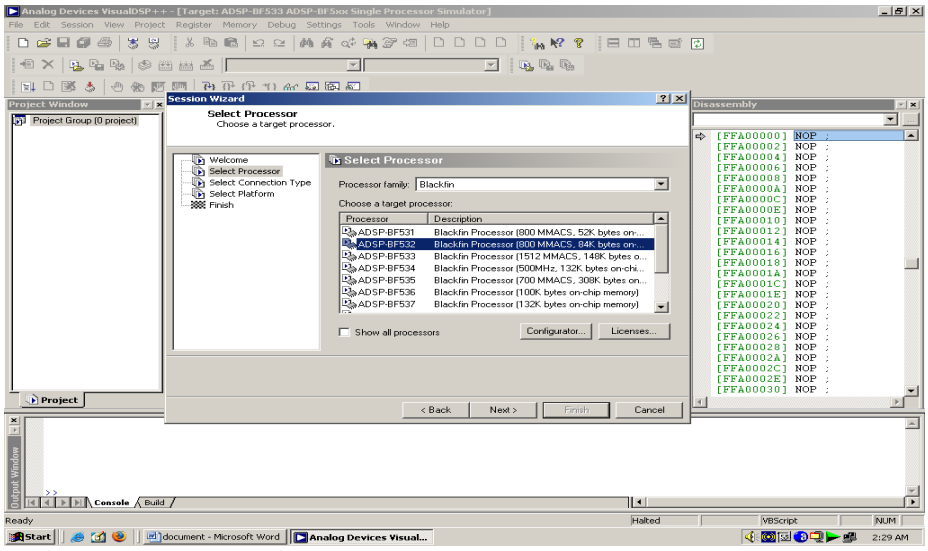
1. Click the Windows **Start** button and select **Programs**, **Analog Devices**, **VisualDSP++5.0**, and **VisualDSP++ Environment**. If you are running VisualDSP++ for the first time, you will not be connected to a debug target. In VisualDSP++ 4.5, it is possible to edit and build your code without being connection to a debug target through a debug session. When you are ready to run and debug your program, you can quickly connect to a target and disconnect when you are finished. Doing so eliminates the overhead associated with the target connection, resulting in a smoother and more responsive experience.



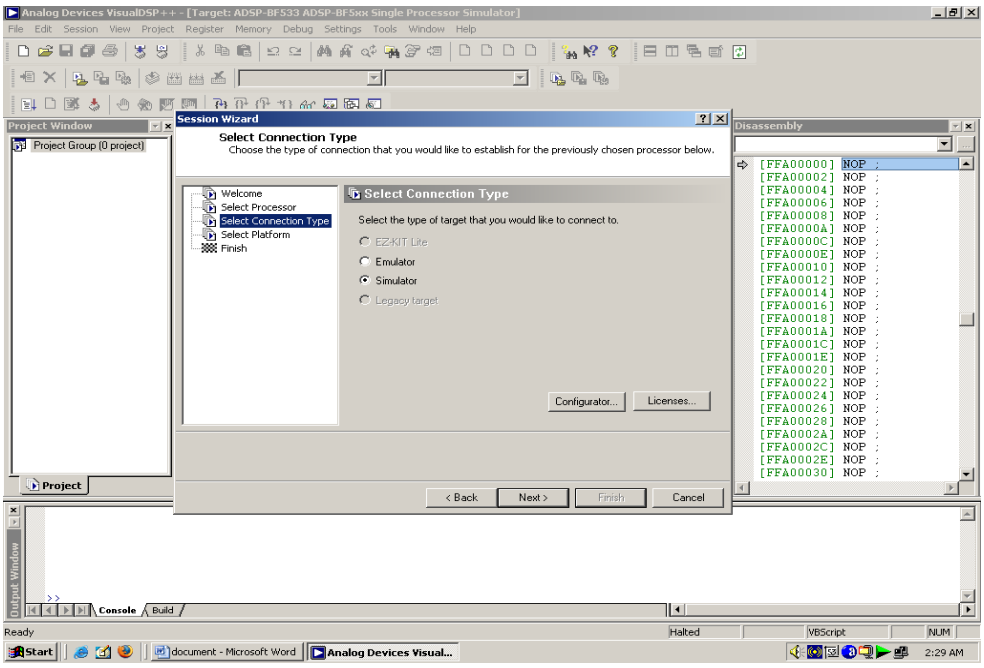
2. When you need to connect to a debug session, click the Connect to Target toolbar button or choose from the available sessions listed under Select Session in the Session menu. To create a debug session, select New Session from the Session menu. This will launch the Session Wizard as shown below



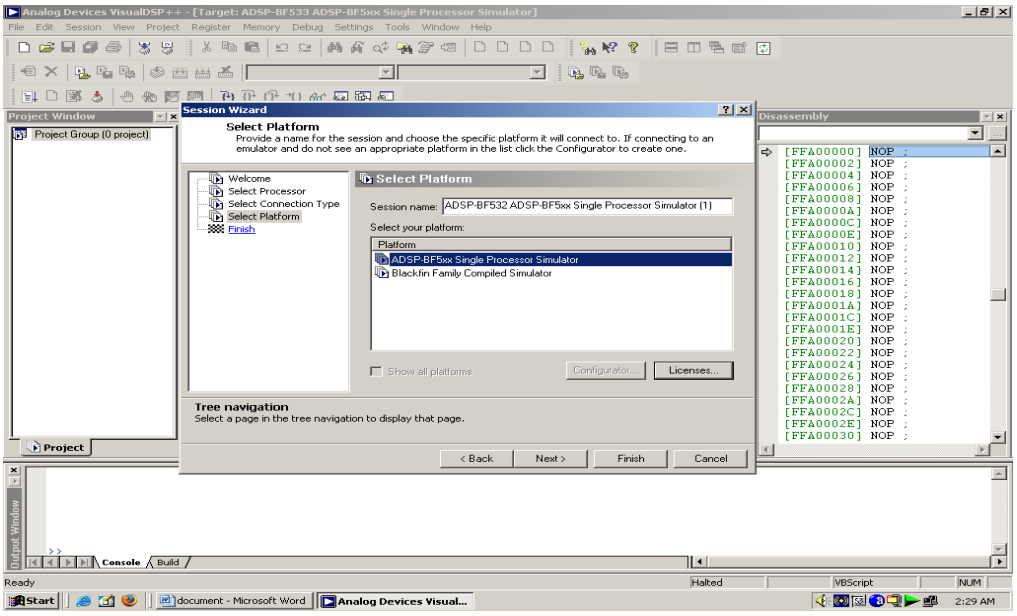
3. On the **Select Processor** page, select the **ADSP-BF532** processor from the **Blackfin** family. Click **next** to continue.



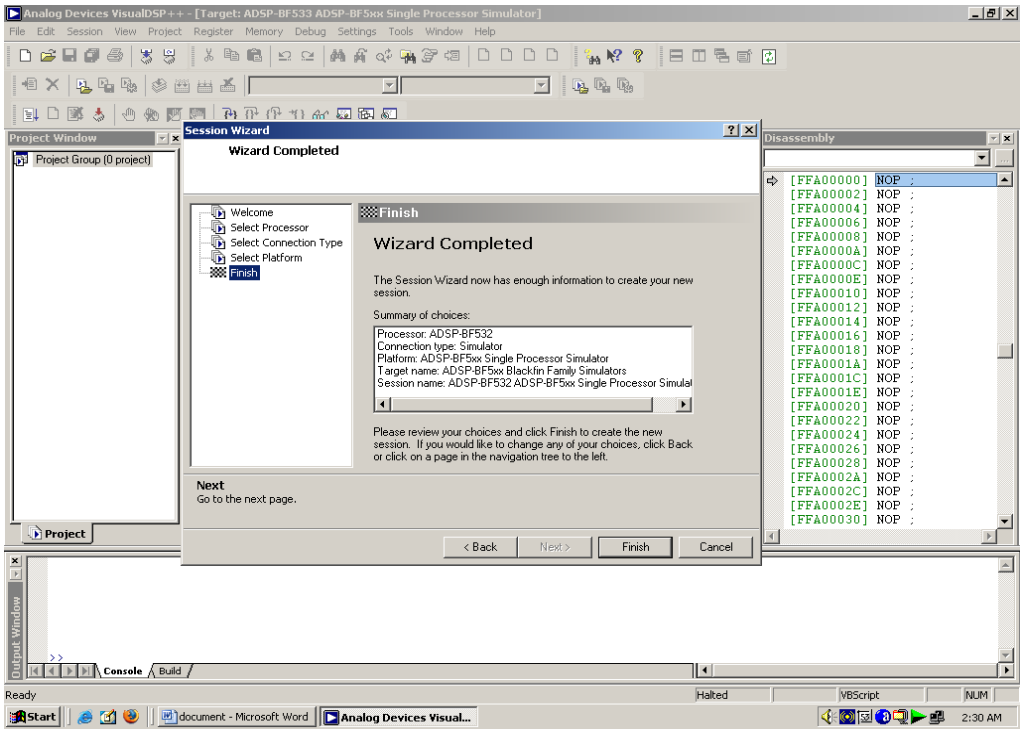
4. On the **Select Connection Type** page, select **Simulator**, and click **Next** to continue.



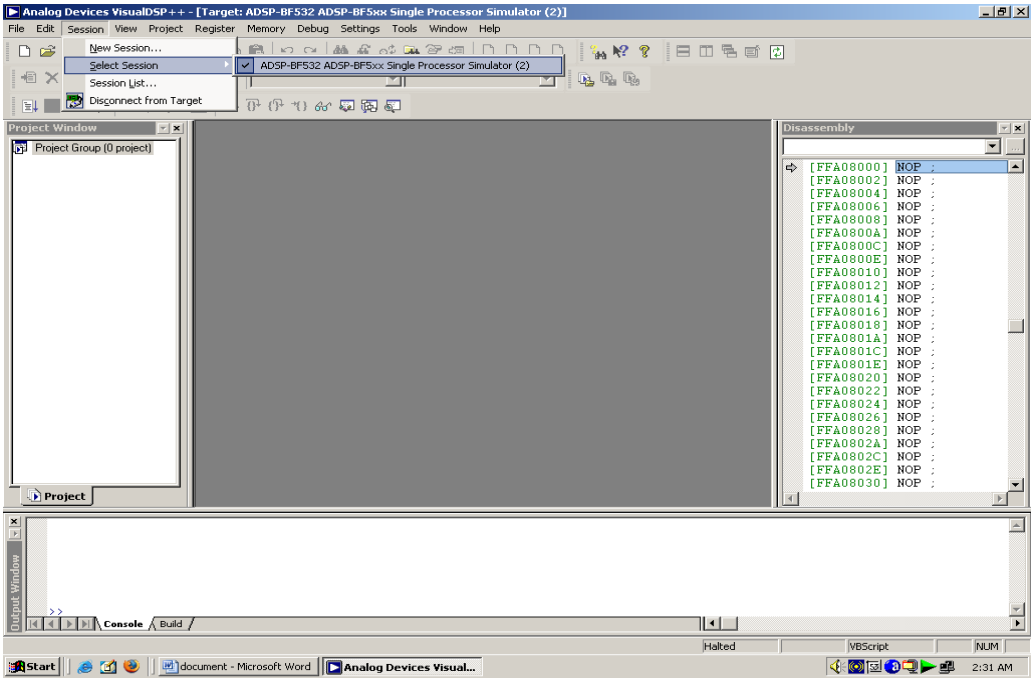
5. On the **Select Platform** page, select **ADSP-BF5xx Single Processor Simulator**. You can either use the default **Session name**, or give it a more meaningful name of your choosing. Click **Next** to review your choices, then click **Finish**



6. Select ADSP BF532 Single processor simulator, Click finish to complete the wizard



7. Go to select session from session menu and select the session created

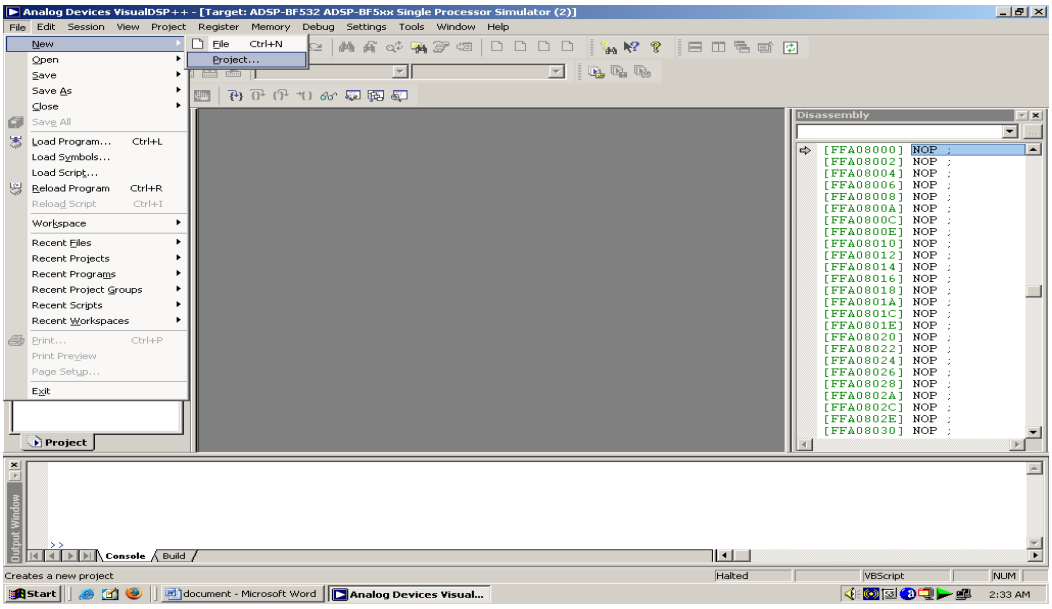


3. Creating A Project In Visual Dsp

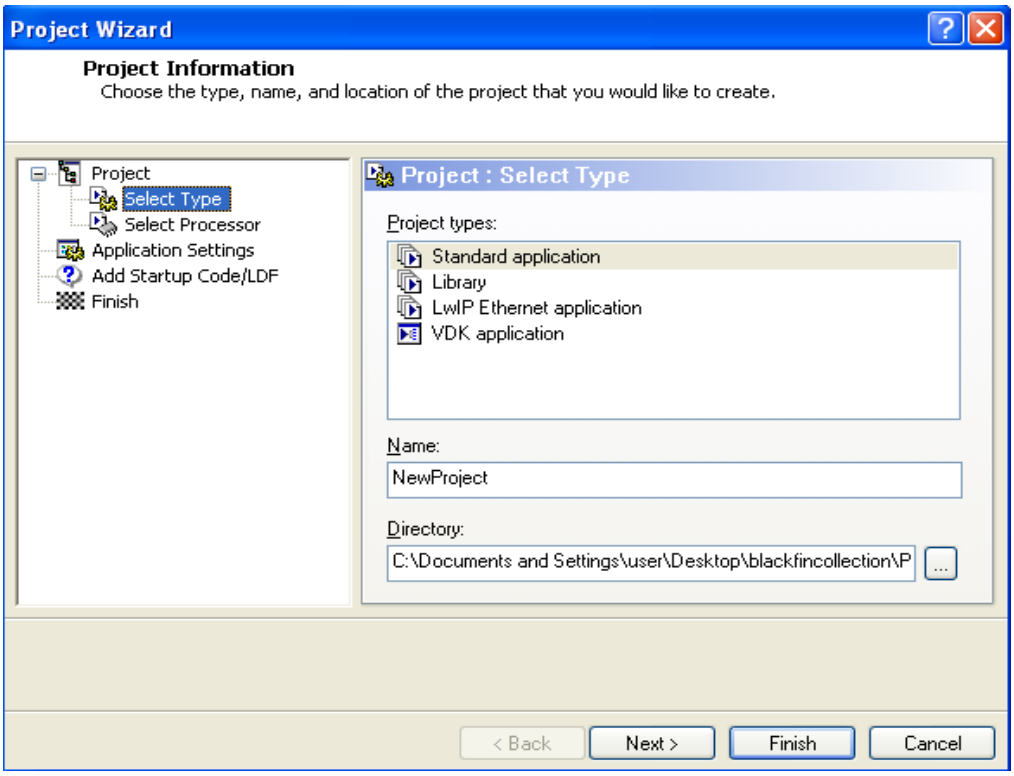
3.1 Step 1: Start VisualDSP++ and Open a Project

- To start VisualDSP++ and open a project Click the Windows **Start** button and select **Programs**, **Analog Devices**, **VisualDSP++5.0**, and **VisualDSP++ Environment**. If you are running VisualDSP++ for the first time, you will not be connected to a debug target. In VisualDSP++ 5.0, it is possible to edit and build your code without being connection to a debug target through a debug session. When you are ready to run and debug your program, you can quickly connect to a target and disconnect when you are finished. Doing so eliminates the overhead associated with the target connection, resulting in a smoother and more responsive experience. When you need to connect to a debug session, click the Connect to Target toolbar button or choose from the available sessions listed under Select Session in the Session menu. To create a debug session, select New Session from the Session menu. This will launch the Session Wizard, which is covered in previous chapter. If you have already run VisualDSP++ and the **Reload last project at start up** option is selected on the **Project** page under **Settings**

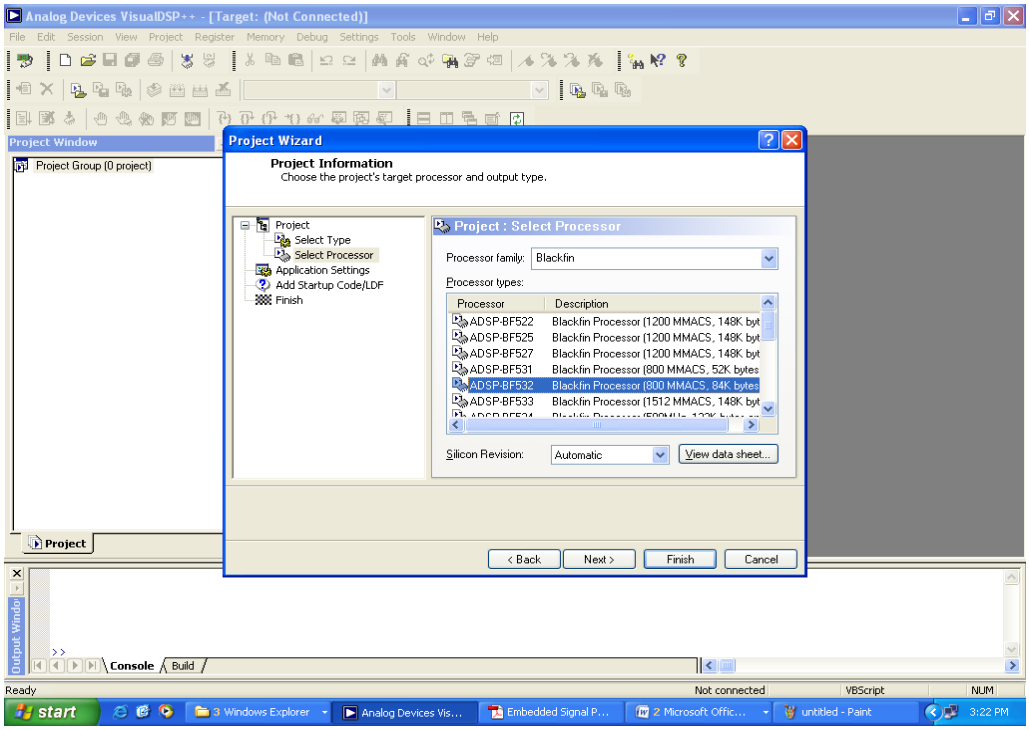
and **Preferences**, VisualDSP++ opens the last project that you worked on. To close this project, choose **Close** and then **Project** from the **File** menu, and then click **No** when prompted to save the project.



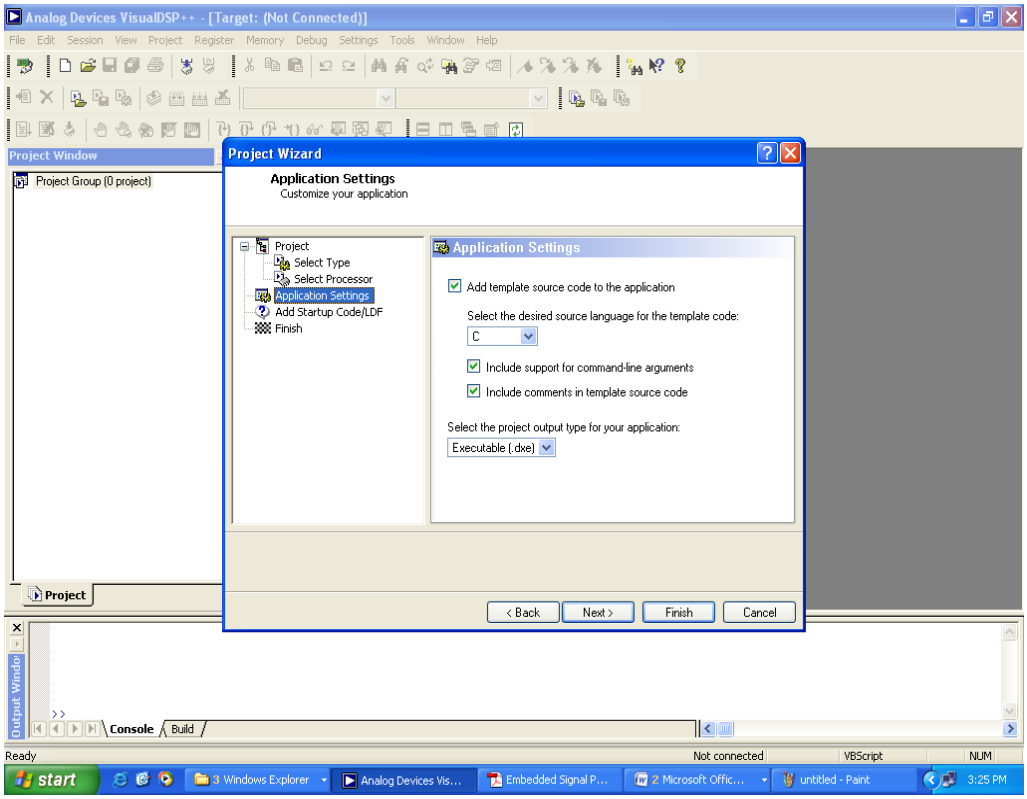
- From the **File** menu, choose **New** and then **Project** to open the **Project Wizard**, shown below



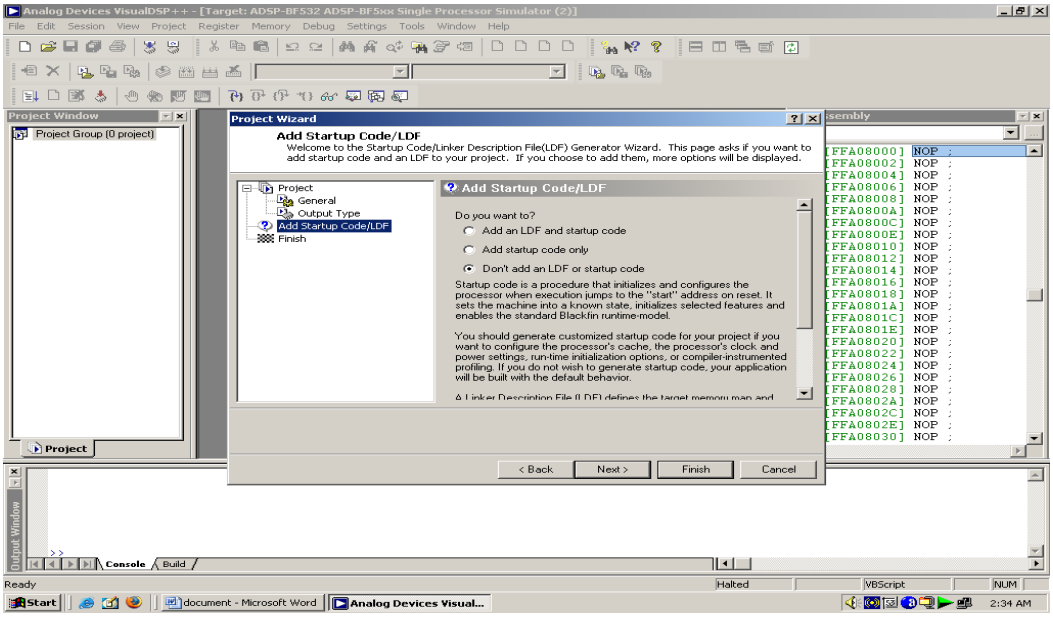
- In the **Name** field, type any name .Click the browse button to the right of the **Directory** field to open the **Browse For Folder** dialog box. Click **Next** to bring up the Output Type page.



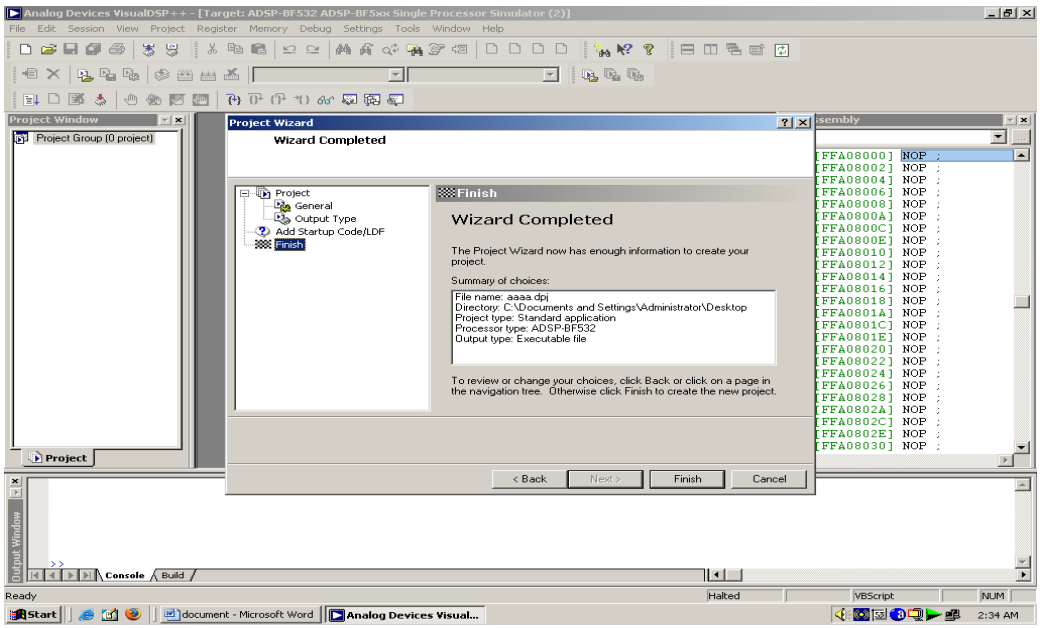
- Verify that the **Processor type** is ADSP-BF532, the **Silicon Revision** is Automatic, click next



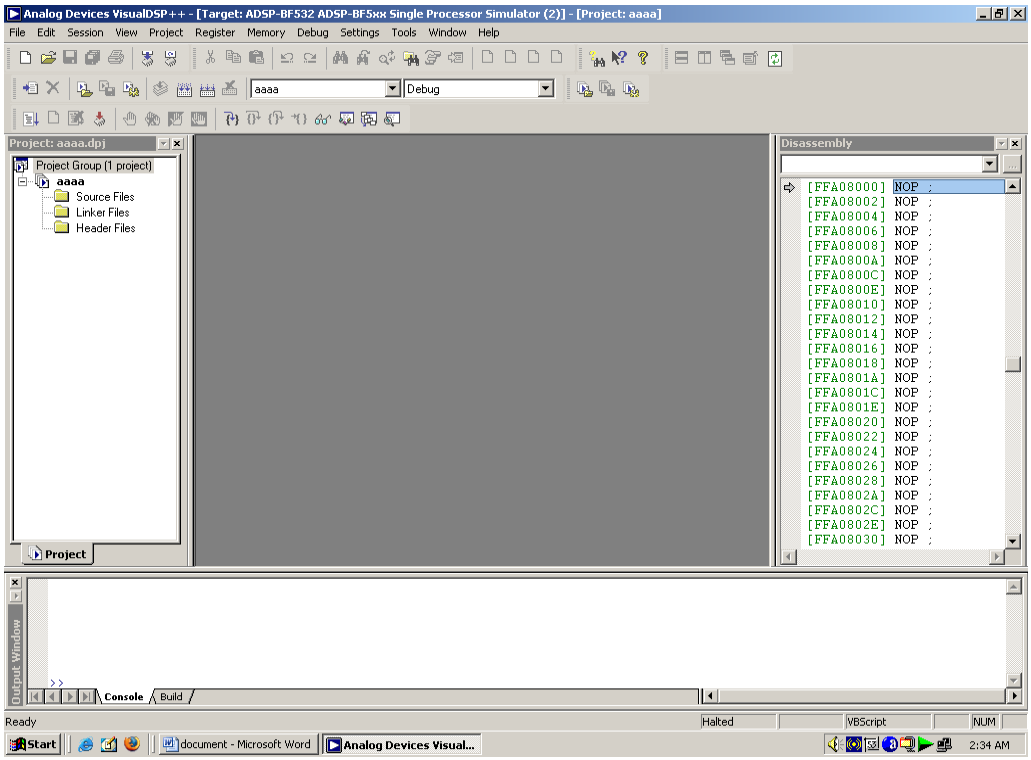
- The **Project output type** is Executable file. Click **Next** to display the **Add Start up Code/LDF** page.



- Read the displayed text, and scroll down to the bottom of the page. Select the **Don't Add an LDF and start-up code** option. When this project is created, start-up code that initializes and configures the processor will be added to the project, as will a Linker Description File that defines the target memory map and the placement of program sections within processor memory. The options available to configure the start-up code and LDF are beyond the scope of this tutorial. Make sure the **Don't Add an LDF and start-up code** option is selected, and click **Finish**. The new project is created and is shown in the Project window of the IDDE.



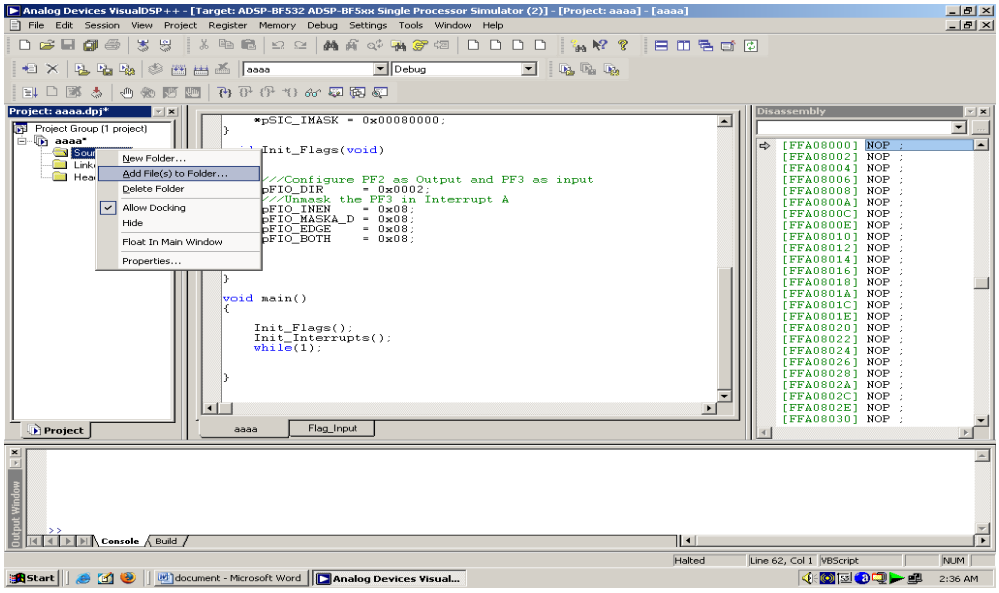
- **Click finish to complete the wizard**



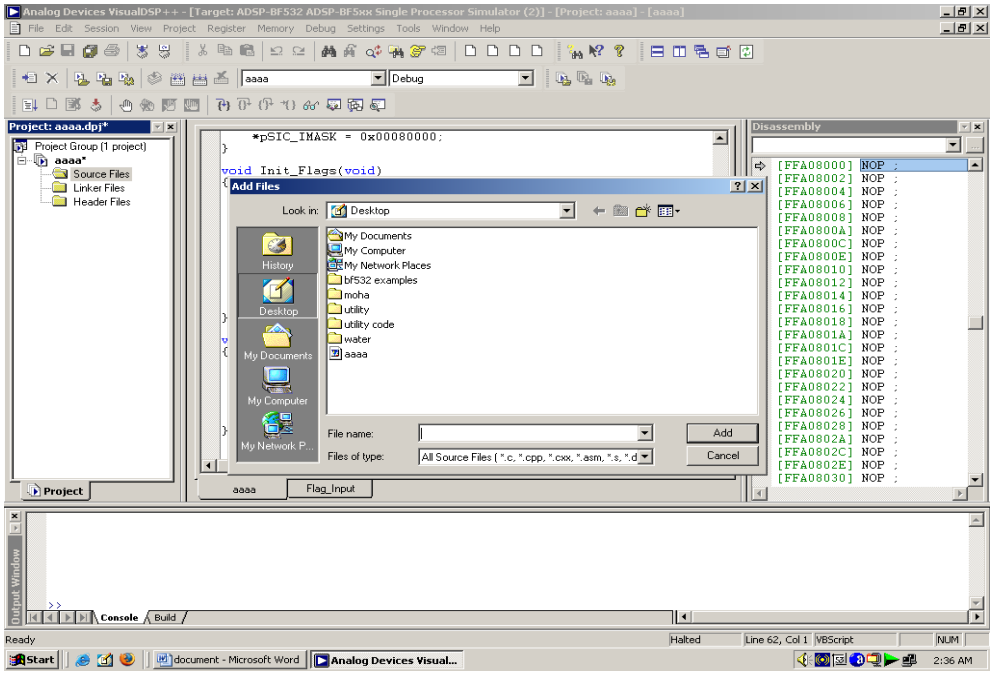
3.2 How To Create a New Project

To add the source files to the new project:

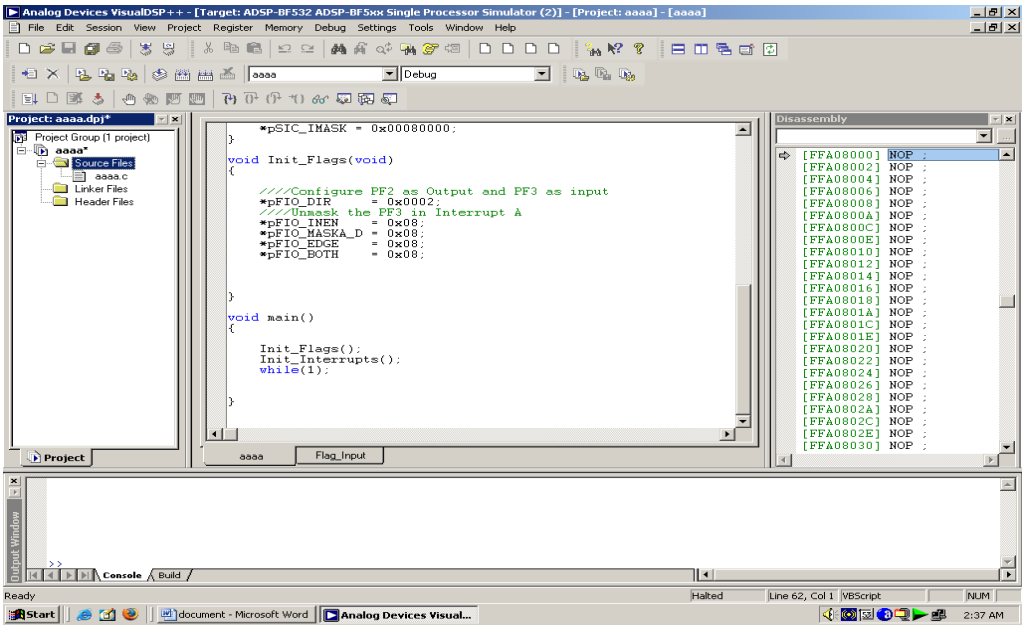
1. Click the **Add File** button , or from the **Project** menu, choose **Add to Project**, and then choose **File(s)**.



2. The **Add Files** dialog box appears .In the **Look in** box, locate the project folder, In the **Files of type** box, select **All Source Files** from the drop-down list. Select the file and Then click **Add**.

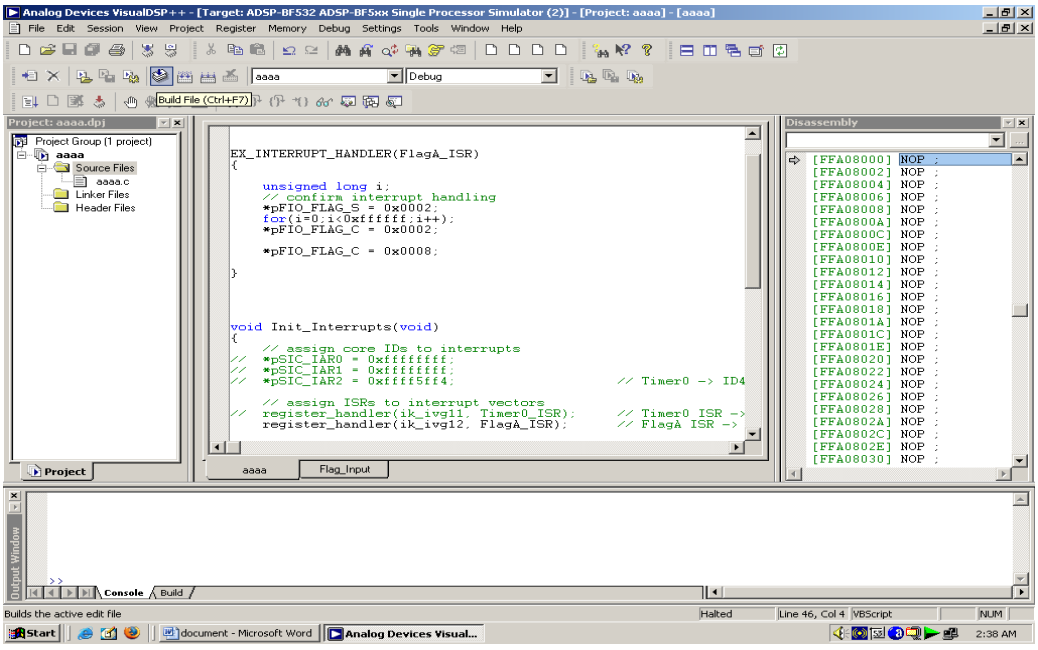


3. To display the files that you added in step 4, open the Source Files folder in the **Project** window. Click the **Rebuild All** button ( ) to build the project. The C source file opens in an editor window, and execution halts Save the Project and then builds the Project**.**



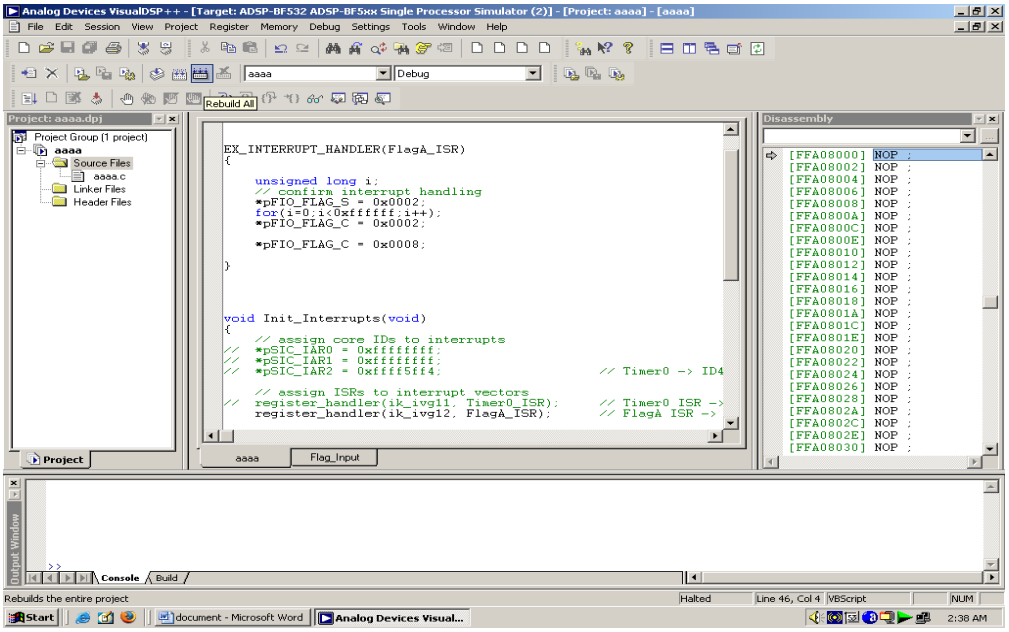
4. Build the project by performing one of these actions.

- Click the **Build Project** button or From the **Project** menu, choose **Build Project**.

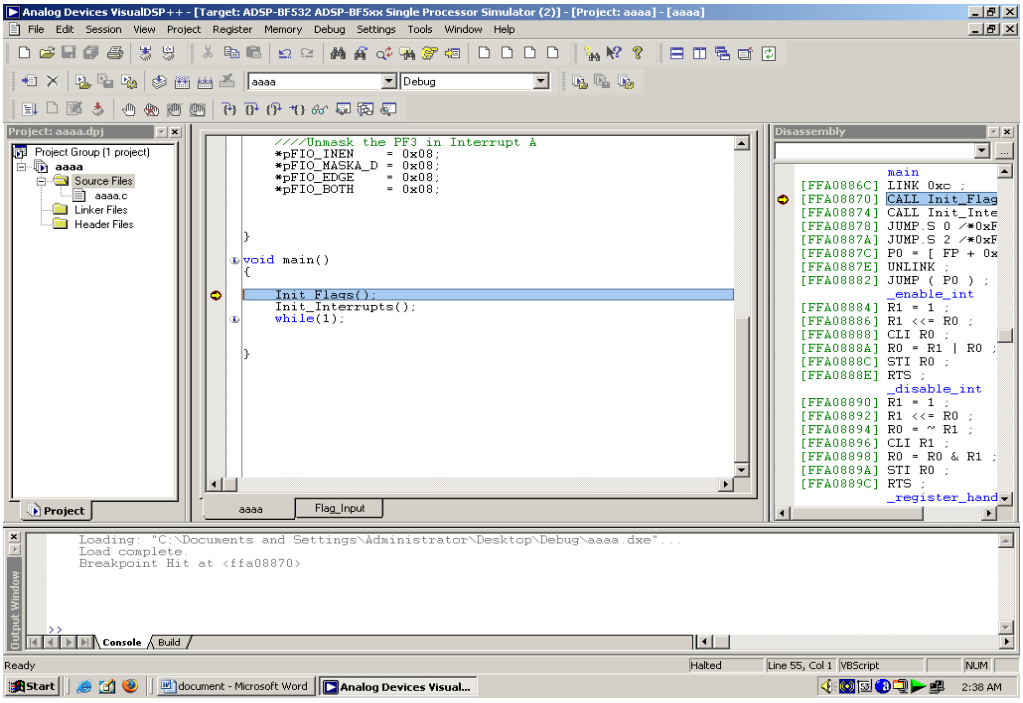


At the end compilation, the **Output** window displays this message in the Build view:

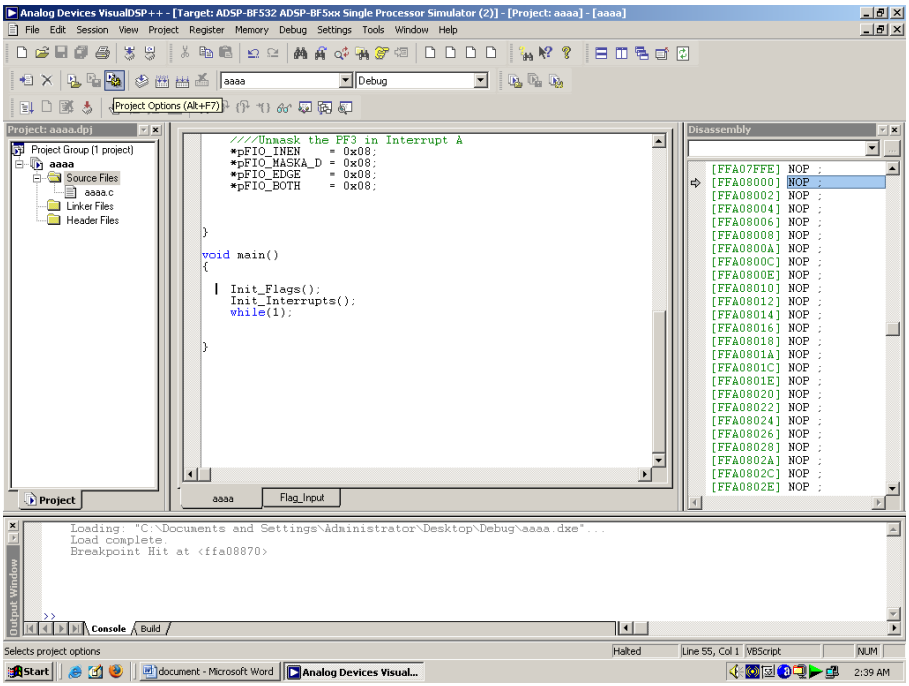
“Build completed successfully.” The project can be rebuild by choosing rebuild all.



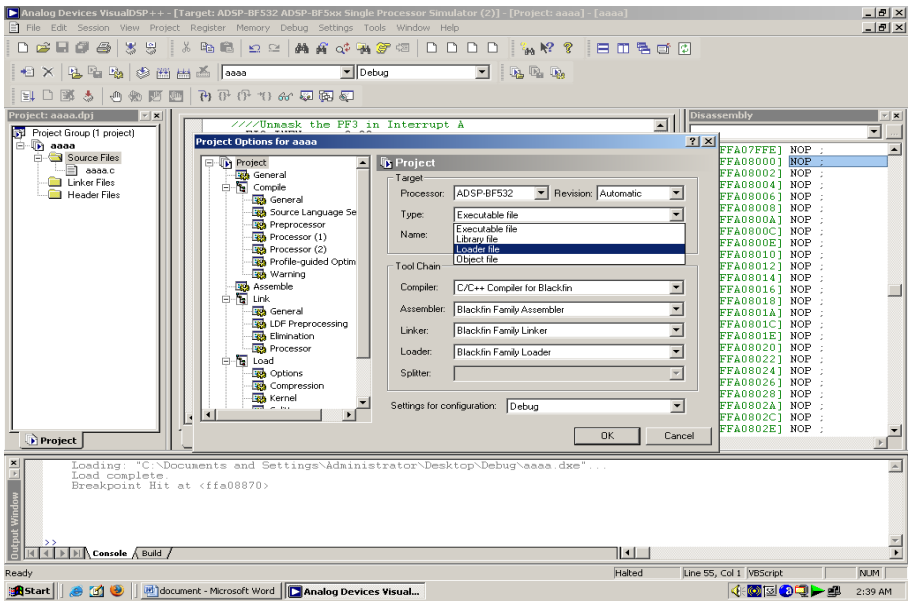
Press F5 to run the project



3.3 How To Changing the Project Options



- From the **Project** menu click the **Project Options** command to display the **Project Options** dialog box



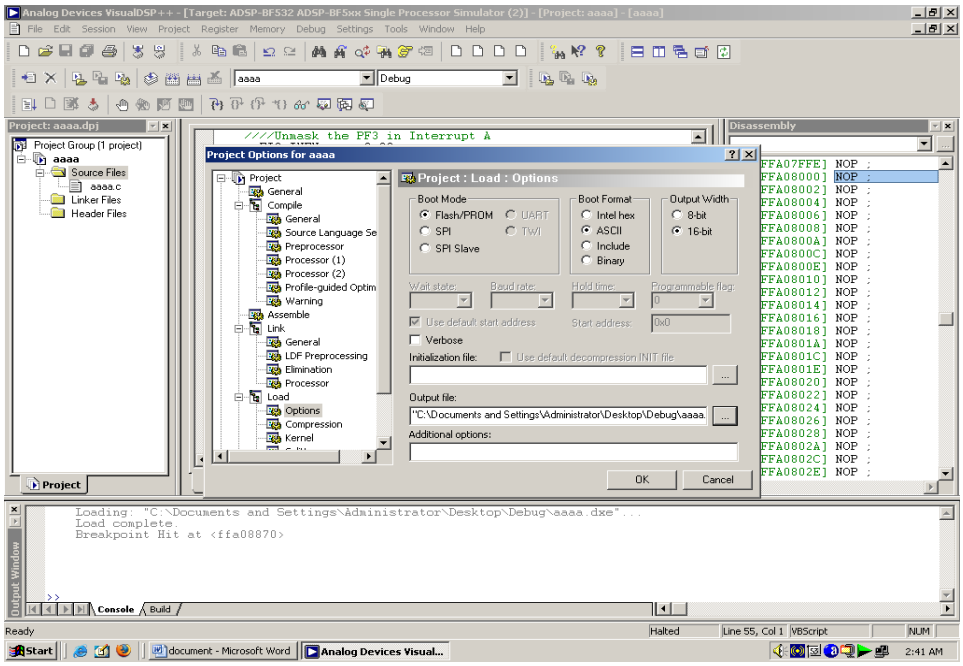
- This dialog box enables you to specify project build information.

- Take a moment to view the various pages in the **Project Options** dialog box by selecting them from the tree on the left: **Project**, **General**, **Compile**, **Assemble**, **Link**, **Load**, **Pre-Build**, and **Post-Build**. On each page, you specify the tool options used to build the project.

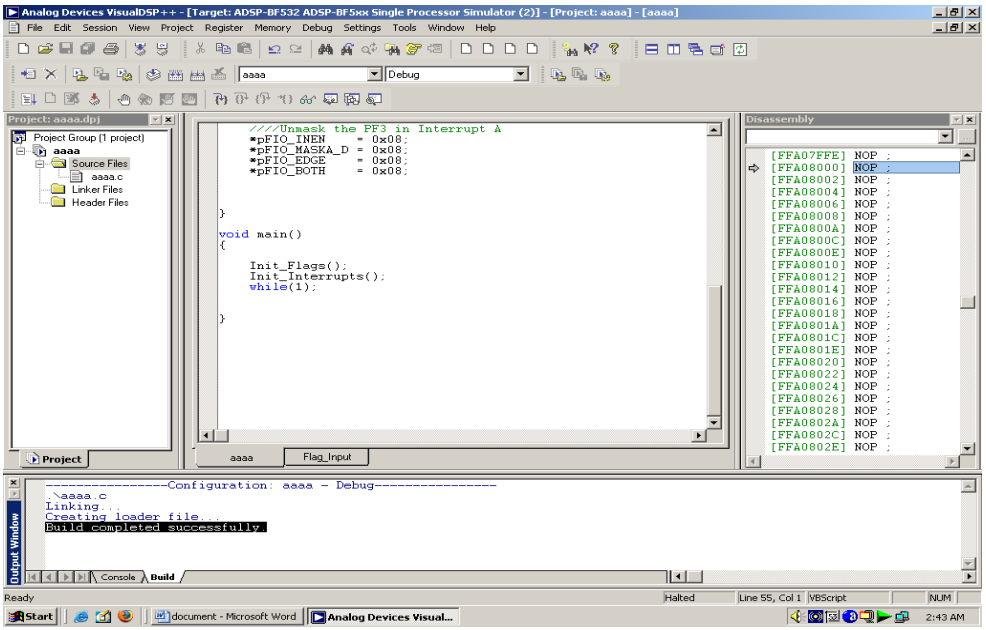
- On the **Project** page , verify that the values shown in Table are entered here.

Field	Value
Processor	ADSP BF532
Revision	Automatic
Type	Loader File
Name	File.c
Settings For Configuration	Debug

- These settings specify information for building an executable file for the ADSP-BF533 processor. The executable contains debug information, so you can examine program execution. Click the **LOAD** tab to display the **General** page, shown in Figure



- Choose boot mode as **flash/ PROM**, Boot Format as Intel **ASCII** and Output width as **16 bit. Choose a folder for an output file . After changing the options again Rebuild All**

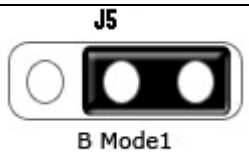
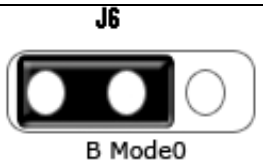
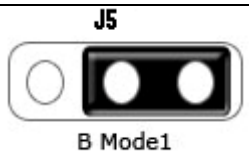
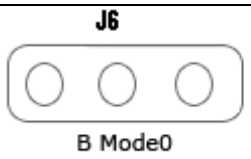
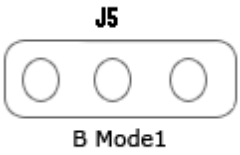
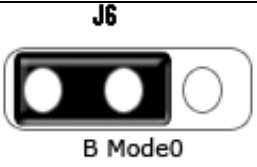
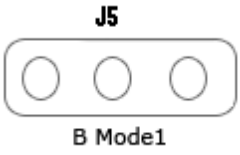
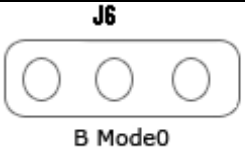


- Loader file will be generated in the folder mentioned in the project options This loader can be loaded in the flash memory by using Blackfin external flash programmer which is explained in chapter 4

4. Programming Flash Using Pantech Programming Software

4.1 Booting modes of BLACKFIN for Audio development board

The ADSP-BF531/ADSP-BF532/ADSP-BF533 processor has two mechanisms (listed in Table) for automatically loading internal L1 instruction memory after a reset. A third mode is provided to execute from external memory, bypassing the boot sequence.

Jumper settings		Boot Mode	Description
J5-BMODE1	J6-BMODE0		
		00	Execute from 16 bit external memory (Bypass Boot Rom)
		01	Boot from 8bit/16 bit flash
		10	Boot from serial master
		11	Boot from serial slave EEPROM/flash(8/16- or 24 bit address range)

Notes:

1. Here in these diagrams “C” side is GND side. So, if we connect a jumper in “C” side the Corresponding pin is “0”

2. The BMODE pins have Pull-ups in the Circuit. So, to make any BMODE to “HIGH“there is no need to connect

Anything. The "NC" Side is No Connection Side

The BMODE pins of the reset configuration register (SYSCFG), sampled during power-on resets and software-initiated resets, implement the following modes:

Execute from 16-bit external memory – Execution starts from address 0x2000 0000 with 16-bit packing. The boot ROM is bypassed in this mode. All configuration settings are set for the slowest device possible (3-cycle hold time; 15-cycle R/W access times; 4-cycle setup).

Boot from 8-bit or 16-bit external flash memory – The flash boot routine located in boot ROM memory space is set up using asynchronous Memory Bank 0. All configuration settings are set for the slowest device possible (3-cycle hold time; 15-cycle R/W access times; 4-cycle setup).

Boot from SPI serial EEPROM/flash (8-, 16-, or 24-bit addressable, or Atmel AT45DB041, AT45DB081, or AT45DB161) – The SPI uses the PF2 output pin to select a single SPI EEPROM/flash device, submits a read command

and successive address bytes (0x00) until a valid 8-, 16-, or 24-bit addressable EEPROM/flash device is detected, and begins clocking data into the processor at the beginning of L1 instruction memory.

Boot from SPI serial master – The Blackfin processor operates in SPI slave mode and is configured to receive the bytes of the LDR file from an SPI host (master) agent. To hold off the host device from transmitting while the boot ROM is busy, the Blackfin processor asserts a GPIO pin, called host wait (HWAIT), to signal the host device not to send any more bytes until the flag is deasserted. The GPIO pin is chosen by the user and this information is transferred to the Blackfin processor via bits[10:5] of the FLAG header in the LDR image. For each of the boot modes, a 10-byte header is first read from an external memory device. The header specifies the number of bytes to be transferred and the memory destination address. Multiple memory blocks may be loaded by any boot sequence. Once all blocks are loaded, program execution commences from the start of L1

instruction SRAM. In addition, Bit 4 of the reset configuration register can be set by application code to bypass the normal boot sequence during a software reset. For this case, the processor jumps directly to the beginning of L1 instruction memory.

Every Board comes along with SPI Boot loader, ensure there is jumper on WP and Jumper in J8

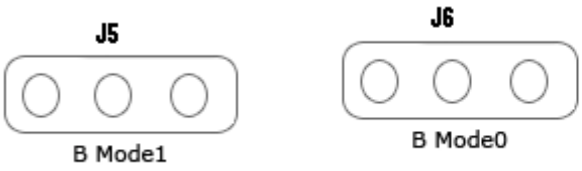
We have two modes

- Programming Mode(Booting from SPI –BOOTMODE:-11)
- General or Normal Mode(Booting 8-/16-bit Flash—BOOTMODE:-01)

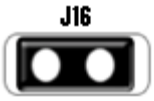
4.2 Programming Mode

In Programming Mode J5, J6 (BMODE1,BMODE0)should be connected on connection side(NC) as shown below .

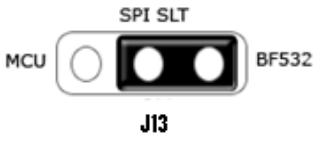
So, that processor BOOTMODE is 11. .This mode will boot the processor from SPI.



J15, WP should have a jumper as shown below,



SSEL should be configured for BF532 as shown below

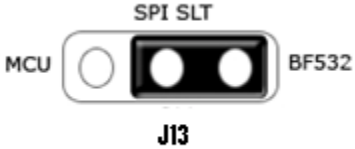


4.3 General Mode

In general mode a jumper must be connected to J5 as shown below. In this BMODE1 should have jumper in “C” or GND side so, that BMODE1 = 0; and BMODE0 should have jumper on “NC” side or No jumper is needed so, that BMODE0 = 1;

J15, WP should have a jumper as shown below,

SSEL should be configured for BF532 as shown below



And Reset the kit Previously whatever are there in the ”Programming Mode” keep all, Additionally just we need to put the JUMPER in J1 or BMODE1 in “C” side Now the Boot Mode is changed to “01 ” where it will Boot from 8-bit/16-bit Flash

4.4 Basic setup

Blackfin External Flash programmer is Windows software from the Pantech solutions private limited that allows easy access to the Flash memory. These features include:

- Communicating to the Black fin audio development module
- Erasing the Flash memory
- Programming the Flash memory

External flash programmer provides a clear and simple user interface to these features and more as described in the following sections.

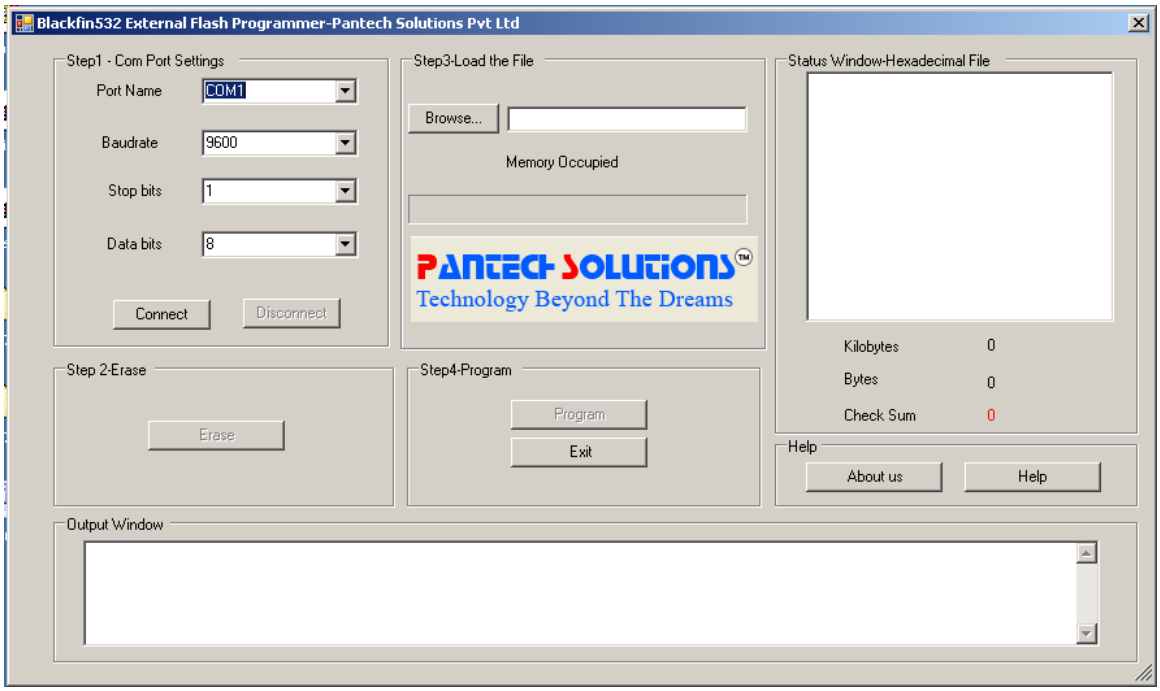
Minimum Requirements

- Windows 95/98/ME/NT/2000/XP
- Mouse
- COM Port
- 16Mb RAM
- 3Mb Disk Space

4.5 Programming uses Blackfin532 external flash programmer software

Main Window

The following is a screenshot of the main window.



The window is divided up into six sections. Work your way from section 1 to section 4 to program a device using the most common functions. Each section is described in detail in the following sections. At the very bottom the window is an area where output messages will be displayed and at the very bottom right is where the progress bar is displayed.

Four Step Programming

For each step there is a corresponding section in the main window as described in the User Interface Tour.

Step 1 – Connection Settings

Before the device can be used the settings required to make a connection must be specified.

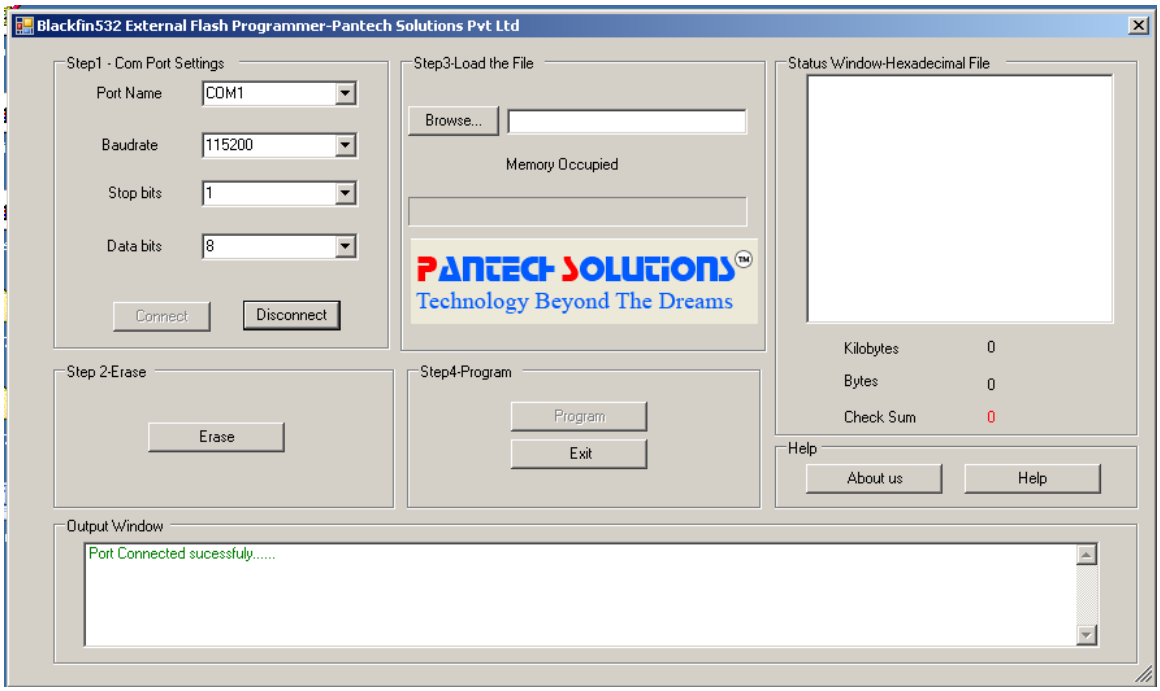
Select the desired COM port from the drop down list or type the desired COM port directly into the box. If you enter the COM port yourself then you must enter it in one of the following formats

Port name COM1

Baud Rate 9600

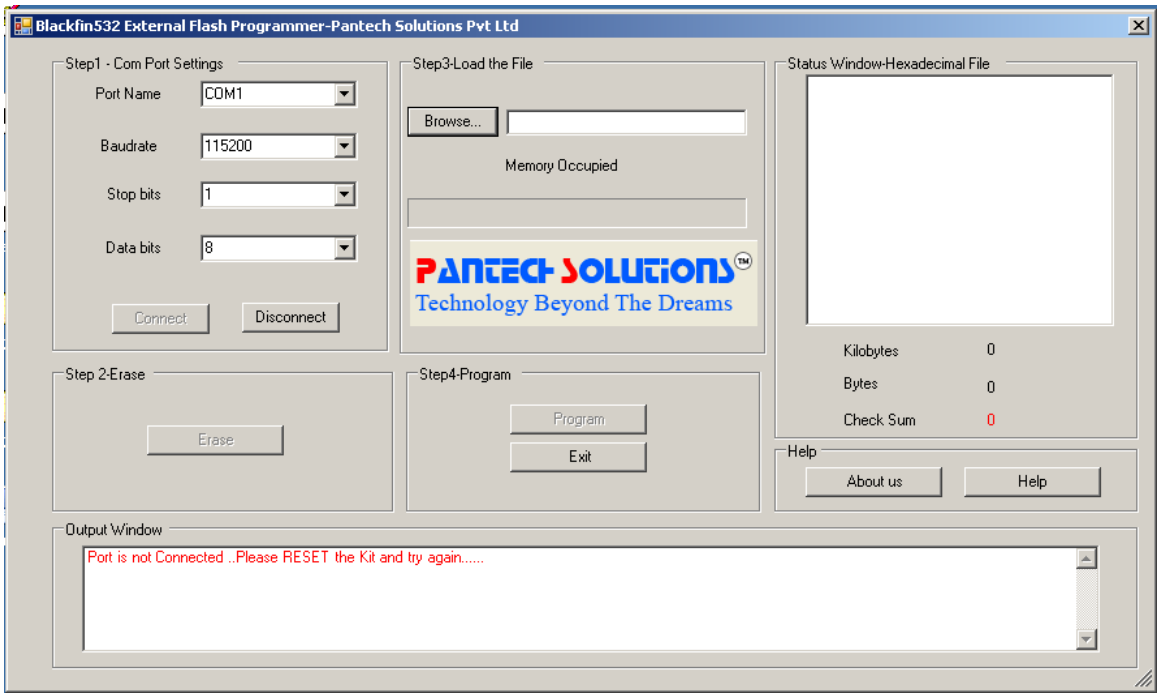
Stop bits 1

Data bits 8



Port connected successfully will be displayed in output window

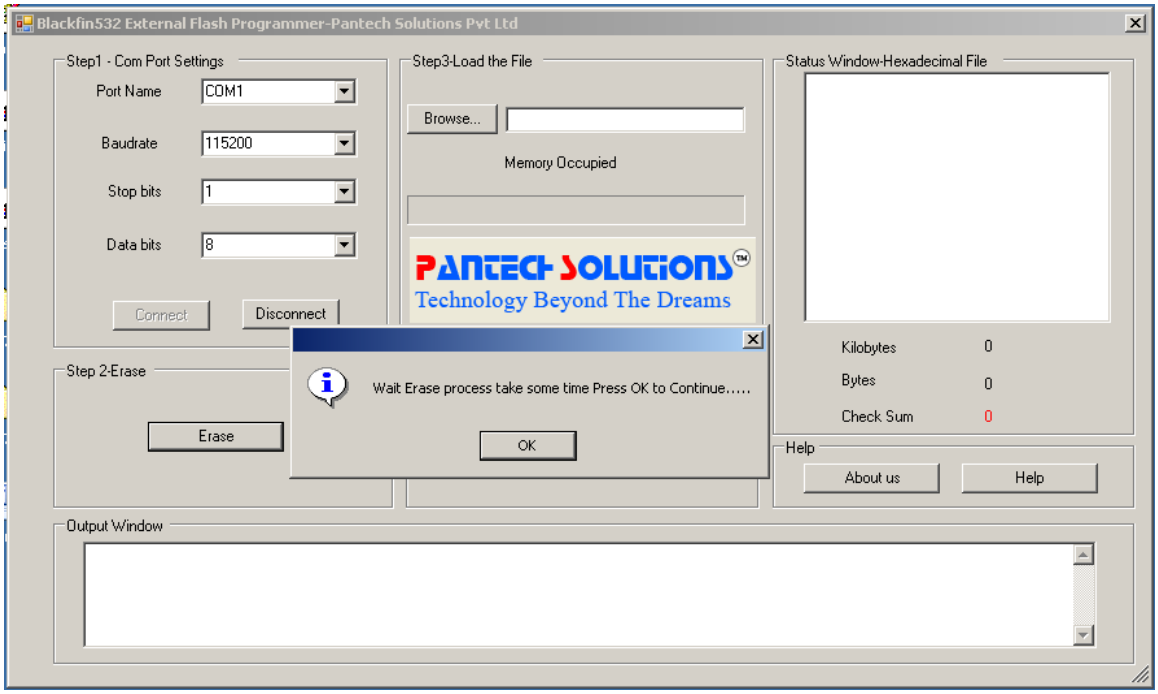
If the port is not connected .The following message will display.



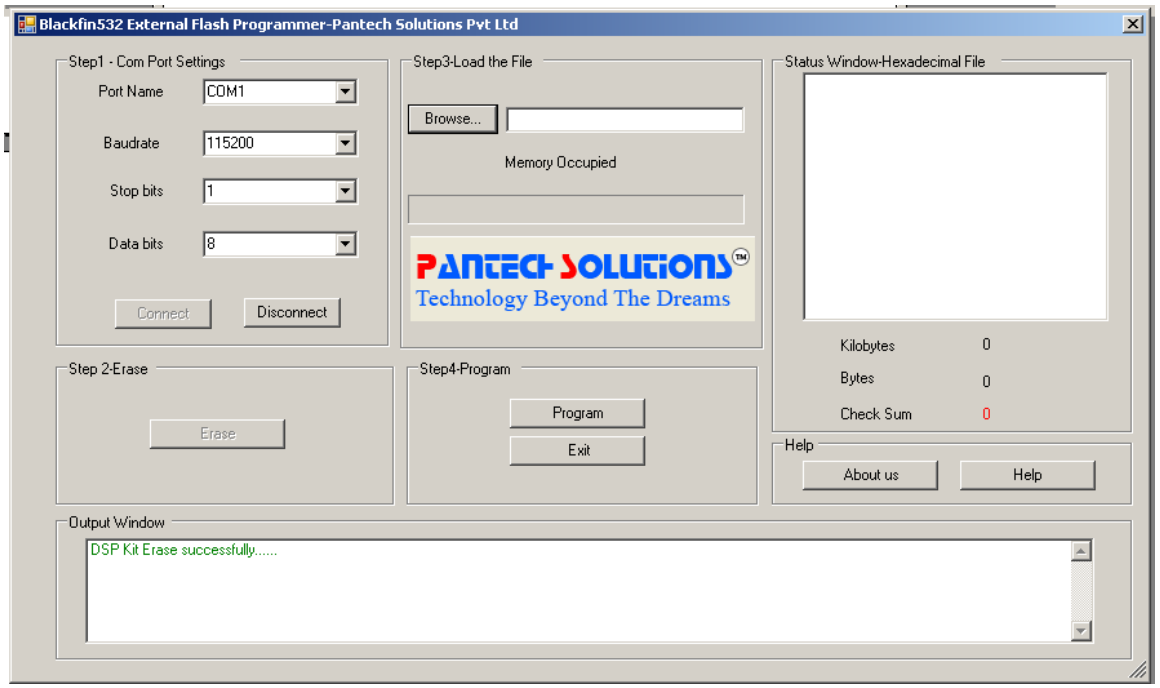
Ensure the kit is in programming mode and Press the RESET button in the Kit and try again.

Step 2 – Erasing

Press the erase button

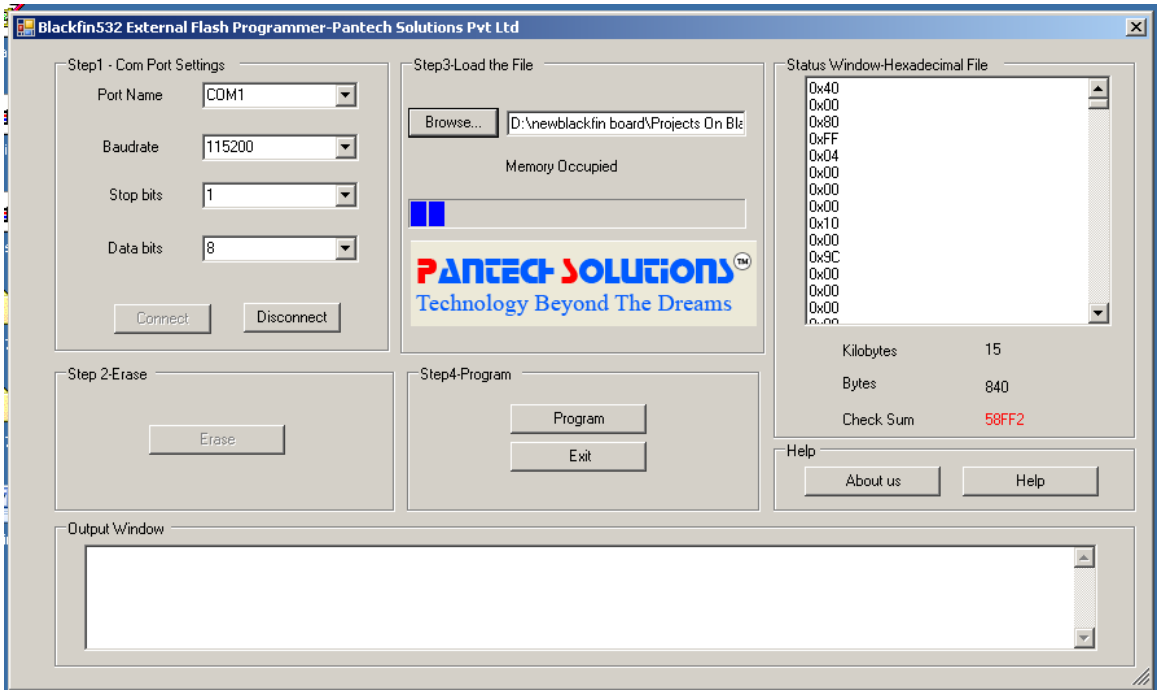


Click ok to continue after erasing the following message will be displayed in output window



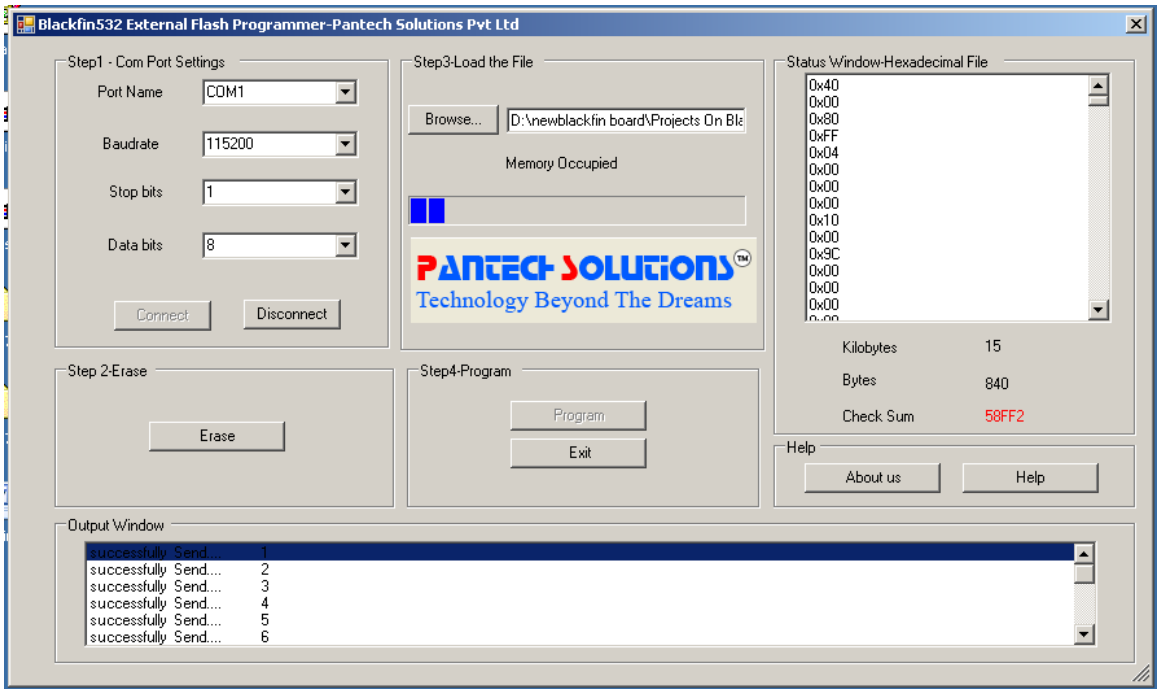
Step 3 – Selecting the Hex File

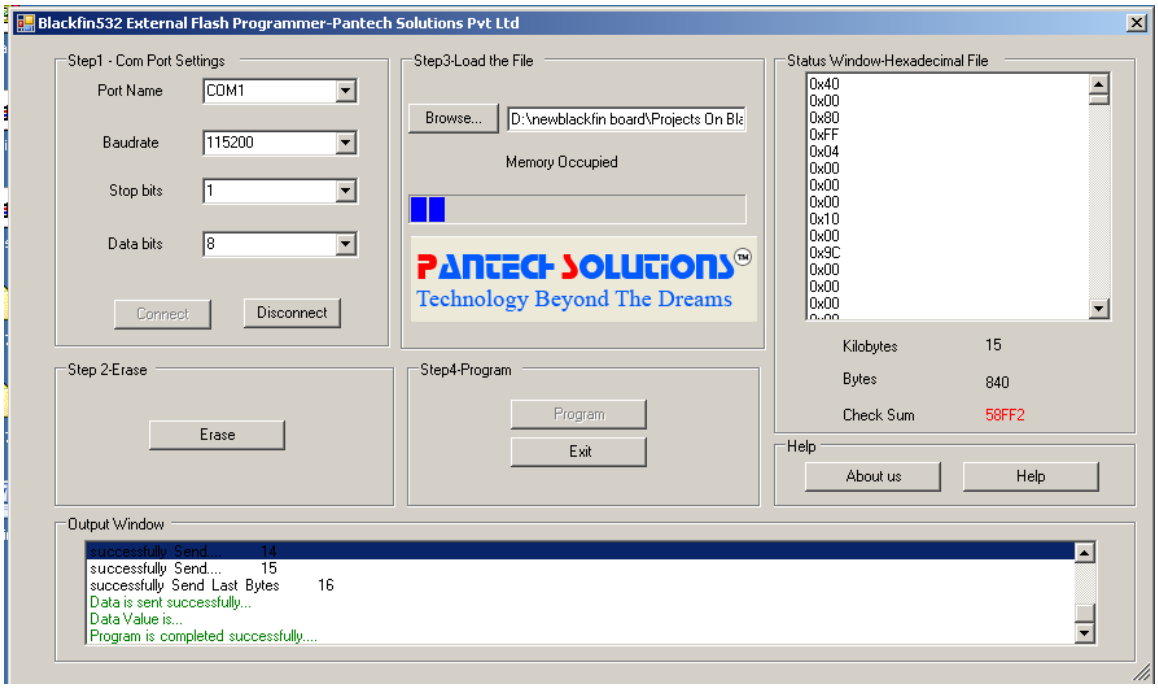
Select the file by using browse button. The status bar will show you the memory occupied and the file contents, file size and checksum will be displayed in status window.



Step 4 – Programming the flash

Click program button to program the device



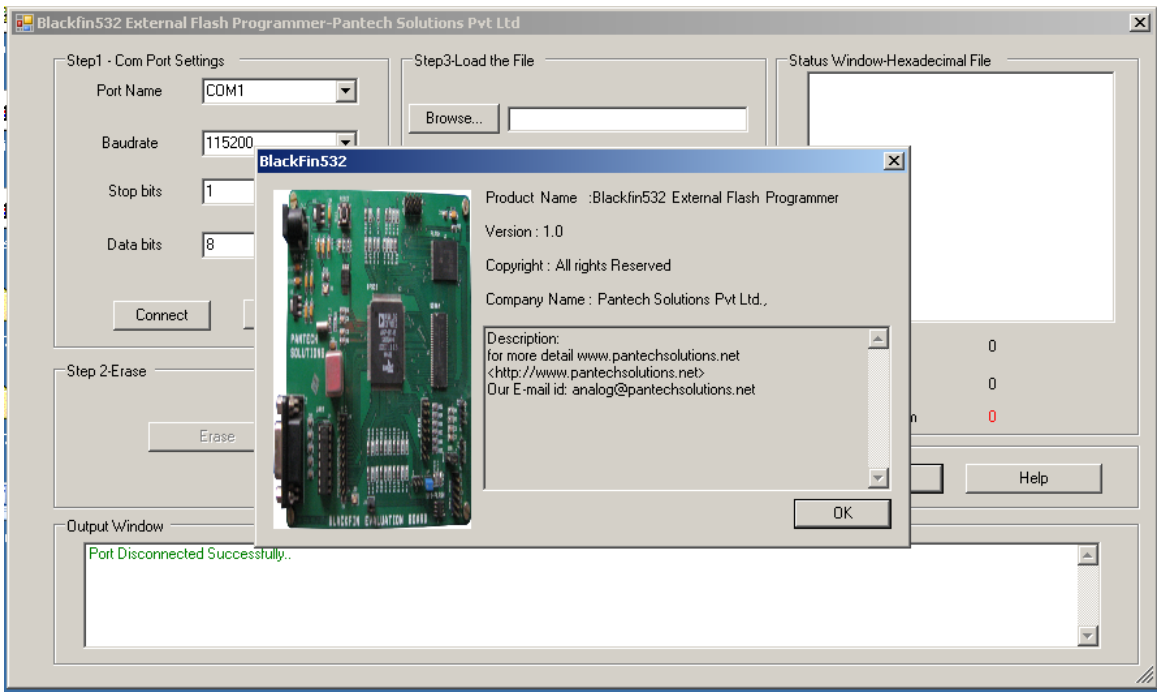


After programming kit should be connected in general mode and reset the kit again

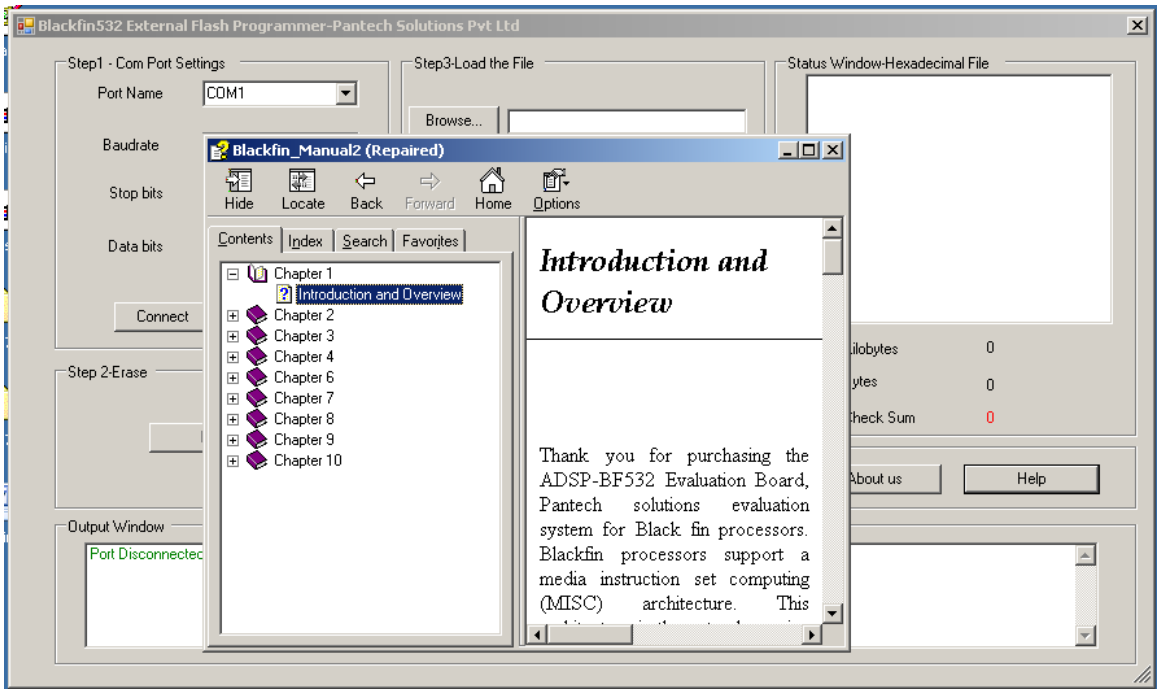
About Us

This box provide the information about product description, Version, Copy right

and company name



Help



5. Practical Dsp Applications: Audio Coding And Audio Effects

Audio coding exploits unique features of audio signals to compress audio data for storage or transmission. Today, digital audio coding techniques are widely used in consumer electronics such as portable audio players. This chapter introduces basic audio effects and their implementations are presented and used for experiments.

5.1 HANDS-ON EXPERIMENT -Talk through for the BF-532 Audio development Board

This experiment implements a real-time Talkthrough with the BF532 Audio development board. A stereo or mono sound source is connected to the audio input channels of the BF532 Audio development board, and the output of the development board is connected to a headphone or speaker. The project files are located in directory --------\final\Talkthrough, Load the project file, (Open the project option menu and select Processor – ADSP-BF532 and Type – loader file) ,and finally build and run the project. The loader (Hex) file will be created.

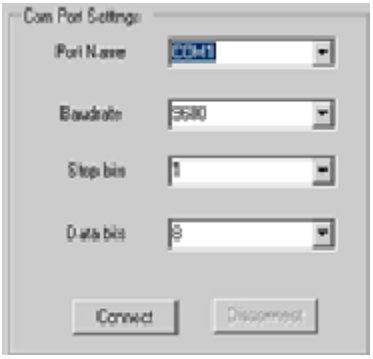
Programming Mode

In Programming Mode we should not connect any jumper to J5 and J6. The JUMPERS should be there in J13, J12, and J16 Such as MOSI, WP and SSEL Should be Configured for BF532 i.e. The JUMPER should be there in

the BF532 Side. Now Actually BF532 Booting in “11“mode i.e. booting From SPI Flash for boot modes refers BF532 Hardware reference manual

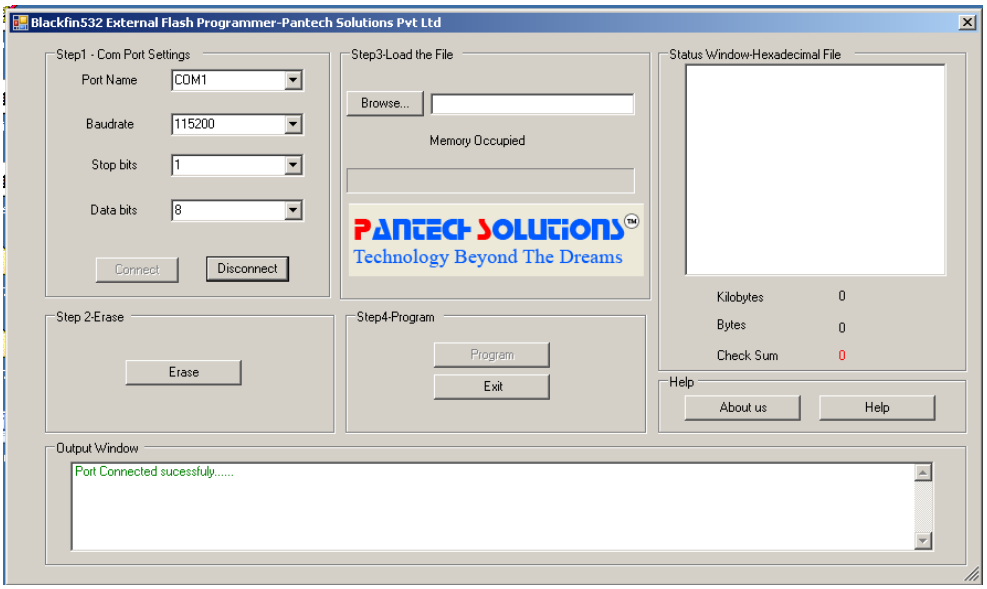
Step 1 – Connection Settings

Before the device can be used the settings required to make a connection must be specified

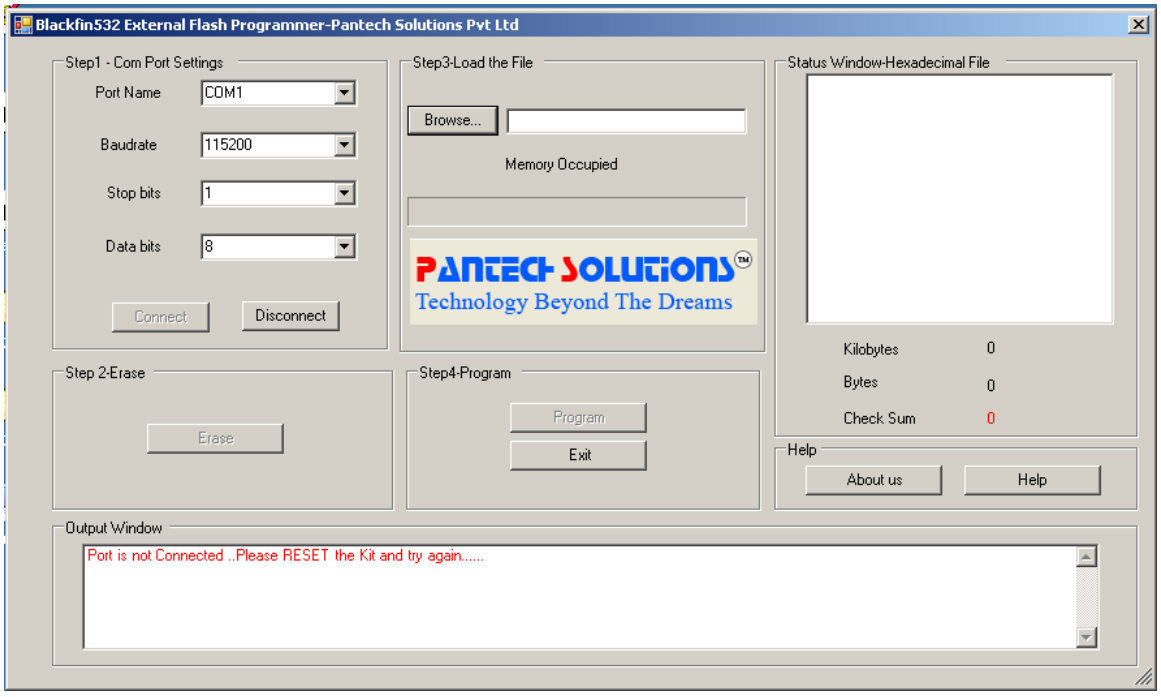


Select the desired COM port from the drop down list or type the desired COM port directly into the box. If you enter the COM port yourself then you must enter it in one of the following formats

- Port name COM1
- Baud Rate 9600
- Stop bits 1
- Data bits 8



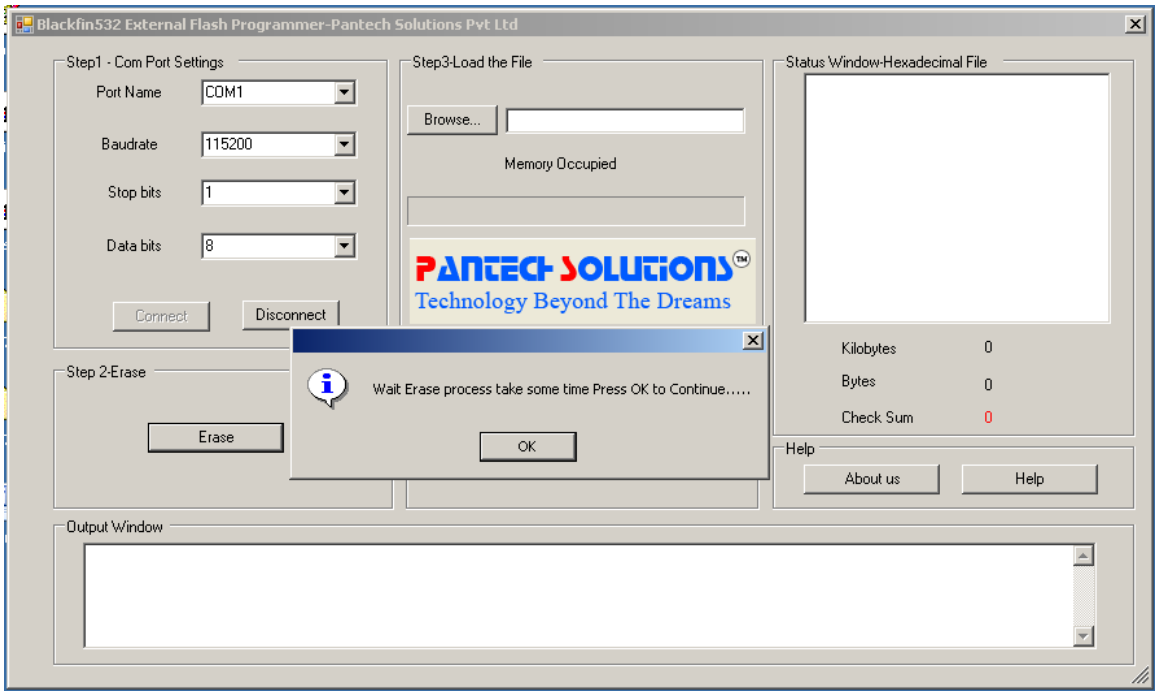
Port connected successfully will be displayed in output window If it the port is not connected .The following message will display…



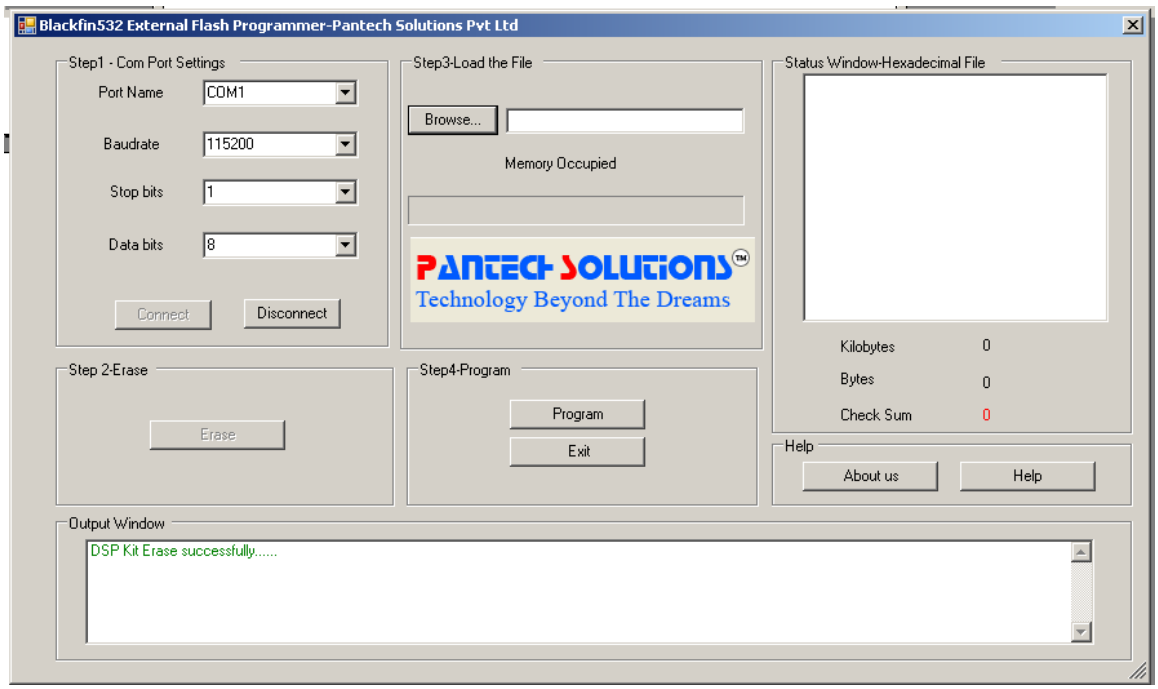
Ensure the kit is in proper mode and Press the RESET button in the Kit and try again..

Step 2 – Erasing

Press the erase button

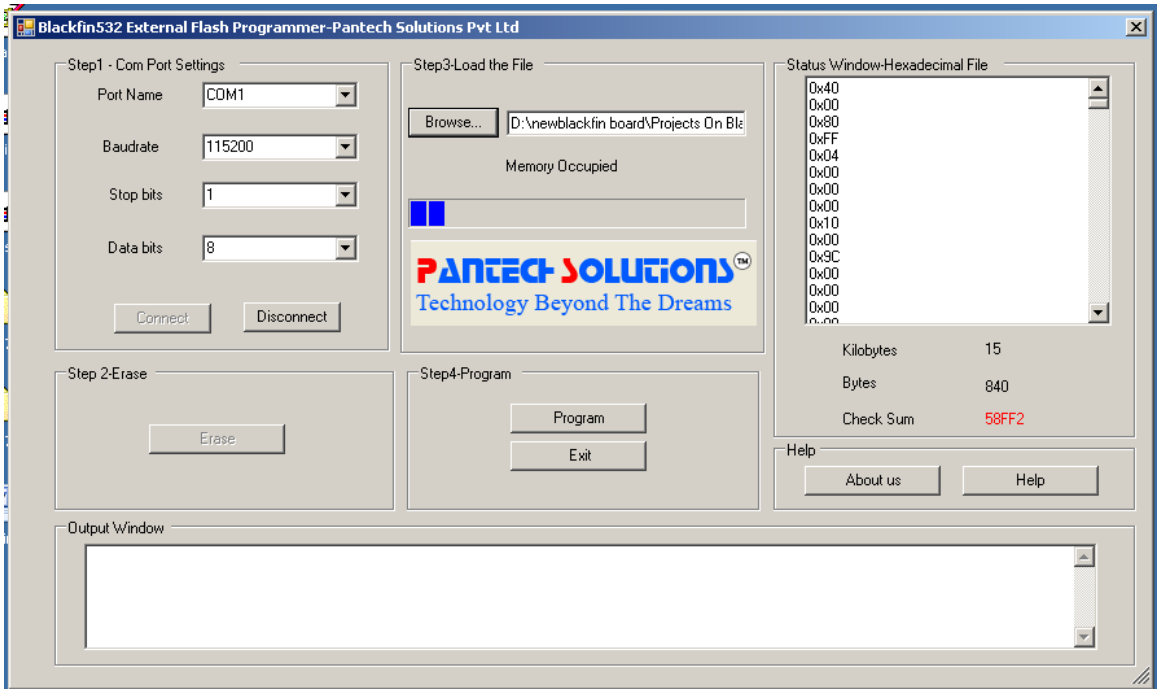


Click ok to continue after erasing the following message will be displayed in output window

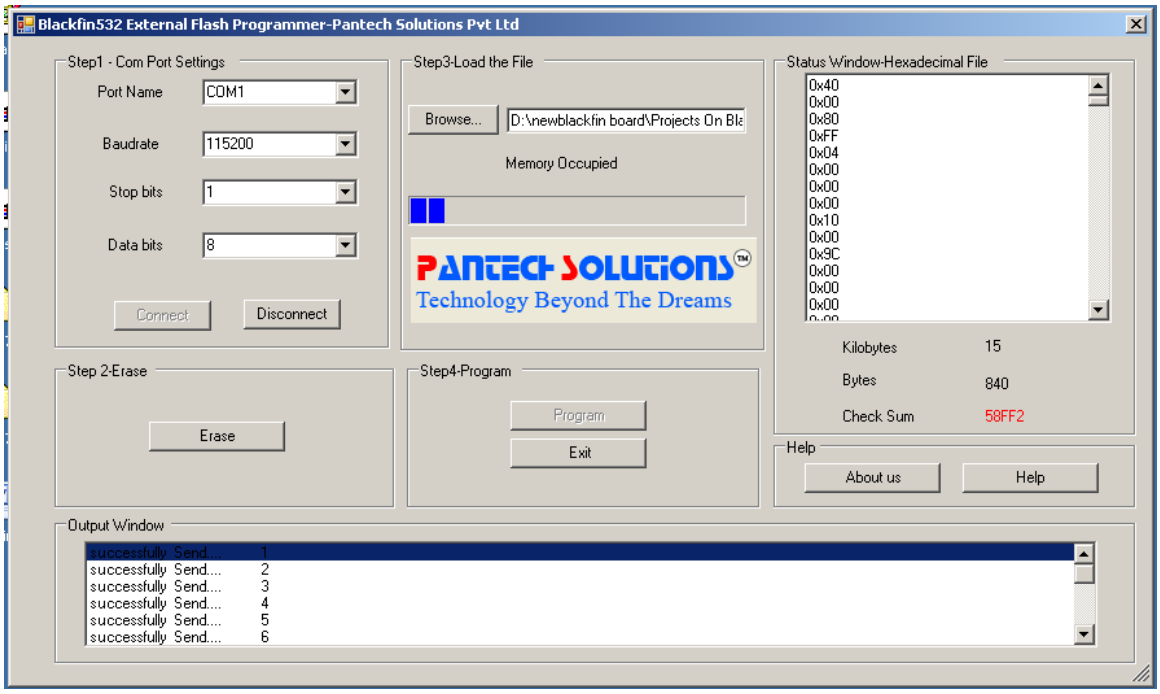


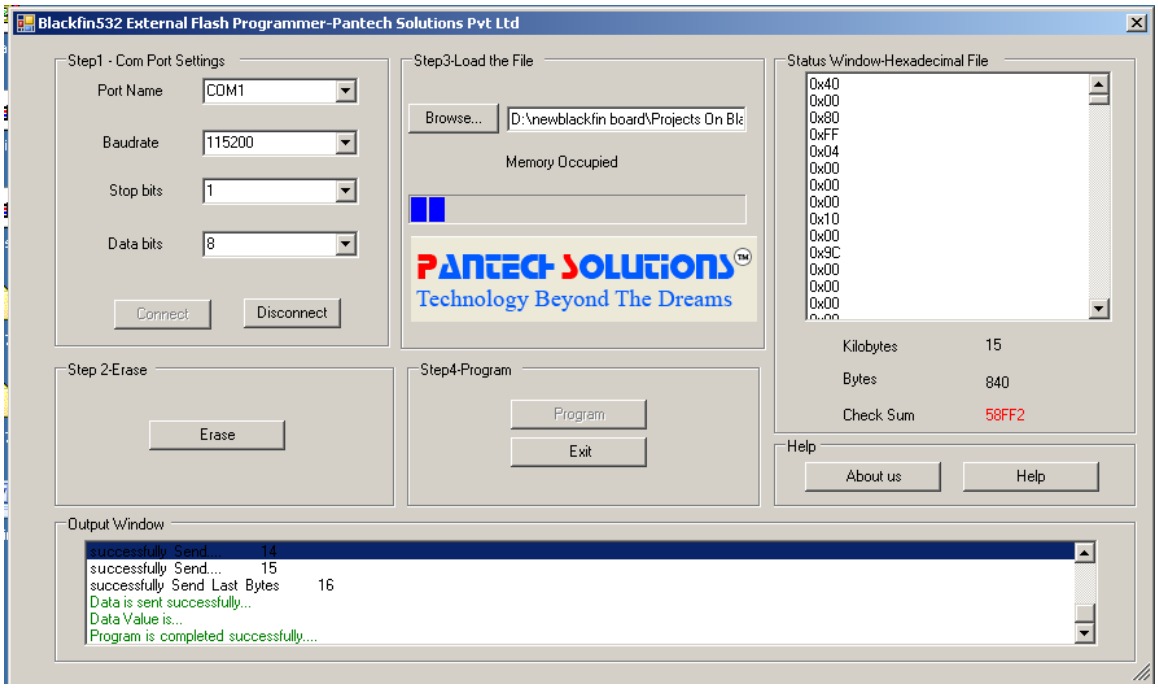
Step 3 – Selecting the Hex File

Select the file by using browse button. The progress bar will show you the memory occupied and the file contents, file size and checksum will be displayed in status window.



Step 4 – Programming the flash Click program to program the device





2. General Mode:

In general mode a jumper must be connected to J1 as shown below. Previously whatever are there in the "Programming Mode" keep all Additionally just we need to put the JUMPER in J5 or BMODE1 in "C" side ,reset the board one times .Now the Boot Mode is changed to "01 " where it will Boot from 8-bit/16-bit Flash.

5.2 HANDS-ON EXPERIMENT 1.2 – Noise added, compressed and decompressed Using rand (), mu_law commands

This experiment implements add noise to the signal with the Blackfin processor.. The project files are located in directory ---\final\noise, Load the project file, (Open the project option menu and select Processor –ADSP-BF532 and Type – loader file) ,and finally build and run the project. The loader file will be created.

To accomplish this EXPERIMENT, A sound is inputted to a development board. A random uniform white noise function is generated and added to the sound data. This data is compressed using mu-law compression and then decompresses the data and processes it. If the first button (SW3) is pressed, the Original sound is played. If the second button (SW1) is pressed, the sound is played with noise.

Programming Mode, Programming the flash , Connection Settings, **and General Mode same as**

HANDS-ON EXPERIMENT 5.1

5.3 HANDS-ON EXPERIMENT – Noise removal using band pass and high pass filter

This experiment implements noise removal from the signal with the Blackfin processor.. The project files are located in directory ------\final\NOISEREMOVAL , Load the project file, (Open the project option menu and select Processor – ADSP-BF532 and Type – loader file) ,and finally build and run the project. The loader file will be created.

To accomplish this Project, A sound is inputted to a development board. A random uniform white noise function is generated and added to the sound data. This data is compressed using mu-law compression and then decompresses the data and band pass and high pass filter processes for noise removal. If the first button (SW3) is pressed, the Original sound is played. If the second button (SW1) is pressed first time, the sound is played with removal of noise from band pass filter.

If the second button (SW1) is pressed Second time, the sound is played with removal of noise from High pass filter.

Programming Mode, Programming the flash, Connection Settings, **and General Mode same as**

HANDS-ON EXPERIMENT 5.1

5.4 HANDS-ON EXPERIMENT – Digitalized Surround Sound Effects

This experiment implements Digitalized Surround Sound Effects with the Blackfin processor.. The project files are located in directory ----\final\ Digitaleffect532,Load the project file, (Open the project option menu and select Processor –ADSP-BF532 and Type – loader file) ,and finally build and run the project. The loader file will be created. The objective of the EXPERIMENT was to create surround sound effects (this project considers surround sound as movement of sound between different speakers) such that the user can feel the sound moving across the users head.

Ideally this effect should have an input sound signal processed such that the sound from an input source moves around the user's head at a revolution rate of few milliseconds. To study the acoustic effects this EXPERIMENT considered different revolution rates to determine the most optimal values and effects different revolution rates can have on users hearing.

If the first button (SW3) is pressed, the Original sound is played. If the second button (SW1) is pressed first time, the sound is played with Surround Sound Effects.

Code description:

This case populates a huge buffer to store 14400 samples of input dma buffer. The length of this buffer is predetermined so that it holds values for all four speakers pointers are pointing to equal delta time delay of 0.1 seconds. First the buffer is populated at least for once.

Then the values pointed by all four speaker pointers are written to the output dma buffer for each of the speakers. Thereafter, the speaker pointers point to the next item on the buffer.

Programming Mode, Programming the flash, Connection Settings, **and General Mode same as**

HANDS-ON EXPERIMENT 5.1

5.5 HANDS-ON EXPERIMENT – Audio effects on Blackfin processor

This experiment implements Audio effects on Blackfin processor with the Blackfin processor.. The project files are located in directory ----\final\chrous, Load the project file, (Open the project option menu and select Processor – ADSP-BF532 and Type – loader file) ,and finally build and run the project. The loader file will be created. If the first button (SW3) is pressed, the Original sound is played. If the second button (SW1) is pressed first time, the sound is played with Chorus Sound Effects.

Chorus: This effect is used to thicken the output signal by adding to it a delayed signal. The effect would give the sound like there is more than one instrument playing at the same time.

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