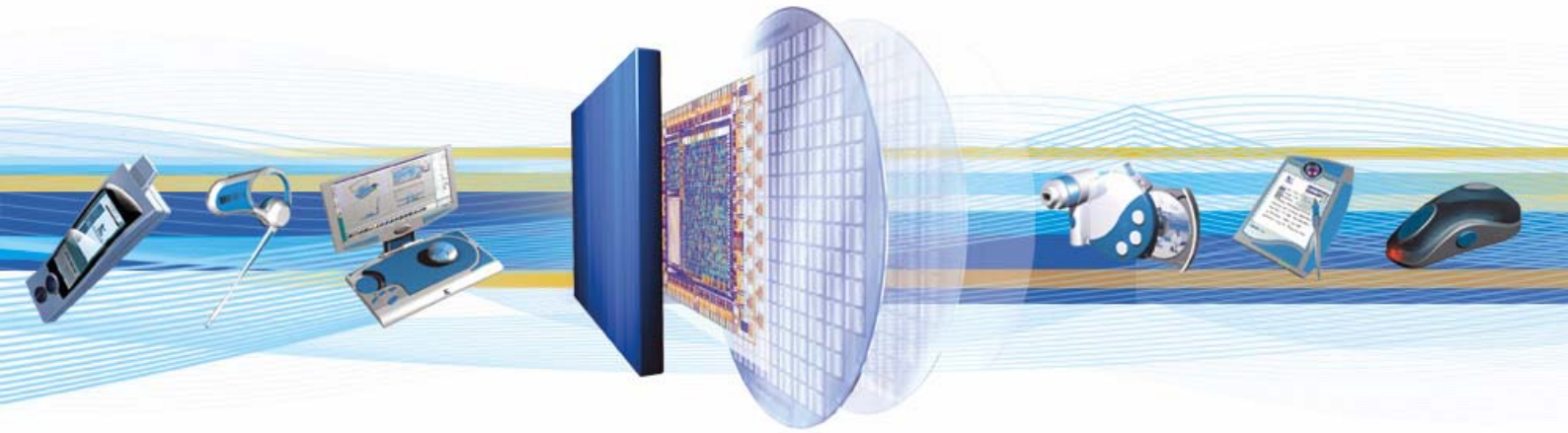
BlueLab™

BlueLab™ v3.2 Combined AV Headset

User Guide

May 2005



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1 Introduction

This document provides information on the Combined AV Headset application that accompanies BlueLab™ v3.2. This document describes how to compile, download and run the application.

The application demonstrates to product developers the features of **BlueCore™3-Multimedia**. The application is a starting point for product development programs. It is envisaged that product developers may define their own Man Machine Interface (MMI) and add such features as battery monitoring to create a finished end-product.

2 Target Audience

The target audience for this document is hardware and software developers using the Combined AV Headset application that accompanies BlueLab v3.2 as a basis for their own product developments.

3 Target Hardware

The target hardware is CSR's BlueCore3-Multimedia Development Board (DEV-PC-1307 Rev C). The user will also need a suitable AV source capable of providing a Bluetooth® wireless technology-compliant SBC encoded audio stream.

Note: CSR's BlueCore3-Multimedia Development Board (DEV-PC-1307 Rev A) is not suitable to run this application. The microphone input circuit does not work on this revision of the board.

4 BlueLab Installation

This chapter provides guidance on the installation of xIDE as supplied on the BlueLab CD-ROM.

4.1 Prerequisites

BlueLab xIDE should be installed on a PC running Windows 2000 or Windows XP.

CSR recommend that 150Mbytes of free disk space is available.

> **Note:** A typical BlueLab installation requires 125Mbytes and each application built will need approximately 10Mbytes of additional space.

A minimum of Windows Power User privileges is required to install the software correctly.

> **Note:** If you are unsure of your current level of privileges, please contact your system administrator.

New BlueLab installations can coexist with previous releases provided they are installed in different directories. The use of a convention such as C:\BlueLabversion (eg `C:\Bluelab3_2`) to create the program folder will avoid conflict between versions.

> **Note:** Spaces in folder names of the directory path are not supported ie you should not try to install the software in a directory which itself has spaces in its name or is contained within a folder that has spaces in its name eg xIDE cannot be successfully installed in the `Program Files` directory.

4.2 Installation procedure

CSR recommend that any applications running on the PC are closed before installing the BlueLab software.

1. Insert the Bluelab CD-ROM into the computer's CD drive.
2. Right-click on the Windows Start menu and explore the CD-ROM.

   The CD-ROM contains PDFs of the Bluelab documentation and the BlueLab executables.
3. Double-click on `BlueLab-3.2.exe` file to launch the Setup wizard, which will guide you through the rest of the installation process.
4. Follow the on-screen instructions, clicking **Next** to continue.

   For a first time installation, CSR recommend that the default settings are accepted.
5. When the VM and DSP libraries have been built, the PC the Setup Wizard will display the final setup screen.
6. Click **Finish** to complete the installation.

   If the default option to install the Serial Peripheral Interface (SPI) device driver was accepted, the PC must be restarted to complete the installation.

4.2.1 MP3 Support

The Digital Signal Processor (DSP) libraries required to build the MP3 decoder must be obtained and installed separately (please contact the support channel for details).

They contain MP3 technology which incorporates intellectual property owned by Thomson and/or Fraunhofer Gesellschaft.

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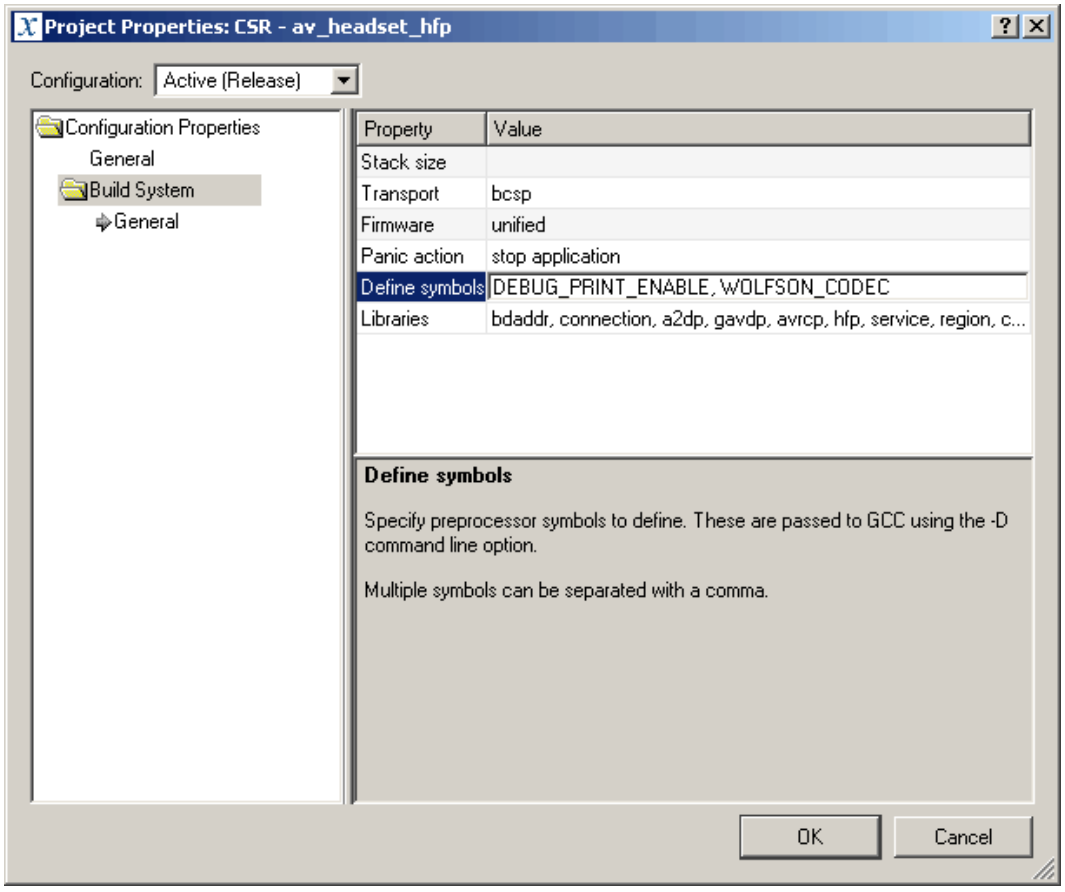
4.2.2 Wolfson external CODEC support

The Combined AV application shipped with BlueLab v3.2 includes support for the Wolfson (WM8731) CODEC.

To enable support for the Wolfson CODEC simply add `WOLFSON_CODEC` to the list of **Define symbols** in the **Project Properties** (as shown below) before building the application.



5 Combined AV Headset Application

When BlueLab v3.2 has been successfully installed, the Combined AV Headset application can be built and executed using the application source code, shipped with BlueLab v3.2.

This section guides you step-by-step through the process of building and executing this application.

The application implements the following profiles:

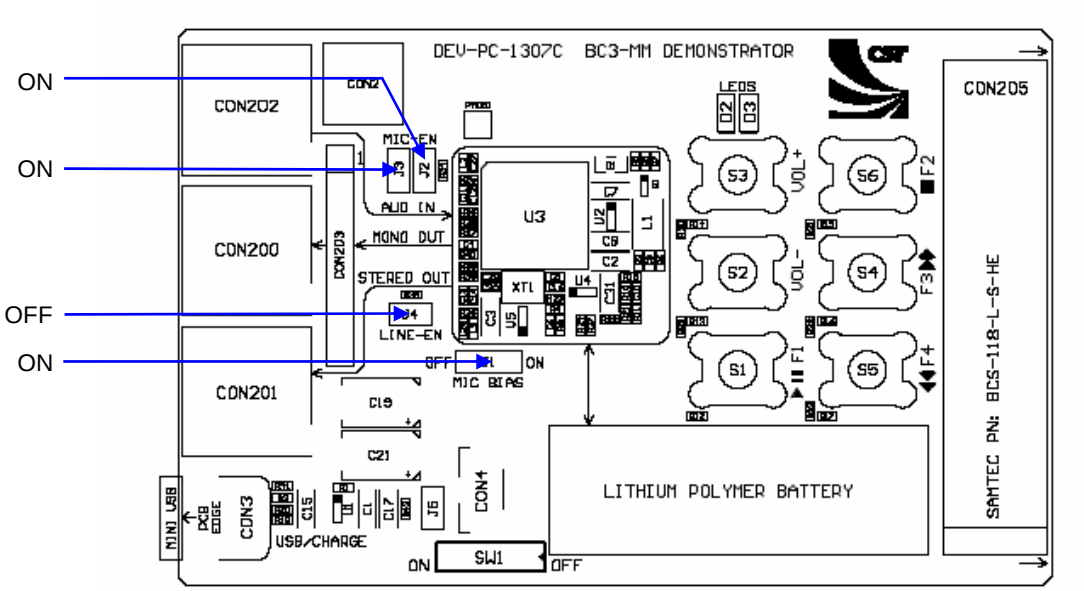
- Headset Profile
- Handsfree Profile
- Advanced Audio Distribution Profile
- Audio/Video Remote Control Profile

This enables stereo music to be streamed to the headset with the ability to accept and make telephone calls via a Bluetooth-enabled mobile phone.

5.1 Building the Combined Headset Application

Step 1: Connect BlueCore3-Multimedia Development Board

1. Connect your BlueCore3-Multimedia Development Board to your PC per the instructions supplied with the development kit.
2. Ensure that you have connected the mini-USB connection and the SPI connection.
3. Turn on the board and ensure that the jumpers are configured as shown in Figure 5.1.



Step 2: Start xIDE

Double-click on the **xIDE** icon on your desktop or from the **Start / Programs** menu.

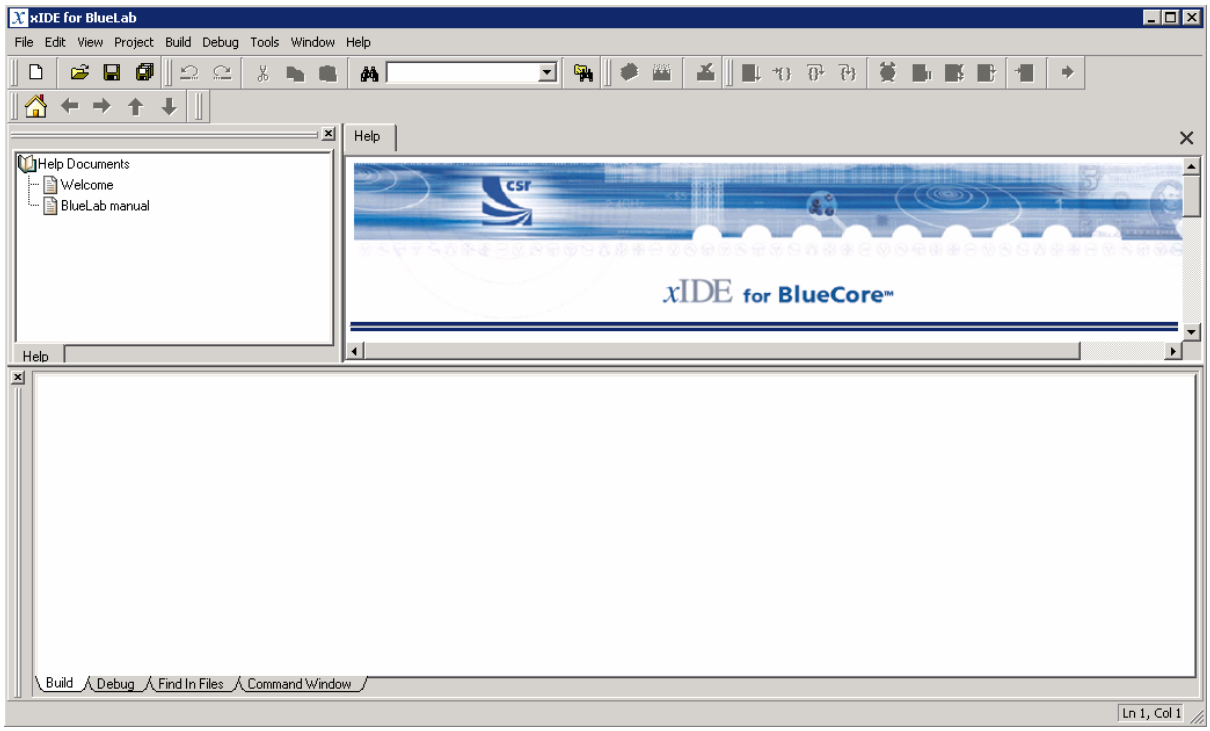


Figure 5.2: Start xIDE

If previous application development work has been carried out on the BlueCore3-Multimedia Development Board, CSR recommends that you restore the factory setting of the BlueCore chip.

A .psr file has been added to BlueLab v3.2 to simplify this process, for further information see section 5.3.

Step 3: Open sbc_decode Workspace

Select **Project** / **Open Workspace**, navigate to `\BlueLab\apps\av_headset_hfp` and select `sbc_decoder.xiw`.

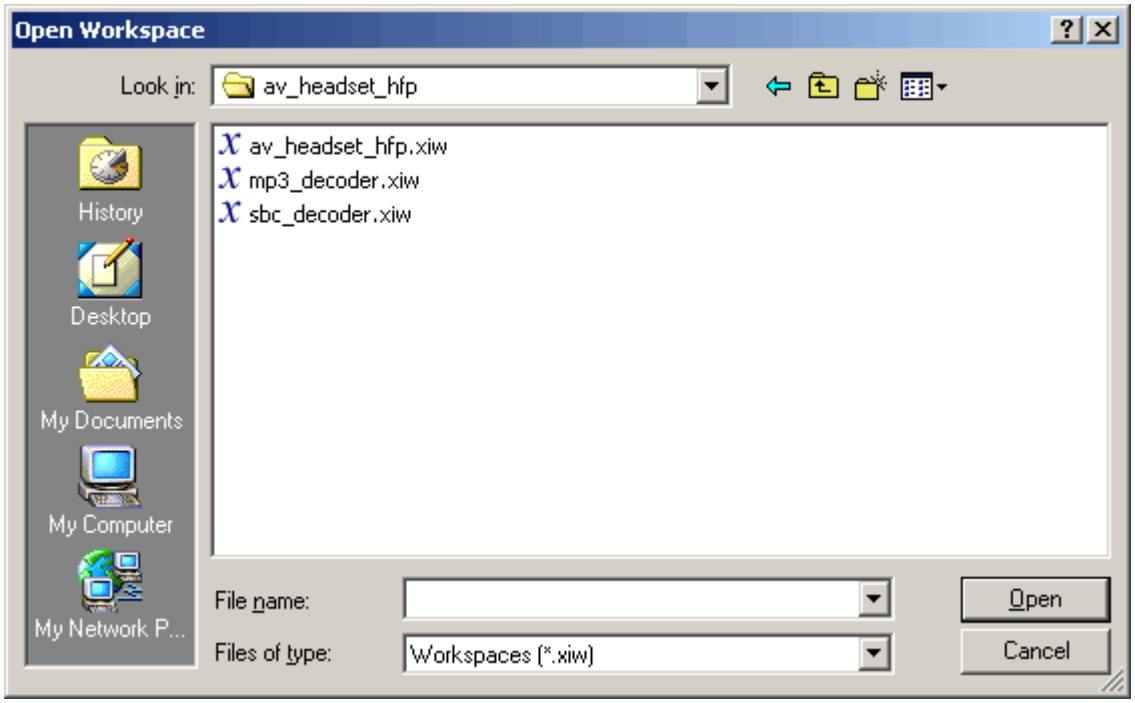


Figure 5.3: Open sbc_decode Workspace

Step 4: Optional – set streaming options

Three options are defined in the code to control the latency/robustness of the DSP buffer operation. By default this is set to maximum robustness (`STREAMING_MAX_RANGE_AND_ROBUSTNESS`).

If this option is acceptable proceed to step 5.

Note: Only one option can be defined when building the project.

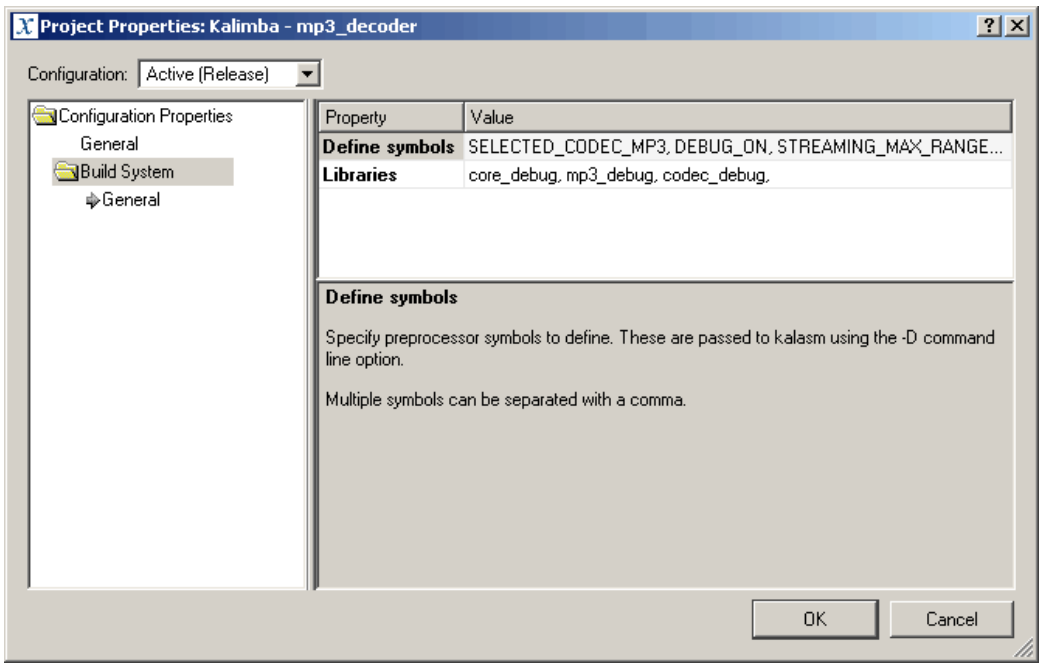
However, if a reduction in latency is required, two other options are available as defined by `STREAMING_STANDARD_LATENCY` and `STREAMING_LOW_LATENCY`.

Note: The values controlled by these definitions can be changed in the code, if required

To implement one of these options add the required definition to the Define symbols field in the Project Properties dialogue:

4.1. Select **Project \ Properties**

The Properties dialogue appears:



4.2. Delete the existing definition.

4.3. Enter the required definition to the Define symbols field

Step 5: Build sbc_decoder DSP Application

Select **Build** / **Build** or press **F7** to build `the sbc_decoder` DSP application.

Note: If the MP3 add-on has been installed xIDE will not download the `av_headset_hfp` application if the `mp3_decoder.xiw` has not been built, see section 4.2.1.

If the MP3 add-on has not been installed proceed as described in step 5.

Step 5: Open av_headset_hfp Workspace

Select **Project** / **Open Workspace**, navigate to `\BlueLab\apps\av_headset_hfp` and select `av_headset_hfp.xiw`.

Step 6: Build av_headset_hfp Application

Select **Build / Build** menu or press **F7** to build the `av_headset_hfp` VM application.

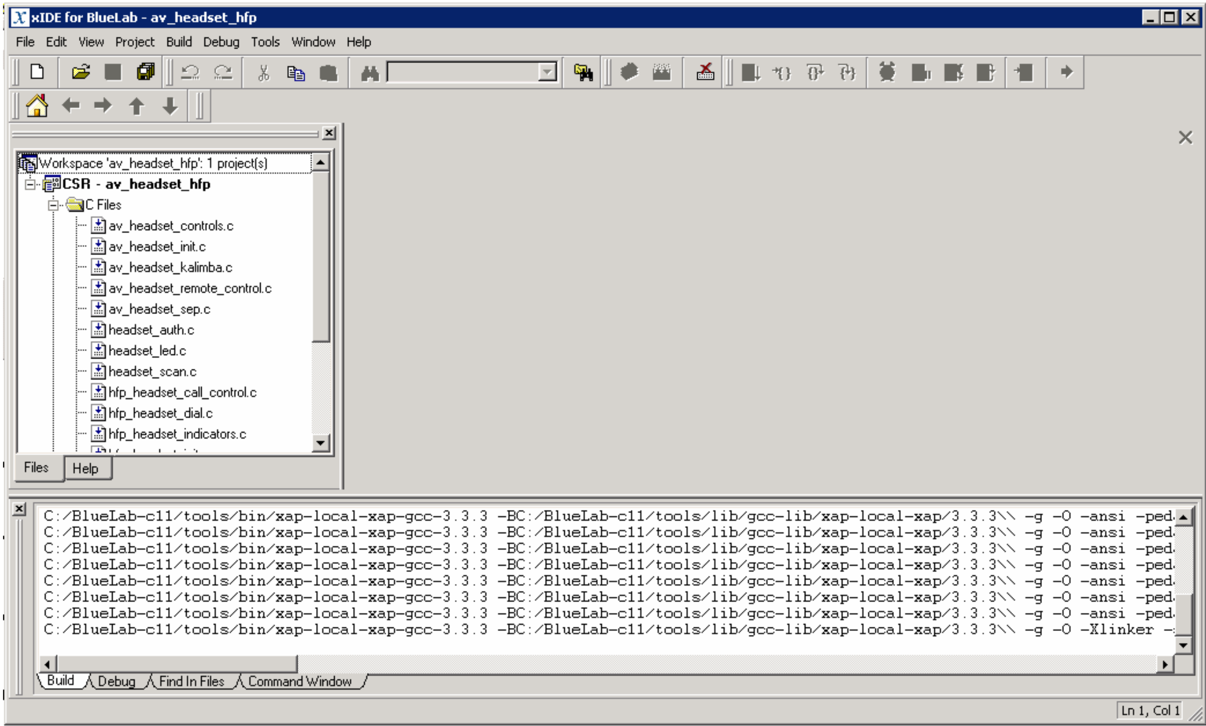


Figure 5.4: Build av_headset_hfp Application

Step 7: Download and Execute Combined AV Headset Application

Select **Run** from the **Debug** menu or press **F5** to download and execute the application. The application image (including the DSP code built in Step 3) will be downloaded to the BlueCore3-Multimedia development board connected to your PC.

5.2 Building the Combined Headset Application with MP3 Support

The DSP libraries required to build the MP3 decoder must be obtained and installed separately (please contact the support channel for details).They contain MP3 technology which incorporates intellectual property owned by Thomson and/or Fraunhofer Gesellschaft.

Note: The Combined Headset application does not need to include the MP3 support code and can be built using just the `sbc_decoder.xiw` as long as the MP3 add on executable has not been run.

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Note: Once the MP3 add-on has been installed the `av_headset_hfp.xiw` will not download without the `mp3_decoder.xiw` having been built.

Step 1: Installing the MP3 add-on

Having installed BlueLab v3.2, install `BlueLab_3.2-release-mp3.exe` (available via your usual support channel).

Step 2: Building the MP3 decoder

Build the MP3 decoder application by opening the mp3_decode workspace and selecting build in xIDE. The `mp3_decode` workspace can be built in exactly the same way as the `sbc_decode` workspace in section 5.1 Step 4.

Once the `mp3_decode` application has been built go back to section 5.1 step 3 and continue with building the `av_headset_hfp` application.

5.3 CVC echo cancellation and noise reduction software

To include CVC (Clear Voice Capture) echo cancellation and noise reduction simply add the define symbol `INCLUDE_CVC` to the **Project Properties / Define symbols** field before building the `av_headset_hfp.xiw` project.

Note: The CVC software is supplied for demonstration purposes only, is time limited and will become inactive after processing data for five minutes.

The ParamMgr Utility can be used to fine tune the CVC code to optimise the performance based on the acoustic characteristics of your product. Please see the ParamMgr User guide (CSR reference blab-ug-007Pa).

5.4 Restoring Factory Chip Settings

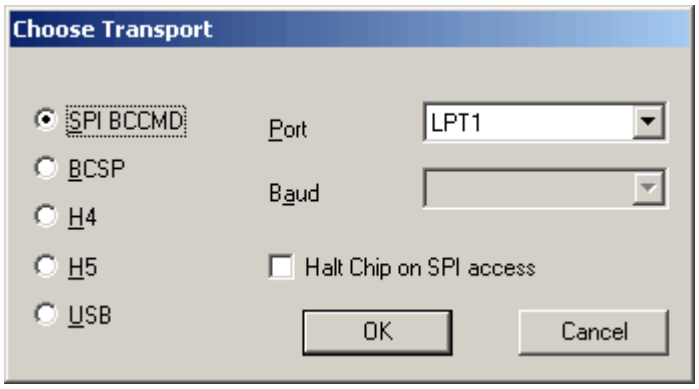
The factory settings can be restored using the PSTool application supplied with BlueLab v3.2.

To restore the factory default settings using PSTool:

1. Open the PSTool application.

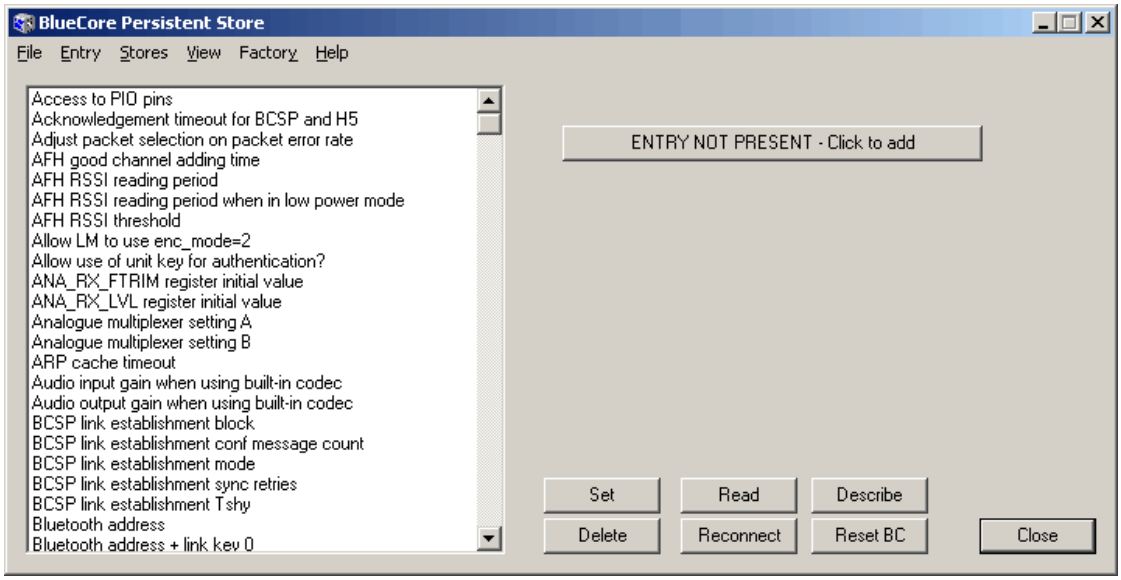
   Note: The `PSTool.exe` can be found in the BlueLab install directory `\tools\bin\PSTool.exe`

   The Choose transport dialog appears:



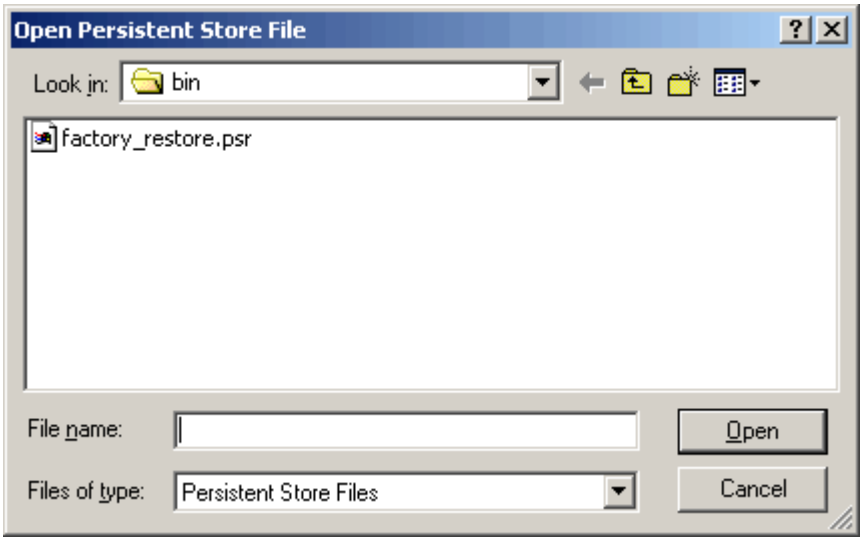
2. Select **SPI BCCMD** and **LPT1** as the transport settings and click **OK**.

The PSTool application dialog appears:



3. Select **Merge / File** menu:

An ‘Open Persistent Store File’ dialog appears:



4. Browse to the location of the `factory_restore.psr` file.

   The file is located in the BlueLab install directory .....`\tools\bin\factory_restore.psr.`

5. Select the file and click **Open**.

   The PSkeys that may result in unexpected chip behaviour, will be restored to their factory defaults.

   Note: This may take a few minutes.

6 Pairing

The Combined AV Headset Application is now running on the BlueCore3-Multimedia Demonstration Board. To stream audio and connect a mobile telephone to the headset, it needs to be paired.

Stop the application by pressing **Shift-F5**. This stops the application debugger and halts operation.

6.1 Pairing

To make the headset discoverable for 60 seconds, hold down **VOL-** and **VOL+** and press the **Reset** button. The blue LED will begin flashing more rapidly indicating the device is discoverable. In this state the headset can be discovered by AV sources or a Bluetooth-enabled handset that supports the Headset or Handsfree profile.

6.1.1 Handset

With the Combined AV Headset in discoverable mode, pair the handset with the headset. The Pin Code is 8888. Refer to the Instruction Manual supplied by the Handset manufacturer for further information on pairing.

6.1.2 CSR USB Multimedia Dongle

The USB Multimedia dongle is supplied as part of the BlueLab3-Multimedia Development Kit. Plug this dongle into the USB port of your PC and start the `avcontrol.exe` application located in the following folder:

```
\BlueLab\tools\bin\
```

With the Combined AV Headset in discoverable mode, click on the **Discover New Headphones** button. The Multimedia dongle will locate the headset, pair and connect to the headset.

Note: By default a device running the `av_headset_hfp` application has a PIN of 8888. However, Multimedia dongles shipping with previous versions of BlueLab have a PIN of 4444.

If the devices fail to connect it is probable because the PINs are not matched.

The way to resolve this conflict is to change the entry in the `av_headset_hfp.psr` file that sets the `PSKEY_FIXED_PIN`. Change &035b = 0038 0038 0038 0038 to &035b = 0034 0034 0034 0034. When the application is run in xIDE the PIN will then be set to 4444.

7 Operation

7.1 Modes of Operation

The actions performed by the buttons change dynamically, depending on the current mode of operation.

7.1.1 HFP/HSP Modes

These modes of operation are active when there is no media stream active or whenever an HSP/HFP operation is performed while a media stream is active. These operations suspend the audio stream until the operation is complete. At this point, the media stream continues to play.

When initiating a Service Level Connection (SLC), the application will tries to connect using the HFP profile. If the handset does not support HFP, it tries HSP and, if that fails, the attempt to connect is aborted.

When the handset is connecting to the headset it accepts the connection for whatever profile the handset chooses.

It should be noted the CVC (Acoustic Echo Canceller and Noise Reduction) DSP algorithm can be compiled for inclusion into the `av_headset_hfp` reference application. Refer to section 5.3 for compile instructions (default is CVC disabled).

7.1.2 AV Mode

This mode of operation is active whenever a media stream is active.

7.2 Powering the Combined AV Headset On or Off

To power the headset on, hold down the **Play/Pause** (**F1**) button for at least two seconds.

To power the headset off, hold down the **Stop** (**F2**) button for at least four seconds. The headset will only completely power down from that point when all current connections are closed, or a further timeout of five seconds occurs.

7.3 Button Functionality

Table 7.1, Table 7.2 and Table 7.3 define the button functionality while the headset is in the different operation modes.

Note:

- Long press - Button held for more than two seconds
- Short press - Button held for less than two seconds

7.3.1 AV Mode

Table 7.1 shows how the buttons operate while the headset is in AV Mode. Long presses have no effect, except for the **Volume** buttons.

Button	AV Mode
VOL+ Pressed	Vol Up
VOL+ Held (Acted on every 1s)	Vol Up
VOL- Pressed	Vol Down
VOL- Held (Acted on every 1s)	Vol Down
PLAY/PAUSE Pressed	Play/Pause music
STOP Pressed	Stop music
FORWARD Pressed	Skip track forwards
BACKWARD Pressed	Skip track backwards

Table 7.1: Button Functionality in AV Mode

7.3.2 HFP + AV

Table 7.2 shows how the buttons operate while the headset is in HFP Mode. It shows how the buttons operate depending on the state of the headset.

Table entries in *italic* describe the button functionality assuming an active AV stream.

Button/State	Init	Ready	Connecting	Connected	Incoming Call	Active Call	Outgoing Call
If there is no AV source connected replace *avrcp* calls with the non-italic calls							
PLAY/PAUSE Short Press	*Play/Pause* X	*Play/Pause* X	*Play/Pause* X	*Play/Pause* X	Answer Call	Transfer Audio	X
PLAY/PAUSE Long Press	X	X	X	Voice Recog. Enable	Answer Call	Transfer Audio	X
STOP Short Press	*Stop* X	*Stop* X	*Stop* X	*Stop* X	Reject Call	Hang up Call	Hang up Call
STOP Long Press	X	Last number redial	X	Last number redial	Reject Call	Hang up Call	Hang up Call
Vol+ Short Press	*Volume up* X	*Volume up* X	*Volume up* X	*Volume up* Volume up	Volume up	Volume up	Volume up
Vol+ Held (Acted on every 1s)	*Volume up* X	*Volume up* X	*Volume up* X	*Volume up* Volume up	Volume up	Volume up	Volume up
Vol- Short Press	*Volume down* Volume down	*Volume down* Volume down	*Volume down* Volume down	*Volume down* Volume down	Volume down	Volume down	Volume down
Vol- Held (Acted on every 1s)	*Volume down* Volume down	*Volume down* Volume down	*Volume down* Volume down	*Volume down* Volume down	Volume down	Volume down	Volume down
Forward (Long/Short) Press	*Forward* X	*Forward* X	*Forward* X	*Forward* X	X	X	X
Backward (Long/Short) Press	*Backward* X	*Backward* X	*Backward* X	*Backward* X	X	*x* CVC Mode*	X

Table 7.2: Button Functionality in HFP Mode

CVC Mode* If CVC is compiled in the application, with each short button press the software toggles between HF, NR and PSTHRGH modes. This button is only operational if a connection exists and the device is not muted. When operational and the Backward button is pressed, the next mode will be selected and a tone will be played to the loudspeaker. The tone will identify the currently operating mode. The following indicates the tone mapping.

1 Beep, HF mode: Hands-Free is the combination of an AEC (Acoustic Echo Canceller with microphone Noise Reduction). Default mode for CVC.

2 Beeps, NR mode: Noise Reduction to the microphone send-out signal.

3 Beeps, PSTHRGH mode: Pass through mode where the audio is routed through the Kalimba, disabling Hands-free, effectively bypassing any audio processing.

7.3.3 HSP + AV

Table 7.3 shows how the buttons operate while the headset is in HSP Mode. It shows how the buttons operate depending upon the state of the headset.

Table entries in *italic* describe the button functionality assuming an active AV stream.

Button/state	Init	Ready	Connecting	Connected	Incoming Call	Active Call	Outgoing Call
If there is no AV source connected replace *avrcp* calls with the non-italic calls							
PLAY/PAUSE Short Press	*Play/Pause* X	*Play/Pause* X	*Play/Pause* X	*Play/Pause* X	Button press	Button press	Button press
PLAY/PAUSE Long Press	X	Button press	X	Button press	Button press	Button press	Button press
STOP Short Press	*Stop* X	*Stop* X	*Stop* X	*Stop* X	X	End Call	X
STOP Long Press	X	X	X	X	X	X	X
Vol+ Short Press	*Volume up* X	*Volume up* X	*Volume up* X	*Volume up* X	X	Volume up	Volume up
Vol+ Held (Acted on every 1s)	*Volume up* X	*Volume up* X	*Volume up* X	*Volume up* X	X	Volume up	Volume up
Vol- Short Press	*Volume down* X	*Volume down* X	*Volume down* X	*Volume down* X	X	Volume down	Volume down
Vol- Held (Acted on every 1s)	*Volume down* X	*Volume down* X	*Volume down* X	*Volume down* X	X	Volume down	Volume down
Forward (Long/Short) Press	*Forward* X	*Forward* X	*Forward* X	*Forward* X	X	X	X
Backward (Long/Short) Press	*Backward* X	*Backward* X	*Backward* X	*Backward* X	X	*x* CVC Mode*	X

Table 7.3: Button Functionality in HSP Mode

CVC Mode* If CVC is compiled in the application, with each short button press the software toggles between HF, NR and PSTHRGH modes. This button is only operational if a connection exists and the device is not muted. When operational and the Backward button is pressed, the next mode will be selected and a tone will be played to the loudspeaker. The tone will identify the currently operating mode. The following indicates the tone mapping.

1 Beep, HF mode: Hands-Free is the combination of an AEC (Acoustic Echo Canceller with microphone Noise Reduction). Default mode for CVC.

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8 Decoder behaviour settings

The `codec` library contains a range of settings that control the decoding behaviour of the DSP.

The values defined for the variable `$decoder_codec_stream_struc` control the user experience, especially when the device is at the extreme limits of Bluetooth range.

The parameters themselves are defined in the `$decoder_codec_stream_struc` source code found in `C:\BlueLab\apps\av_headset_hfp\codec_decoder.asm`. The numerical values can be simply manipulated in the source code to optimise the required.

Note: The decoder project must be rebuilt in xIDE when any of these parameter values is changed in the source code.

See the xIDE on-line help (DSP Reference guide/File List/codec/stream_decode) for further explanation.

Document References

Document	Reference
BlueLab v3.2 Combined AV Headset Release Note	blab-srn-002Pa
BlueLab v3.2 Release Note	blab-srn-001Pa
BlueLab v3.2 ParamMgr User Guide (for CVC only)	Blab-ug-007Pa

Terms and Definitions

BlueCore™	Group term for CSR's range of Bluetooth wireless technology chips
BlueLab™	CSR's development toolset for building applications to run in the firmware's VM
Bluetooth®	Set of technologies providing audio and data transfer over short-range radio connections
CSR	Cambridge Silicon Radio
CVC™	Clear Voice Capture DSP audio processing performing AEC and NR
DSP	Digital Signal Processor
HFP	Handsfree Profile
HSP	Headset Profile
MMI	Man Machine Interface
SBC	Sub-band Coding
SLC	Service Level Connection
SPI	Serial Peripheral Interface
USB	Universal Serial Bus

Document History

Revision	Date	Reason for Change
a	28 MAY 05	Original publication of this document (CSR reference blab-ug-005Pa)

BlueLab v3.2™

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blab-ug-005Pa

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