ASI5402

TWO CHANNEL PCI COBRANET® SOUND CARD

1 DESCRIPTION

The ASI5402 is a professional PCI audio adapter designed for use in the installed sound and entertainment markets.

Using Cirrus Logic's CobraNet® technology for streaming audio over Ethernet, the ASI5402 provides 2 channels of CobraNet receive and transmit. It can be connected to any CobraNet compliant device.

The ASI5402 is based on the TMS320C6713 floating point DSP connected to a high-speed bus-master PCI interface.

AudioScience MRX technology allows up to four streams of different sample rates to be played, recorded and mixed over CobraNet. A choice of 16, 24, and 32bit PCM is available on all streams.

AudioScience provides ASIControl, an application that allows CobraNet routing connections to be set up between the ASI5402 and any other compliant CobraNet device on the network.

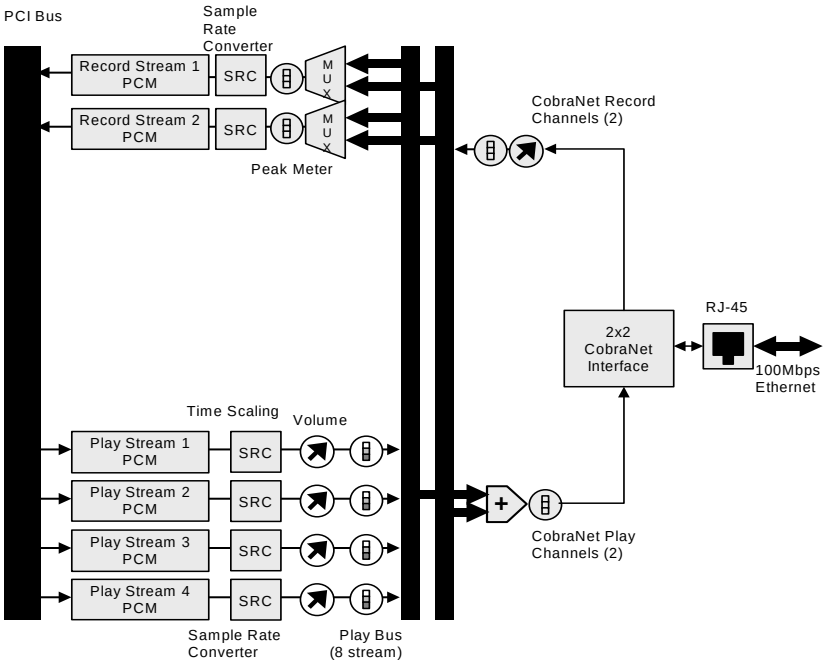
2 FEATURES

- 2 channels of CobraNet® receive and transmit on 100Mbit Ethernet operating at 48kHz
- 4 mono/stereo PCM playback
- 2 mono/stereo streams of PCM record
- MRX™ technology supports recording, playing and mixing of multiple stream formats and sample rates
- Low Profile PCI card allows use in 2RU high rackmount computers
- Up to 4 cards in one system
- Windows 2000/XP/Server 2003/Vista and Linux software drivers available

CobraNet is a registered trademark of Cirrus Logic

3 BLOCK DIAGRAM

ASI5402



4 SPECIFICATIONS

COBRANET INPUT/OUTPUT		
Type		100BaseT Ethernet
Connector		RJ-45
Precision		16, 20 or 24bit PCM
Sample Rate		48kHz
Latency		1.33, 2.66 or 5.33ms
Control Protocol		SNMP
SIGNAL PROCESSING		
DSP		Texas Instruments TMS320C6713@300MHz
Memory		8MB
Audio Formats		8 bit unsigned PCM 16 bit signed PCM 24 bit signed PCM 32 bit signed PCM 32 bit floating point PCM
MRX	Playback sample rates	8 to 96kHz with 1Hz resolution
	Record sample rates	8 to 96kHz with 1Hz resolution
	SRC THD+N	-110dB
GENERAL		
Bus		Universal 32bit PCI (3.3V or 5V signaling)
Dimensions		PCI form factor – 5.25" x 3.25" x 0.5" (133mm x 82mm x 13mm)
Weight		8 oz (227g) max
Operating Temperature		0C to 70C
Power Requirements		+3V@1.5A, +5V @ 100mA

5 REVISIONS

Date	Description
12 November 2008	First release.

6 CONTENTS

7 INTRODUCTION

The ASI5402 is a PCI audio adapter that supports the CobraNet™ audio interface providing 2 channels of CobraNet receive and transmit.

The ASI5402 features a powerful Texas Instruments 32bit floating point DSP that allows sophisticated switching and mixing.

AudioScience provides application software that may be used to set up the ASI5402. ASIControl sets up all internal features of the unit such as levels also allows CobraNet routing connections to be set up between the ASI5402 and any other CobraNet compliant device on the network.

7.1 CobraNet Background

CobraNet is a combination of software, hardware and network protocol that allows distribution of many channels of real-time, high quality digital audio over an Ethernet network. It was developed by Peak Audio in the 1990s and is now owned by Cirrus Logic. Interoperability between CobraNet devices from different manufacturers is supported through a standard communications protocol. CobraNet compliant devices are based on a common silicon or hardware reference design from Cirrus Logic.

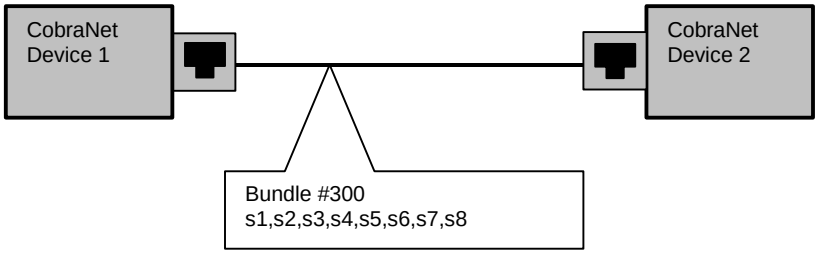
The Cirrus Logic website, www.cobranet.info, is dedicated to CobraNet. Wikipedia has a useful introduction to CobraNet here (http://en.wikipedia.org/wiki/Cobranet).

CobraNet delivers audio in standard Ethernet packets over 100Mbit Fast Ethernet. Switches, hubs, media converters and other gear that operate in compliance with the IEEE 802.3u specification for Fast Ethernet, will work with CobraNet. CobraNet does not support 10Mbit Ethernet varieties (10BASE-T, Coaxial) due to their limited bandwidth.

CobraNet operates at the Data Link Layer also referred to as OSI Layer 2 or MAC layer. Because it does not use the higher IP layer for audio data transport, CobraNet does not suffer from IP latency limitations . In most cases data communications and CobraNet data can coexist on the same network without QOS issues. All audio is sent inside a custom Ethernet packet whose header that tells network devices that the packet contains CobraNet audio rather than plain data. The CobraNet term for an audio packet is "Bundle". A Bundle may contain from one to eight audio channels, each channel being composed of PCM samples of 16, 20 or 24 bits in length.

7.1.1 CobraNet Routing

The whole point of network audio is to route digital audio from point A to point B. CobraNet introduces a concept called a “bundle” to define virtual audio routes from one CobraNet device to another one. A bundle is a logical collection of up to 8 channels that can be sent from on device to another. Each bundle is assigned a unique number between 1 and 9999. Bundles form the heart of the CobraNet routing capability.



The bundle number 300 is used to describe this collection of channels coming from Device 1. s1 to s8 represent audio samples. The bundle shown above consists of 1 to 8 samples of audio each taken from different channels of Device 1.

Figure 1. Illustration of a CobraNet bundle going between 2 CobraNet devices.

The above figure illustrates a bundle of audio being sent from one CobraNet device to another. Device 1 is transmitting the CobraNet bundle, while Device 2 is receiving it. In this case, both devices need to be set to bundle 300 for the audio link to be made. The CobraNet mechanism for transmitting bundles uses “transmitters”. Similarly, the mechanism for receiving bundles uses receivers. Each CobraNet device has several transmitters and receivers and so can simultaneously send and receive audio channels using several different bundle numbers. This capability supports audio links between many different CobraNet devices.

7.1.2 ASI5402 CobraNet Audio Channel Mapping

Before further discussion of CobraNet transmitters and receivers, terminology useful for specifying audio channels within a bundle needs to be introduced. Somewhat obviously, these channels are called the Audio Routing Channels. On an ASI5402 audio routing channels 1-2 map to line out 1-2. Routing channel 1 maps to line out 1 left and routing channel 2 maps to line out 1 right and so on.

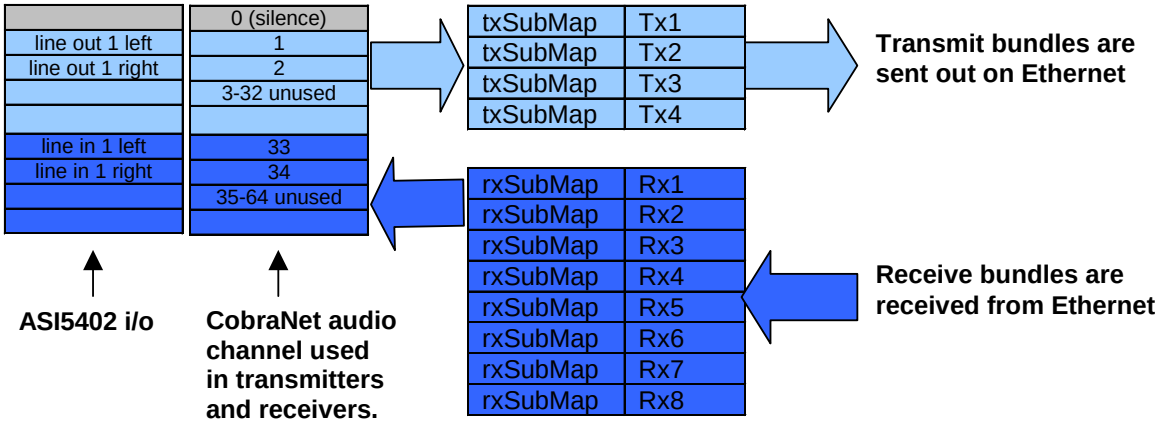


Figure 3. Mapping of ASI5402 inputs and outputs to CobraNet channels.

7.1.3 CobraNet Transmitters

A CobraNet transmitter is a logical entity in the CobraNet interface that has the ability to send a bundle of audio samples on the CobraNet network. CobraNet devices typically have multiple transmitters. The ASI2416, for example, has 4 transmitters. An incomplete list of transmitter routing variables follows:

- txBundle – this variable specifies the bundle number to transmit. A value of 0 indicates that the transmitter is disabled.
- txSubMap – a sequence of up to 8 audio routing channel numbers that specify which audio samples should be placed in the bundle. A value of 0 indicates an unused slot in the bundle.
- txSubFomat – a sequence of format specifiers that define how many bits per sample are placed in the bundle.
- txSubCount – the number of channels in this bundle.

7.1.4 CobraNet Receivers

A CobraNet receiver is a logical entity in the CobraNet interface that has the ability to receiver a bundle of audio samples from the CobraNet network. CobraNet devices typically have multiple receivers. The ASI2416, for example, has 4 receivers. An incomplete list of receiver routing variables follows:

- rxBundle – the number of the bundle to receive. This should be the same a bundle number being transmitted somewhere else on the network. A value of 0 indicates that the receiver is disabled.
- rxSubMap – a sequence of up to 8 audio routing channel numbers that specify where incoming bundle samples should be routed.

7.1.5 CobraNet Sample Rate and Latency

The CobraNet sample rate supported by the ASI2416 and ASI6416 is fixed at 48kHz with three latency modes of 5.33ms (default), 2.67ms or 1.33ms.

7.1.6 CobraNet References

This document is not intended to be an expansive guide to CobraNet networking and routing. The ASI2416 and ASI6416 adhere to the CobraNet standard through the use of off-the-self CobraNet silicon from Cirrus Logic. More detailed CobraNet information is available from them.

The following links may be helpful:
CobraNet Info: http://www.cobranet.info/en/support/cobranet/

CobraNet Discovery:
http://www.cobranet.info/dispatch/forms/sup/boardreg/breg/BregController.jpf

Audio Routing Primer:
http:// www.cirrus.com/en/pubs/appNote/CobraNet_AudioRoutingPrimer.pdf

Hardware manual and programmer's reference:
http://www.cobranet.info/en/support/cobranet/developer/tech_data_sheet.html

8 CONNECTORS

The ASI5402 uses a standard RJ-45 connector.

9 CABLES

The ASI5402 is connected to a CobraNet network using a standard Ethernet cable. The Ethernet cable is not supplied with the ASI5402.

9.1 Hardware Installation

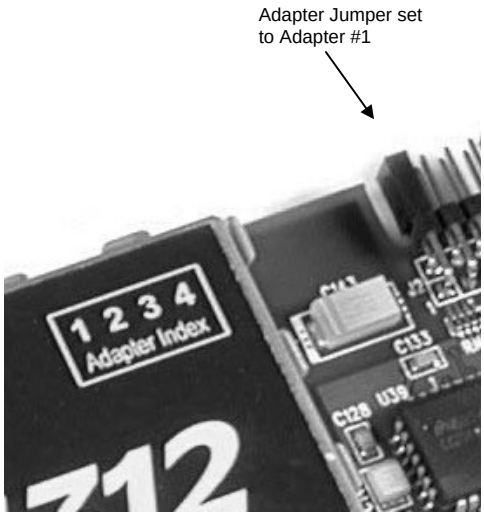
This section explains how to install one or more AudioScience adapters in a computer.

1. Make sure your computer is turned off.

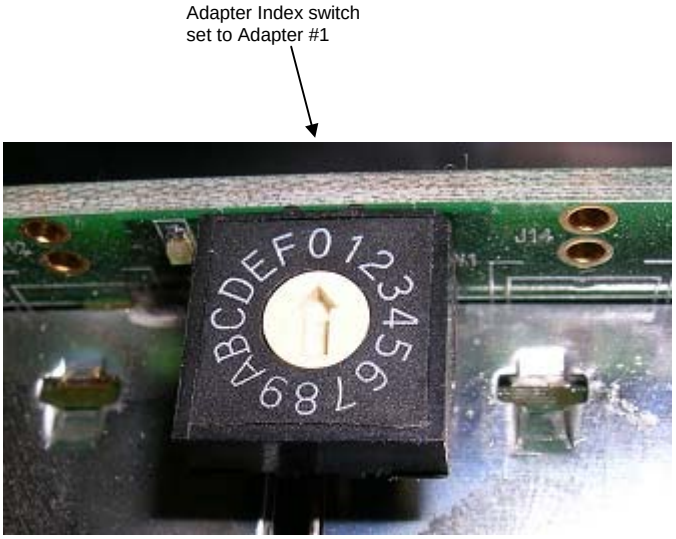
2.PCI adapters should be installed in any empty PCI slot and PCIe adapters should be installed in any x1 (or greater) PCIe slot.

3. Make sure the adapter jumper is set to adapter index #1 (factory default). Depending on the adapter family, there are different ways of setting the adapter index.

For ASI4000, ASI5000, ASI6000 families, there is an adapter jumper that must be set. The left most position represents adapter index #1.



For ASI8700 and ASI8900 families, there is a rotary switch. NOTE Position 0 (zero) represents adapter #1, position 1 is adapter #2, etc



4. When installing two or more adapters in the same computer, make sure they have the adapter jumper/rotary switch position set to unique numbers. For example if you are installing two adapters, the first one would be set to adapter index #1 and the second to adapter index #2.

Different adapter types can coexist in the same computer; for example, an ASI6416 and ASI8702 will work correctly if installed in the same PC. Different adapter types still require unique adapter index numbers.

5. Turn on the computer and let it boot. Under Windows 2000/XP a dialog box will pop up informing you that the computer has detected a new Multimedia Audio card. Cancel out of this dialog box and proceed to the software installation section of this datasheet.

10 SOFTWARE INSTALLATION

AudioScience makes audio adapters and drivers for various operating systems. Enhancements to an adapter's utility come from the integrators software that uses the audio driver to implement sophisticated audio playback and recording functions.

10.1 Drivers for Windows 2000/XP/Server 2003/Vista

The first step is what type of driver is needed for the adapter. There are two types of drivers for Windows: The WAVE driver and the WDM driver. Typically this will be decided by the application used with the AudioScience adapter. For any application that uses DirectSound, use the WDM driver.

Driver 3.10 and later present the user with three install options during installation:

- Install Standard PCI/PCIe Driver.
- Install Standard + Network Audio Driver.
- Remove all driver components

Traditional installs should select the first of these options. Users of AudioScience CobraNet products should select the second option with the "+Network Audio Driver." in the text.

10.1.1 WAVE Driver

Download the file named ASIWAVE_xxxxxx.EXE from www.audioscience.com and run it (_xxxxxx is the version number). After the EXE has run, reboot the computer and the audio adapter will be operational. If the cover is off the computer, one can see one or two blinking LEDs on top of the card indicating its DSP is running and communicating with the driver.

Verify that the adapter is running using ASIControl (see ASIControl section in this document).

10.1.2 WDM Driver

Download the file named ASIWDM_xxxxxx.EXE from www.audioscience.com and run it (_xxxxxx is the version number). After the EXE has run, reboot the computer and the audio adapter will be operational. If the cover is off the computer, one can see one or two blinking LEDs on top of the card indicating its DSP is running and communicating with the driver.

Verify that the adapter is running using ASIControl (see ASIControl section in this document).

10.1.3 Combo Driver

The Combo driver presents both Wave and WDM devices to the user. Download the file named ASICOMBOV_xxxxxx.EXE from www.audioscience.com and run it (_xxxxxx is the version number). After the EXE has run, reboot your computer and the audio adapter will be operational. If the cover is off the computer, one can see one or two blinking LEDs on top of the card indicating its DSP is running and communicating with the driver.

Verify that the adapter is running using ASIControl (see ASIControl section in this document).

10.1.4 ASIO

The AudioScience drivers listed above also install an ASIO driver interface. It is installed by default.

10.1.5 Driver Failure

In the event that an adapter's driver fails to load correctly, the OS's event viewer should be checked. The event log is viewed as follows:

XP: The system event log is accessed from \Start\Control Panel\Administrative Tools\Event Viewer. The System view should be selected.

Vista: The system event log is accessed from \Start\Control Panel\System and Maintenance\Administrative Tools\Event Viewer. The Windows Logs\System view should be selected.

If two or more adapters are installed in the same system, the first thing to check is that the adapters were assigned unique adapter numbers. If issues persist, please email support@audioscience.com.

10.1.6 Drivers for Linux

The latest Linux driver can be downloaded from the AudioScience website – www.audioscience.com

10.2 Applications for Windows

AudioScience provides two application for adapter set-up and configuration: ASIControl and ASIMixer.

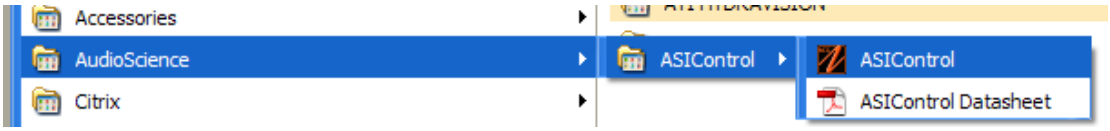
10.2.1 ASIControl

All Windows drivers install an AudioScience application called ASIControl that can be used to setup and verify functionality of adapters. ASIControl provides a common interface for users across all driver types.

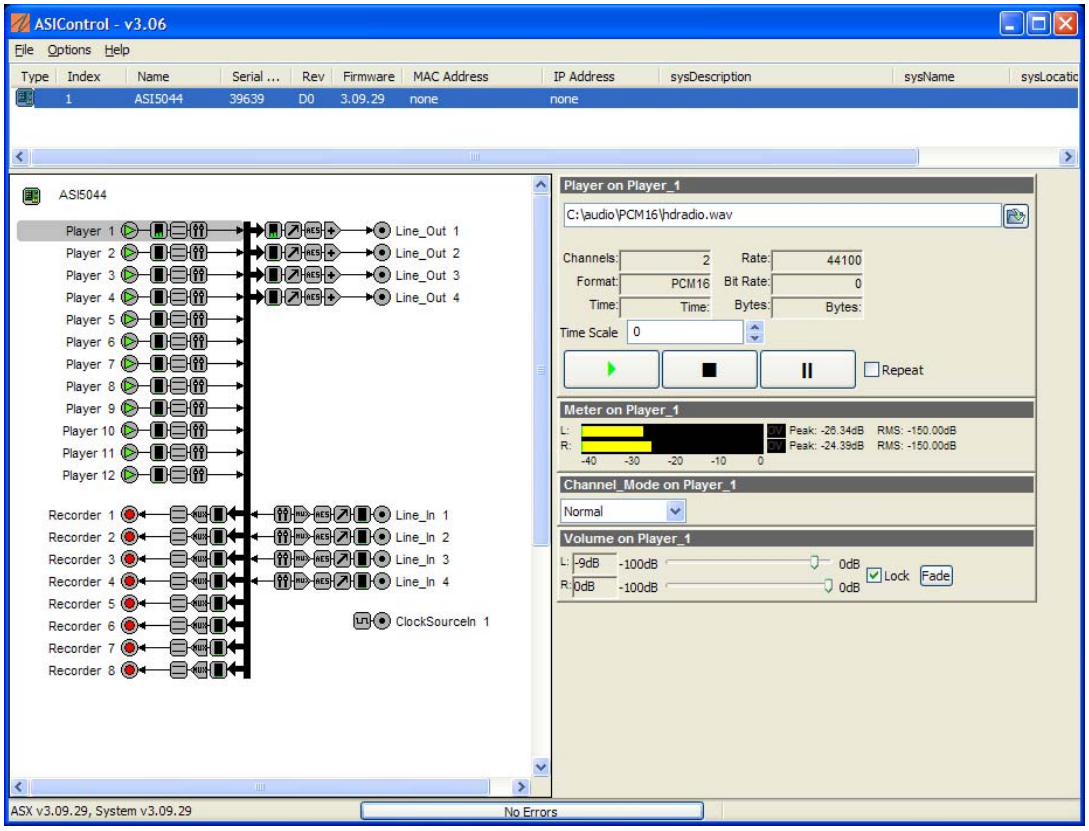
The following list of controls are uniquely supported in ASIControl (as opposed to ASIMixer):

- ASI8700 tuner pre-emphasis
- ASI8900 tuner RDS
- ASI8900 tuner FM stereo indication
- ASI8914 HD Radio PAD field
- ASI8914 HD Radio Digital status field
- ASI8914 HD Radio Digital program number selection

From the Windows Start menu, navigate to Start→Programs→AudioScience and run the ASIControl program.



When started, ASIControl will look something like the following:



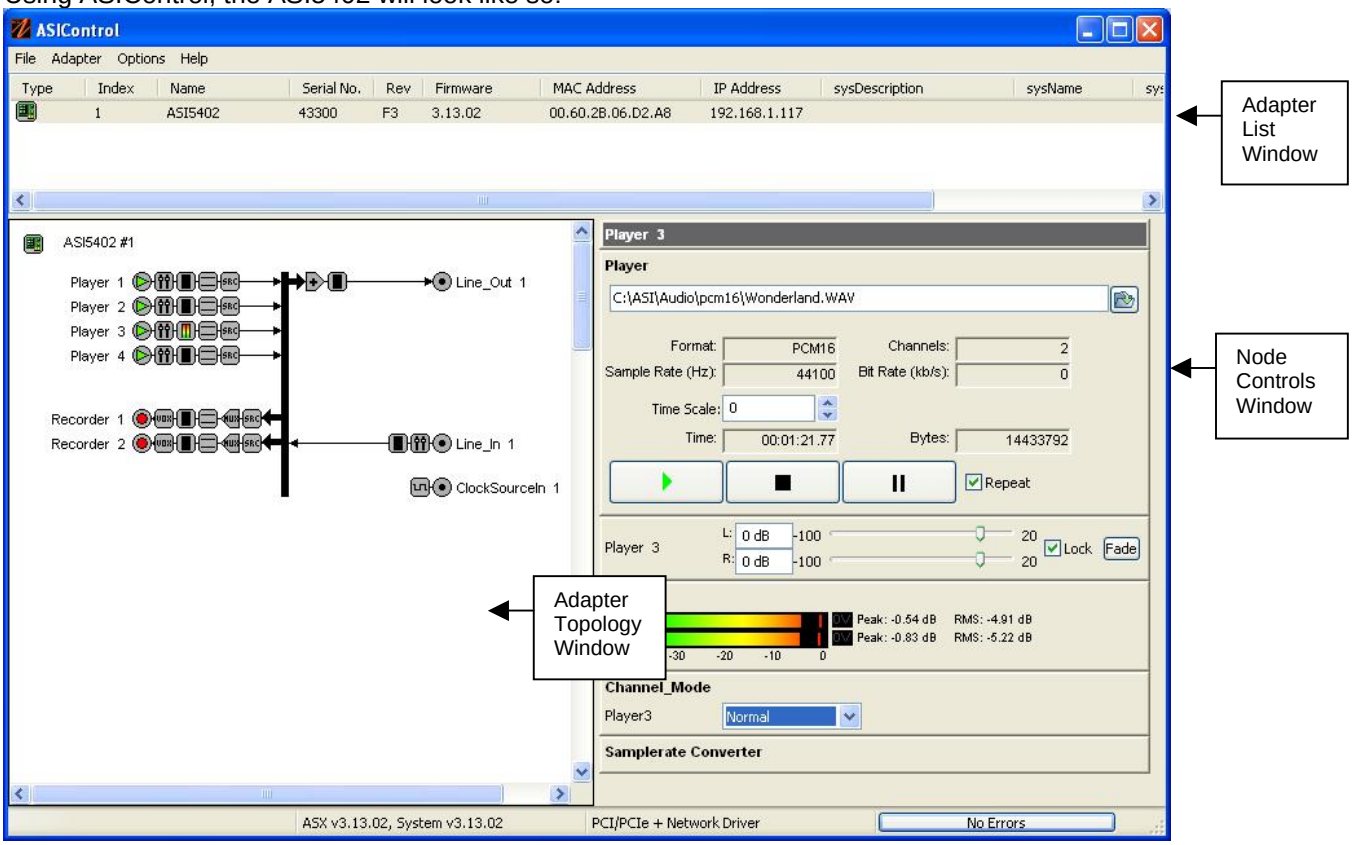
10.2.2 ASIMixer

ASIMixer is specific to the Wave and Combo drivers and is available from the AudioScience website. It uses the Wave/Mixer interface to control AudioScience adapters. Users of driver version 3.10 and later are encouraged to use ASIControl for manipulating adapter controls.

See the list of controls in the previous section that that are only available in ASIControl.

11 OPERATION USING ASICONTROL

Using ASIControl, the ASI5402 will look like so:



11.1 User Interface

ASIControl consists of three main windows: the adapter list in the top portion of the window, the adapter topology view on the left hand side and the node control list on the right hand side.

11.1.1 Adapter List Window

The top portion of ASIControl shows a list of all the adapters that the application has found. By default, only bus based (i.e. PCI and/or PCI Express) adapters will be shown. If network support has been installed with the driver then AudioScience and other 3rd party CobraNet devices will be shown.

Adapters are listed in order of adapter index. For bus-based adapters, this is determined by the adapter index jumper on the card. For AudioScience CobraNet devices such as the ASI2416 this is calculated from the units MAC address. 3rd party CobraNet devices are listed last as they have no AudioScience index.

11.1.2 Adapter Topology Window

The left hand side of ASIControl contains the topology view of the adapter. It is essentially a block diagram of the device showing the available physical inputs and outputs on the right hand side. On the left hand side, bus based adapters show player and recorder streams, while CobraNet adapters show their network connections.

Each of these inputs and outputs is referred to as a Node and each Node contains one or more Controls on it. The topology shows each Control as a small square icon. A non-exhaustive list of nodes follows:

- Line In
- Line Out
- AES/EBU In
- AES/EBU Out
- Player
- Recorder
- Tuner
- Clock Source In
- CobraNet In
- CobraNet Out

Hovering the mouse over a particular node will highlight it. Clicking on a node will bring up the controls resident on that node in the right hand control list.

There is an adapter node in the top left corner. Clicking on this will show adapter specific controls and properties on the right hand side.

11.1.3 Node Controls Window

The right hand side of ASIControl shows the controls associated with the selected node on the topology view. The controls are arranged, from top to bottom, in order of audio signal flow, i.e. the audio signal can be viewed as entering the node at the top control and leaving at the bottom control.

12 Controls

The following subsections list all of the controls for the ASI5402. Each control's interface as it appears in ASIControl is detailed and where applicable, the API to use the control is described.

12.1 Adapter_Info

This control displays information about the installed adapter or ASI2416.

12.1.1 Interface

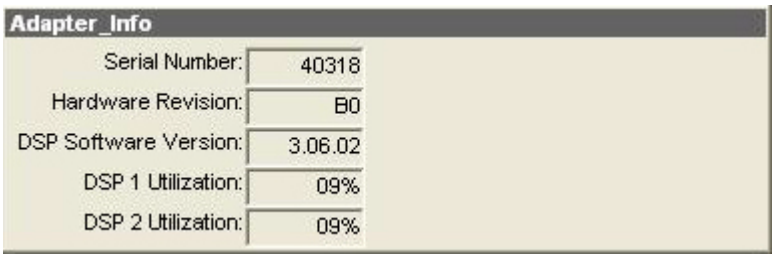


Figure 4. Adapter information seen in right side of ASIControl.

Serial Number:
The serial number is displayed here.

Hardware Revision:
This lists the hardware revision.

DSP Software Version:
The DSP software version is displayed; usually the same as the driver version installed.

DSP Utilization:
This shows the loading of the adapter's DSP in percent.
Note: Utilization should be kept below 90%.
Note: Not all adapters have two DSPs as shown in the screenshot above, and the ASI2416 does not list its DSP utilization here (it's listed on its front panel).

12.2 Player

The Player control supports playback of an audio file from the computer's hard drive.

12.2.1 Interface

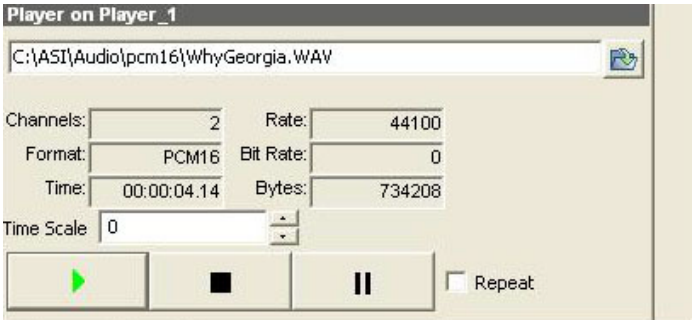


Figure 1. A player in ASIControl.

The first line of static text contains the selected playback file. Below the filename is the file information; playback time and playback bytes, the timescale select options, the player control buttons and the file repeat option.

12.2.2 How To Play a File

The first step in playing a file is to select the file to play. Use the **file icon button** to navigate to the desired file. After opening the file, the complete filename, including the path, will appear immediately to the left of the file open icon. At this point the file information is also filled in so that it contains the following fields: "**Channels**", "**Rate**", "**Format**", and "**Bit Rate**". Most of there are self-explanatory. The "**Rate**" refers to the sample rate of the audio recorded in the file. The "**Bit Rate**" applies only to MPEG compression and is set to 0 for all other formats.

At this point the percentage time scaling without pitch shift can be set if desired. The default of 0 indicates that time scaling is disabled. The valid range of settings is +/- 20 percent.

The "**Repeat**" check box indicates whether the file should be played again after playback has completed. It can be set either before playback has begun, or while playback is underway.

The file is now ready to be played. To start playback press the **play button**. At this point the "**Time**" and "**Bytes**" fields report playback time and the number of bytes of the file that have been played.

Once playback has started, the **stop** and **pause buttons** can be used to stop or pause the playback.

12.2.3 Using embedded sine wave generator

Manually typing in a filename of "~" and pressing play will cause a full-scale 1 kHz sine wave to be played at 48 kHz. The format of the filename string is: "~w, c,f,a,m,s,t".

w = waveform = SINE (default=SINE)
c = channels = 1..8 (default = 2)
f = frequency = 1000 for 1kHz (default=1000)
a = amplitude = -1 for -1dBFs (default=0dBFS, i.e. full scale)
m = channel mask = 10 for left only, 01 for right only, 11 for stereo etc (default=1 for all channels)

t = sample type = (PCM8,PCM16,PCM24,PCM32,FLOAT32), (default=FLOAT32)
s = sample rate = positive integer (default=48000) [validity depends on adapter]

Defaults can be used if the complete string is not specified, i.e.
"~" becomes "~wSINE,c2,f1000,a0,m11,s48000,tFLOAT32"

Any subset of the options may be specified, the remaining options will be set to the defaults. e.g. "~f500" = 500Hz stereo sine wave at 0dBFS, 48kHz sample rate.

12.2.4 Developer

12.2.4.1 Windows APIs

Wave – waveOutOpen(), waveOutWrite(), waveOutClose() etc.
HPI – Output stream functions documented here.
ASX – ASX Player control functions documented here.
DirectSound – TBD.

12.2.4.2 Linux APIs

HPI – TBD.

12.3 Recorder

The Recorder control supports recording of an audio file.

12.3.1 Interface

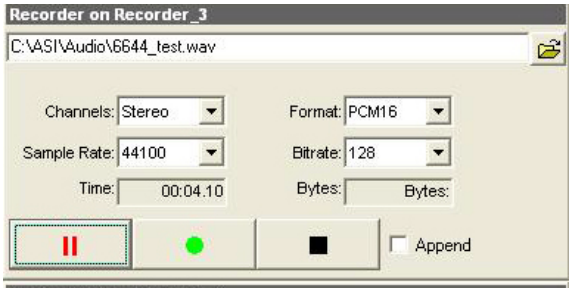


Figure 2. A recorder in ASIControl.

The first line of text contains the name given to the recorded file along with the location where it is to be saved. Below the filename is the file information: record time and record bytes, the recorder control buttons and the file Append option.

12.3.2 How To Record a File

The first step in recording a file is to have audio coming into the adapter. This can be from a line-in or from one of the players in ASIControl. See appropriate sections in this datasheet to accomplish this. Next, the new file needs a name and place to be saved, or an existing audio file can be selected to be overwritten or appended to. Use the **file icon button** to navigate to the location to create the file and to give it a name, or to open a previously recorded file to overwrite or append to it. Next, from the dropdown arrows, select the number of “Channels”, the “Sample **Rate”,** the “Format”, and the “Bitrate” that the file should be recorded in.

Check the **Append** checkbox to save the audio to the end of an already existing file.

The file is now ready to be recorded. To start recording, press the **record button.** At this point the “Time’ and “Bytes’ fields report record time and the number of bytes of the file that have been recorded.

Once recording has started, the **stop** and **pause buttons** can be used to stop or pause the playback.

Note: The green monitor button, used to test functionality, acts as a record button but does not create a recorded audio file.

12.3.3 Developer

12.3.3.1 Windows APIs

Wave – use waveInOpen(), waveInStart() etc.
HPI – use HPI_InStreamxxx() functions.
ASX – use ASX_Recorder_xxx() functions.
DirectSound – TBD.

12.3.3.2 Linux APIs

HPI – use HPI_InStreamxxx() functions.
ASX – use ASX_Recorder_xxx() functions.
ALSA – TBD

12.4 Volume

The Volume control allows the audio signal's gain to be altered in the range of –100 to +20dB.

12.4.1 Interface

Figure 3. A Volume of a Player in ASIControl.

Left and **Right** display boxes:
Displays the gain settings that the slider bars are set to.

Slider Bars:
Click on the bar with the mouse and drag to desired gain. Once the bars are selected, the left and right arrow keys can also be used to change the settings.

Lock:
When checked, locks the left and right channels to the same gain value. When unchecked, allows the left and right channels to have independent gains.

Autofade:
When pressed, automatically fades the volume to the opposite end of the scale.

12.4.2 Developer

12.4.2.1 Windows APIs

Wave/Mixer – MIXERCONTROL_CONTROLTYPE_VOLUME
This is a Windows standard volume control. Settings are in the range of 0 to 65535, where 0 completely mutes the output and 65535 is the maximum volume.
HPI – HPI_Volume APIs.
ASX – ASX_Volume APIs.
DirectSound – TBD.

12.4.2.2 Linux APIs

HPI –HPI_Volume APIs.
ASX –ASX_Volume APIs.
ALSA – TBD.

12.5 Meter

Meters in ASIControl are located on audio nodes and display the audio level as the audio signal passes through the node. Most AudioScience devices return both RMS and peak level readings and ASIControl displays both simultaneously.

12.5.1 Interface

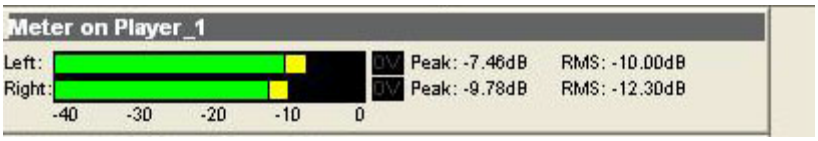


Figure 4. A stereo peak meter display. The RMS is the green bar and the peak is the yellow bar.

To the right of the peak meter is the absolute readings in dBFS. These can be useful when testing input tones of a specific known level.

The ASI2416 has mono (single channel) peak meter, so only a single bar is displayed in that instance.

12.5.2 Developer

12.5.2.1 Windows APIs

Wave/Mixer – Meters are read using mixerGetControlDetails() on a control of type signed and with type “Peak” the name “Peak Meter”. A minimum value is 0 and maximum is 32767. The interface returns the peak readings only, not the RSM level. It confirms to expected Windows functionality.
HPI – Meters are read using the HPI_Meterxxx() API.
ASX – Meters are read using the ASX_Meter_xxx() API.
DirectSound – TBD.

12.5.2.2 Linux APIs

HPI – Meters are read using the HPI_Meterxxx() API.
ASX – Meters are read using the ASX_Meter_xxx() API.
ALSA – TBD.

12.6 Channel_Mode

The channel mode is a mechanism for handling mono to stereo conversions and directing the output to either left or right channels, as well as outputting left to stereo and right to stereo.

12.6.1 Interface

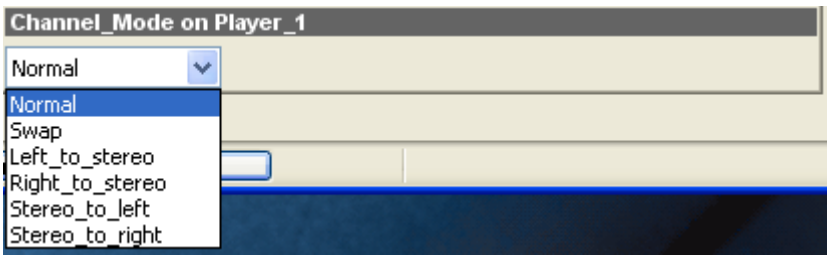
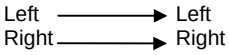


Figure 5. ASIControl view of a player's channel mode control.

Default playback of either mono or stereo files causes audio to be output from the player on both the left and right audio channels. The channel mode control can allow the audio to be directed to either the left only or the right only. Select a channel mode setting from the dropdown list.

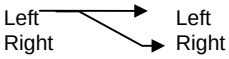
Valid settings are:

Normal – left channel out left channel, right channel out right channel

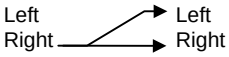


Swap – left channel out right channel and right channel out left channel

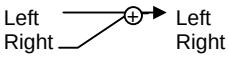
Left_to_stereo – left channel out to both left and right channels



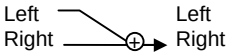
Right_to_stereo – right channel out to both left and right channels



Stereo_to_left – left and right channels out to left channel



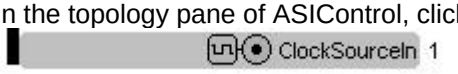
Stereo_to_right – left and right channels out to right channel



The Stereo_to_left and Stereo_to_right operations perform a sum of the left and right channels and then divides the result by 2.

12.7 ClockSourceIn

In the topology pane of ASIControl, click on Clock Source 1



to see the ClockSourceIn information in the node pane..

12.7.1 Interface

Figure 6. Clock Source information for CobraNet devices as seen in ASIControl.

Clock Source:
CobraNet supports 48kHz. For this reason, the Clock Source is grayed out and is not user selectable.

Adapter Rate:
Displays CobraNet clock rate.

<end>