

1 DESCRIPTION

The ASI6416 is a professional PCI audio adapter designed for use in the broadcast and entertainment markets.

Using Cirrus Logic's CobraNet technology for streaming audio over Ethernet, the ASI6416 provides 8 stereo inputs and outputs. It can be connected to any CobraNet compliant device.

The ASI6416 is based on the TMS320C6713 VLIW floating point DSP connected to a high-speed bus-master PCI interface.

AudioScience MRX technology allows up to 16 streams of different formats and sample rates to be played, recorded and mixed over CobraNet. A choice of 16bit PCM, MP3 or MPEG layer 2 compression is available on all streams.

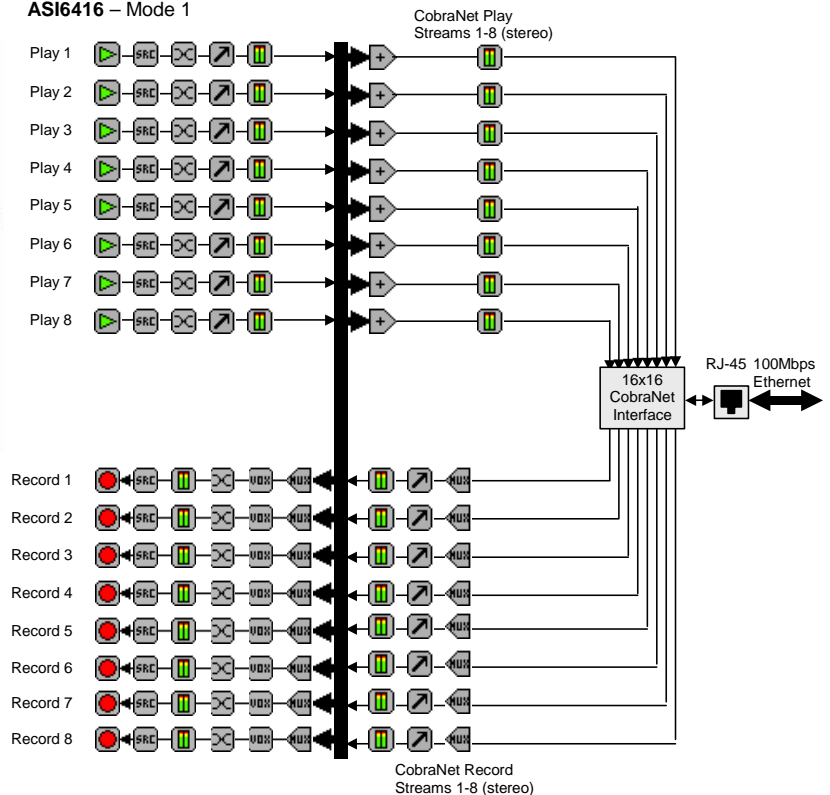
AudioScience provides ASIControl, an application that allows CobraNet routing connections to be set up between the ASI6416 and any other compliant CobraNet device on the network. Alternatively, third party CobraNet design and management software may be used such as CobraCAD and CobraNet Discovery from Cirrus Logic or CobraNet Manager from D&R Electronica B.V.

2 FEATURES

- 8 stereo 24bit CobraNet inputs and outputs on 100Mbit Ethernet operating at 48kHz
- 8 stereo streams of MP3, MPEG Layer2 or PCM playback
- 8 stereo streams of MP3, MPEG Layer2 or PCM record.
- MRX™ technology supports recording, playing and mixing of multiple stream formats and sample rates.
- TSX™ time scaling allows compression/expansion of play streams by up to +/-20% with no pitch shift.
- Low Profile PCI card allows use in 2U high rackmount computers.
- Up to 4 cards in one system.
- Windows 2000/XP/Server 2003/Vista and Linux software drivers available.



ASI6416 – Mode 1



- Key:
- Play Stream
 - Sample Rate Converter
 - Channel Mode
 - Volume
 - Meter
 - Mixer
 - Record Stream
 - Voice Operated Switch
 - Multiplexer

3 SPECIFICATIONS

COBRANET INPUT/OUTPUT		
Type	100BaseT Ethernet	
Connector	RJ-4	
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 floating point PCM MPEG-1 Layer 2 MPEG-1 Layer 3(MP3) (MPEG Layer-3 audio coding technology licensed from Fraunhofer IIS and THOMSON multimedia)	
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	

4 REVISIONS

Date	Description
07 November 2008	Added Introduction section, CobraNet background, CobraNet configuration and a drawing showing how lines map to CobraNet audio channels.
29 September 2008	Updated datasheet to new style.
09 February 2009	Updated block diagram.
01 May 2009	Added Mono mode to Section 13.2. Mono mode added in driver 3.14.00. Added DSP Mips tables; Section 5.
11 May 2009	Combined DSP Mips tables into one.
30 October 2009	Page 1: Removed rogue elements on block diagram
21 May 2010	Updated Hardware Installation, User Interface, Volume, ClockSourceIn and CobraNet sections.

5 DSP UTILIZATION

The ASI6xxx series of adapters have world-class audio signal processing capabilities. The ASI6xxx algorithm complexity has increased at a faster rate than DSP processing power, resulting in a situation where not all available algorithms on an ASI6xxx can run simultaneously.

The following tabulates processing “budgets” so that problem configurations can be identified before system design is completed. The following tables assign a utilization percentage for various operations. By summing up the utilizations for the target (worst case) configuration, one can determine whether audio processing will run without causing dropouts or breakup

5.1 ASI6416 Rev:D, samplerate 48kHz, driver 3.12.02

Idle DSP utilization in Mode 1 = 12%, in 16-Play mode = 18%.

Operation	Play (utilization/ device)		Record (utilization/ device)	
	Mode 1	16-Play	Mode 1	16-Play
PCM 32 @ 48kHz	3	2	3	2
MPEG-1 Layer-2, 256 kbps @ 48kHz	6	6	11	10
MPEG-2 Layer-3, 256 kbps @ 48kHz	11	11	30	30
SampleRate Conversion to/from 32kHz PCM	7	7	7	7
SampleRate Conversion to/from 44.1kHz PCM	6	6	6	5
SampleRate Conversion to/from 32kHz MPEG-1 Layer-2	9	9	13	12
SampleRate Conversion to/from 44.1kHz MPEG-1 Layer-2	10	10	13	13
SampleRate Conversion to/from 32kHz MPEG-2 Layer-3	13	13	26	26
SampleRate Conversion to/from 44.1kHz MPEG-2 Layer-3	14	14	31	32
TimeScale (90%) PCM	3	3	NA	NA
TimeScale (110%) PCM	3	3	NA	NA
TimeScale (90%) MPEG-1 Layer 2	6	6	NA	NA
TimeScale (110%) MPEG-1 Layer 2	6	6	NA	NA
TimeScale (90%) MPEG-2 Layer 3	11	11	NA	NA
TimeScale (110%) MPEG-2 Layer 3	11	11	NA	NA

From the above table:

ASI6416 in 16-Play mode, 4xMP2 playback (all at 44.1 kHz) =
 idle + 4x6% = 18% + 24% = 42%.

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7 INTRODUCTION

The ASI6416 is a PCI audio adapter that supports the CobraNet™ audio interface providing 16 channels of CobraNet receive and transmit.

The ASI6416 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 ASI6416. ASIControl sets up all internal features of the unit such as levels also allows CobraNet routing connections to be set up between the ASI6416 and any other compliant CobraNet 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.

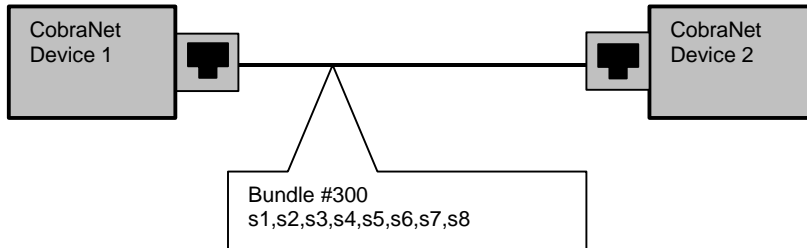
The Cirrus Logic website, www.cobranet.info, is dedicated to CobraNet. Wikipedia has a useful introduction to CobraNet [here](#).

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 one 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.

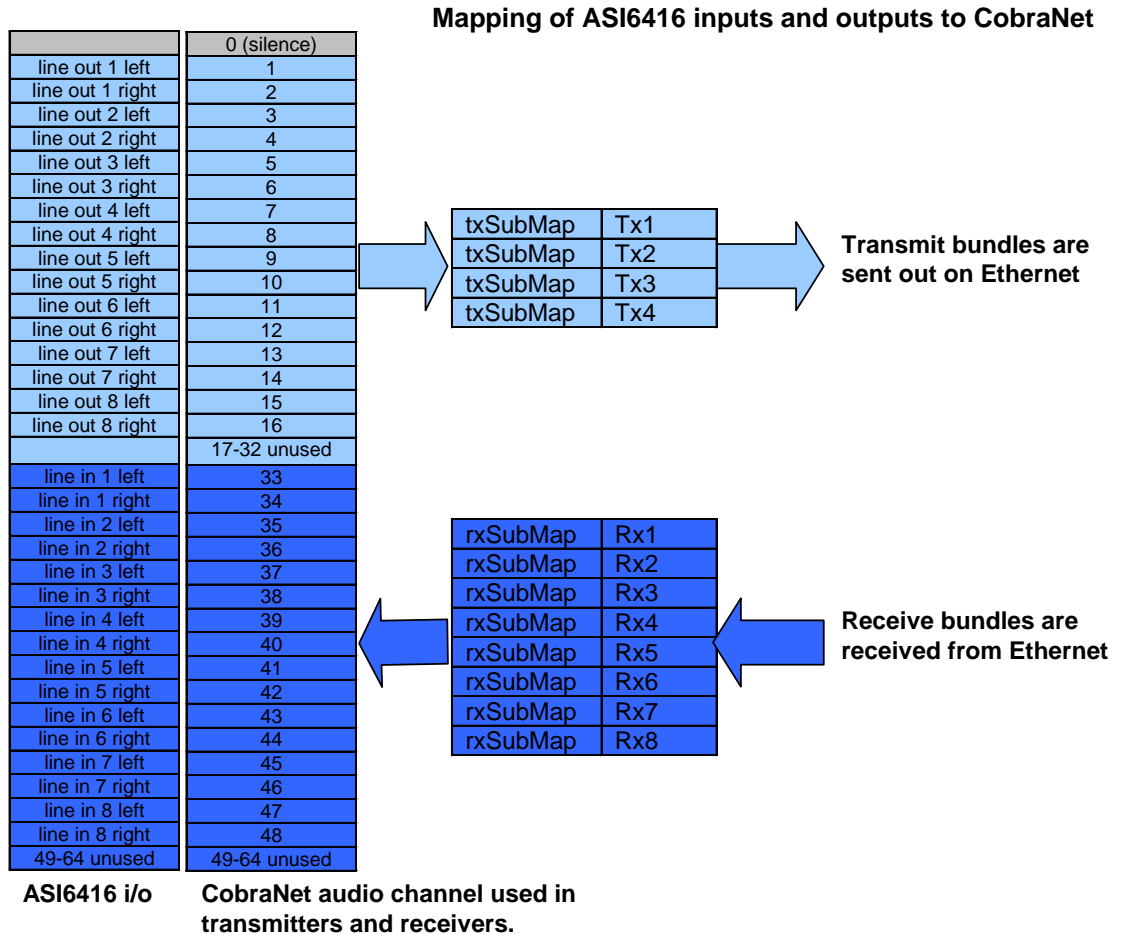
Illustration of a CobraNet bundle going between 2 CobraNet devices.

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 ASI6416 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 ASI2416 audio routing channels 1 – 16 map to input channels 1 – 16. Similarly, on the output side audio routing channels 33-49 map to output channels 1 –16. On an ASI6416 audio routing channels 1-16 map to line out 1-8. Routing channel 1 maps to line out 1 left and routing channel 2 maps to line out 1 right and so on.

Figure 3. 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.
- txSubFormat – 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 receive 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.jpj>

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 ASI6416 uses a standard RJ-45 connector.

9 CABLES

The ASI6416 is connected to a CobraNet network using a standard Ethernet cable. The Ethernet cable is not supplied with the ASI6416.

10 HARDWARE INSTALLATION

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

Setting Adapter Index – One Adapter in the PC

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, the factory default. For a new card no changes need to be made. For an AudioScience adapter from another installation, check that it is set to adapter index #1.

Depending on the adapter family, there are different ways of setting the adapter index.

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

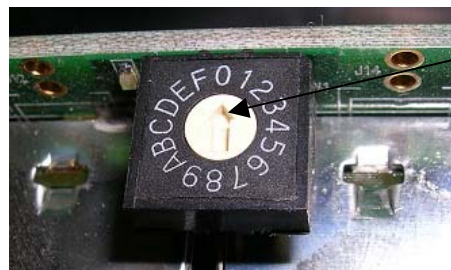
For ASI5300, ASI6300, ASI8700, and ASI8900 families, there is a rotary switch.

NOTE: Position 0 (zero) represents adapter #1, position 1 is adapter #2, etc.

Adapter Jumper set to Adapter #1



Adapter Index switch set to Adapter #1



4. Turn on the computer and let it boot. Under Windows, 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.

Setting Adapter Index - Two or More Adapters in the PC

1. Make sure your computer is turned off.
2. PCI adapters should be installed in any empty PCI slots and PCIe adapters should be installed in any x1 (or greater) PCIe slots. Different adapter types can coexist in the same computer; for example, an ASI6416 and ASI8921 will work correctly if installed in the same PC. Different adapter types still require unique adapter index numbers.

3. Each adapter in the PC needs to have its 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.

For ASI5000 and ASI6000 families, the position to the right of index #1, when jumpered, represents adapter index #2. The next position represents #3, and the rightmost position, when jumpered, represents #4.

3.1. For ASI5300, ASI6300, ASI8700, and ASI8900 families, rotate the rotary switch to indicate what position is required.

4. Turn on the computer and let it boot. Under Windows, 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.

11 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.

11.1 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.

11.1.1 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).

11.1.2 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).

11.1.3 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).

11.1.4 ASIO

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

11.1.5 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.

11.1.6 Drivers for Linux

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

11.2 Applications for Windows

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

11.2.1 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.

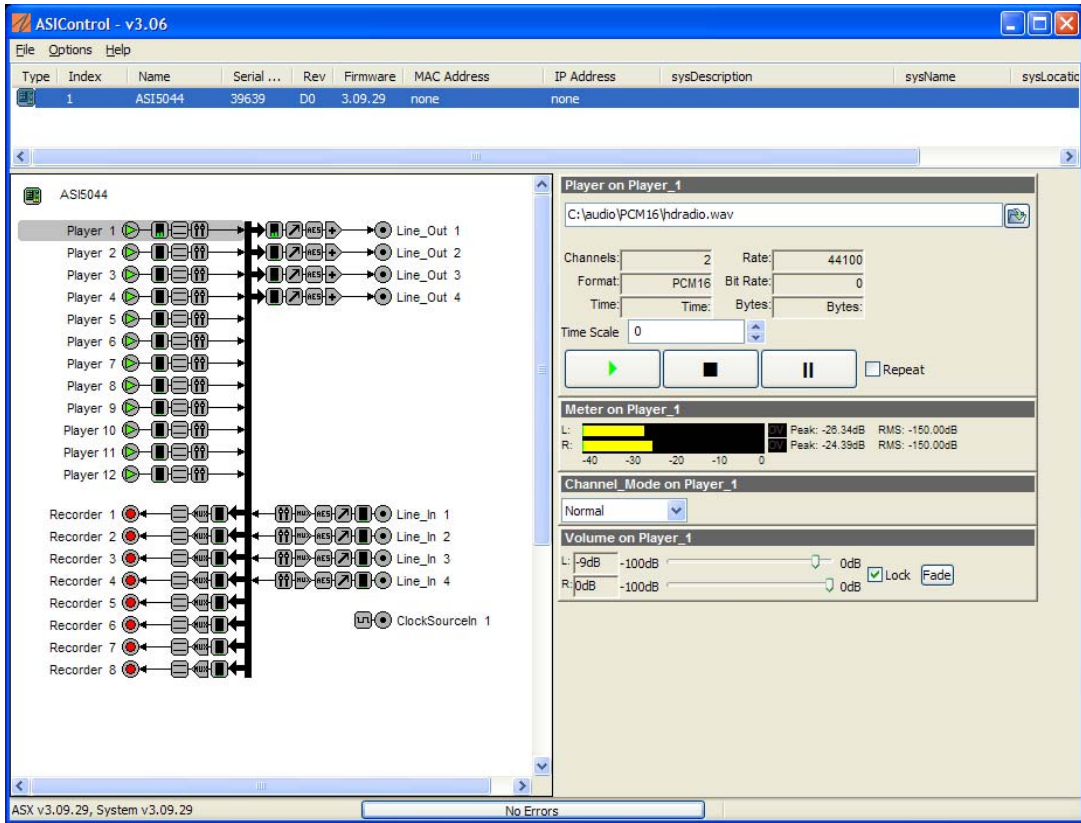
The following list of controls are uniquely supported in ASIControl (as opposed to ASIMixer):

- 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:



11.2.2 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.

12 OPERATION USING ASICONTROL

Using ASIControl, the ASI6416 will look like so:

The screenshot displays the ASIControl application window. At the top is a menu bar with 'File', 'Options', and 'Help'. Below it is a table titled 'Adapter List Window' containing the following data:

Type	Index	Name	Serial No.	Rev	Firmware	MAC Address	IP Address	sysDescription	sysName	sysLocation
	1	ASI6416	24750	D0	3.10.05	00.60.2B.06.D0.4C	192.168.1.102			

The main area is divided into three sections:

- Adapter Topology Window (Left):** A block diagram showing 8 Player and 8 Recorder streams connected to 8 Line_Out and 8 Line_In ports. A 'ClockSourceIn' port is also visible.
- Node Controls Window (Right):** A panel for 'ASI6416' with two sections:
 - Adapter_Info:** Serial Number: 24750, Hardware Revision: D0, DSP Software Version: 3.10.05, DSP Utilization: 13%.
 - Adapter_Mode:** Mode-1 (dropdown menu).

At the bottom, the status bar shows 'ASX v3.10.05, System v3.10.05', 'PCI/PCIe + Network Driver', and 'No Errors'.

12.1 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.

12.1.1 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 the network portion of the driver is installed (by selecting "Install Standard + Networked Audio Driver" after running the driver installer) and "Local PCI(e) + Networked adapters" is selected from ASIControl's Options→Configure adapter interface, then AudioScience and other third 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 this is calculated from the unit's MAC address. Third party CobraNet devices are listed last as they have no AudioScience index.

12.1.2 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	Recorder
Line Out	Tuner
AES/EBU In	Clock Source In
AES/EBU Out	CobraNet In
Player	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 of the topology window. Clicking on this will show adapter-specific controls and properties on the right hand side.

12.1.3 Node Controls Window

The right hand side of ASIControl shows the controls associated with the selected node in 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.

13 Controls

The following subsections list all of the controls for the ASI6416. Each control's interface as it appears in ASIControl is detailed and where applicable, the API to use the control is described.

13.1 Adapter Information

This control displays information about the installed adapter or ASI2416.

Interface

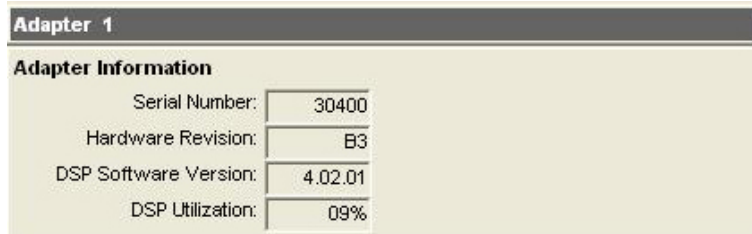


Figure 1. Adapter information seen in right side of ASIControl.

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%.

13.2 Adapter Mode

The Adapter_Mode control changes the number of players/recorders/lineouts that an adapter has. Not all sample rates/formats are supported; changing the mode of the adapter allows for best functionality with certain sample rates/formats. Not all adapters have the same modes, and not all adapters have modes. Please see datasheets on specific adapters, available at www.audioscience.com, to learn more.

13.2.1 Interface

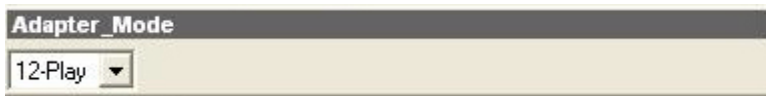


Figure 2. Adapter_Mode in ASIControl.

Selecting the appropriate mode from the list using the dropdown arrow changes the Adapter_Mode setting. A reboot is necessary after changing adapter mode. The mode setting is saved to the adapter's EEPROM.

The ASI6416 supports four adapter modes: 16-Play, Mode 1, Mode 2, and Mono (driver 3.14.00 or later required for Mono mode).

13.2.1.1 16-Play

This mode supports 16 Play streams and 16 Record streams with restricted mixing capabilities (with driver 3.14.00 and later, there are no mixing restrictions). It is recommended that play and record formats be constrained to 48 kHz mono PCM if all 16 devices are to be used.

13.2.1.2 Mode 1 (default) – Standard Mixing

This mode supports 8 Play streams and 8 Record streams with full mixing capabilities.

13.2.1.3 Mode 2 – Minimal Mixing

This mode supports playback from each Play device to a single LineOut and has no LineIn to LineOut mixing capabilities. This conserves DSP MIPS. Mode 2 supports recording stereo MP2 at 48 kHz on all 8 Record streams.

13.2.1.4 Mono

NOTE: Driver 3.14.00 or later is required for this mode.

This mode supports 16 mono Play streams and 16 mono Record streams with full mixing capabilities. Mono mode supports PCM only. Mono mode supports mapping a single Play device to a mono CobraNet channel, allowing independent audio output on each channel.

13.3 Player

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

13.3.1 Interface

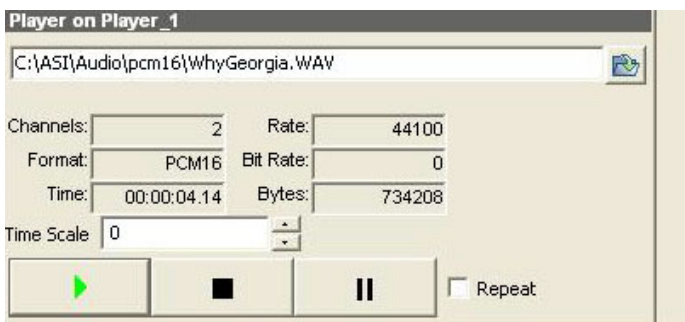


Figure 3. A player in ASIControl.

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.

13.3.2 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 these 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.

13.3.3 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.

13.3.4 Developer

13.3.4.1 Windows APIs

Wave – waveOutOpen(), waveOutWrite(), waveOutClose() etc.

HPI – Output stream functions documented [here](#).

ASX – ASX Player control functions documented [here](#).

DirectSound – TBD.

13.3.4.2 Linux APIs

HPI – TBD.

13.4

13.5 Recorder

The Recorder control supports recording of an audio file.

13.5.1 Interface

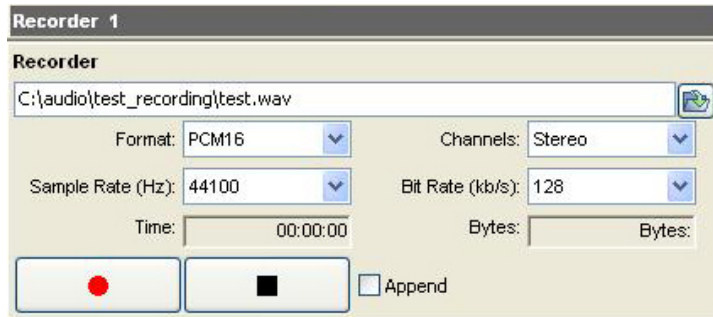


Figure 4. A recorder in ASIControl.

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, the record time and record bytes, the recorder control buttons and the file Append option.

13.5.2 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.

13.5.3 Developer

13.5.3.1 Windows APIs

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

13.5.3.2 Linux APIs

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

13.6 Volume

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

13.6.1 Interface



Figure 5. 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. (Note that if an adapter is in SSX2 mode, the Player volumes cannot be unlocked to move the left and right channels independently.)

Autofade:

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

13.6.2 Developer

13.6.2.1 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.

13.6.2.2 Linux APIs

HPI – HPI_Volume APIs.

ASX – ASX_Volume APIs.

ALSA – TBD.

13.7 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.

13.7.1 Interface

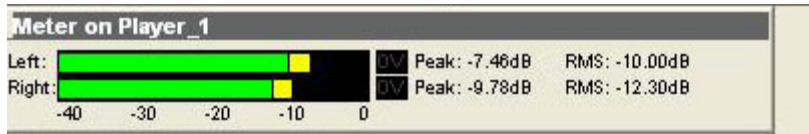


Figure 6. A stereo peak meter display. The RMS is the green bar and the peak is the yellow bar.

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.

13.7.2 Developer

13.7.2.1 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 conforms 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.

13.7.2.2 Linux APIs

HPI – Meters are read using the [HPI_Meterxxx\(\)](#) API.

ASX – Meters are read using the [ASX_Meter_xxx\(\)](#) API.

ALSA – TBD.

13.8 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.

13.8.1 Interface

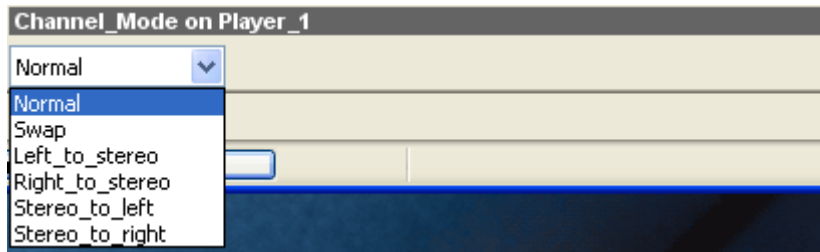
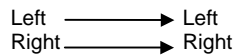


Figure 8. ASIControl view of a player's channel mode control.

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:

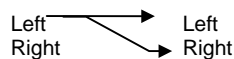
Normal – left channel out left channel, right channel out right channel



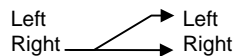
Swap – left channel out right channel and right channel out left channel



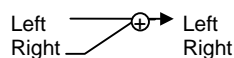
Left_to_stereo – left channel out to both left and right channels



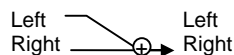
Right_to_stereo – right channel out to both left and right channels



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.

13.9 ClockSourceIn

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



to see the ClockSourceIn information in the node pane..

13.9.1 Interface



Figure 7. 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.

14 COBRANET

ASiControl can be used to configure both AudioScience CobraNet devices and third party CobraNet devices, via its CobraNet Configuration dialog box. This dialog box can be used to configure CobraNet devices and assign names, locations, bundle numbers, channel assignments, etc. Third party applications such as CobraNet Discovery can also be used to configure AudioScience CobraNet devices.

Below lists how to set up AudioScience’s software so ASiControl may be used to configure CobraNet.

NOTE: Under some Windows operating systems, ASiControl must be run as administrator in order to see all networked CobraNet devices. In Windows 7 this is done by right clicking on the ASiControl shortcut on the desktop and selecting “Run as administrator.”

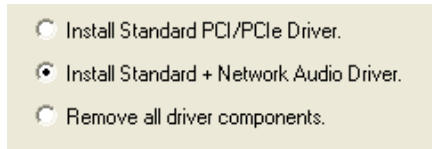
NOTE: Some antivirus programs and/or firewalls can prevent ASiControl from showing all CobraNet devices on a CobraNet network. If all CobraNet devices are not showing in the top pane of ASiControl, please check settings and/or turn off any antivirus programs or firewalls that may be running on the PC.

14.1 Setting Up AudioScience Software to Configure CobraNet

To configure an AudioScience CobraNet devices using ASiControl, the following must be in place: the AudioScience network driver must be installed, the networked adapters option must be selected in ASiControl, the AudioScience CobraNet device must be connected to the CobraNet network via an Ethernet cable, and the PC that is running ASiControl must also be connected to the same CobraNet network.

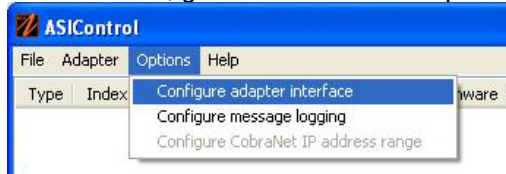
14.1.1 Install the Network Driver

When an AudioScience driver install EXE is run, three choices are made available as shown in the image below. Select “Install Standard + Network Audio Driver” when installing AudioScience CobraNet products, then run the driver install EXE as usual.

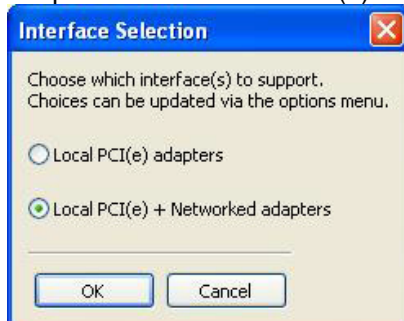


14.1.2 Select Networked Adapters in ASiControl

In ASiControl, go to the menu item Options, then select Configure adapter interface, as shown below.



Since ASiControl is used for both AudioScience’s non-CobraNet adapters and CobraNet adapters, the correct interface must be selected when using ASiControl for CobraNet configuration. Click on menu item Options, then Configure adapter interface. The Interface Selection dialog box opens; the default selection is “Local PCI(e) adapters. Select ‘Local PCI(e) + Networked adapters.’ then click OK.



ASiControl will restart, looking for all CobraNet devices on the network, assigning IP addresses where needed, and showing CobraNet devices on the network in its top pane.

14.1.3 Connect CobraNet Device to the Network

Plug one end of an Ethernet cable into the back of the AudioScience CobraNet device. Plug the other end into the CobraNet or test network.

14.1.4 Connect PC to the Network

CobraNet control is via SNMP. In order for ASiControl to establish an SNMP connection to an AudioScience (or other) CobraNet device(s) for configuring, a valid network path must be established between the PC running ASiControl and the AudioScience (or other) CobraNet device(s). This is done by plugging one end of an Ethernet cable into the back of the PC's network interface card (NIC) and plugging the other end into the CobraNet or test network.

If the PC running ASiControl must be connected to an office network and if the CobraNet network data is required to be separate from the office network, another NIC must be added to the PC; one for the office and one for CobraNet.

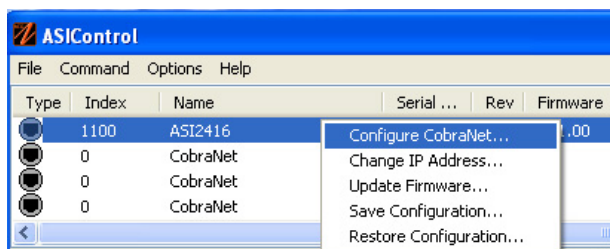
If the PC is on an office network and the CobraNet network data is not required to be separate from the office network, the PC can temporarily be removed from the office network and plugged into the CobraNet or test network. After the CobraNet configurations are made, the PC can be taken off the CobraNet network and placed back on the office network. **Note:** If any CobraNet configurations need to be changed in the future, the PC must be placed back on the CobraNet network in order to establish the SNMP connection.

If the PC does not need to be on an office network, plug it's NIC into the CobraNet or test network and either leave it there or remove it after configuring CobraNet. If it's removed, the PC must be connected to the CobraNet or test network again if CobraNet configurations need to be changed in the future.

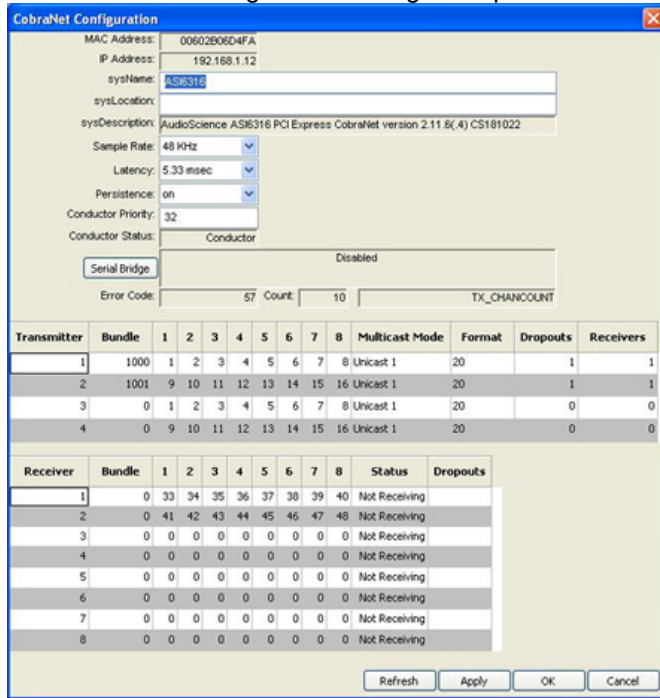
Note: If plugging an AudioScience CobraNet device into an already existing CobraNet network, the PC must have the same IP address range as the CobraNet network in order for it to assign the AudioScience CobraNet device an IP address in the same range. Alternatively, if another CobraNet set-up application was used such as CobraNet Discovery, the same application may be used to assign an IP address and configure AudioScience CobraNet devices.

14.2 Configuring CobraNet Using ASiControl

The CobraNet Configuration dialog box is accessed via ASiControl, which is installed when the driver EXE is run. Double click on the ASiControl icon on the desktop, then in the top section right click on the CobraNet device and select Configure CobraNet... (see further for information on the other selections available):



The CobraNet Configuration dialog box opens:



14.2.1 CobraNet Configuration Interface

There are three main sections of the dialog box: the top shows the configuration section of the CobraNet device, the transmitter section is in the middle, and the receiver section is at the bottom. There are also four user control buttons on the bottom right.

14.2.1.1 CobraNet Device Configuration Section

MAC Address:

Read only; displays the MAC address of the CobraNet device.

IP Address:

Read only; displays the assigned IP address of the CobraNet device.

SysName:

Editable; a meaningful name can be given to a CobraNet device here.

SysLocation:

Editable; a physical location can be listed here for ease of reference.

SysDescription:

Read only; lists the type of CobraNet interface.

Sample Rate:

48k (default) or 96 kHz. A CobraNet device must run at one sample rate only. Two CobraNet devices on the same network can each operate at a different sample rate.

Latency:

Choose between 1.33, 2.67, or 5.33 (default) ms.

Persistence:

On or off. When set to on, settings are saved to flash and will be restored after a restart.

Conductor Priority:

Editable; set a low number to ensure the CobraNet device will always be a Performer (it is never a Conductor) or set it to a high number to ensure it will always be a Conductor (it is never a Performer). The following are Cirrus numbering conventions:

- 0 = never conductor
- 32 = normal conductor priority (the CobraNet device will either be the Conductor or the Performer)
- 128 = high conductor priority (the CobraNet device will be the Conductor)

Conductor Status:

Read only; displays if the CobraNet device is a Conductor or Performer.

Serial Bridge:

Not available on all CobraNet devices. Clicking on this button opens the Serial Bridge Configuration dialog box.

Error Code:

Displays CobraNet-specific error information using Cirrus' error numbering conventions.

Count:

Displays the number of errors that have occurred on the device. Some errors result from normal operation; disconnecting cables, rerouting, etc. The text field to the right of Count displays the Cirrus-related text.

14.2.1.2 Transmitter Section

Transmitter:

Sends an audio bundle, made up of up to 8 audio channels, to a CobraNet receiver on the network.

Bundle:

The basic CobraNet audio routing component, can have 0 to 8 audio channels. Assign specific bundle numbers here. Bundle numbers can be 0 and 1 – 65535

- 0 for turning transmitter off or for silence
- 1-255 for multicast
- 256-65279 for unicast
- 65280-65535 for private

1-8 Audio Channels:

The number of mapped channels from mixer to transmitter. Channels 0 (inactive) and 1-32 can be assigned. A 0 mapping of end channels 'shortens' the bundle; a mapping of 0 in the middle of mapping denotes silence.

Multicast Mode:

Double click to change setting in the dropdown list; use the following table to determine what setting to select:

Settings	Number of Receivers <= N	Number of Receivers > N
Multicast Bundle # < 256	Multicast	Multicast
Always	Multicast	Multicast
Unicast N	Unicast	Unicast if Receiver = 1-N Fail if Receiver > N
Multicast Over N	Unicast	Multicast

Format:

Double click to change the audio sample format to 16, 20, or 24 bits.

Dropouts:

The number of times the channel transmission has been interrupted. Interruptions can be caused by loss of transmit permission from conductor (i.e. conflict with another transmitter set to the same bundle number) or by changes to txBundle.

Receivers:

The number of receivers requesting this bundle.

14.2.1.3 Receiver Section

Receiver:

Can receive from a CobraNet transmitter on the network one bundle made up of up to 8 audio channels.

Bundle:

The basic CobraNet audio routing component; assign a specific Bundle number here. A Receiver can carry 0 (channel will not be mapped to mixer) to 8 audio channels.

1-8 Audio Channels:

The number of audio channels in the bundle to be routed to the particular Receiver; channels 0 (inactive) and 33-64 can be assigned.

Status:

Displays 'Receiving' when a bundle is successfully routed to it.

Dropouts:

Displays number of times bundle reception has been interrupted. Interruptions can be caused by transmitter failure or by reconfiguring the receiver.

14.2.1.4 User Control Buttons

Refresh:

Updates fields and statuses. If clicked before Apply, clears any changes made.

Apply:

Accepts changes and leaves dialog box open.

OK:

Accepts changes and closes dialog box.

Cancel:

Does not accept any changes made and closes dialog box.

14.3 How To Configure and Transmit a Bundle

The minimum configuring needed to test basic functionality of sending and receiving a bundle is to set a transmitter bundle and channels on one CobraNet device, and then set the receiver of another CobraNet device to the same bundle number, plus assign its channel numbers.

For example, an ASI6416 is installed in a computer, ASIControl is opened and is used to play a stereo audio file in the ASI6416's Player 1. The Repeat box is checked to have continuous audio playing.

ASIControl is then used to set the ASI6416's first transmitter to have bundle number and channel assignments. Double clicking in receiver 1's bundle field makes it editable and 255 (for example) is typed in. Double clicking in the receiver 1, channel 1 box makes it editable and 1 is typed in (numbers 0 and 1-32 can be used). Hitting the Tab key auto fills the rest of the channels. Since only two channels are needed, double clicking in the channel 3 box, typing in 0, and then hitting the Tab key changes channels 3-8 to have 0s in them. The OK button is clicked and the dialog box closes.

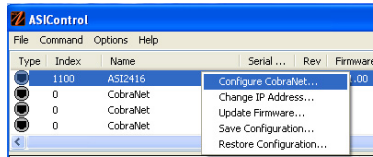
On the same CobraNet network is an ASI2416. Its CobraNet Configuration dialog box is opened using ASIControl. Using the same procedures as above, 255 is typed in (since 255 was used in the example above) as the bundle number for the ASI2416's receiver 1, and its first two channels are assigned numbers 33 and 34 (numbers 0 and 33-64 can be used). This time the Apply button is clicked so the dialog box remains open. Immediately in the CobraNet Configuration dialog box the first two channels in receiver 1 turn green and the Status field changes to 'Receiving' to indicate a bundle has been successfully routed to the receiver. If any errors, the receivers would turn red.

Clicking OK closes the CobraNet Configuration dialog box. ASIControl is still open and meter movement is seen in CobraNet_Ch 33 and 34, as well as Line_Outs 1 and 2.

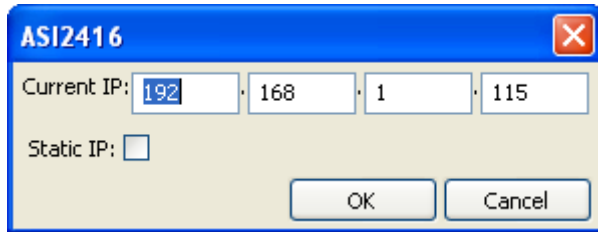
14.4 Change IP Address

Change the IP address of a CobraNet device here.

After right clicking on a CobraNet device in ASIControl and selecting “Change IP Address...”, the dialog box below opens.



14.4.1 Interface



Current IP:

The CobraNet device’s current IP address is shown. Double click in the fields to highlight the current number and overwrite it.

Static IP:

It is recommended to click on the Static IP checkbox to have a fixed IP address.

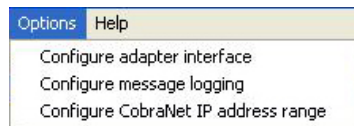
OK/Cancel:

Click OK to accept the changes and close the dialog box, or Cancel to not accept any changes and close the dialog box.

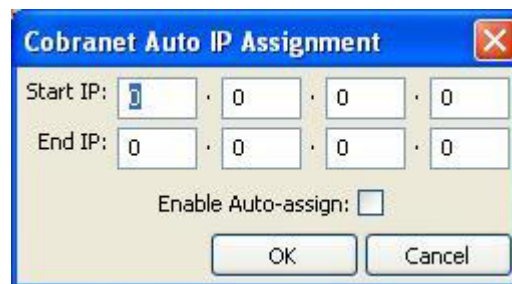
14.5 Configure CobraNet IP Address Range

Assign a starting and ending IP address range, and enable auto-assign here.

Click on ASIControl's menu item Options, then select Configure CobraNet IP address range. This opens the CobraNet Auto IP Assignment dialog box.

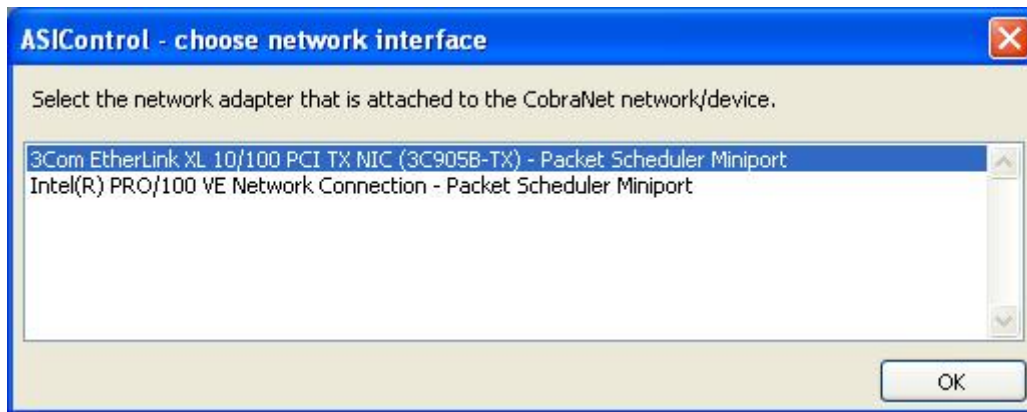


Type in the starting and stopping CobraNet IP address to be used. When Enable Auto-assign is checked, ASIControl assigns IP addresses to all discovered devices according to the IP address range. Click OK.



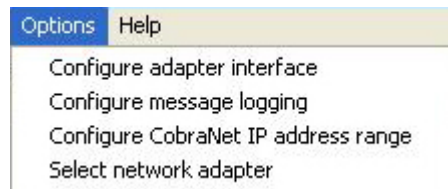
14.6 Choose a Network Interface

If a PC has more than one network interface card (NIC) in it, the following dialog box will pop up when first opening ASIControl:



Select the correct NIC that the CobraNet devices will be using, then click OK.

The network interface can be changed at any time. To change the NIC used, click on ASIControl's menu item Options, then Select network adapter. This opens the ASIControl – choose network interface dialog box.



NOTE: If Select network adapter is not showing under Options, close and then reopen ASIControl.

14.7 References

http://cirrus.com/en/pubs/appNote/CobraNet_AudioRoutingPrimer.pdf

http://cirrus.com/en/pubs/manual/CobraNet_Programmer_Manual_PM25.pdf

http://www.cirrus.com/en/support/cobranet/design/switched_networks.html

15 ERRATA

15.1 "Buzzy" Audio

If "buzzy" audio is heard from an ASI6416, the following may fix it:

- (If needed, save current ASI6416 settings using ASIControl by going to menu item Adapter→Save Configuration.)
- Open ASIControl and click on menu item Configuration. If Persistence is set to on, change it to off.
- Close ASIControl and restart the machine.

<end>