SquawkBox
User Manual

Date 02/18/2014

Revision 04

IMPORTANT SAFETY INSTRUCTIONS

The symbols below are internationally accepted symbols that warn of potential hazards with electrical products.

This symbol, wherever it appears, alerts you to the presence of un-insulated dangerous voltage inside the enclosure -- voltage that may be sufficient to constitute a risk of shock.

This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Please read the manual.

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and third grounding prong. The wider blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by Attero Tech.
12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus.
13. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
14. Unplug this apparatus during lightning storms or when unused for long periods of time.
15. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
16. This apparatus shall be connected to a mains socket outlet with a protective earthing connection.
17. When permanently connected, on all-pole mains switch with a contact separation of at least 3mm in each pole shall be incorporated in the electrical installation of the building.
18. If rack mounting, provide adequate ventilation. Equipment may be located above or below this apparatus but some equipment (like large power amplifiers) may cause an unacceptable amount of hum of may generate too much heat and degrade the performance of this apparatus,
19. This apparatus may be installed in a industry standard equipment rack. Use screws through all mounting holes to provide the best support.

TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules and EN55022. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Contents

1 – Overview

The SquawkBox CobraNet Audio Interface is a cost-effective desktop audio product designed to allow a user to easily monitor multiple channels of audio on a CobraNet-based AV system. Up to 16 channels can be monitored using either the internal speaker or headphones. A 17th "override" channel can be initiated externally for system wide announcements.

The SquawkBox features:
- o   A backlit LCD display showing the description of the audio being played
- o   An internal speaker and a headphone jack for choice of listening method
- o   CobraNet Interface Port - Connects the SquawkBox to a CobraNet network using standard CAT-5 cable
- o   Front-panel volume and channel control buttons
- o   Override indictor

The SquawkBox can be powered by either using PoE from a standard 802.3af compatible PoE network switch or mid-span injector, or by using an external +12 V DC source.

Configuration of the channels to be monitored, their descriptions and setting up of the override configuration is done using the Attero Tech Control Center software.

1.1 – What's in the Box?

The SquawkBox comes supplied with the following
- o   SquawkBox device

1.2 – Optional Extras

All of the following are available as options for the SquawkBox:
- o   A 12 V DC power supply is available if PoE power is not available.
- o   Desktop stand

Each optional item required must be ordered separately to the SquawkBox itself.

2 – Installation

Figure 1 – SquawkBox Connectors and Indicators

①	Power Socket – Use with optional 12 V DC wall wart only.
②	CobraNet Ethernet interface connector and indicators
③	3.5mm Headphone jack

Installation of the SquawkBox only requires that power be supplied to the unit and a connection made to the CobraNet network.

If the SquawkBox is to be powered using PoE, then simply
   o   Attach the CobraNet I/F port to a spare PoE-enabled port on a PoE switch using a CAT-5 cable. If a mid-span injector is being used, connect a spare input port to the CobraNet network switch using a CAT-5 cable, and then connect the corresponding output port to the CobraNet I/F of the SquawkBox.

When powering using an optional external 12 V DC supply:
   o   Attach the CobraNet I/F port to a spare port on the CobraNet network switch using a CAT-5 cable.
   o   Attach the power supply to the power input jack and then power up the external supply.

When powered, the LCD backlight should turn on, and the unit will show its name and software version number for a couple of seconds before reverting to show the description of the audio being played. If the unit has yet to be configured, "CH1" will be displayed.

3 – User Operation

Figure 2 - User Controls

The main feature of the SquawkBox is to monitor up to 16 different audio streams on a CobraNet network. Each stream is identified by selecting a bundle and submap combination that tells the SquawkBox where to locate a given stream. The audio stream can also be given a descriptive name to help identify what audio is being monitoring. This descriptive name is shown on the screen whenever that audio stream is selected.

There are two choices for the audio output. The default output is through the SquawkBox built-in speaker. However, the unit also has a 3.5mm stereo jack connector on the rear that allows a set of headphones to be used. If a set of headphones are plugged in, the output from the built-in speaker is turned off.

The monitored audio is controlled by the buttons on the front of the unit (see Figure 1). There are up and down channel buttons which are used to select the audio stream being monitored. Pressing either of these will move to the next available channel. There are also volume buttons to alter the volume of the audio output. Selecting a volume of zero will mute the output. The output can also be muted if both volume buttons are pressed simultaneously. When active the screen will show "MUTED". To remove the mute, press either volume button.

Note: The mute affects both the speaker output and the headphone output. The audio will remain muted when switching between outputs.

3.1 – General Configuration

Configuration of the SquawkBox requires the use of the Attero Tech Control Center application. Refer to the Attero Tech Control Center User's Guide for installation and setup instructions for the application.

Note: The configuration of the SquawkBox uses SNMP variables that are outside the standard set of CobraNet parameters. Whilst the current audio channel being monitored can be altered by changing the standard receive bundle settings, this is only temporary and should be avoided. Any values altered in this way will not be retained if the channel buttons are used to change to a different channel.

Once Control Center is installed and running, configuration of the SquawkBox can be done by selecting the device in the device list and then clicking the Device Setup button. Alternately, you can right click on the desired device and click on the Device Setup option from the menu that pops up.
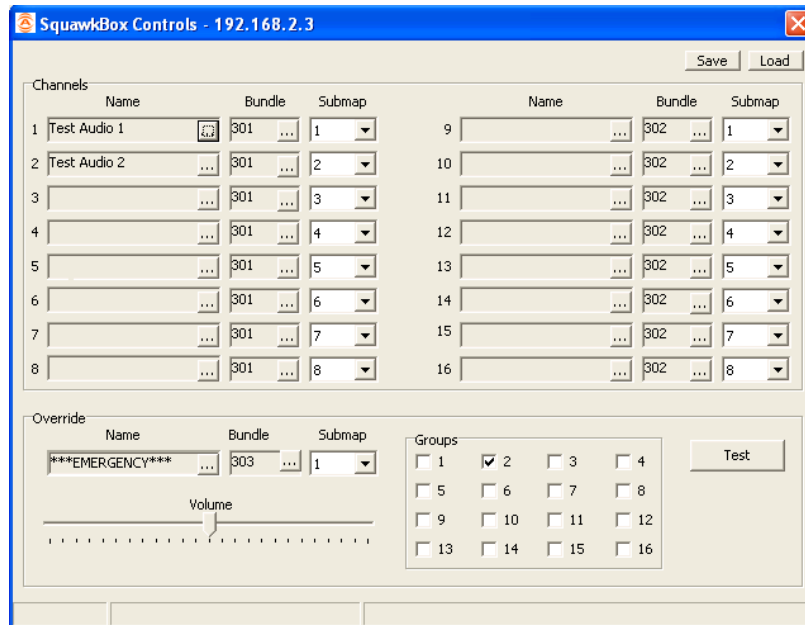
3.2 – Channel Controls

Figure 3 - SquawkBox Configuration Screen

Each of the 16 possible audio streams has its own Name, Bundle and Submap. Each stream can be from a different Bundle/submap combination and combinations may be duplicated if required.

Name
Each audio stream that can be monitored can be given a descriptive name. The name can be up to 16 characters long and include upper or lower case letters, numbers or punctuation marks. It appears on the SquawkBox screen when the user selects that stream. To update a name, click on the button at the end of the names edit box (with 3 dots in it). This opens and edit window. Type in the name and click OK or press Enter. Press cancel or simply closing the window will not update the name and no changes are sent to the device.

Bundle
The bundle setting is the bundle number in which the desired audio stream is contained in. This should be a number from 1 through to 65279. A bundle number of 0 can be used for unused bundles and any channel configured with a bundle number of 0 will be skipped over by the user interface. Any combination of bundle numbers can be used.

Note: Bundles 65280 to 65535 are private and cannot currently be used with a SquawkBox.

Submap
This is the location of the audio stream within the desired bundle. The submap is a number between 1 and 8. If the submap ever shows no value, then the value read from the SquawkBox is either invalid or zero.

3.3 – Applying Changes

Settings are sent to a SquawkBox as they are made on the form and are acted upon as soon as they are received. However, the values sent will not be retained by the SquawkBox unless the devices persistence setting is enabled. If persistence is not enabled, any changes may be lost if the device is reset or powered down.

Note: The persistence on a SquawkBox is not instantaneous. Changes to the configuration made in Control Center are written to the device at the time they are made but the SquawkBox itself only checks for configuration changes once every 15 seconds and consequently stores the new values if something has changed. To ensure that any modifications are stored, at least 15 seconds must pass before turning off the SquawkBox being configured. Otherwise, there is no guarantee that the changes will have been saved when the unit powers up.

3.4 – Load/Save Settings

In order to ease configuration of multiple SquawkBox devices, the settings may be saved and that saved configuration then loaded into other SquawkBox devices. Once all the parameters have been set correctly, the complete configuration can be saved by clicking the Save button at the top of the form (as shown in Figure 4). The Configuration Save dialog will appear allowing you to select a folder and a file name. Clicking on OK will save the configuration using the chosen filename in the chosen location. The filename will, by default, use a .DCF extension.
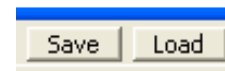

Figure 4 - Save/Load Buttons

To load a previously saved configuration, click the Load button. The Load Configuration dialog will appear so the desired configuration file can be located. Locate and select the file to be loaded and click OK. A confirmation message will then be shown as a reminder that the current device configuration will be overwritten. Click "Yes" to continue.

Note: The saved configuration is very device specific so only SquawkBox configuration files can be loaded into a SquawkBox. The revision of SquawkBox firmware is also taken into account. A warning will be shown and the file will not be loaded if either the device type or the firmware revision does not match the device being set up.

4 – Remote Control

Note: *This feature is only available in firmware version 4.0 or later. The firmware version number is displayed when the SquawkBox powers up. .Devices can be updated in the field. Contact Attero Tech technical support for more details.*

The SquawkBox has a remote control feature that allows a 3ʳᵈ party control system to control certain aspects of the SquawkBox functionality remotely. When enabled, remote control of the selected channel and the devices volume become available and the on-board channel and volume buttons then have no affect.

The remote control functions are accessed using SNMP and the table below shows the variables that are used.

Paramter Name	SNMP OID	Type	Persistent
remoteEnable	1.3.6.1.4.1.2680.1.3.3.5.14	RW	Yes
remoteChannel	1.3.6.1.4.1.2680.1.3.3.5.15	RW	
remoteVolume	1.3.6.1.4.1.2680.1.3.3.5.16	RW	Yes

Both the remoteEnable setting and remoteVolume setting are persistent and will be retained during a power cycle or re-boot if persistence on the SquawkBox has been enabled.

Note: As with all persistence variables on the SquawkBox, there is a one minute delay after a change to the LAST persistent variable modified before the variables are written to FLASH. This is to preserve FLASH write cycles. After changing a variable, wait at least one minute before power cycling or re-booting the unit to ensure the values have been saved.

4.1 – Remote Control Enable

Before the remote control functions can be used, the remote control function has to be enabled. The "remoteEnable" variable is treated as an on off. Writing zero to the remoteEnable SNMP variable means remote control is NOT enabled while writing any other value other than zero means remote control IS enabled.

When remote mode is activated, an "IN REMOTE MODE" message is displayed on the screen of SquawkBox in question. Anytime the unit is in remote mode (remoteEnable = non-zero), any keys pressed will result in an "IN REMOTE MODE" message being displayed on the display and the key press will have no effect on the operation of the unit.

When exiting remote mode, the channel and volume settings that were active prior to going into remote are restored. Thus, going into remote mode, changing the channel and/or volume and then exiting remote mode will not leave the unit with any of the remotely controlled settings active.

4.2 – Remote Channel Control

The remoteChannel variable is used to set the channel remotely. The remoteChannel may be set to a value of 1 through 16 with each value representing one of the 16 channel presets the SquawkBox has stored. All bundle and channel submaps for each channel preset need to be set prior to setting remoteChannel. If the bundle or submap settings are not set or are invalid, the remoteChannel command will be silently ignored. When a change to remoteChannel is made, the name for the newly selected channel is displayed on the screen of the SquawkBox,

While remoteChannel can be set and read while remoteEnable is disabled, its value is ignored. Changes to remoteChannel will only have an affect if they are made while remoteEnable is enabled. Setting remoteChannel then setting remoteEnable to "enabled" will not affect the current channel setting.

The remoteChannel setting is not stored as a persistent value and will be reset to its default of 1 on a power cycle or re-boot.

4.3 – Remote Volume Control

The remoteVolume variable sets the desired volume level. The permitted values are 0 to 24 where 0 is mute and 24 is max volume. Anything outside the acceptable range is silently ignored. The remoteVolume behaves differently than the remoteChannel when the remote control is not enabled with any changes written to the device being silently ignored. Reading the remoteVolume variable works the same regardless of the setting of remoteEnable. The current value of remoteVolume (either the last value written when remoteEnable was active, or the default of 0) will be returned on a read.

When a change to remoteVolume is made, the name for the newly selected channel is displayed on the screen of the SquawkBox,

5 – Remote Override

The SquawkBox includes an override facility whereby the audio stream being monitored can be temporarily overridden and switched remotely to an override audio stream. This allows the SquawkBox network to be used for pages or system broadcasts and so on. When the override is active, a red LED will illuminate on the SquawkBox front panel, the name shown will also switch to the name designated to the override stream, and the volume will alter to a value set specifically for the override. Once the override is de-activated, the SquawkBox returns to the original audio stream and original volume level.

The override audio stream is configurable. Each SquawkBox has a set of default parameters for the override audio stream (name, bundle and submap) just like the standard audio streams but with an additional volume setting that is used when the override is activated, setting the volume for the override audio over the current volume even if the volume is muted! The override system also facilitates use in systems where, rather than be a single override stream there are several depending on the situation. The override audio stream can be dynamically configured by including the audio stream information in the override activation message. This additional data supersedes any or all of the default settings stored in the unit. More information on how to do this is in section 5.3.1.

Not only is the override audio configurable, so are which SquawkBoxes are overridden. Each SquawkBox can be configured to be part of up to 16 different override groups. Each group may contain one or more SquawkBox devices and each SquawkBox may be a member of multiple groups. The end result is a very flexible and powerful override system that can target a single SquawkBox, a group of SquawkBoxes, multiple groups of SquawkBoxes or every SquawkBox on the network.

*Note: While the override is active, the volume can be changed as normal but the channel buttons have no affect.
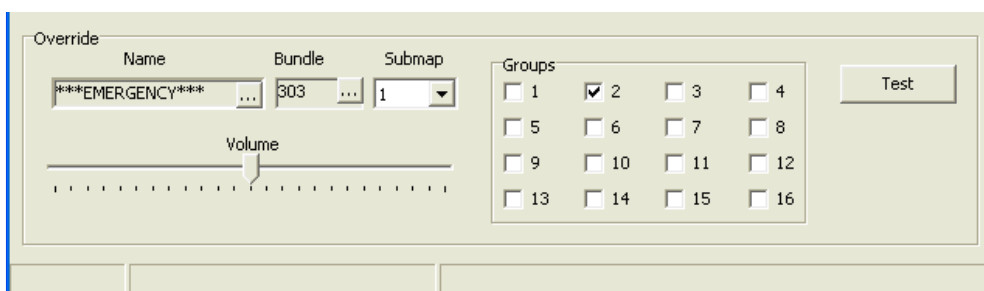
5.1 – Override Settings

Figure 5 - Override configuration controls

Along with the default values for fields Name, Bundle and Submap, there are additional override settings and controls.

Override Volume
This volume level is automatically set when the override is activated and once the override is removed, the volume will return to its original level.

Override Groups
The override group setting configures which of the sixteen different groups this particular SquawkBox belongs to. A SquawkBox can be a member of multiple groups. If no groups are selected, only system wide overrides will activate the override facility on this unit.

Override Test
The override has a test facility that can be used to activate or not activate, depending on the group settings, the device being configured. Clicking the test button opens the override test page.
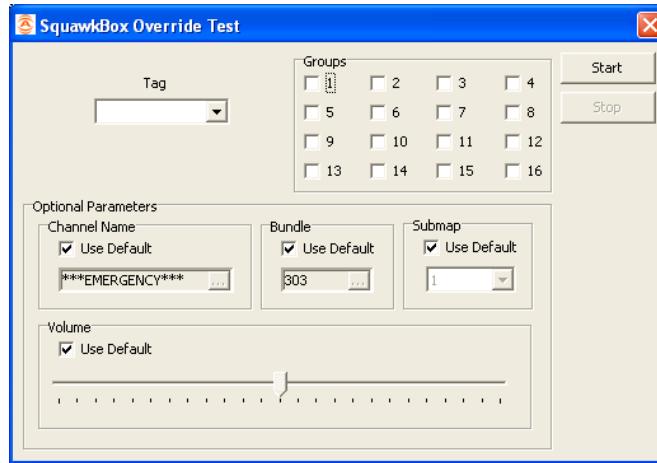
5.2 – Override Test

Figure 6 - Override Test Form

The override test form allows the user to test the override settings on a SquawkBox system. It can be used to generate full system or partial system overrides as required. Select the EMERGENCY option for a full system override or select the blank option for a partial system override. If a partial system override is required, one or more of the Group check boxes will also need to be checked. These refer to which groups of SquawkBox units should be included in the override.

The override can also include substitute values that can be used instead of each devices' own override defaults. Initially, the override test is setup to use each SquawkBoxes default override settings with the on-screen values taken from the set-up of the device whose configuration is being edited. The substitute values are applied to each SquawkBox that the override affects in place of the defaults override settings when the override is active.

Note: The substitute values are only temporary and valid as long as the override lasts. The default override values of those SquawkBoxes that are overridden are not changed.

If values that differ from the defaults are required, prior to starting the override test, clear the "Use Default" box for the setting to be substituted and then change the setting to the required value.

To start the override test, click the start button. The override will remain active until the stop button is pressed. The override will also terminate if the form is closed.

Note: A SquawkBox that is already in overridden cannot be overridden again. If a second override occurs, the values from the initial override will be retained. However, any unit in override WILL drop out of override it is sees the stop packet. If this packet is a broadcast, such as used by this test facility, any unit in override will drop out irrespective of the number of overrides active on the system.

5.3 – Activating the Override

The override is activated by sending a UDP packet to port 4120 on one or more SquawkBox devices from an Ethernet device (such as a PC). The packet sent contains a small amount of data. This data includes the type and scale of the override as well as optional parameters that can be used as a substitute for the devices' own override default settings. The packet must contain at least the following fixed length fields:

Field	Type	Description
Tag	9 char + null	A null terminated character string. This should either be blank (first character a null) for a general override or set to "EMERGENCY" for a system-wide override of all units.
groupMask	16-bit	16-bit mask, one bit per group. Group 1 is the LSB, group. Group 16 is the MSB.

For a system-wide override, set the tag field to "EMERGENCY" and broadcast the packet to all units by using an appropriate broadcast destination IP address for the network in use. If the tag field is set to EMERGENCY, a group mask is not required.

To override one or more groups of units, use a general override but broadcast to all units using an appropriate broadcast destination IP address. This is achieved by leaving the Tag field empty (just send NULL's) and including a group mask. The group mask must contain at least one active group for the override to activate.

To target a single unit, use a general override but target the UDP packet to a specific devices IP address ensuring that the group mask sent matches at least one of the groups in the unit it is being sent to. Using a single unit override requires the application starting and stopping the override knows the IP address of the unit concerned. If each device has a static IP address, this is not a problem but if dynamic IP addresses are used, a device's IP address may change periodically. The application will therefore need to obtain the devices IP address from its MAC address which is unique and never changes.

Note: It is possible to activate overrides on multiple units by sending multiple override requests to individual units.

When the packet is received, a unit will go into override if
    1. The tag is set to EMERGENCY
or
    2. The tag is empty and at least one group mask bit matches the units own group mask.

5.3.1 – Substitute Override Settings

The UDP packet sent can also include additional data that allows the default override settings to be replaced. The following additional fixed length fields may also be included in the packet following the Tag field.

Field	Type	Description
Bundle	16-bit	Bundle number. A value of 0 defaults to the units override bundle number
Submap	8-bit	Value between 1 and 8. A value of 0 defaults to the units override submap
Volume	8-bit	Value between 1 and 20. A value of 0 defaults to the units override volume
Override Name	16 char	A null terminated character string. Sending just a null will default to the units own override name

The additional data, if non-zero, is used as a substitute for the devices own override settings. If these values are not sent or they are set to zero, the unit will use its own override default settings.

5.3.2 – Exiting Override

All units that go into override mode will remain in override mode until they receive a second UDP packet with both a blank tag and group mask set to 0. Any other data added is ignored.

Note: Although it is possible to activate the override on multiple SquawkBoxes simultaneously using multiple override messages, it should be noted that any unit receiving the stop packet will drop out override irrespective of what packet was used to force it into override initially.

5.4 – Overrides and IP addresses

In order for the override to work, each SquawkBox must be assigned an IP address. The IP address can be statically or dynamically assigned.

Assigning a static IP address is done by setting the static IP address parameter on each unit. A static subnet mask must also be configured. Each SquawkBox must have a unique static IP address on a network and all the addresses must be on the same subnet for the overrides to work.

Note: Retention of a static IP address is subject to persistence being active. If persistence is turned off, any static IP address will be lost if the SquawkBox is reset or turned off.

For dynamic assignment, a DHCP server that supports BOOTP is preferable. Control Center can be used as a temporary solution but Control Center, on its own does not provide any facility to update the SquawkBox firmware (a BOOTP server is required to do that). While a BOOTP server provides a subnet mask that's configurable on the server, Control Center cannot. Instead, it relies on the SquawkBox itself to define a subnet mask based on the IP address it has been given as follows:

IP address range	Subnet used
1.0.0.0 through to 127.254.254.254	255.0.0.0
128.0.0.0 through to 191.254.254.254	255.255.0.0
192.0.0.0 and greater	255.255.255.0

Note: It is recommended on large system of 250 or more SquawkBoxes to use either a BOOTP server or set static IP addresses.

Note: Any SquawkBox that is reset or powered off will lose its dynamically assigned address. It will attempt to get another one when it turns back on so whatever mechanism is used to supply an IP address must be running all the time.

Note: Any SquawkBox not assigned an appropriate IP address and subnet mask will not respond to override requests

6 – Troubleshooting

6.1 – Checking the Network Connection

The CobraNet network connection can be diagnosed by noting the status of the LEDs just above the Ethernet connector on the SquawkBox. These LEDs will be on, off, or flashing depending on the current state of the network connection. Below is a table showing the states of the LEDs and what device status they represent.

LED status	Device Status
Neither LED On	No Ethernet Connection
Left LED on permanently Right LED off but flashes every 3 seconds	Ethernet connected but no devices found
Left LED on permanently Right LED flashing 3 times a second	Connected and CobraNet devices found Device is a performer

Table 1 - CobraNet Interface LED Status

6.2 – Common Faults

Below are some common faults. Accompanying each one is a list of the most common solutions. While the lists of solutions are not exhaustive, they represent the majority of the likely failures.

The SquawkBox does not show up in Control Center.
o   If using PoE, check the SquawkBox is attached to a PoE-enabled port on a switch or the output port on a midspan injector and the power light on the switch/injector is on
o   If using the optional wall wart, check power is supplied and the power light is on
o   Check the Ethernet cable is correctly connected
o   If connected to a switch ensure the link indicator is lit and activity flashes at least occasionally. If not, ensure the correct type of cable is used for the switch. Some switches require standard patch cables. Others can use standard or crossover cables
o   If connected directly to a PC, ensure the Ethernet cable is a crossover type
o   Ensure the PC is running Windows 98SE or later (Windows 95 is not suitable)
o   Ensure a compatible version of Control Center is running (1.1.5 onwards)

The SquawkBox does not play audio
o   Check the volume is set correctly
o   Check the correct channel is selected
o   Check that headphones have not been plugged into the headphone jack
o   Check the correct channel/submap combination is set-up for the channel being listened to
o   Check the source device is running and the source bundle is being transmitted correctly
o   Check the source bundle is not private

7 – ARCHITECTS & ENGINEERS SPECIFICATION

The CobraNet interface unit shall provide monitoring of any one of 16 CobraNet audio channels, with user selection of the monitored channel facilitated by "Channel Up" and "Channel Down" keypad buttons. Monitoring will be through either an internal loudspeaker or via a 3.5mm headphone jack. The internal speaker shall be automatically muted when a headphone plug is inserted into the 3.5mm jack. Volume control shall be facilitated by "Volume Up" and Volume Down" keypad buttons. An externally triggered 17th channel shall be provided for system wide override messages. The internal digital to analog signal conversion shall be performed at 16-bit resolution with a sampling frequency of 48 kHz. The CobraNet interface unit shall receive power over the Ethernet cable from an 802.3af PoE compliant network switch, or from a +5VDC external power supply. The CobraNet interface shall have a 16 character, one line LCD display to show the names of each of the 16 audio channels. Names of audio channels, as well as other system configuration shall be accomplished using a web browser.

The CobraNet interface shall be compatible with Attero Tech Control Center software monitoring in system applications. The CobraNet interface shall be compliant with the RoHS directive.

The CobraNet interface shall be the Attero Tech SquawkBox.

7.1 – Device Specifications

General	
Number of Channels Monitored:	16 User Selectable + 1 Externally Enabled Override
LCD Display:	16 Characters
User Controls:	4 Buttons - Channel Up/Down, Volume Up/Down
Audio Outputs	
Output Type:	Internal Speaker and 3.5mm Headphone Jack, autoswitching
Headphone Output	Optimized for 32 Ohm headphones

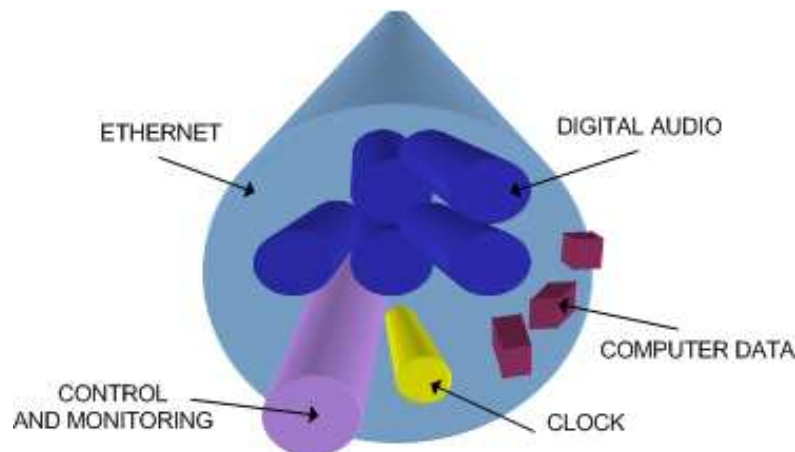| CobraNet Network	
Physical Level:	Standard Ethernet
Connector:	Single RJ-45
Cable Quality:	CAT-5
Transmission Speed:	100 Mbps
Power Requirements	Class 2 802.3af PoE PD Compliant or Optional 12 V DC @ 0.6a
Power Consumption	11 Watts maximum
Dimensions	7.5"W x 1.75"H x 5.0"D
Weight	15 oz, 425 g
Compliance	RoHS, UL Listed power source, FCC Part 15 Class A Compliant

APPENDIX A – Introduction to CobraNet

CobraNet is an audio networking technology for delivery and distribution of real-time, high quality, uncompressed digital audio using a standard Ethernet network. It is implemented using a combination of hardware, firmware, and the CobraNet protocol.

Unlike other audio networking or distribution technologies, CobraNet is a true network and exists on standard Ethernet networks using standard Ethernet hardware. Since it is a true network, audio routing is highly flexible between network nodes and can be used in a variety of audio distribution applications.

In addition to the high degree of routing flexibility that CobraNet provides, the technology also incorporates the ability to monitor and control CobraNet devices remotely. This is a key feature that is highly important in fixed installation applications where the audio distribution equipment may not be readily accessible. All CobraNet devices on the network can be controlled and monitored from a central location by sending control commands and monitoring device specific parameters.

CobraNet provides this capability by implementing Simple Network Management Protocol (SNMP). SNMP is a standard protocol typically used for monitoring network devices such as Ethernet switches. In the case of CobraNet, it allows users to communicate with any CobraNet device using standard SNMP tools or a customized user interface designed specifically for CobraNet, such as Attero Tech's Control Center application.

The figure above represents the types of data that coexist on a CobraNet network.

Before a CobraNet system can be configured, it is important to first understand how CobraNet distributes audio between devices.

Audio is sent in "bundles" on a CobraNet system. Each bundle is capable of holding up to 8 logical audio channels. Every CobraNet device has a number of bundle transmitters and bundle receivers. These transmitters and receivers are the mechanism used to send and receive bundles between devices.

For a transmitted bundle, audio may be sourced either directly from the local audio inputs of the device or from internal audio via the on-board DSP[1], but not both simultaneously. Internal audio from the onboard DSP could have originally been sourced from the local device inputs, sent from another CobraNet device or even generated by the DSP itself. Combinations of the local or internal audio may exist within a bundle in any order. Additionally, a single audio source in a device may be used multiple times in a single transmitter bundle or across multiple transmitter bundles.

For a received bundle, the received network audio may be routed directly to the device's local outputs, the internal DSP[1] or simply ignored.

Once the contents of a bundle have been decided, the next step is to pass the bundle to another CobraNet device. To do this, every CobraNet device has up to 4 bundle transmitters. Each bundle transmitter has a transmit mode that must first be selected. This affects how many devices may receive that particular bundle at a time.

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[1] Not available on all devices – CS496xxx devices only

The modes are as follows:

- o Unicast – Used for one-to-one connections. In this mode, only one receiver at a time can receive this bundle. Once a link is established from this transmitted bundle to a receiver, any future requests for that bundle from other potential receivers will fail.
- o Multicast – Used for one-to-many connections. This mode broadcasts its contents over the entire network. There is no restriction on the number of receivers. However, the downside is that CobraNet packets are distributed to all nodes on the network, whether they need them or not thus creating possible network bandwidth issues.
- o Multi-unicasts – Another one-to-many mode. Whilst this is the most efficient method for getting a bundle to multiple receivers in terms of network bandwidth, it requires more processing power on the CobraNet device so in this mode there is a maximum limit of four receiver connections (this can be reduced if required). If more connections are required than the limit, the node can be configured to automatically switches to multicast.

Note: When a bundle must be transmitted to multiple receivers, multi-unicast transmissions should be used where possible.

Once the mode is selected, to enable a device to transmit the bundle, simply allocate the particular transmitter bundle a non-zero number. Since this number identifies all the network packets sent out by that transmitter, each transmit bundle number must be unique on a network[2].
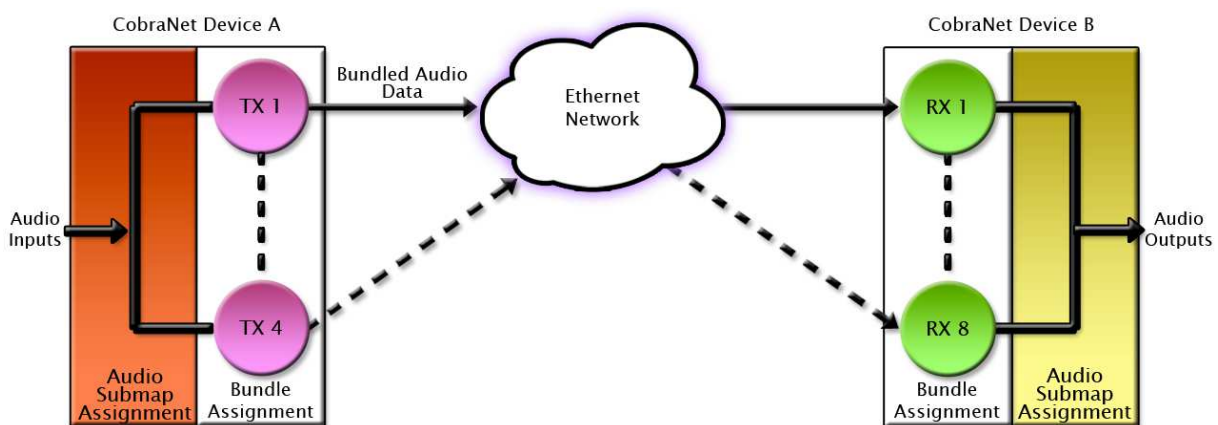
Now that the transmitter is set up, it is time to set up the receivers. In order to receive bundles, each CobraNet device has up to eight bundle receivers. To enable a device to receive a bundle, simply allocate one of that device's bundle receivers the same bundle number as a transmitted bundle. By doing so, a virtual link is created and audio should now be passed from one device to the other. It should be noted that no knowledge of a device's network topology or connection is thus required in order to configure audio connections. The only restriction to this is that a device cannot be set up to receive a bundle it is also transmitting.

The above case creates a simple, one-to-one, unidirectional link. If more devices are required to receive that bundle, allocate the same transmitted bundle number to a bundle receiver on the other CobraNet devices.

It is also important to note that CobraNet supports simultaneous bidirectional audio distribution in each device. Not only could audio be sent from Device A to Device B but at the same time, should it be needed, audio could also be sent from Device B to Device A. The exact bundle and routing configuration will be determined by the needs of each individual installation. An installation may have multiple units transmitting multiple bundles. The only restriction is the bandwidth available on the network to transfer the audio.

CobraNet does more than just transfer audio data. It can be used to pass serial information as well. A feature called serial bridging has been incorporated that allows the passage of serial data between nodes. Each node can pass serial data to a specific node or multicast the data to multiple nodes. A node can also receive data from either a single source or multiple sources. Baud rates, data bits, stop bits, parity, and so on are all configurable. There is also support for multi-drop serial buses as well.

Finally, CobraNet has the capability to alter all of the above options in real time making the whole system completely dynamic. By use of control software, all of the bundle assignment parameters can be configured with no need to change cables, switch out connectors, or pull new wiring. Most importantly, this control capability can be implemented from a single location!

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[2] Bundle numbers range from 1 through 65535. A value of 0 represents an inactive bundle. Numbers 1-255 are reserved for multicast mode transmissions only.

APPENDIX B - Reference Documents

The following table lists the relevant reference documents.

Document Title	Revision
CobraNet Programmer's Reference (Cirrus Logic)	v2.5