Design Guide

Attero Tech by QSC Axiom Series

QSC

Attero Tech by QSC's Axiom family analog extension products offer AV technology designers a flexible and cost-effective family of single gang wall plates that support analog, digital and RF audio interfaces. The same performance and control that's a hallmark of the QSC networked wall plates is available with the Axiom family, along with the use of standard CAT5e/6 cabling for infrastructure wiring.

This design guide aims to show all valid combinations of these Axiom products for both analog and networked audio applications, including the proper setup for each of the Axiom devices.

ML1
Mic/Line Input Wall Plate

- 3.5 mm line level audio input and an XLR / 1/4" mic/line input
- Accommodates microphone and pro and consumer line level sources.
- Local gain controls
- Audio signal level indicator LEDs for each input provide quick feedback for proper input gain adjustments

More Info

BT1
Bluetooth and 3.5mm Wall Plate

- BYOD connectivity solution
- Bluetooth plus a 3.5 mm analog input
- Provides wireless and wired audio streaming from phones, tablets and PCs.
- Call bridging support provides a simple connection between a person on the far end of a call and the room sound system.
- BT1 functions such as volume and pairing/ unpairing can easily be managed over RS-232 from any control system

More Info

USB1
USB Audio I/O Wall Plate

- Easy USB audio connectivity to PCs and laptops
- Stream audio from a device, connect a room's sound system to a soft codec or simply record a lecture.
- Allows custom USB enumeration names, so it's easy for a user to select the USB1 from among several USB interfaces for use with their application.
- Functions such as send and receive volume can easily be managed over RS-232 from any control system.

More Info

QSC

AXPio

Axiom I/O On and Off Ramp

- Simple, flexible and installation-friendly solution for point-to-point analog audio signal extension over CAT-5/6
- Two balanced, line-level Flex I/O ports allow 2 x 0, 1 x 1 and 0 x 2 audio extension
- Supports up to +24 dBu analog audio signal level on inputs and outputs
- RS-232 allows for control integration into network AV systems

More Info

Axon D2i

Mic/Line Dante/AES67 Wall Plate

- Networked Dante/AES67, single-gang wall plate with two mic/line XLR inputs
- Features an Axiom port, compatible with any Axiom wall plate, for flexible in-wall audio I/O
- +48 V phantom power and remote level adjustment in 1 dB steps
- Available Q-SYS Extension for quick integration into your system design

More Info

Figure 1 below shows a typical interconnection of an Axiom device to the D2i. The D2i and an Axiom device can also be mounted up to 100m apart as the needs of the project dictate.
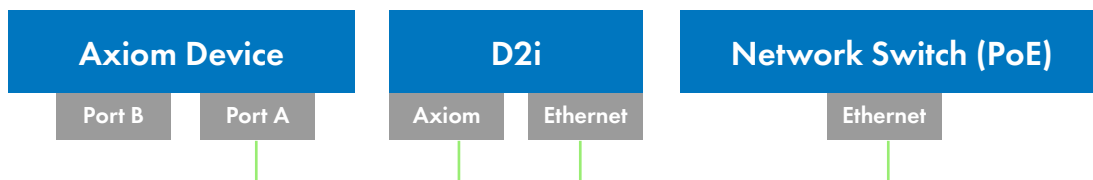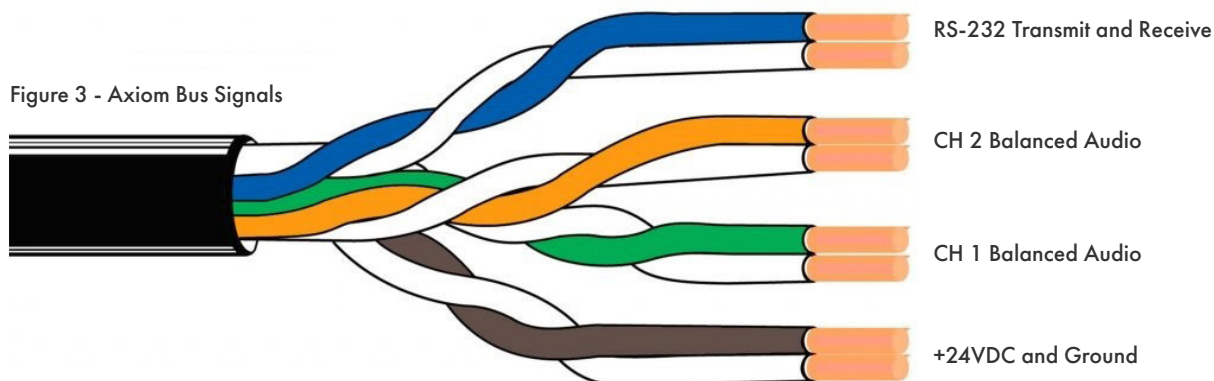
Axiom Device		D2i		Network Switch (PoE)
Port B	Port A	Axiom	Ethernet	Ethernet

Figure 2 Both the D2i and all Axiom wall plates are designed to mount side-by-side in a US two-gang enclosure.

The Axiom Bus

This section of the design guide describes the Axiom Bus, and how the four twisted pairs that comprise a CAT5e/6 cable are used in the transport of audio, power and RS-232 control data. The Axiom Bus was designed to deliver professional level audio quality, and to extend RS-232 control capability up to 100 meters (at 9600 baud). Power distribution on the Axiom Bus will power up to two Axiom wall plates in the daisy chain configuration. The maximum distance for an Axiom Bus, whether to a single device or the sum of distances in a daisy chained implementation, is 100 meters (330 feet). Figure 3 shows the use of the four pairs.

Figure 3 - Axiom Bus Signals

RS-232 Transmit and Receive

CH 2 Balanced Audio

CH 1 Balanced Audio

+24VDC and Ground

Each of the Axiom wall plates has two Axiom ports, creatively named "Port A" and "Port B". Port A is the "upstream" port, which means it's connected to an AXPio or the Axiom Port on an Axon D2i. In addition, Port A on the second (i.e. furthest from the AXPio, since the Axon D2i doesn't support daisy chain) Axiom device in a daisy chain connects to Port B on the first device. Port B is known as the "downstream" port. Figure 4 shows an example of an Axiom daisy chain connection.
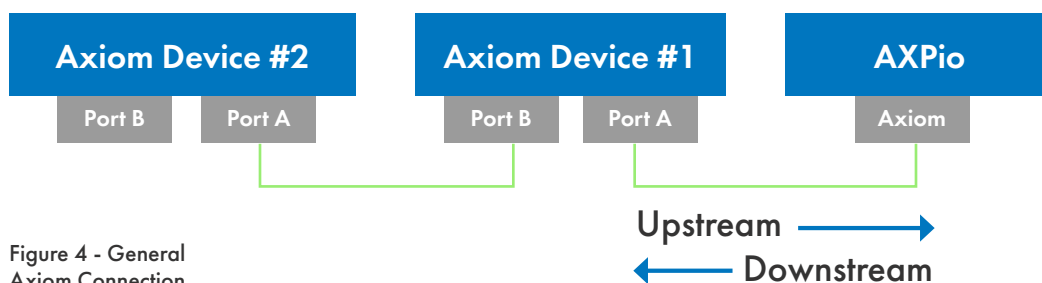
Axiom Device #2		Axiom Device #1		AXPio
Port B	Port A	Port B	Port A	Axiom

Upstream →
← Downstream

Figure 4 - General
Axiom Connection

Axiom Control

Of the three Axiom wall plates in the current product portfolio, the BT1 and USB1 interfaces have controllable features. For the BT1, source volume control and pairing/unpairing are a couple of commonly controlled parameters. The USB1 also supports control of source volume, and both devices allow control of several other parameters described in the control API document for each product. When the devices are used in an analog audio system, control takes place over the RS-232 link. Control is bidirectional, so a control system can both set and monitor the controllable features of Axiom devices that support RS-232. Control commands for the BT1 and USB1 are simple ASCII (i.e. text), so virtually any control system or DSP with an RS-232 port can be used.

However, when the BT1 or USB1 are paired with an Axon D2i and connected to the D2i's Axiom Port, these devices can be controlled directly over the network. In this use case, the D2i acts as an Ethernet-to-RS-232 bridge. There are two key concepts to remember about RS-232 control of Axiom devices:

- The BT1 and USB1 do not pass RS-232 control to a daisy-chained device, since both devices are controllable and RS-232 is a point-to-point protocol. Therefore, in any Axiom daisy chain setups involving two controllable devices only one of these devices can be controlled. The device to be controlled must be the one directly connected to the AXPio or Axon D2i (see Figure 5).

Figure 5 - No RS-232 Pass-thru on BT1 and USB1
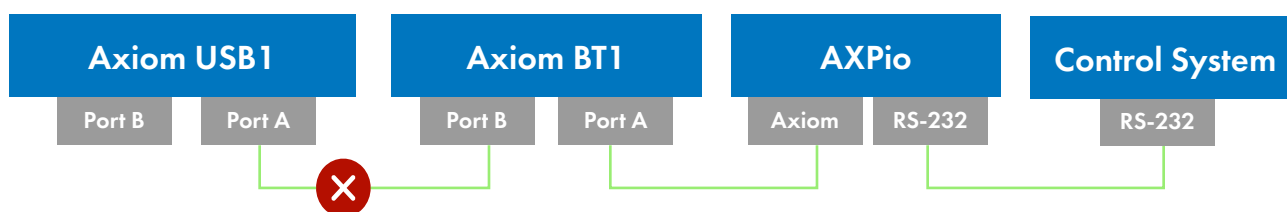
- The ML1, since it is not RS-232 controllable, does pass-through RS-232 control to a daisy-chained device. As a result, daisy chain setups involving an ML1 and either a BT1 or USB1 have no constraints on device order in the daisy chain. The BT1 or USB1 can be controlled via RS-232 whether it is the first or second device in the daisy chain (see Figure 6).
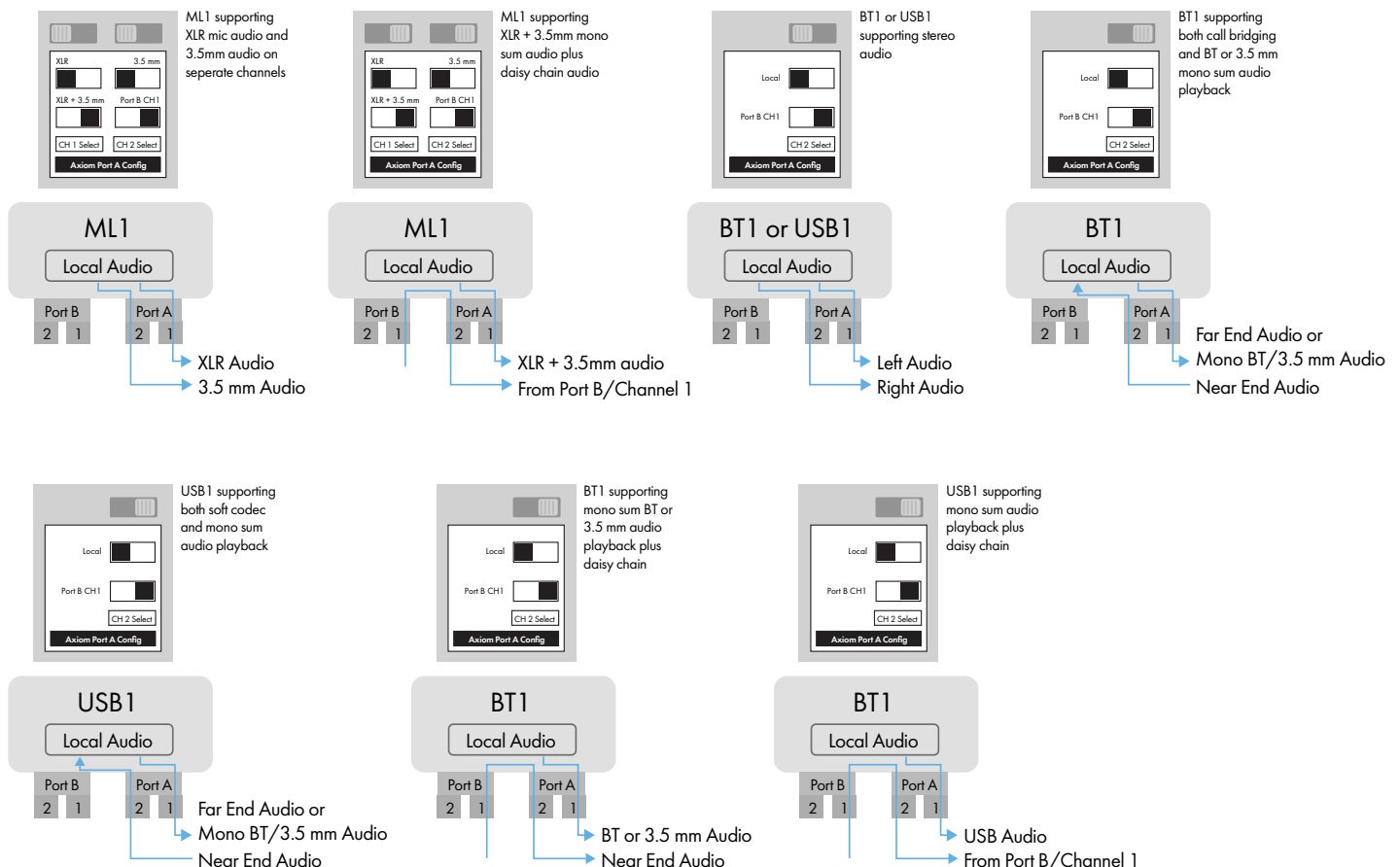
Figure 6 - RS-232 Pass-thru on the ML1
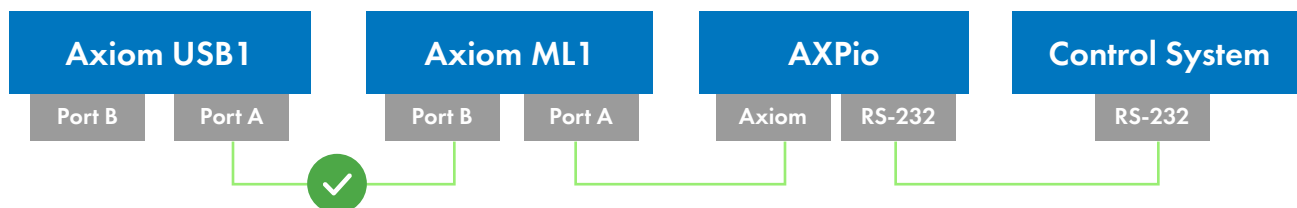
Axiom Audio

Audio in an Axiom system is always run balanced and line level over the CAT cabling. This, plus the "twisted-pair" nature of category cable, minimizes the possibility of noise pickup and signal degradation. In the Axiom Use Case diagrams on the following pages, you'll see pictures of two-position slide switches that are on the top side of an Axiom device's rear enclosure. These switches determine how the audio generated by the Axiom device itself will be passed upstream through its Port A. They also determine how any audio coming into Channel 1 of an Axiom device's Port B will be further sent upstream through that device's Port A. Here are a couple of key concepts to keep in mind when thinking about Axiom audio routing:

- All Axiom devices will use their Port A/Channel 1 to send their locally generated audio upstream. In other words, Port A/Channel 1 is the way "local audio" from an Axiom device gets to either Port B/Channel 1 of an upstream daisy chained Axiom device or to Channel 1 of the Axiom Port of an AXPio. So, irrespective of the position of any top panel switches, an Axiom device will always use its Port A/Channel 1 to transmit its own audio upstream.

- Port A/Channel 2 is where all the fun happens, and where these top panel switches come into play. Port A/Channel 2 can be used in several ways (depending on the top panel switch setups):

o For Axiom devices that support stereo audio, like the BT1 and USB1, Port A/Channel 1 can transport Left Audio Out while Port A/Channel 2 transports Right Audio Out upstream to an AXPio, making stereo audio available from the AXPio flex channels (set as outputs).

o For the ML1, which can support XLR and 3.5 mm audio on separate channels, Port A/Channel 1 can transport the XLR audio while Port A/Channel 2 transports the 3.5 mm jack audio (L+R are summed to mono).

o Bidirectional Axiom devices, like the BT1 and USB1, can use their Port A/Channel 2 for incoming (i.e. downstream) audio. The typical use case for this scenario is the return of far end audio to the Axiom device to support call bridging (BT1) or soft codec audio interface (USB1).

o All Axiom devices have the ability, based on top panel switch settings, to transfer incoming audio from their Port B/Channel 1 to their Port A/Channel 2. This is how daisy chain audio is supported.

- Note that in any setup where an Axiom device uses both its Port A/Channel 1 and Port A/Channel 2 for local audio, no daisy chaining is possible.
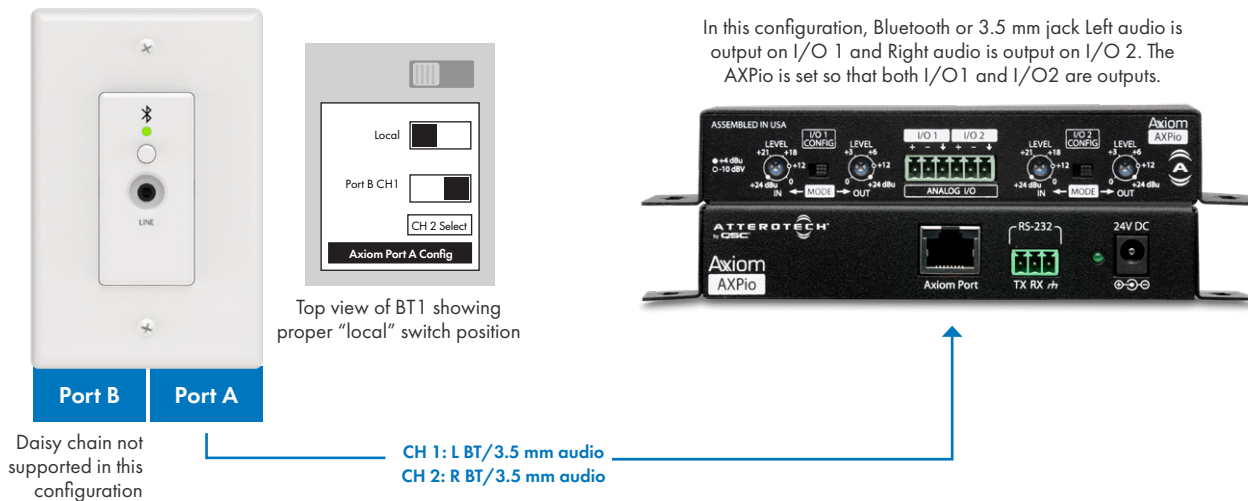

ML1 supporting XLR mic audio and 3.5mm audio on seperate channels

ML1
Local Audio
Port B 2 1 — Port A 2 1
→ XLR Audio
→ 3.5 mm Audio

ML1 supporting XLR + 3.5mm mono sum audio plus daisy chain audio

ML1
Local Audio
Port B 2 1 — Port A 2 1
→ XLR + 3.5mm audio
→ From Port B/Channel 1

BT1 or USB1 supporting stereo audio

BT1 or USB1
Local Audio
Port B 2 1 — Port A 2 1
→ Left Audio
→ Right Audio

BT1 supporting both call bridging and BT or 3.5 mm mono sum audio playback

BT1
Local Audio
Port B 2 1 — Port A 2 1
→ Far End Audio or Mono BT/3.5 mm Audio
→ Near End Audio

USB1 supporting both soft codec and mono sum audio playback

USB1
Local Audio
Port B 2 1 — Port A 2 1
→ Far End Audio or Mono BT/3.5 mm Audio
→ Near End Audio

BT1 supporting mono sum BT or 3.5 mm audio playback plus daisy chain

BT1
Local Audio
Port B 2 1 — Port A 2 1
→ BT or 3.5 mm Audio
→ Near End Audio

USB1 supporting mono sum audio playback plus daisy chain

BT1
Local Audio
Port B 2 1 — Port A 2 1
→ USB Audio
→ From Port B/Channel 1

Axiom Use Case Diagrams

Following are comprehensive diagrams of the interconnection, Port A / Port B switch positions and receiving devices for all of the possible combinations of Axiom devices. The first group of diagrams show Axiom devices used singly, with the AXPio or the Axon D2i. The second group of diagrams shows all of the valid daisy chain use cases for all AXIOM devices. The third group shows how to use two AXPio devices "back-to-back" for unidirectional or bidirectional audio signal extension.
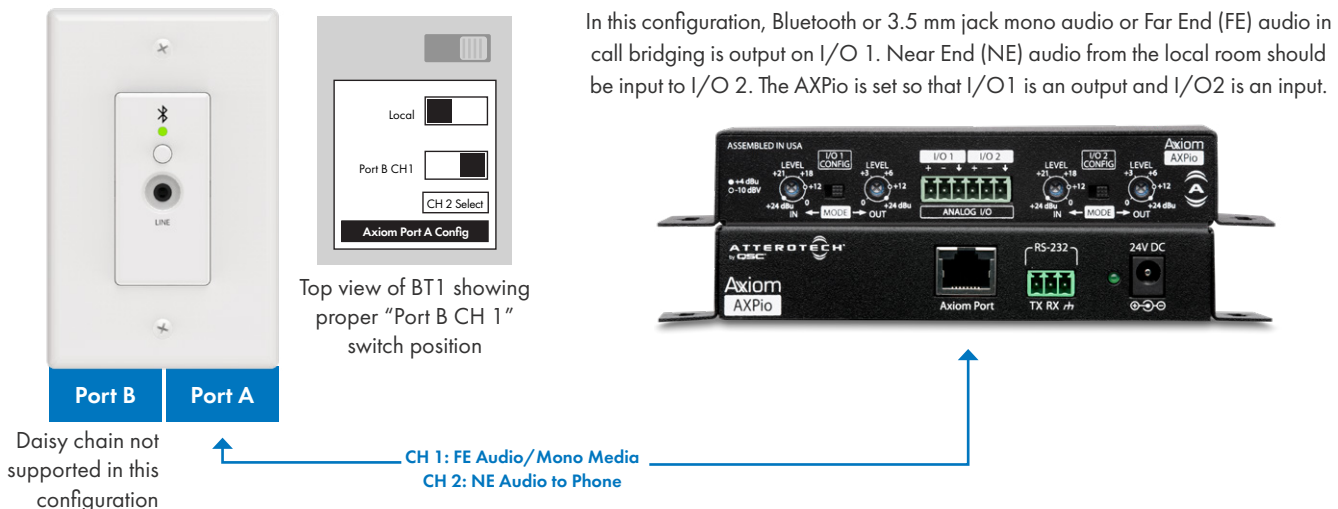
BT1, Stereo BT Audio or Stereo Line Audio Only (Analog)

This configuration supports stereo audio from either a Bluetooth connected device or an analog line level device.
BT1 jack detection automatically switches to line level audio when a device is plugged in.
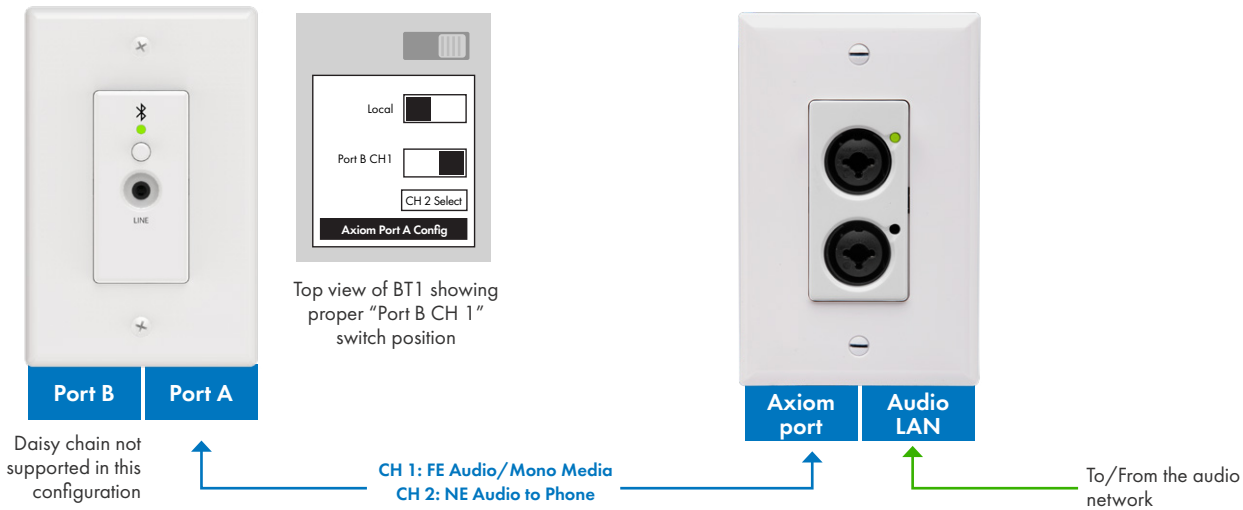
In this configuration, Bluetooth or 3.5 mm jack Left audio is output on I/O 1 and Right audio is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

Top view of BT1 showing proper "local" switch position

Port B   Port A

Daisy chain not supported in this configuration

CH 1: L BT/3.5 mm audio
CH 2: R BT/3.5 mm audio

BT1, Mono BT or Line Audio + Call Bridging (Analog)

This configuration supports mono audio from either a Bluetooth connected device or a 3.5 mm analog line level device, as well as bi directional audio for call bridging. BT1 jack detection automatically switches to line level audio when a device is plugged in for both streaming and call bridging modes.

In this configuration, Bluetooth or 3.5 mm jack mono audio or Far End (FE) audio in call bridging is output on I/O 1. Near End (NE) audio from the local room should be input to I/O 2. The AXPio is set so that I/O1 is an output and I/O2 is an input.

Top view of BT1 showing proper "Port B CH 1" switch position

Port B   Port A

Daisy chain not supported in this configuration

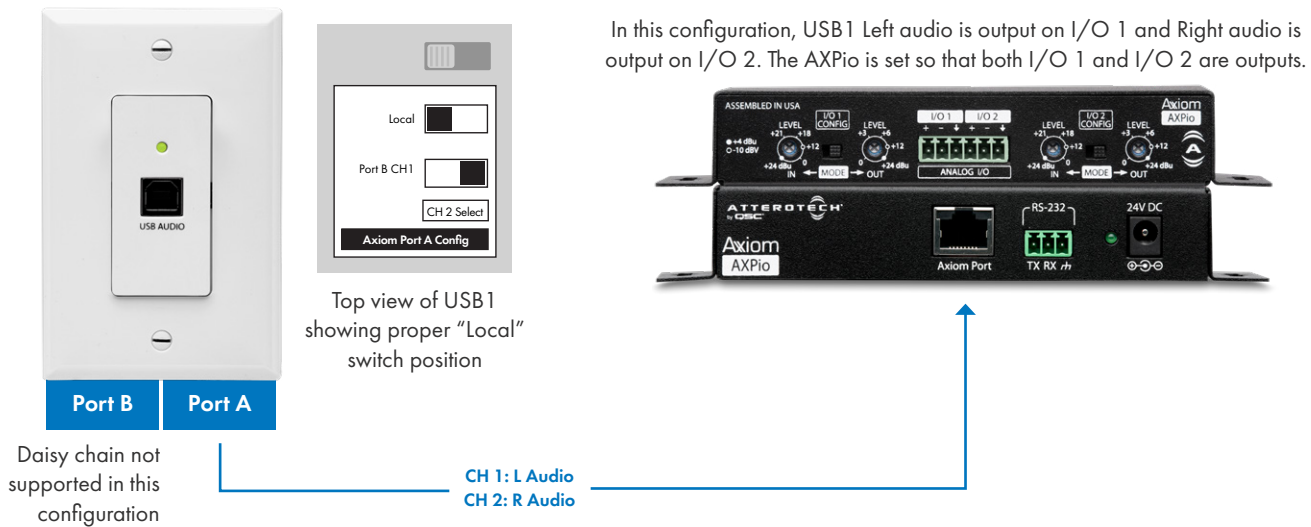**CH 1: FE Audio/Mono Media**
CH 2: NE Audio to Phone

BT1, Mono BT or Line Audio + Call Bridging (Networked via Axon D2i)

This configuration supports mono audio from either a Bluetooth connected device or a 3.5 mm analog line level device, as well as bidirectional audio for call bridging. BT1 jack detection automatically switches to line level audio when a device is plugged in for both streaming and call bridging modes. The Axon D2i provides the audio network interface.
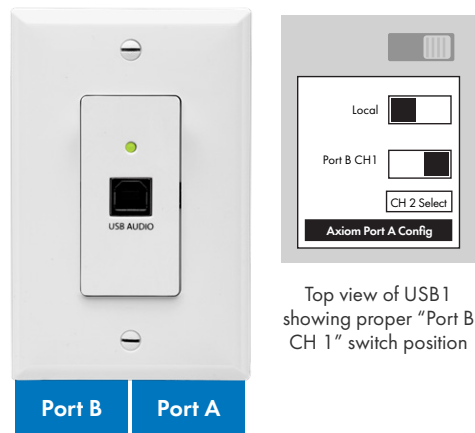

Top view of BT1 showing proper "Port B CH 1" switch position

Port B	Port A

Daisy chain not supported in this configuration

CH 1: FE Audio/Mono Media
CH 2: NE Audio to Phone

Axiom port	Audio LAN

To/From the audio network

USB1 Stereo Audio (2x0) Only (Analog)

This configuration supports stereo audio playback (2x0) from a USB device connected to the USB1.

Top view of USB1 showing proper "Local" switch position

Port B	Port A

Daisy chain not supported in this configuration

CH 1: L Audio
CH 2: R Audio

In this configuration, USB1 Left audio is output on I/O 1 and Right audio is output on I/O 2. The AXPio is set so that both I/O 1 and I/O 2 are outputs.

USB1, Mono Playback Audio (1x0) + Bidirectional Audio (1x1) (Analog)

This configuration supports mono playback from a USB device connected to the USB1, as well as bidirectional audio for use with soft codec conferencing applications.
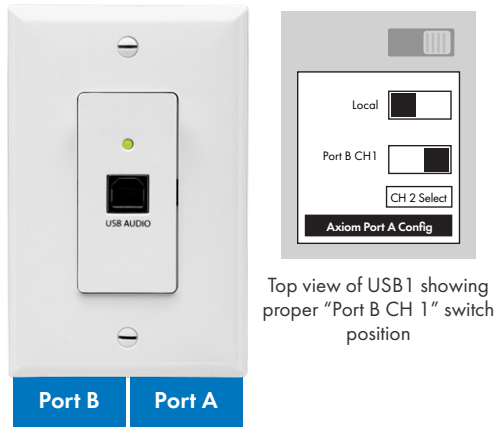
In this configuration, USB mono audio or Far End (FE) audio (from a PC hosted soft codec application) is output on I/O 1. Near End (NE) audio from the local room to the soft codec should be input to I/O 2. The AXPio is set so that I/O1 is an output and I/O2 is an input.

Top view of USB1 showing proper "Port B CH 1" switch position

Port B   **Port A**

Daisy chain not supported in this configuration

CH 1: FE Audio/Mono Media
CH 2: NE Audio to Phone

USB1, Mono Playback Audio (1x0) + Bidirectional Audio (1x1) (Networked via Axon D2i)

This configuration supports mono playback from a USB device connected to the USB1, as well as bi directional audio for use with soft codec conferencing applications. The Axon D2i provides the audio network interface.

Top view of USB1 showing proper "Port B CH 1" switch position

Port B   **Port A**

Daisy chain not supported in this configuration

CH 1: FE Audio/Mono Media
CH 2: NE Audio to Phone

Axiom port   **Audio LAN**

To/from the audio network

ML1 XLR Mic Audio and 3.5 mm Audio on Separate Channels (Analog)

This configuration supports separate audio outputs for the XLR input audio and a mono sum of L + R 3.5 mm jack audio.

In this configuration, XLR audio is output on I/O 1 and 3.5 mm L+R audio is output on I/O 2. The AXPio is set so that both I/O 1 and I/O 2 are outputs.
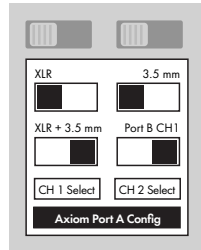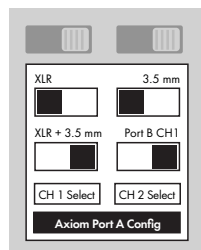
Top view of ML1 showing proper "XLR" and "3.5 mm" switch positions

Port B   **Port A**

Daisy chain not supported in this configuration

CH 1: XLR Audio
CH 2: 3.5 mm L+R Audio

ML1 XLR + 3.5 mm Summed Audio (Networked via Axon D2i)

This configuration supports the addition of a mono sum of the ML1's XLR and 3.5 mm jack audio to a networked audio system.

The ML1 audio is placed on its own Dante or AES67 channel on the network. The Axon D2i provides the audio network interface.

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions

Port B   **Port A**

Daisy chain not supported in this configuration

CH 1: XLR + 3.5 mm Summed Audio
CH 2: N/A

Axiom port   **Audio LAN**

To/from the audio network

ML1(A) Mono Audio Daisy Chain with ML1(B) Mono Audio (Analog)

This configuration supports two ML1s, with the mono sum of each ML1's XLR + 3.5 mm L+R audio.
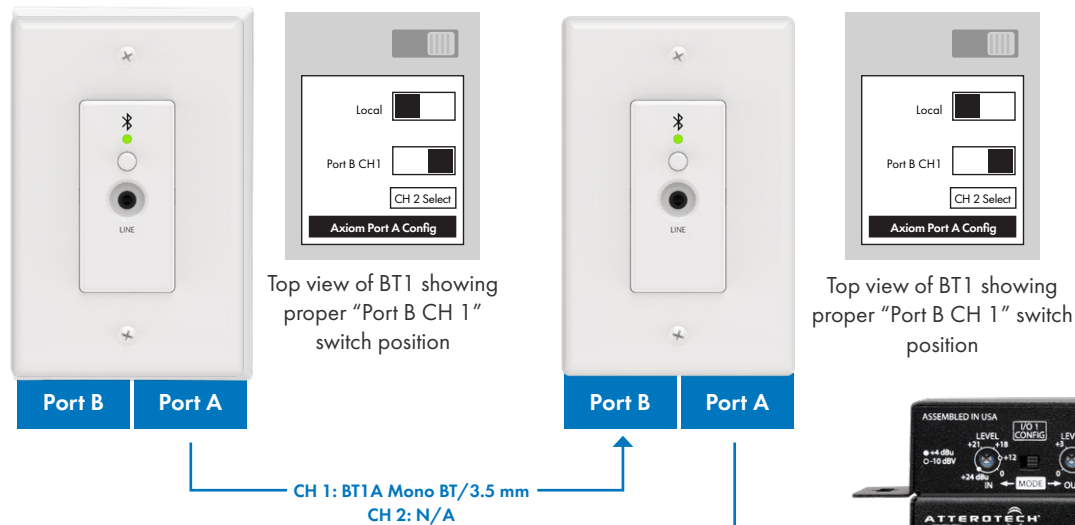

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions

CH1: ML1(A) Mono XLR + 3.5mm
CH2: N/A

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions
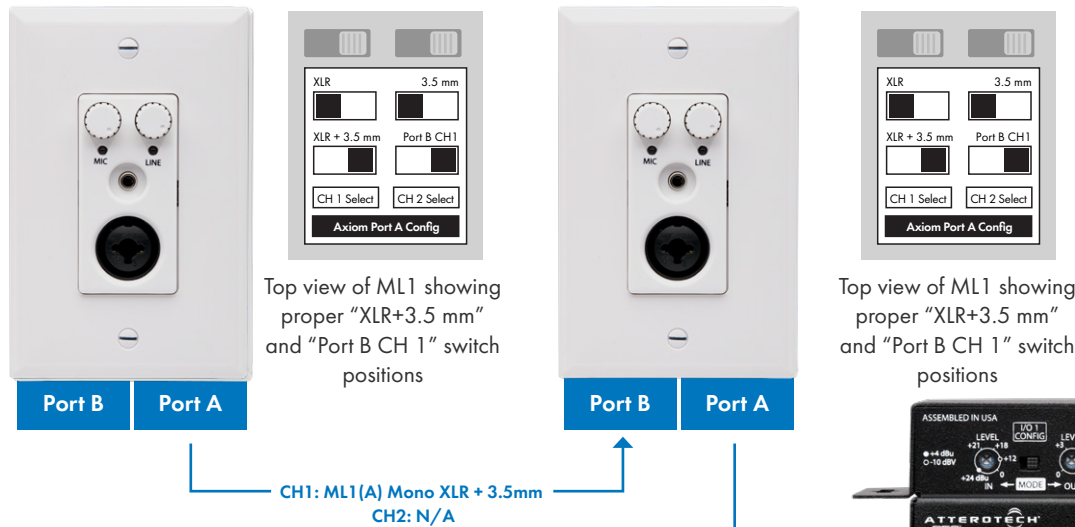
In this configuration, ML1(B) Mono XLR + 3.5 mm mono sum audio is output on I/O 1 and ML1(A) XLR + 3.5 mm mono sum audio is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

CH 1: ML1(B) Mono XLR + 3.5 mm
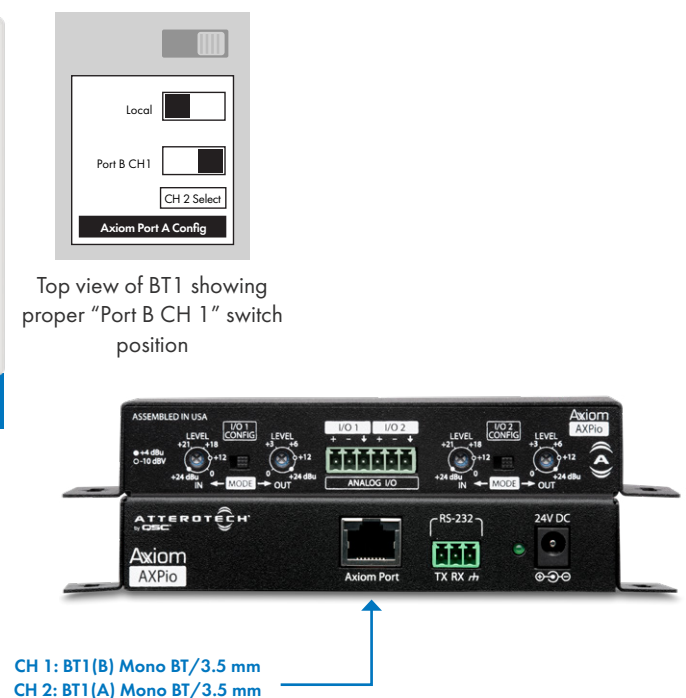**CH 2: ML1(A) Mono XLR + 3.5 mm**
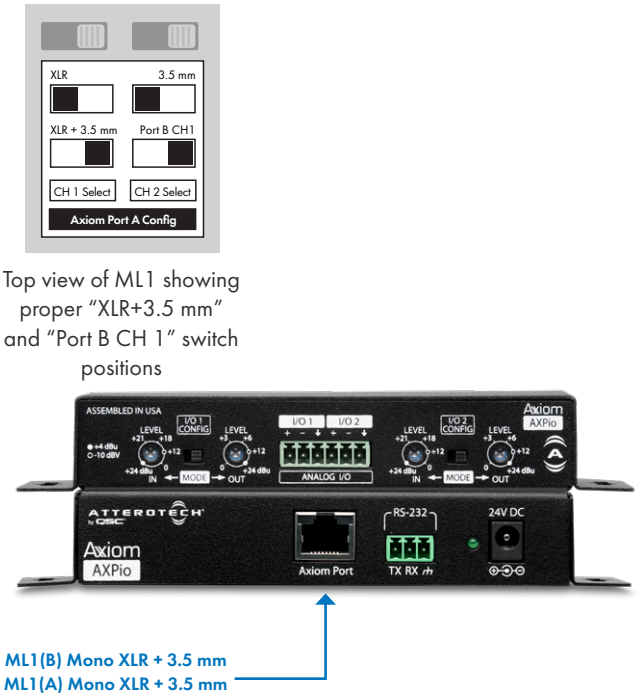
BT1(A), Mono BT or Line Audio Daisy Chain with BT1(B), Mono BT or Line Audio (Analog)

This configuration supports mono audio from either a Bluetooth connected device or an analog line level device on both BT1(A) and BT1(B).

Jack detection on both BT1s automatically switches to line level audio when a device is plugged in for both streaming and call bridging modes.

Top view of BT1 showing proper "Port B CH 1" switch position

CH 1: BT1A Mono BT/3.5 mm
CH 2: N/A

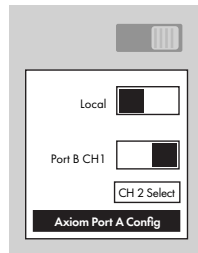Top view of BT1 showing proper "Port B CH 1" switch position

In this configuration, Bluetooth or 3.5 mm jack mono audio from BT1B is output on I/O 1 and Bluetooth or 3.5 mm jack mono audio from BT1A is output on I/O 2. The AXPio is set so that both I/O 1 and I/O 2 are outputs.
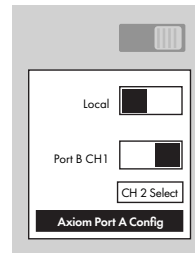
CH 1: BT1(B) Mono BT/3.5 mm
CH 2: BT1(A) Mono BT/3.5 mm

USB1(A) Mono Audio Daisy Chain with USB1(B) Mono Audio (Analog)

This configuration supports mono audio (1x0) from both USB1(A) and USB1(B).

Top view of USB1 showing proper "Port B CH 1" switch position

Top view of USB1 showing proper "Port B CH 1" switch position

| Port B | Port A |

| Port B | Port A |

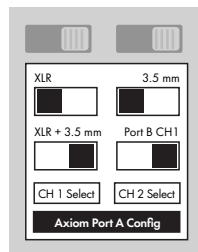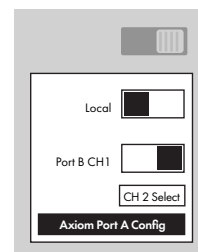**CH 1: USB1(A) Mono**
CH 2: N/A

In this configuration, USB (B) mono audio is output on I/O 1 and USB (A) mono audio is output on I/O 2. The AXPio is set so that both I/O 1 and I/O 2 are outputs.

CH 1: USB1(B) Mono
CH 2: USB1(A) Mono

ML1 Mono Audio Daisy Chain with BT1, Mono BT or Line Audio (Analog)

This configuration supports BT1 mono audio from either a Bluetooth connected device or an analog line level device, and a mono mix of the ML1's XLR and 3.5 mm inputs. BT1jack detection automatically switches to line level audio when a device is plugged in.

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions

Top view of BT1 showing proper "Port B CH 1" switch position
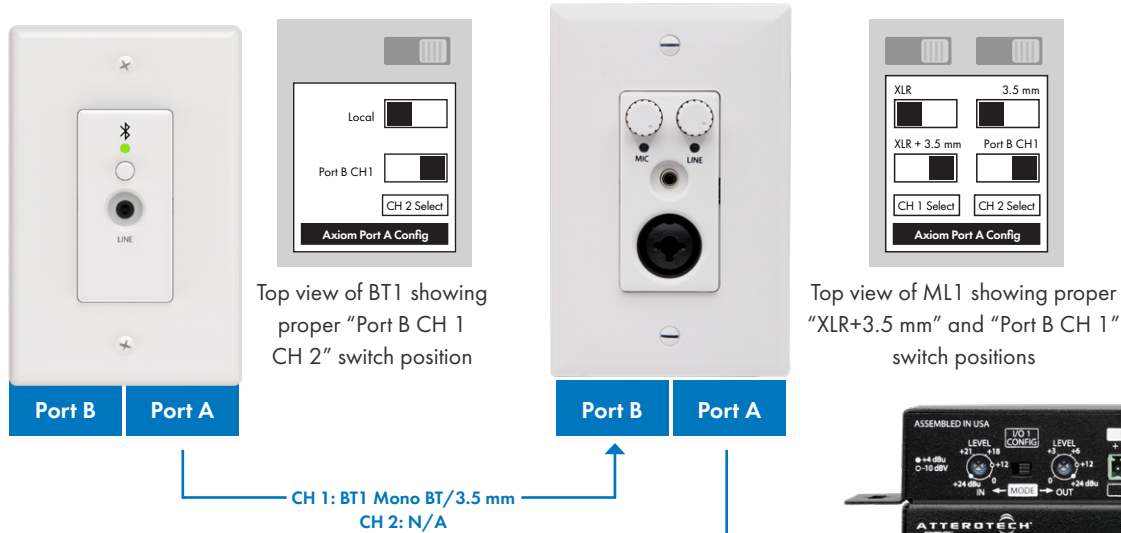
| Port B | Port A |

| Port B | Port A |

CH 1: ML1 Mono XLR + 3.5 mm
CH 2: N/A

In this configuration, BT1 Bluetooth or 3.5 mm jack is output on I/O 1 and ML1 XLR + 3.5 mm mono sum audio is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

CH1: BT1 Mono Out
CH2: ML1 Mono XLR + 3.5mm

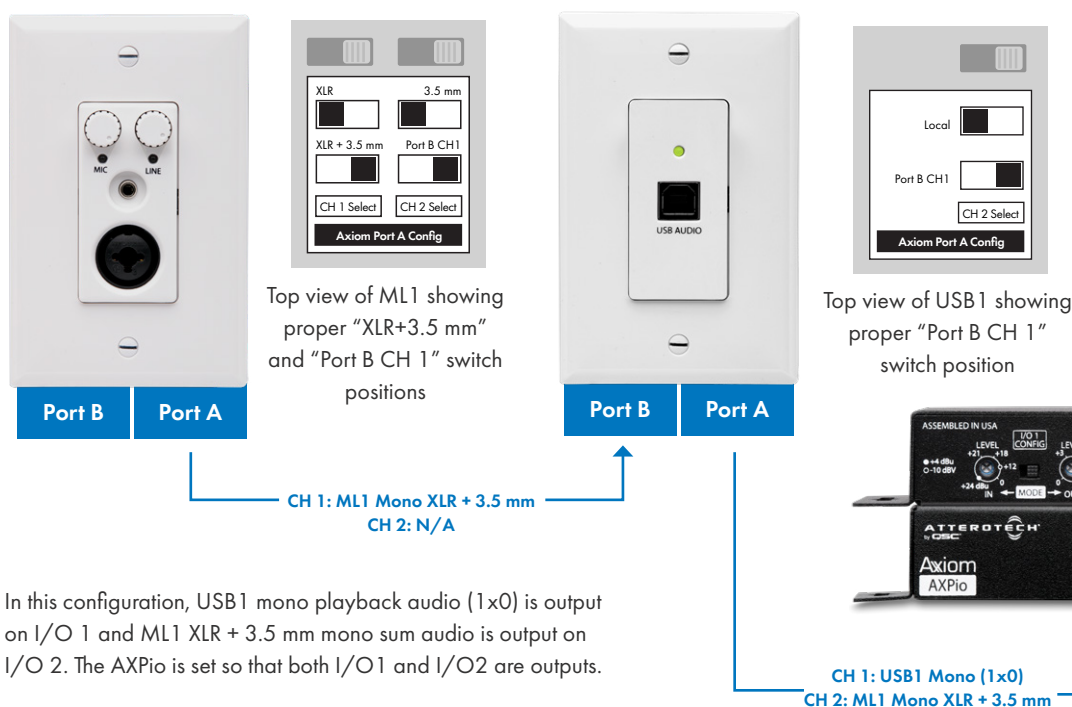## BT1, Mono BT or Line Audio Daisy Chain with ML1 Mono Audio (Analog)

This configuration supports BT1 mono audio from either a Bluetooth connected device or an analog line level device), and a mono mix of the ML1's XLR and 3.5 mm inputs. BT1 jack detection automatically switches to line level audio when a device is plugged in.

Local	
Port B CH1	
	CH 2 Select
Axiom Port A Config	

Port B | **Port A**

Top view of BT1 showing proper "Port B CH 1 CH 2" switch position

XLR	3.5 mm
XLR + 3.5 mm	Port B CH1
CH 1 Select	CH 2 Select
Axiom Port A Config	

Port B | **Port A**

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions

CH 1: BT1 Mono BT/3.5 mm
CH 2: N/A

In this configuration, ML1 XLR + 3.5 mm mono sum audio is output on I/O 1 and BT1 Bluetooth or 3.5 mm jack is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

CH 1: ML1 Mono XLR + 3.5 mm
CH 2: BT1 Mono BT/3.5 mm

ML1 Mono Audio Daisy Chain with USB1, Mono Playback Audio (1x0) (Analog)

This configuration supports mono playback audio (1x0) from a device connected to the USB1, and a mono mix of the ML1's XLR and 3.5 mm inputs.

XLR	3.5 mm
XLR + 3.5 mm	Port B CH1
CH 1 Select	CH 2 Select
Axiom Port A Config	

Port B | **Port A**

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions

USB AUDIO

Port B | **Port A**

Local	
Port B CH1	
	CH 2 Select
Axiom Port A Config	

Top view of USB1 showing proper "Port B CH 1" switch position

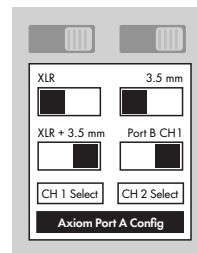CH 1: ML1 Mono XLR + 3.5 mm
CH 2: N/A

In this configuration, USB1 mono playback audio (1x0) is output on I/O 1 and ML1 XLR + 3.5 mm mono sum audio is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

CH 1: USB1 Mono (1x0)
CH 2: ML1 Mono XLR + 3.5 mm

USB1 Mono (1x0) Audio Daisy Chain with ML1 Mono Audio (Analog)
This configuration supports mono playback audio (1x0) from a device connected to the USB1, and a mono mix of the ML1's XLR and 3.5 mm inputs.
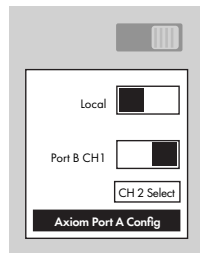
Top view of USB1 showing proper "Port B CH 1" switch position

Top view of ML1 showing proper "XLR+3.5 mm" and "Port B CH 1" switch positions

Port B | **Port A**

**Port B** | **Port A**

CH 1: USB1 Mono (1x0)
CH 2: N/A

In this configuration, ML1 XLR + 3.5 mm mono sum audio is output on I/O 1 and USB1 mono playback audio (1x0) is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

CH 1: ML1 Mono XLR + 3.5 mm
CH 2: USB1 Mono (1x0)

USB1 Mono Audio Daisy Chain with BT1, Mono BT or Line Audio (Analog)
This configuration supports mono audio from either a Bluetooth connected device or an analog line level device, as well as mono audio from the USB1. Jack detection on the BT1 automatically switches to line level audio when a device is plugged in both streaming and call bridging modes.
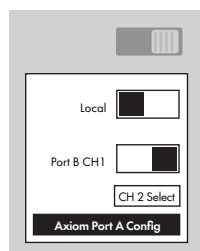
Top view of USB1 showing proper "Port B CH 1" switch position

Top view of BT1 showing proper "Port B CH 1" switch position

Port B | **Port A**

Port B | **Port A**
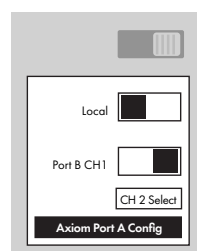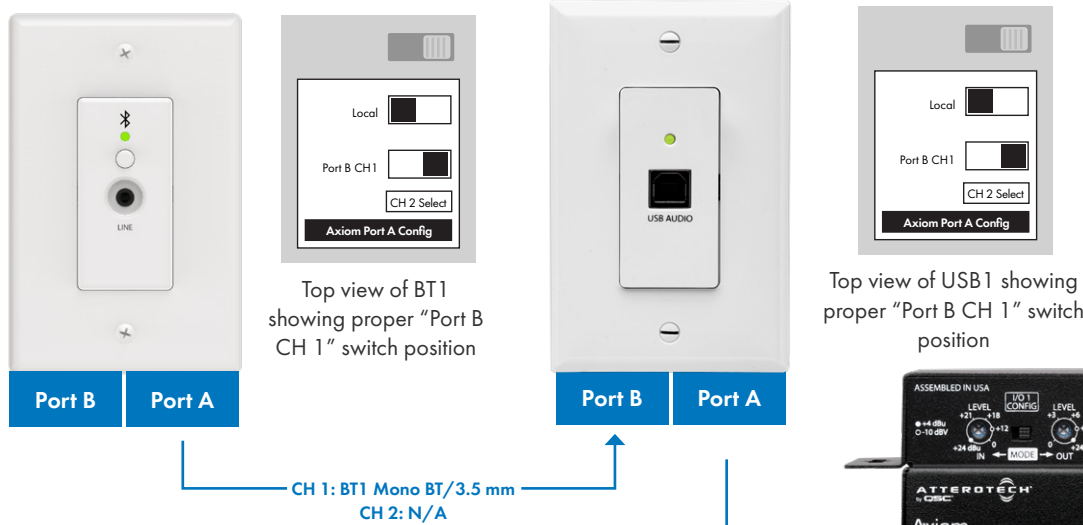
CH 1: USB1 Mono
CH 2: N/A

In this configuration, BT1 Bluetooth or 3.5 mm jack mono audio is output on I/O 1 and USB1 mono audio is output on I/O 2. The AXPio is set so that both I/O 1 and I/O 2 are outputs.

CH 1: BT1 Mono BT/3.5 mm
CH 2: USB1 Mono

BT1, Mono BT or Line Audio Daisy Chain with USB1 Mono Audio (Analog)
This configuration supports BT1 mono audio from either a Bluetooth connected device or a 3.5 mm analog line level device, as well as mono audio from the USB1. BT1 jack detection automatically switches to line level audio when a device is plugged in both streaming and call bridging modes.

Top view of BT1 showing proper "Port B CH 1" switch position

Top view of USB1 showing proper "Port B CH 1" switch position

| Port B | Port A |

| Port B | Port A |

CH 1: BT1 Mono BT/3.5 mm
CH 2: N/A

In this configuration, USB1 mono audio is output on I/O 1 and BT1 Bluetooth or 3.5 mm jack mono audio is output on I/O 2. The AXPio is set so that both I/O1 and I/O2 are outputs.

CH 1: USB1 Mono Out
CH 2: BT1 Mono BT/3.5 mm

AXPio used for Audio Signal Extension

Two AXPio devices may be used to extend analog signals over a CAT5e/6 infrastructure. Since the AXPio has two Flex IO, two unidirectional signals or a pair of bidirectional signals can be extended. Only one AXPio needs to be powered (either one), and the powered AXPio will provide power to the other AXPio.

In this configuration, audio signals input to AXPio A are output at AXPio B. I/O 1 and I/O 2 on AXPio A are set as inputs, and I/O 1 and I/O 2 on AXPio B are set as outputs. +24 V DC power provided to either AXPio will power both of them.

AXPio A

AXPio B

CH 1: AXPio A from I/O 1
CH 2: AXPio A from I/O 2
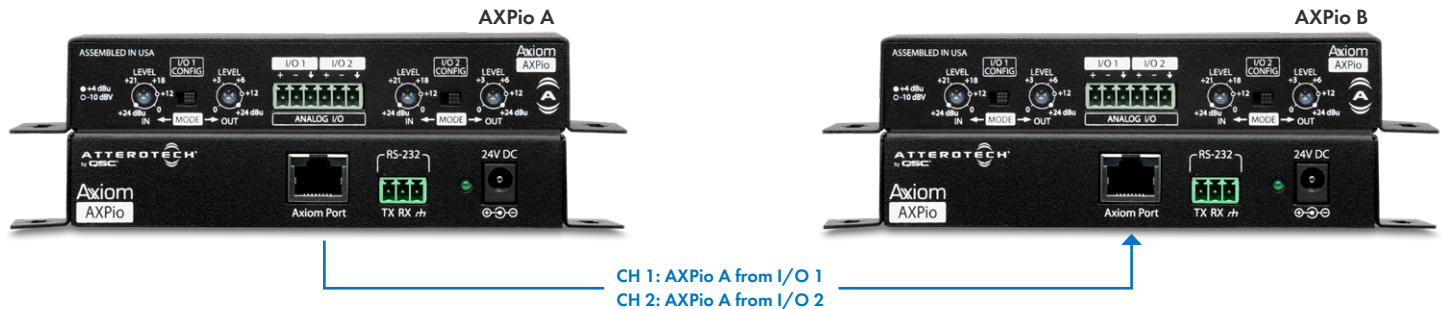
In this configuration, audio signals input to AXPio B are output at AXPio A. I/O 1 and I/O 2 on AXPio B are set as inputs, and I/O 1 and I/O 2 on AXPio A are set as outputs. +24 V DC power provided to either AXPio will power both of them.

AXPio A

AXPio B

CH 1: AXPio B from I/O 1
CH 2: AXPio B from I/O 2
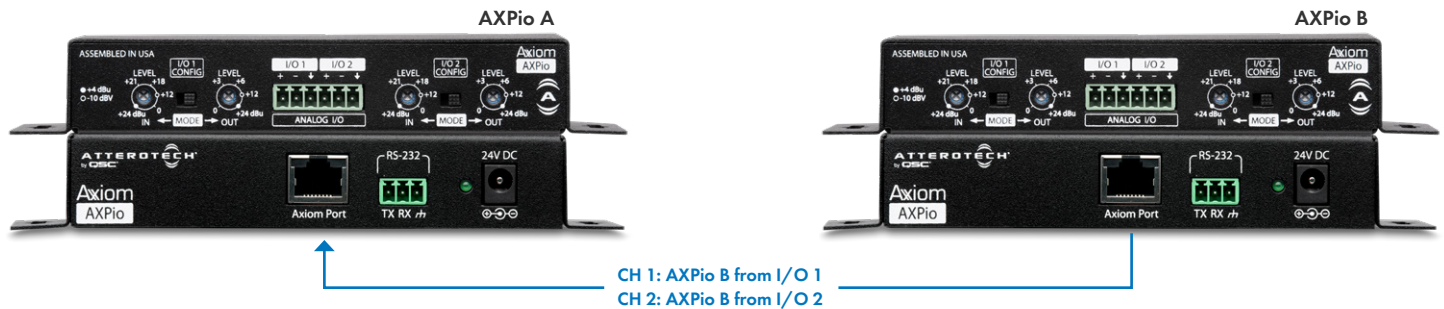
In this configuration, bi directional audio signals are supported. The input signal to AXPio A I/O 1 is output at AXPio B I/O 1. Similarly, the input signal to AXPio B I/O 2 is output at AXPio A I/O 2. On AXPio A, I/O 1 is set as an input, and I/O 2 is set as an output. On AXPio B, I/O 1 is set as an output, and I/O 2 is set as an input. +24 V DC power provided to either AXPio will power both of them.

AXPio A

AXPio B

CH 1: AXPio A from I/O 1
CH 2: AXPio B from I/O 2

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