Model 209
Talent Console

User Guide

Issue 1, November 2022

This User Guide is applicable for serial numbers
M209-00151 and later with application firmware 1.05 and later
and STcontroller application version 3.08.00 and later.

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Revision History

Issue 1, November 2022:

- Initial release.

Introduction

The Model 209 Talent Console offers a unique combination of audio, remote control, and tally-output resources for use in podcast and other specialized audio applications. The unit is housed in a compact enclosure that's intended for mounting under a tabletop, within custom furniture, or as part of an on-air set.

The Model 209 supports Dante® audio-over-Ethernet digital media technology as well as AES67 for integration into contemporary applications. In addition, Audinate's Dante Domain Manager™ software application is supported.

The Model 209 is extremely simple to deploy, is "pro" quality throughout, and provides an intuitive user experience. The Model 209's audio quality is excellent, with low distortion, low noise, and high headroom. Careful circuit design and rugged components ensure long, reliable operation.

The Model 209 integrates directly into Dante audio-over-Ethernet environments. With just a Power over Ethernet (PoE) connection, a microphone, and a pair of headphones or an earpiece, a complete audio position can be created. In addition, remote control inputs and tally outputs allow the Model 209 to integrate directly into more complex applications.

A host of Model 209 features are configured using the STcontroller personal computer software application. This allows the unit's operation to be tailored to meet the exact needs of many installations. STcontroller is a fast and simple means of confirming and revising the unit's operating parameters.

Applications

The Model 209 can provide an all-Dante solution for one podcast location. A wide range of other applications can also be supported, including sports and entertainment TV and radio events, streaming broadcasts, corporate and government AV installations, and post-production facilities. The unit's capabilities allow it to be easily integrated into REMI/At-Home applications.

A high-performance microphone preamplifier and associated analog-to-digital circuitry routes the input audio signal to the Model 209's digital microcontroller integrated circuit. The audio quality compares very well to that provided by high-end external microphone preamplifiers, consoles, and I/O interfaces. A pushbutton switch provides the user with direct control over the microphone-associated audio signal as it is routed to the Dante main and talkback transmitter (output) audio channels. The audio switching is performed in the digital domain and is virtually click-free. Two Dante receiver (input) audio channels supply the user with their talent cue signals. (Often referred to as IFB in broadcast applications.) Should the talent cue signal be "mix-minus" an integrated sidetone function can provide the user with a microphone confidence signal.

Remote control of a number of Model 209's functions can be easily performed. This is available in the form of two contact-closure inputs, by way of high-frequency tones that are embedded in the Dante receiver (input) audio channels, or using UDP commands supplied via Ethernet. Two tally outputs allow direct control of LED status arrays associated with the microphone mounting method. Using the Model 209 will often eliminate the need for an additional interface or LED control method.

Installation, Configuration, and Operation

Installation, configuration, and operation of the Model 209 is simple. The lightweight aluminum enclosure mounts under a tabletop or other work surface. On the unit's back panel an RJ45 jack is used to interconnect with a standard Ethernet port that supports Power over Ethernet (PoE). This connection provides both Model 209 power and bidirectional Dante digital audio. Also located on the unit's back panel is a 3-pin female XLR connector which allows connection of a dynamic, ribbon, or condenser microphone. The connected microphone can be a standalone stick type, a microphone associated with a broadcast headset, or a mic installed as part of a microphone mounting assembly. An integrated low-noise P48 phantom power source allows support for a wide range of professional condenser microphones.

Stereo or monaural headphones, headsets, or earpieces can be connected by way of the ¼-inch and 3.5 mm 3-conductor jacks that are located on the Model 209's front panel. The headphone connections on the two jacks

Figure 1. Model 209 Talent Console front and back views

are connected in parallel ("multed"), providing the same 2-channel signal to various connected devices. The unit's two remote control inputs, accessible using a 3.5 mm 3-conductor jack, allow one or two contact closures to be connected. These contact closures can be configured to provide a remote version of the front-panel button function or to activate the tally output functions. Accessible on a separate 3.5 mm 3-conductor jack, two tally outputs provide DC signals to operate associated LED status indicators. The tally outputs are 12 volts DC and can provide up to 100 milliamperes of current. These robust outputs can function independently or as a single bidirectional current source to ensure compatibility with a range of microphone on/off status indicators.

The STcontroller software application is used to configure the Model 209's many operating parameters. This allows the unit's performance to be optimized to meet the needs of specific applications. Separate STcontroller versions are available, free of charge, to support personal computers running the Windows® and macOS® operating systems.

The user is presented with a simple set of controls and indicators. A lighted pushbutton switch is used to select the status of the microphone signal as it is sent to the Dante main and talkback transmitter (output) channels. A rotary level control, with internal RGB LED lighting, allows on/off control and level adjustment of the headphone output. An eight-LED multipurpose display provides a status indication of various Model 209 operating characteristics.

Ethernet Data and PoE

The Model 209 connects to a local area network (LAN) by way of a standard 100 Mb/s twisted-pair Ethernet interface. Two LEDs display the status of the network connection. The Model 209's operating power is provided by way of the Ethernet interface using the 802.3af Power over Ethernet (PoE) standard. This allows fast and efficient interconnection with an associated data network. To support PoE power management, the Model 209's PoE interface reports to the power sourcing equipment (PSE) that it's a class 2 (low power) device.

Dante Audio-over-Ethernet

Audio data is sent to and received from the Model 209 using the Dante audio-over-Ethernet media networking technology. As a Dante-compliant device, the Model 209's two Dante transmitter (output) and two Dante receiver (input) audio channels can be routed (subscribed) to other devices using the Dante Controller software application. The Dante transmitter and receiver channels are limited to supporting four Dante flows, two in each direction. The digital audio's bit depth is up to 32 with supported sample rates of 48 and 96 kHz. The Model 209 is compatible with the AES67 interoperability standard. In this mode, the two Dante transmitter (output) channels will function in multicast; unicast is not supported. In addition, the unit is compatible with the Dante Domain Manager™ (DDM) software application.

Audio Quality

The Model 209's audio performance is completely "pro." A low-noise, wide dynamic-range microphone preamplifier ensures that mic input audio quality is preserved while minimizing the chance of signal overload. The output of the microphone preamp is routed to a high-performance analog-to-digital conversion (ADC) section. The audio signal, now in the digital domain, routes through the unit's microcontroller integrated circuit and on to the Dante interface section where it is packetized and prepared for transport over Ethernet.

Audio input signals arrive via the Dante receiver (input) channels and pass into the Model 209's microcontroller integrated circuit. Channel routing, headphone level control, and sidetone creation are performed within the digital domain. This provides flexibility, allows precise control, and keeps the level control from having to directly handle analog audio signals. The two audio channels destined for the headphone outputs are sent to a high-performance digital-to-analog (DAC) integrated circuit and then on to robust driver circuitry. High signal levels can be provided to a variety of headsets, headphones, and earpieces.

Configuration Flexibility

The Model 209 can be configured to meet the needs of specific applications and user-preferences. All configuration choices are performed using the STcontroller personal computer software application which is available free of charge on the Studio Technologies website. There are no mechanical switch settings or button-press sequences required to configure how the unit functions. Selectable parameters include P48 phantom power on/off, microphone preamplifier gain, headphone and sidetone operation, talkback button operation, level display, remote control inputs, and tally outputs.

Microphone Input and Audio Outputs

The gain of the microphone preamplifier can be selected over a range of 20 to 65 dB in single dB steps. This allows the Model 209 to match the output sensitivity of a range of standalone and headset-associated microphones. A low-noise source of P48 phantom power can be enabled, if required, to support a variety of condenser microphones.

The talkback pushbutton switch, located on the Model 209's front panel, can be configured from among five operating modes. These choices allow the Model 209's

audio output operation to be tailored to meet the specific needs of the application. As an example, for a podcast application the pushbutton would typically be configured to provide a push to mute (cough) function. This would ensure that the microphone signal would remain active unless the talent needs to momentarily disable it.

Headphone Output

The headphone output signal routing can be configured from among three choices. The dual-channel stereo mode is provided for applications where two channels of talent cueing need to be independently sent to the left and right headphone output channels. The dual-channel mono mode allows the two Dante receiver (input) audio channels to be summed (mixed together) and sent to both the left and right headphone output channels. Lastly, a unique single-channel mono mode is provided for applications where a single-channel headphone, earpiece, or earbud is being used. The two Dante receiver (input) channels are mixed together and sent only to the left channel of the headphone output. No audio signal is present on the headphone output's right channel.

The integrated sidetone function can be configured to meet specific user needs. Sidetone allows audio associated with the microphone input and microphone preamplifier to be returned to the headphone output. This is important as different applications may provide "full mix" or "mix-minus" talent cue signals. If a full mix cue signal is provided, sidetone audio will not be needed and the function can be disabled. In the case where a mix-minus signal is present, providing the user with sidetone can be an important means of confirming the signal that's coming from the connected microphone. The level of the sidetone signal can either be fixed or allowed to be adjusted using the front-panel control.

Remote Control Inputs and Tally Outputs

The two remote control inputs can be configured to activate a number of functions. They can be assigned to perform the same action as the talkback pushbutton switch. This allows control of the audio signal as it is sent to the two Dante transmitter (output) channels. The remote control inputs can also be configured to control the tally outputs.

Unique to the Model 209 are the two tally outputs. These 12 volts DC, 100 milliamperes maximum outputs are designed to drive arrays of LED status indicators, such as are often associated with microphone boom mounting arms. Each output can function independently, providing separate DC outputs. They can also be configured to provide a single differential output. In this way, a tally status change will result in the tally output current changing direction. This allows support for some very useful implementations. For example, without the need for extra circuitry or an additional interface, the Model 209 can directly control the status LED indicator assembly associated with the excellent on-air microphone mounting products from Yellowtec® of Germany. With just two connections the Model 209 can control both the white and red LED indicators associated with the m.ka mounting system.

The status of the tally outputs can be configured to respond to six sources. Virtual buttons within the STcontroller application can control the on/off status of the tally outputs. This can be useful during unit installation and testing. The status of the main output can also be used to control the tally outputs. This allows a direct "on-air" light function to be established. As previously noted, the two contact closure inputs can be used to control the tally outputs. Finally, a high-frequency tone present in a Dante receiver (input) channel can also be configured to control the state of a tally output. This tone-operated (TOX) control function allows easy integration with a DSP-based audio processing unit. With no additional wiring and simple programming, the processor can generate tones required to control the state of the tally outputs.

Future Capabilities and Firmware Updating

The Model 209 was designed so that its capabilities and performance can be enhanced in the future. A USB receptacle, located on the unit's back panel, allows the application firmware (embedded software) to be updated using a USB flash drive. The Model 209 uses Audinate's Ultimo™ integrated circuit to implement the Dante interface. The firmware in this integrated circuit can be updated via the Ethernet connection, helping to ensure its capabilities remain up to date.

Getting Started

What's Included

Included in the shipping carton will be a Model 209 Talent Console and instructions on how to obtain an electronic copy of this guide. As a device that is Power over Ethernet (PoE) powered, no external power source is provided.

In this section, the unit will be mounted under a tabletop, desk, stage set, or other flat surface. Once that has been completed signal interconnections will be made using the connectors located on the front and back surfaces of the Model 209's enclosure. Ethernet, microphone, remote control input, and tally output interfacing will be performed on the unit's back panel. Headphone connections will be made by way of either of the two connectors on the unit's front panel.

Mounting the Unit

Four screws are used to mount the Model 209's enclosure to the underside of a flat surface. The specific type of fastener would depend on the surface material that the unit is being mounted to. The overall size of the necessary mounting hardware would meet the standard for #6 (English) or 3 mm (metric). Refer to Appendix B for mounting-dimension details.

Figure 2. Model 209 Talent Console shown in an under-tabletop mounting configuration

Connections

An Ethernet data connection with Power over Ethernet (PoE) capability will be made using a standard patch cord that is terminated with an RJ45 plug. A microphone will be connected using a cable-mounted 3-pin male XLR connector. If one or both of the remote control inputs are going to be utilized, they will be connected by way of a 3-conductor (TRS) 3.5 mm plug. Two tally outputs are available on the back panel and are interfaced using another 3-conductor (TRS) 3.5 mm plug. On the front panel are two jacks that are provided for use by headphones, the earpieces of headsets, or wired ear buds. Both are 3-conductor (stereo), one being ¼-inch and the other 3.5 mm.

Ethernet Connection with PoE

A 100BASE-TX Ethernet connection that supports Power over Ethernet (PoE) is required for Model 209 operation. This one connection will provide both the Ethernet data interface and power for the Model 209's circuitry. A 10BASE-T connection is not sufficient and a 1000BASE-T (GbE) connection is not supported unless it can automatically fall back to 100BASE-TX operation. The Model 209 supports Ethernet switch power management, enumerating itself as a PoE class 2 device.

The Ethernet connection is made by way of a standard RJ45 jack that is located on the back of the Model 209's enclosure. This allows connection by way of a cable-mounted standard RJ45 plug. The Model 209's Ethernet interface supports auto MDI/MDI-X so that a crossover or reversing cable will never be required.

Microphone Input

The Model 209 provides a 3-pin female XLR connector for interfacing a microphone with the high-performance input circuit. The connected microphone can be a standalone handheld (stick) type or can be part of a broadcast-style headset. The Model 209's microphone input is directly compatible with balanced dynamic, ribbon, or P48 phantom powered microphones. A microphone should be connected such that its common is on connector pin 1, its signal high (+) is on connector pin 2, and its signal low (–) is on connector pin 3.

An STcontroller configuration setting allows the P48 microphone power source to be enabled or disabled as desired. The gain of the microphone preamplifier can also be configured over a 20 to 65 dB range. Details on configuring the unit will be described in a later section.

Headphone Output

The Model 209 provides a 2-channel (stereo) headphone output by way of both a 3-conductor ¼-inch phone jack and a 3.5 mm TRS jack. Both are located on the front panel. Devices such as stereo headphones or "dual-muff" broadcast-style headsets can be directly connected using a 3-conductor ¼-inch plug. Following the usual convention, the left channel should be terminated on the tip lead, the right channel on the ring lead, and common on the sleeve lead.

It's also possible to use a monaural ("single-muff) headset or broadcast-type single earbud as long as sufficient care is taken. If a 3-conductor ¼-inch plug is used by the device, it should be wired such that the tip lead is connected to the positive terminal of the transducer, the sleeve lead is connected to the negative or common lead of the transducer, and the plug's ring should be left unconnected. It is also likely that the monaural device will be terminated on a 2-conductor (tip and sleeve) ¼-inch plug. When a plug of this type is inserted into the Model 209's headphone output connector (jack), the Model 209's right headphone output channel will be shorted. (This will occur since the ring lead will be directly shorted to the sleeve lead.) This can lead to stress on the Model 209's right channel headphone output circuitry as well as drawing extra current from the output stage. To prevent this condition from occurring, the Headphone Output – Routing configuration choice should be set for Single-Channel Mono. This disables the right headphone output channel and sends the listen audio source or sources only to the left headphone output channel. Refer to a later section for details on configuring the headphone output.

Remote Control Inputs

The Model 209 allows connection of two remote control signals. Configuration settings in STcontroller allow the remote control inputs, referred to as GPI 1 and GPI 2, to impact several Model 209 functions. (GPI refers to "general purpose input.") The exact functioning of the two remote control inputs is determined by configuration settings, details of which are discussed in a later section.

A 3-conductor (TRS) 3.5 mm jack is located on the Model 209's back panel and provides access to the two remote control inputs. Each input circuit is "active low," with a 3.4 k (3400) ohm resistor connected to +3.3 volts DC to act as an input pull-up. (In addition, a combination of resistors and capacitors provide ESD protection, minimizing the chance of damage due to static discharge or other extraneous signals.) A current flow of less than one milliampere is required for a remote control input to be recognized as active.

Prepare the interconnecting cable and associated 3-conductor (TRS) 3.5 mm plug to reflect that the tip lead is used by remote control input GPI 1, the ring lead by remote control input GPI 2, and the sleeve lead is the common connection for both inputs.

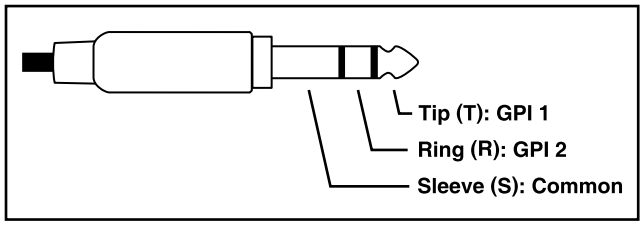


Figure 3. 3-conductor (TRS) 3.5 mm plug configured for use with remote control inputs

Tally Outputs

The Model 209 provides two general-purpose tally outputs that can be used for a variety of applications. Each can directly drive an LED array or be utilized by the input on another piece of equipment. The state of the tally outputs (disabled or enabled) can follow the state of Model 209's Dante main transmitter (output) channel, the state of the remote control inputs, the presence of a high-frequency tone on the Dante receiver (input) channels, or by using virtual buttons accessible in the STcontroller application.

The important thing to note about the tally outputs is that they provide 12 volts DC with a significant amount of current (100 milliamperes maximum). This is in contrast to more-typical tally outputs provided by other pieces of equipment. These tally outputs may provide logic signals of 3.3 or 5 volts DC with just a few milliamperes of current.

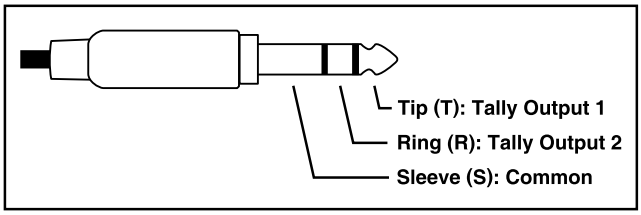


Figure 4. 3-conductor (TRS) 3.5 mm plug configured for use with tally outputs

While the Model 209's tally outputs are much more flexible, it's important to ensure that the connected devices can support the voltage and current. For example, a series resistor might be required if a Model 209 tally output is to be connected to a single LED indicator. Two resistors that create a voltage divider might be needed for compatibility with an input that requires a more-standard logic voltage level.

The two tally outputs can function independently, each providing either 0 or 12 volts DC, depending on their configuration and output status. (The source or sink current of each output is limited to 100 milliamperes.) Settings in the STcontroller software application also allow the two tally outputs to serve in a differential mode. In this way, tally output 2 can provide an output that is always opposite in polarity to tally output 1, something required to directly support bidirectional LED arrays.

The tally outputs were expressly designed to support the status indicator LED assembly that can be included as part of the m.ka-Series of microphone mounting arms from Yellowtec (yellowtec.com). Specifically provided are the tally output's 12 volts DC, 100 mA maximum capability along with two differential output mode configuration settings. The Model 209 can be easily configured to allow direct support for m.ka's bidirectional LED assembly. This will enable the assembly's two LED colors, depending on the status of Model 209 resources. Refer to Appendix C for details on connecting to a Yellowtec microphone mounting arm.

Prepare an interconnecting cable and associated 3-conductor (TRS) 3.5 mm plug for the design application. The plug's tip lead provides access to tally output 1, the ring lead to tally output 2, and the sleeve lead to the common connection for both outputs.

Figure 5. Model 209 Talent Console can be configured to allow direct support for the Yellowtec m.ka's bidirectional LED assembly

Dante Configuration

For audio to pass to and from the Model 209 requires configuration of several Dante-related parameters. These configuration settings are stored in non-volatile memory within the Model 209's circuitry. Configuration will typically be done with the Dante Controller software application which is available for download free of charge at getdante.com. Versions of Dante Controller are available to support Windows and macOS operating systems.

The Model 209's Dante interface is compatible with the Dante Domain Manager (DDM) software application. Refer to the DDM documentation, also available from Audinate, for details on which Model 209 and related parameters may have to be configured.

Audio Routing

The Model 209 has two Dante transmitter (output) channels that are associated with the unit's Dante interface. They must be assigned to the desired Dante receiver (input) channels on one or two devices. This achieves routing of the Model 209's two output audio channels to the device (or devices) that will be "listening" to them. The two Dante receiver (input) channels associated with the Model 209's audio inputs need to be subscribed (routed) with the desired Dante transmitter (output) channels. These two audio signals will provide the headphone cue signals to a Model 209 user. They can also be used in a TOX (tone operated) mode to control the state of the tally outputs. Within Dante Controller a "subscription" is the term used for routing a transmitter flow (a group of up to four output channels) to a receiver flow (a group of input channels).

The Model 209 uses an Ultimo integrated circuit to implement its Dante functionality. The number of flows associated with this integrated circuit is four: two transmitter (output) and two receiver (input). With this small number of flows it's possible that a flow limitation condition could occur. A flow can be unicast, multicast, or a combination of the two. If the Model 209's Dante transmitter (output) channels need to be subscribed (routed) to more than two flows it's possible that an intermediary device, such as the Studio Technologies Model 5422A Dante Intercom Audio Engine, can be used to repeat the signals.

Note that when the AES67 mode has been enabled in the Dante Controller application, the Model 209's Dante transmitter (output) channels will only function in multicast; unicast is not supported.

Unit and Channel Names

The Model 209 has a default Dante device name of **ST-M209-** and a unique suffix. The suffix identifies the specific Model 209 that is being configured. The suffix's actual alpha and/or numeric characters relate to the MAC address of the unit's Ultimo integrated circuit. The two Dante transmitter (output) channels have default names of **Main** and **Talkback**. The two Dante receiver (input) channels have default names of **Headphone Ch1** and **Headphone Ch2**. Using Dante Controller, the default device name and channel names can be revised as appropriate for the specific application.

Device Configuration

The Model 209 supports audio sample rates of 48 and 96 kHz with no pull-up/down options available. The digital audio data is in the form of pulse-code modulation (PCM) samples. Encoding choices within Dante Controller are **PCM 16**, **PCM 24**, and **PCM 32**, but in most cases, the selection of PCM 24 would be appropriate. Clocking and device latency parameters can be adjusted within Dante Controller if required, but the default values are typically correct.

Network Configuration

Typically, the Model 209's Dante IP address and related network parameters will be determined automatically using DHCP or, if that's not available, the link-local network protocol. If desired, Dante Controller allows IP address and

related network parameters to be manually set to a fixed or static configuration. While this is a more-involved process than simply letting DHCP or link-local do their thing, if fixed addressing is necessary, this capability is available.

AES67 Configuration – AES67 Mode

Dante Controller allows a Model 209 to be configured for AES67 operation. This requires the AES67 mode to be set for Enabled. As previously noted, if AES67 mode is Enabled, the Dante transmitter (output) channels will use multicast and their sample rate will be fixed at 48 kHz.

Model 209 Clocking Source

While technically the Model 209 can serve as a Leader Clock for a Dante network (as can all Dante-enabled devices), in most cases, the unit will be configured to receive its timing reference (“sync”) from another Dante device. As such, the Dante Controller check box for the Preferred Leader that is associated with the Model 209 would typically not be enabled.

Model 209 Configuration

The STcontroller software application is used to configure the way in which the Model 209 functions. No DIP switch settings or other local actions are used to configure the unit. This makes it imperative that STcontroller be available for convenient use on a personal computer that's connected to the related LAN. The configuration of a specific Model 209 can be saved, in XML format, onto the personal computer associated with STcontroller. A configuration file can also be loaded into the associated Model 209.

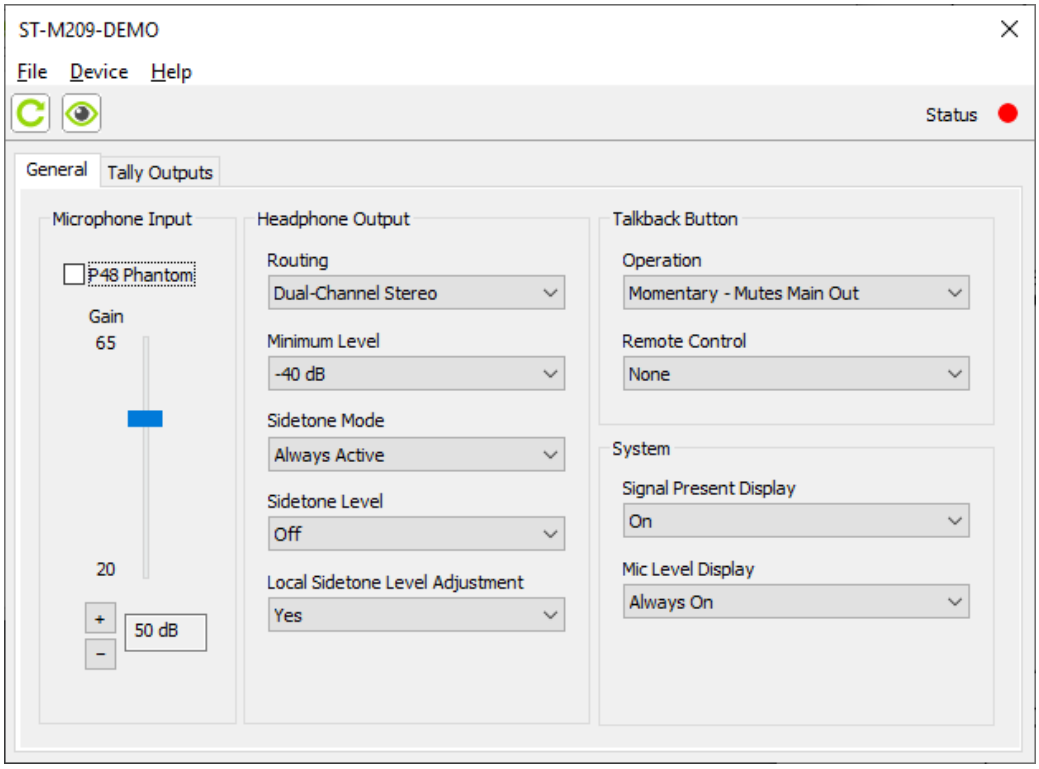
Installing STcontroller

STcontroller is available free of charge on the Studio Technologies website. If required, download and install STcontroller onto a designated personal computer. This personal computer must be on the same local area network (LAN) and subnet as the Model 209 unit or units that are to be configured. Immediately after starting STcontroller the application will locate the devices that it can control. The Model 209 unit or units will appear in the device list. Use the **Identify** command to allow easy recognition of a specific Model 209 unit. Double-clicking on a device name will cause the associated configuration menu to appear. Review the current configuration and make changes as required.

Changes made using STcontroller will be immediately reflected in the unit's operation. No reboot of the Model 209 is required. Each time a change is made the eight LEDs in the multipurpose display will light orange in a distinctive pattern to indicate that a command from STcontroller has been received. All changes made using STcontroller will be stored within the Model 209 in non-volatile memory. As such, changes will remain, even as the unit undergoes power-down/power-up cycles.

General Menu Page

The following configuration selections are available in the General menu selections tab.



Microphone Input – P48 Phantom Power

Choices are *Off* and *On*.

STcontroller allows selection of the on/off status of the microphone input's P48 phantom power source. A green LED, labeled P48 and located on the lower-right corner of the Model 209's front panel, will light when P48 is active. Using the check box, select the on/off status of the P48 source to meet the needs of the connected microphone.

Microphone Input – Gain

Choices are 20 dB to 65 dB in 1-dB steps.

The Model 209's microphone preamplifier can be adjusted over a range of 20 to 65 dB in 1-dB steps. There's no problem changing the gain setting while the unit is operating although small audio clicks or pops may occur during gain transitions. Selecting the correct amount of gain for an application might require some experimentation. The goal is to bring the analog microphone's signal up to the Dante reference level which Studio Technologies considers to be –20 dBFS. (This is 20 dB below digital maximum.) Configuring operation to meet this Dante reference signal level will help ensure the delivery of optimal audio to the destination device or devices.

There's no "perfect" preamplifier gain setting that this guide can recommend. The two issues that impact the setting are the output sensitivity of the connected microphone and the acoustical output level of the microphone's user. A popular dynamic microphone for podcast applications is the Shure® SM7B. The Model 209's default preamplifier gain value of 50 dB might work well to support it. For microphones associated with broadcast headsets such as the Sennheiser® HMD 26 or HMD 27, selecting an initial setting of 40 dB or 45 dB would be appropriate. For users who speak loudly the gain might need to be reduced to 35 dB or even 30 dB. Quiet speaking users might need a gain setting of 55 dB or even greater.

The multipurpose display, located on the Model 209's front panel, can serve as an 8-segment audio level meter which can be used when setting the microphone preamplifier gain. Its operation is enabled by default in STcontroller. In this case, when a voice signal at a normal level is present on the connected microphone, the five green LEDs should light. The two orange LEDs should light on signal peaks; the red LED will only light when the signal is near to or actually "clipping." If the meter does not light in this manner, it's recommended that the gain of the preamplifier be adjusted as required.

As a reality check, it's recommended that a level meter associated with a device that's digitally connected to the Model 209's Dante Main transmitter (output) channel be observed. This will be an excellent means of checking the actual signal level within the signal chain. If necessary, adjust the gain of the Model 209's microphone preamplifier to achieve the desired result.

Headphone Output – Routing

Choices are *Dual-Channel Stereo, Dual-Channel Mono*, and *Single-Channel Mono*.

STcontroller allows selection from among three headphone output modes. Each mode is distinct and careful selection will help optimize the Model 209's operation for a range of applications.

Dual-Channel Stereo: The *Dual-Channel Stereo* mode is provided for applications where two independent audio sources need to be independently routed to the two headphone output channels. Dante receiver (input) channel 1 will be routed to the left headphone output channel and Dante receiver (input) channel 2 will be routed to the right headphone output channel. Note that in this mode, the sidetone audio signal, if enabled, will be routed to both the left and right headphone output channels.

Dual-Channel Mono: The *Dual-Channel Mono* mode can be useful in applications where the same audio signals need to be provided to the user on both the left and right headphone output channels. In this mode, Dante receiver (input) channel 1 and Dante receiver (input) channel 2 are combined (mixed together or "summed") and routed to both the left and right headphone output channels. Note that in this mode, the sidetone audio signal, if enabled, will be routed to both the left and right headphone output channels.

Single-Channel Mono: The *Single-Channel Mono* mode is specifically provided for applications where a 2-conductor ¼-inch plug is being used with the connected headphones, headset, or a broadcast-style earpiece. In this mode, audio from Dante receiver (input) channel 1 and Dante receiver (input) channel 2 are combined (mixed or summed) to monaural and routed to only the left channel of the headphone output; no audio signal is routed to the right channel of the headphone output. Note that in this mode, the sidetone audio signal, if enabled, will be routed to only the left headphone output channel.

Headphone Output – Minimum Level

Choices are *Full Mute* and *–40 dB*.

Full Mute: A setting in STcontroller is used to configure the headphone output's minimum level. When *Full Mute* is selected, moving the headphone level control fully counterclockwise will cause the headphone output to fully mute. Selecting the full mute mode may be appropriate for applications where minimizing the chance of audio leakage is important. This could occur when during an event the connected headphones or headset is at times placed on a desk or tabletop. This could result in unwanted audio leakage from the ear cups.

–40 dB: In the *–40 dB* setting the minimum headphone output level is approximately 40 dB below its maximum; the headphone output channels will never fully mute. This ensures that any audio signal present on the Dante receiver (input) channels will always be present on the headphone output, even if they are at a very-low level. In many on-air broadcast or streaming applications this would be the appropriate setting, ensuring that a minimum amount of signal is always present on the 'phones. This minimal level can make certain that talent cue (IFB) or other production audio sources can always be heard, even faintly, by a Model 209 user.

Headphone Output – Sidetone Mode

Choices are *Main Active*, *Talkback Active*, and *Always Active*.

STcontroller allows selection from among three sidetone modes. Sidetone is audio from the output of the microphone preamplifier that is sent to the headphone output channel or channels. It is mixed (combined or summed) with audio that arrives by way of the Model 209's Dante receiver (input) channels. Sidetone can be important, allowing the user to hear themselves as appropriate for performance confirmation and comfort. The time at which sidetone audio is actively routed to the headphone output channel or channels is determined by this configuration.

Main Active: In this mode, the sidetone function will be active whenever the main output is active, i.e., sidetone audio will be sent to the headphone output whenever an audio signal associated with the microphone input is present on the Dante main transmitter (output) channel.

Talkback Active: In this mode, the sidetone function will be active whenever the talkback function is active and the audio signal is present on the Dante talkback transmitter (output) channel.

Always Active: In this mode, the sidetone function will always be active and sidetone audio will be continuously routed to the headphone output.

Note that the actual level of sidetone audio as it is sent to the headphone output will be determined by the selection made in the Headphone Output – Sidetone Level configuration. It can also be configured to be adjusted using the unit's headphone level control.

Headphone Output – Sidetone Level

Choices are *High*, *Medium High*, *Medium*, *Medium Low*, *Low*, and *Off*.

As previously discussed, the Model 209 includes a sidetone function that allows microphone audio coming from the microphone preamplifier to be sent to the headphone output. This will provide a user confirmation function, confirming that they are actively sending audio to the Dante main transmitter (output) channel, the Dante talkback transmitter (output) channel, or both the Dante main and talkback transmitter (output) channels. Overall sidetone operation is configured using the Sidetone Mode selection function as previously described.

The sidetone level can be adjusted from among six choices, including five active levels as well as off (no sidetone). This is the sidetone level that will be active when the Model 209 is initially powered up. If Local Sidetone Level Adjustment is set to No the sidetone level will not change. If Local Sidetone Level Adjustment is set to Yes the user is able to change the sidetone level from among the six choices.

Headphone Output – Local Sidetone Level Adjustment

Choices are *No* and *Yes*.

This configuration setting selects whether or not the user is able to adjust the sidetone level using the front-panel headphone level control. If the *No* setting is selected, the rotary level control will not allow the sidetone level to be adjusted. If the *Yes* setting is selected, using the rotary level control in a press-hold-and-turn sequence will allow the sidetone level to be adjusted from among five choices as well as no sidetone.

Selecting *Yes* is the most flexible configuration selection, but can lead to confusion if multiple users have access to the Model 209 on a regular basis. Each would have to be aware of the sidetone level adjustment method so they could optimize the sidetone level for their own use. If the *No* setting was selected, the sidetone level would be fixed from among the five available values or completely off as selected in the Sidetone Level configuration choice.

Talkback Button – Operation

Choices are *Momentary – Mutes Main Out*, *Latching – Mutes Main Out*, *Momentary – Doesn't Mute Main Out*, *Latching – Doesn't Mute Main Out*, and *Disabled*.

STcontroller allows the operating configuration of the talkback button to be selected. There are five choices available.

Momentary – Mutes Main Out: If this mode is selected when the talkback button is not pressed, the button will light green, the microphone signal will be sent out the Dante main transmitter (output) channel, and the Dante talkback transmitter (output) channel will be muted. Whenever the talkback button is pressed and held, the button will light orange, the audio signal will mute on the Dante main transmitter (output) channel, and the audio signal will become active on the Dante talkback transmitter (output) channel.

Latching – Mutes Main Out: If this mode is selected, the talkback function will alternate between its off (inactive) and on (active) states whenever the talkback button is momentarily pressed. The button will light green whenever the Dante main transmitter (output) channel is active and light orange whenever the Dante talkback transmitter (output) channel is active. Upon power being initially applied to the Model 209, the talkback function will be inactive, the button will light green, and audio will be present on the Dante main transmitter (output) channel.

Momentary – Doesn't Mute Main Out: If this mode is selected when the talkback button is not pressed, the button will be lit green, the microphone signal will be sent to the Dante main transmitter (output) channel, and the Dante talkback transmitter (output) channel will be muted. Whenever the talkback button is pressed and held, the button will light alternating between green and orange, audio signal will continue to be present on the Dante main transmitter (output) channel, and the audio signal will also become active on the Dante talkback transmitter (output) channel. The button lighting both green and orange is intended to indicate that both Dante transmitter (output) channels are active.

Latching – Doesn't Mute Main Out: If this mode is selected, the talkback function will alternate between its off (inactive) and on (active) states whenever the pushbutton is momentarily pressed. In either state, audio will be sent out the Dante main transmitter (output) channel; it will never mute. The talkback button will light green whenever the Dante main transmitter (output) channel is active and the Dante talkback transmitter (output) channel is not active. It will alternate between green and orange whenever the talkback function is active. This indicates that audio is being sent to both the Dante main and talkback transmitter (output) channels. Upon power being initially applied to the Model 209, the talkback function will not be active and no audio will be sent to the Dante talkback transmitter (output) channel. Audio will be sent only to the Dante main transmitter (output) channel and the button will be lit green.

Disabled: If this mode is selected, the talkback function is prevented from becoming active. Microphone audio will always be sent to the Dante main transmitter (output) channel and the talkback pushbutton will be lit green. The Dante talkback transmitter (output) channel will always be muted. Whenever the talkback button is pressed, the button will flash green to indicate to users that the talkback function has been disabled. Whether or not the button is pressed, no change to the audio routing will ever take place; audio will always be present on the Dante main transmitter (output) channel.

Talkback Button – Remote Control

Choices are *None*, *GPI 1*, and *GPI 2*.

The Model 209 provides two remote control inputs which are labeled GPI 1 and GPI 2. (GPI is an acronym for general-purpose input.) They can be used to control the talkback function, serving as an external version of the talkback pushbutton switch.

None: When selected for *None*, the two remote control inputs, GPI 1 and GPI 2, will not impact the operation of the Model 209.

GPI 1: When selected for *GPI 1*, its operation will impact the status of the talkback function. It will perform the same function as the talkback pushbutton. When GPI 1 is in its low (shorted) state, it will perform the same function as if the pushbutton switch is being pressed.

GPI 2: When selected for *GPI 2*, its operation will impact the status of the talkback function. It will perform the same function as the talkback pushbutton. When GPI 2 is in its low (shorted) state, it will perform the same function as if the pushbutton switch is being pressed.

System – Signal Present Display

Choices are *Off* and *On*.

The top surface of the knob associated with the headphone level control can light as an indication of the level of the audio associated with the two Dante receiver (input) channels. This is accomplished by lighting an R-G-B (red-green-blue) LED that is located within the headphone level control. The top of the knob surface will light green when signal levels are in their normal range, yellow when the signal levels are greater than normal, and red when the signal levels are at risk of degrading audio performance. Whether *Off* or *On* is selected will depend on user-preference.

System – Mic Level Display

Choices are *Off*, *Always On*, and *On When Main Active*.

The Model 209's multipurpose display is located on the front panel, directly below the headphone level control. The display consists of eight dual-color LEDs that can individually light green, red, or orange. This configuration setting selects when the multipurpose display will provide a real-time display of the output level of the Model 209's microphone preamplifier. When acting as a level meter, the five LEDs on the left will progressively light green to indicate a normal signal level. The next two LEDs, the sixth and seventh, will light orange to indicate that the signal level is greater than nominal. The eighth LED, on the far-right end, will light red when the microphone preamplifier's output level is approaching or has reached its

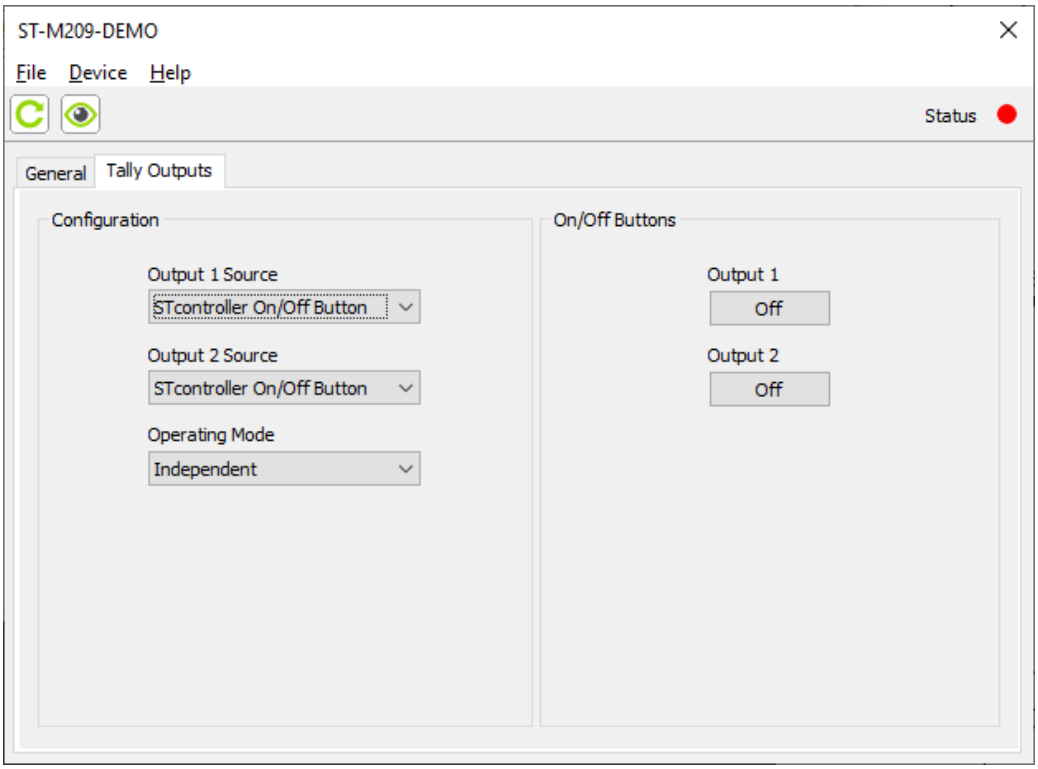
maximum. The action of the level meter can serve as a user-confidence indication or as a guide when adjusting the gain of the microphone preamplifier.

The selected configuration choice will depend on the needs of the unit's application. When selected for *Off,* the display will never show the level associated with the output of the microphone preamplifier. When selected for *Always On*, the display will indicate the level of the output of the microphone preamplifier, no matter the on or off state of the Dante main and talkback transmitter (output) channels. When selected for *On When Main Active*, the level meter will be active only when microphone audio is being sent to the Dante main transmitter (output) channel.

It's possible that the level display will only be enabled during setup and testing of an application. After performance confirmation, including adjusting the gain of the microphone preamplifier, users may request that the microphone level display function be turned off.

Tally Outputs Menu Page

The following configuration selections are available in the Tally Outputs menu selections tab.



Configuration – Output 1 Source

Choices are *STcontroller On/Off Button*, *Main Output Active*, *GPI 1*, *GPI 2*, *TOX – Headphone Ch1*, and *TOX – Headphone Ch2*.

The state (active or inactive) of Tally Output 1 can be controlled by the configuration selected from among the six available sources.

STcontroller On/Off Button: When this source is selected, the state of Tally Output 1 will be controlled by the virtual pushbutton switch that's present on STcontroller's Tally Output configuration page. Using a mouse to click the On/Off button icon will cause the state of Tally Output 1 to change. This function can be useful during installation and configuration of the Model 209 and related signals. It can also be used as a means for an STcontroller user to control the state of Tally Output 1.

Main Output Active: When this source is selected, the state of Tally Output 1 will be controlled by the state of the Dante main transmitter (output) channel; Tally Output 1 will be active when microphone audio is present on the Dante main transmitter (output) channel. This can be used as a locally controlled "on-air" indication.

GPI 1: When *GPI 1* is selected the state of Tally Output 1 will be controlled by the state of the remote control input that is named GPI 1. Tally Output 1 will be inactive when GPI 1 is not active. Tally Output 1 will be active when GPI 1 is in its enabled (low or input shorted) state. This configuration choice can be useful when an external signal, such as an on-air contact closure from an automation system or audio console, needs to control the on/off state of Tally Output 1. In this way, an LED, typically associated with a microphone boom arm, can be directly activated by a contact closure; no external interface would be required.

GPI 2: This choice is similar to GPI 1 except Tally Output 1 responds to the state of GPI 2. This is provided for control flexibility.

TOX – Headphone Ch1: This choice allows a high-frequency signal present on the Dante receiver (input) channel Headphone Ch1 to control the state of Tally Output 1. The acronym TOX has traditionally meant "Tone Operated Relay." In the case of the Model 209, it means that a high-frequency tone (typically 18 kHz or above) can be added "in-band" to the Dante receiver (input) channel and is used as a control signal. When a signal that meets the requirements for level and frequency is present on the Dante receiver (input) Headphone Ch1, then Tally Output 1

will become active. This is provided so that an audio channel can provide both talent cue audio information along with a "trigger" for Tally Output 1. (Refer to the specifications section for details on what constitutes a valid trigger.)

Having talent audio combined with a high-frequency tone is typically not a problem as the Model 209 includes a low-pass filter in the headphone output path that is active only when TOX is selected. This helps to prevent high-frequency signals from reaching a user's ears. However, using 20 kHz, or even 22 kHz, as the trigger will help minimize the chance that a user's ears will be impacted.

TOX – Headphone Ch2: This function has the same action as TOX – Headphone Ch1, but utilizes the Dante receiver (input) channel Headphone Ch2. This is provided for control flexibility.

Configuration – Output 2 Source: The six configuration choices that are available for controlling Tally Output 2 are the same as provided for Tally Output 1. Please refer to the previous paragraphs for details.

Note that this configuration section will be grayed out if the configuration for the Operating Mode has been selected for Differential – Active High or Differential – Active Low. This is because selecting one of the two differential modes will disable Tally Output 2 as a separate function and associate its output state with Tally Output 1.

Configuration – Operating Mode

Choices are *Independent*, *Differential – Active High*, and *Differential – Active Low*.

This configuration choice determines how the Model 209's two tally outputs function.

Independent: When *Independent* is selected, Tally Output 1 and Tally Output 2 are, as expected, completely independent. They are controlled by their selected configuration source, providing 0 volts DC when inactive and 12 volts DC when active.

Differential – Active High: When selected, Tally Output 1 and Tally Output 2 work together, creating a differential action. (Differential relating to the word difference and the two tally outputs always providing states opposite of each other.) When Tally 1 is not active, 0 volts DC is present on Tally Output 1; 12 volts DC is present on Tally Output 2. When Tally 1 is active, 12 volts DC is present on its output and 0 volts DC is present on Tally Output 2.

Differential – Active Low: When selected, Tally Output 1 and Tally Output 2 again work together, but in a manner opposite of Differential – Active High. When Tally 1 is not active 12 volts DC is present on Tally Output 1; 0 volts DC is present on Tally Output 2. When Tally 1 is active, 0 volts DC is present on its output and 12 volts DC is present on Tally Output 2. This choice is provided so that the function supported by the two tally outputs that are functioning differentially, typically a bidirectional LED array, can be operated in a reverse manner. (This configuration setting can eliminate the need for re-wiring connections should the LED array's colors need to operate in an opposite manner.)

Note that when either *Differential – Active High* or *Differential – Active Low* has been selected, the configuration source for Output 2 is no longer available. The function will be grayed out to indicate that only the source for output 1 is active. (It will control the output states of both Tally Output 1 and Tally Output 2.)

Tally Outputs – On/Off Buttons

On the Tally Outputs page there is a section called On/Off Buttons which provides two software-implemented (virtual) pushbutton switches. These allow manual control of the status of the two tally outputs when their respective output source configuration has been selected for STcontroller *On/Off Button*. If this configuration choice has not been selected, the button will be grayed out and not available for use.

On/Off Button – Output 1: This can be pressed, using a mouse or keyboard key, to change the status of Tally Output 1 from off-to-on or on-to-off. This can prove useful during installation and testing of the Model 209's tally outputs. It can also be used to manually control the status of Tally Output 1.

On/Off Button – Output 2: This can be pressed, using a mouse or keyboard key, to change the status of Tally Output 2 from off-to-on or on-to-off. It can find value during installation and testing of the Model 209's tally outputs. It can also be used to manually control the status of Tally Output 2. Note that this button will be grayed out if either of the differential operating modes has been selected. (The action of Tally Output 2 will, in this situation, depend on the action of Tally Output 1.)

Saving and Loading a Model 209 Configuration

For archiving, backup, or "cloning" purposes STcontroller allows a complete Model 209 configuration to be saved in the form of an XML file. This file can then be loaded into the same Model 209 unit as needed, or into another Model 209 unit if desired. Clicking on the **Device** menu tab will provide access to the Save Configuration and Load Configuration functions.

Operation

At this point, everything should be ready such that Model 209 operation can commence. The unit should have been attached to the designated surface or installed as part of an on-air set. An Ethernet connection with Power over Ethernet (PoE) capability should have been made to the RJ45 jack on the back panel. A microphone connection should have been made by way of the 3-conductor female XLR connector which is located on the back panel. Using the ¼-inch or 3.5 mm jacks on the front panel, a pair of headphones or a set of earbuds should have been connected. Alternatively, a broadcast-style headset may have been utilized. If desired, connections may have been made to the contact closure inputs and tally outputs using the 3.5 mm jacks located on the back panel.

The Model 209's Dante configuration settings should have been made using the Dante Controller software application. In this way, the unit's two Dante transmitter (output) channels and two Dante receiver (input) channels could be subscribed (routed) to the Dante channels on associated equipment. The Model 209's operating configuration should have been established using the STcontroller application. This will ensure that the unit will meet the needs of the specific application.

Initial Operation

The Model 209 will start to function as soon as a Power over Ethernet (PoE) power source is connected. However, it may take 20 to 30 seconds for full operation to commence. Upon initial power up, the green LED associated with the firmware update USB receptacle will light for a few seconds, then flash once, to indicate that the Model 209's processor has begun to function. The Ethernet status LEDs, labeled LINK and ACT and located on the back panel as part of the RJ45 jack, will then begin to light as the network connection is established.

A few seconds after power up, the front-panel LEDs will go through a power-up test sequence. This will include the LEDs associated with the phones level knob, the push-button switch, the P48 microphone power function, and the eight-LED multipurpose display. After a short interval the multipurpose display will slowly flash green approximately five times as the Dante connection is being established. (It will keep flashing until the Dante connection process has completed.) If there is an issue with the Ultimo integrated circuit that is used by the Model 209 to implement the Dante interface, the multipurpose display will slowly flash red. It will continue to flash red if the problem persists. (This should rarely, if ever, happen.) Once the Dante connection has been established, full Model 209 operation will begin and the unit's controls and associated LEDs will take on their normal actions.

Ethernet and P48 Status LEDs

As previously mentioned, there are two status LEDs located on the bottom of the RJ45 jack. The LINK LED will light orange when an Ethernet connection has been established. The ACT LED will flash green in response to Ethernet data packet activity.

An LED indicator is located on the right side of the front panel. It is labeled P48 and will light green when the Model 209's P48 power source is active and providing phantom power to the microphone input.

Multipurpose Display

The multipurpose display is located on the front panel and each of its eight LEDs can light green, red, or orange. (Orange is created when both the green and red LEDs are simultaneously lit.) The multipurpose display is used to provide an indication of various Model 209 operating conditions. Its action when the identification function is active has previously been described. (The eight LEDs will flash red three times.) When a configuration change has been made using STcontroller (or via a UDP command received via Ethernet), the display will light orange once in a unique pattern.

The multipurpose display can be used to indicate the level of the headphone output. When the headphone level knob is turned, LEDs in the display will light green to indicate the current headphone output level. The headphone output level display can also be enabled by momentarily pressing (tapping) the phone level control. The display will first momentarily light red to indicate the sidetone level and then the LEDs will light green for about two seconds to indicate the headphone output level. The more LEDs that are lit the greater the headphone output level.

When the headphone level knob is pressed and held, the multipurpose display will indicate the level of the sidetone function. The five LEDs on the left side of the display will light red to indicate the sidetone level. (Sidetone can be configured from among five level steps and off.) Whenever the sidetone output is off (no sidetone), the LED located on the left side of the display will flash red. As was previously described, when the headphone level knob is released, the display will momentarily light green to indicate the headphone output level.

If the Model 209 is configured to show the microphone level, the display will serve as a VU-type indicator. It can be configured to be always active, or only when the microphone signal is actively being sent to the Dante main transmitter (output) channel. The display will indicate the level of the microphone preamplifier's output; the five LEDs on the left will light green, the next two LEDs will

light orange, and the LED on the far right will light red. The green LEDs will light when the level is in its normal range. The two LEDs lighting orange will indicate that the signal level is greater than normal and is something that a user should be aware of. The red LED lighting will indicate that the signal level is approaching, or has reached, its maximum. During normal operation the red LED should never light. If it does, it typically will indicate that the gain of the microphone preamplifier should be reduced. (This is performed using the STcontroller application.)

How to Identify a Specific Model 209

Functions within the Dante Controller and STcontroller software applications allow a specific Model 209 unit to be identified. Each application provides an "eyeball" icon that when selected (clicked) will activate a unit's *Identify* function. Technically, when *Identify* is selected, it will send a command to the designated Model 209 unit. On that unit the front panel's multipurpose display will flash red in a distinctive pattern three times. (Of course, the *Identify* command will not change the status of the pushbutton switch or the phones level setting.) After the identify LED pattern has completed, normal Model 209 operation will resume.

Talkback Button

The talkback button, located on the front panel, determines the status of the microphone audio as it is sent to the Dante main transmitter (output) channel and the Dante talkback transmitter (output) channel. LED indicators within the button display the status of the talkback function. The manner in which the talkback pushbutton impacts the Model 209's operation depends on how Talkback Button – Operation function has been configured in STcontroller. The specific action that occurs will depend on its configuration as selected from the five available choices.

When the Talkback Button – Operation has been configured for *Momentary – Mutes Main Out,* its functionality is pretty self-explanatory. When the talkback button is not pressed, the button will light green and audio from the microphone preamplifier will be sent out only on the Dante main transmitter (output) channel. Pressing and holding the talkback button will activate the talkback function. When talkback is active, the talkback button will light orange, the Dante main transmitter (output) channel will mute, and microphone audio will be sent out the Dante talkback transmitter (output) channel.

If the talkback button has been configured for the *Latching – Mutes Main Out* mode, it will operate a bit differently. Momentarily pressing (tapping) the talkback button will cause the talkback function to change states: inactive-to-active or active-to-inactive. Whenever the talkback function is inactive, the button will light green and microphone audio will be sent only to the Dante main transmitter (output) channel. The button will light orange when the talkback function is active, the Dante main transmitter (output) channel will be muted, and microphone audio will be sent out the Dante talkback transmitter (output) channel. Upon power being initially applied to the unit, the talkback function will be in its disabled state.

When the Talkback Button – Operation selection has been configured for *Momentary – Doesn't Mute Main Out,* microphone audio will always be present on the Dante main transmitter (output) channel. When the talkback button is not pressed, its LED will be lit green and audio won't be sent out the Dante talkback transmitter (output) channel. Pressing and holding the button will activate the talkback function. When talkback is active, the button will alternate between lighting green and lighting orange. This indicates that microphone audio is being sent out both the Dante main transmitter (output) channel and the Dante talkback transmitter (output) channel.

If the talkback button has been configured for *Latching – Doesn't Mute Main Out,* microphone audio will always be present on the Dante main transmitter (output) channel. Momentarily pressing (tapping) the talkback button will cause the talkback function to change states: inactive-to-active or active-to-inactive. Whenever the talkback function is inactive, the button will light green to indicate that audio is present on the Dante main transmitter (output) channel. When the talkback function is active, the button will alternate between lighting green and lighting orange. This indicates that both audio output channels are enabled; microphone audio will be present on both the Dante main transmitter (output) channel and the Dante talkback transmitter (output) channel. Upon power being initially applied to the unit, the talkback function will be in its inactive state.

When the talkback button function has been configured for *Disabled,* no talkback action will take place. Microphone audio will always be sent out the Dante main transmitter (output) channel. If the pushbutton is pressed, it will flash red to indicate that it is disabled. Audio will continue to be routed only to the Dante main transmitter (output) channel. No audio will be routed to the Dante talkback transmitter (output) channel.

Headphone Output

The 2-channel (stereo) headphone output is accessible on the front panel by way of ¼-inch and 3.5 mm 3-conductor jacks. The jacks are connected in parallel ("multed") and have the left audio channel on their tip leads, the right audio channel on their ring leads, and common on their sleeve leads. Users should find the headphone output audio

quality to be excellent, with a high maximum output level and low distortion. A rotary control (actually a mechanical encoder with 24 steps per full rotation) is located on the front panel and is used to adjust the level of the headphone output as well as performing other functions. Analog audio signals do not pass directly through the rotary control. A position change of the control is recognized by the Model 209's processor which then adjusts the actual signal levels within the digital domain.

The multipurpose display will indicate the level of the headphone output. When the rotary control is adjusted such that the headphone output is at its maximum level, all the multipurpose LEDs will light green with the one on the far right flashing green. When the headphone level control is adjusted such that the headphone output is at its minimum, the left-most LED on the multipurpose display will flash green. (Details about the multipurpose display were covered previously in this guide.)

An STcontroller configuration setting determines the headphone output minimum level. When configured for *Full Mute,* the headphone output can be adjusted to have no output. An alternate configuration setting causes the headphone output level to be attenuated (reduced in level) by a maximum of 40 dB. This helps to ensure that audio will always be present on the headphone output, a condition useful in broadcast applications where important audio cues must always be heard. If a user complains that the headphone output has audio crosstalk or leakage then most likely the –40 configuration has been selected. Providing an explanation to that user might resolve a complaint. If that is not sufficient, selecting the *Full Mute* configuration may be appropriate. Alternatively, a user who tends to turn off their headphone output and then misses audio cues may need to have their headphone output minimum level configuration changed to –40 dB.

What signals are present on the headphone output depends on a configuration setting as made using the STcontroller application. In the *Dual-Channel Stereo* mode, the two Dante receiver (input) channels are sent, respectively, to the left and right channels of the headphone output jacks. Sidetone audio, if enabled, will be sent to both the left and right headphone channels.

In the *Dual-Channel Mono* mode, the two Dante receiver (input) channels are summed (mixed together) and sent to both the left and right headphone output jacks. Again, sidetone audio will be sent to both the left and right headphone channels. (Details about sidetone are covered in a subsequent section of this guide.)

In the *Single-Channel Mono* mode, the two Dante receiver (input) channels are summed and sent only to the left channel of the jacks. Sidetone audio will be sent only to the left headphone channel. The right headphone output channel will not have any signal sent to it and is effectively disabled.

Input Signal Level Display

The end of the knob associated with the headphone level rotary control is translucent and can display the general level of the two Dante receiver (input) channels. The sum (combination) of the two input channels is used as the "trigger" signal to control the input level display. A configuration setting in the STcontroller application determines whether or not the input level display function will be active. If enabled, the end of the headphone level knob will light green when the sum of the Dante receiver (input) channels is in the normal range. It will light yellow as a warning indication that the level is above normal. It will light red if the sum of the input channels is near to, or has reached, the maximum allowable signal level. Lighting red is not a desirable condition and should encourage the user to reduce the level of the input signal sources that are subscribed (routed) to the Dante receiver (input) channels.

Sidetone

The Model 209's sidetone function is used to send post-preamplifier microphone audio to the headphone output as a user confirmation signal. When sidetone audio will be actively sent to the headphone output will depend on the configuration of the Headphone Output – Sidetone mode in the STcontroller application. Three configuration choices are provided. The Sidetone mode can be configured such that sidetone audio will be active when the Dante main transmitter (output) channel is active, is active when the Dante talkback transmitter (output) channel is active, or is active at all times.

Whether sidetone audio will be sent to both the left and right headphone output channels or only to the left headphone output channel depends on the configuration of the Headphone Output – Routing configuration in STcontroller. As expected, when configured for *Dual-Channel Stereo* or *Dual-Channel Mono,* sidetone audio will be sent to both the left and right headphone output channels. When configured for *Single-Channel Mono,* sidetone audio will be sent only to the left headphone output channel.

The sidetone level is configurable from among five values as well as being set for inactive (off). Two configuration settings in STcontroller determine the default sidetone level value and whether the user can adjust the sidetone level. The Headphone Output – Sidetone Level parameter in STcontroller determines the default sidetone level. Five level values are provided for when the sidetone function is

active. In addition, the choice of *Off* configures the sidetone function to be inactive. The user's ability to adjust the sidetone level depends on the configuration of Headphone Output – Local Sidetone Level Adjustment parameter. If configured for *No,* the sidetone level will be determined only by the Headphone Output – Sidetone Level configuration in STcontroller. If configured for *Yes,* simultaneously pressing and turning the headphone level knob will allow the sidetone level to be adjusted from among five choices and off. The multipurpose display will indicate the level of the sidetone function. Details about this were previously discussed.

Remote Control Input

To support special applications, the Model 209 allows an external contact closure to be connected. If utilized, this contact closure will mimic (duplicate) the action of the unit's talkback button. When this external contact is enabled (closes or shorts), the talkback button will change its state, the same as if it was manually pressed by the user. (Both the action of the talkback function and the color of the talkback button will change in the same manner.)

Tally Outputs

The Model 209 has two low-voltage DC outputs which can be useful in a variety of special applications. As an example, these outputs can be utilized in an installation to cause one or two external indicators to change state in response to Model 209 operating conditions. In the broadcast world these could be considered as tally indicators for functions such as on-air lights, recording active, etc. Whether or not the tally outputs are utilized will be dependent on the needs of the specific application.

Technical Notes

IP Address Assignment

By default, the Model 209's Ethernet interface will attempt to automatically obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected an IP address will automatically be assigned using the link-local protocol. This protocol is known in the Microsoft® world as Automatic Private IP Addressing (AutoIP or APIPA). Link-local will randomly assign a unique IP address in the IPv4 range of 169.254.0.1 to 169.254.255.254. In this way, multiple Dante-enabled devices can be connected together and automatically function, whether or not a DHCP server is active on the LAN. Even two Dante-enabled devices that are directly interconnected using an RJ45 patch cord will, in most cases, correctly acquire IP addresses and be able to communicate with each other.

An exception does arise when trying to directly interconnect two Dante-enabled devices that use Ultimo integrated circuits to implement Dante. The Model 209 uses the Ultimo chip and, as such, a direct one-to-one interconnection between it and another Ultimo-based product would not be supported. An Ethernet switch linking these units would be required to successfully interconnect the two Ultimo-based devices. The technical reason that a switch is required relates to the need for a slight latency (delay) in the data flow; an Ethernet switch will provide this. This wouldn't typically prove to be an issue as the Model 209 uses Power over Ethernet (PoE) to provide its operating power. As such, in most cases, a PoE-enabled Ethernet switch would be utilized to support Model 209 units.

Using the Dante Controller software application, the Model 209's IP address and related network parameters can be set for a manual (fixed or static) configuration. While this is a more involved process than simply letting DHCP or link-local do their thing, if fixed addressing is necessary then this capability is available. In this case, it's highly recommended that every unit be physically marked, e.g., directly using a permanent marker or console tape, with its specific static IP address. If knowledge of a Model 209's IP address has been misplaced, there is no reset button or other method to easily restore the unit to a default IP setting.

In the unfortunate event that a device's IP address is lost, the Address Resolution Protocol (ARP) networking command can be used to probe devices on a network for this information. For example, in Windows OS the **arp -a** command can be used to display a list of LAN information that includes MAC addresses and corresponding IP addresses. The simplest means of identifying an unknown IP address is to create a mini LAN with a small PoE-enabled Ethernet switch connecting a personal computer to the Model 209. Then by using the appropriate ARP command the required clues can be obtained.

Optimizing Network Performance

For best Dante audio-over-Ethernet performance a network that supports VoIP QoS capability is recommended. In applications that utilize multicast Ethernet traffic enabling IGMP snooping can be valuable. These protocols can be implemented on virtually all contemporary managed Ethernet switches. There are even specialized switches that are optimized for entertainment-associated applications. Refer to the Audinate website (audinate.com) for details on optimizing networks for Dante applications.

Application Firmware Version Display

A selection in the STcontroller software application allows the Model 209's application firmware version to be

identified. This can be useful when working with factory personnel on application support and troubleshooting. To identify the firmware version, begin by connecting the Model 209 unit to the network (via Ethernet with PoE) and wait until the unit starts to function. After starting STcontroller, review the list of identified devices and select the specific Model 209 for which you want to determine its application firmware version. Then select **Version and Information** under the **Device** tab. A page will display that will provide a lot of useful information. This includes the application firmware version as well as details on the Dante interface firmware.

Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that is utilized by the Model 209's processor (microcontroller or MCU) integrated circuit will be released to add features or correct issues. Refer to the Studio Technologies website for the latest application firmware file. The unit has the ability to load a revised file into its MCU's non-volatile memory by way of a USB interface. The Model 209 implements a USB host function that directly supports connection of a USB flash drive. The Model 209's MCU updates its application firmware using a file named **M209v*XrXX*.stm**, where *XrXX* is the actual version number.

The update process begins by preparing a USB flash drive. The flash drive doesn't have to be empty (blank), but must be in the personal-computer-standard FAT32 format. The processor in the Model 209 is compatible with both USB 2.0, USB 3.0, and USB 3.1-compliant Flash drives. Save the new firmware file in the root directory with a name of **M209v*XrXX*.stm**. Studio Technologies will supply the application firmware file inside a .zip archive file. While the firmware file inside the zip file will adhere to the naming convention required by the Model 209, the name of the zip file itself will include the file's version number. For example, a file named **M209v1r05MCU.zip** would indicate that version 1.05 of the application firmware (**M209v1r05.stm**) is contained within this zip file along with a readme (.txt) text file.

Once the USB flash drive is inserted into the USB interface, located on the back panel of the Model 209, the unit must be powered off and again powered on. At this point, the file will automatically load. The precise steps required will be highlighted in the next paragraphs.

To install the application firmware file, follow these steps:

1. Disconnect power from the Model 209. This will entail removing the Ethernet connection that is made to the RJ45 jack.
2. Locate the USB connector on the back of the unit. Insert the prepared USB flash drive into it.
3. Apply power to the Model 209 by connecting an Ethernet signal that has Power over Ethernet (PoE) present to the RJ45 jack.
4. After a few seconds, the Model 209 will run a bootloader program that will automatically load the new application firmware file (**M209v*XrXX*.stm**). This loading process will take only a few seconds. During this time period, the green LED that's located adjacent to the USB receptacle will flash slowly. Once the entire loading process is over, taking approximately 10 seconds, the Model 209 will restart using the newly loaded application firmware.
5. At this time, the Model 209 is functioning with the newly loaded application firmware and the USB flash drive can be removed. To be conservative, remove the PoE Ethernet connection first, then remove the USB flash drive. Re-connect the Ethernet signal to restart the unit.
6. Using STcontroller, confirm that the desired application firmware version has been correctly loaded.

Note that upon power being applied to the Model 209, if a connected USB flash drive doesn't have the correct file (**M209v*XrXX*.stm**) in its root folder no harm will occur. Upon power up, the adjacent green LED will flash on and off rapidly for a few seconds to indicate this condition and then normal operation using the unit's existing application firmware will begin.

Ultimo Firmware Update

As previously discussed, the Model 209 implements its Dante connectivity using the Ultimo integrated circuit from Audinate. The Dante Controller software application can be used to determine the version of the firmware (embedded software) that resides in this integrated circuit. The firmware (embedded software) residing in Ultimo can be updated using the Model 209's Ethernet port. Performing the update process is easily accomplished using an automated method called Dante Updater, included as part of the Dante Controller application. This application is available, free of charge, from the Audinate website (getdante.com).The latest Model 209 firmware file, with a name in the form of **M209v*X*r*X*r*X*.dnt** (where *X*r*X*r*X* is the actual version number)is available on the Studio Technologies website as well as being part of Audinate's product library database. The latter allows the Dante Updater software application that is included with Dante Controller to automatically query and, if required, update the Model 209's Dante interface.

Restoring Factory Defaults

A command in the STcontroller software application allows the Model 209's defaults to be reset to the factory values. From STcontroller, select the Model 209 for which you want to restore its defaults. Select the **Device** tab and then the **Factory Defaults** selection. Then click on the **OK** box. Refer to Appendix A for a list of the Model 209's factory defaults.

Specifications

Power Source:

Power over Ethernet (PoE): class 2 (low power, ≤6.49 watts) per IEEE® 802.3af

Network Audio Technology:

Type: Dante audio-over-Ethernet

AES67-2018 Support: yes, selectable on/off

Dante Domain Manager (DDM) Support: yes

Bit Depth: up to 32

Encoding Choices: PCM 16, PCM 24, or PCM 32

Sample Rate: 48 or 96 kHz

Pull-Up/Down Support: No

Dante Transmitter (Output) Channels: 2

Dante Receiver (Input) Channels: 2

Dante Audio Flows: 4; 2 transmitter, 2 receiver

Internal Digital Audio Processing: 32-bit, fixed

Transmitter (Output) and Receiver (Input) Nominal Level: –20 dBFS

Network Interface:

Type: 100BASE-TX, Fast Ethernet per IEEE 802.3u (10BASE-T and 1000BASE-T (GbE) not supported.)

Power over Ethernet (PoE): Per IEEE 802.3af

Data Rate: 100 Mb/s (10 Mb/s and 1000 Mb/s not supported)

Analog Microphone Input:

Compatibility: dynamic or phantom-powered microphones

Type: balanced, capacitive coupled

Impedance: 3.6 k (3600) ohms, nominal

CMRR: 63 dB @ 20 Hz, 86 dB @ 1 kHz, 81 dB @ 20 kHz, 40 dB of gain

Gain: 20 to 65 dB in 1-dB steps

Frequency Response: 20 Hz to 22 kHz, +0/–1 dB

Distortion (THD+N): <0.0004 %, 1 kHz, –4 dBFS output, 20 dB gain, 22 kHz BW

Dynamic Range: 120 dB, ref 0 dBFS output, 20 dB gain, A-weighted

Phantom Power: P48 per IEC 61938 standard, on/off selectable with status LED

Headphone Output:

Type: dual-channel (stereo)

Compatibility: intended for connection to stereo (dual-channel) or monaural (single-channel) headphones, headsets, or earpieces with nominal impedance of 50 ohms or greater

Maximum Output Voltage: 3.5 Vrms, 1 kHz, with load of 150 ohms

Frequency Response (TOX Filter Disabled): 20 Hz to 20 kHz, +0/–1 dB

Frequency Response (TOX Filter Enabled): 20 Hz to 10 kHz, –3 dB at 10 kHz

Distortion (THD+N): <0.002 %

Dynamic Range: >102 dB

Remote Control Inputs: 2

Functions: configurable

Type: active low, 1 mA maximum, input pulled up to 3.3 volts DC by way of 3.4 k (3400) ohm resistor

Tally Outputs: 2

Functions: independently configurable, can follow STcontroller On/Off buttons, Dante main transmitter (output) status, remote control input status, or TOX (Tone Operated Relay) status

Type: active high, active low, differential – active high, differential – active low, configurable

High Output: 100 mA maximum at 12 volts DC

Low Output: 100 mA sink

TOX (Tone Operated Relay) Tally Activation:

Method: in-band audio tone

Source: Dante receiver (input) Headphone Ch1 or Dante receiver (input) Headphone Ch2, selectable

Tone Characteristics: 18 to 23 kHz, nominal

Minimum Level: –25 dBFS, nominal

Detect Time: 10 milliseconds, minimum

Connectors:

Ethernet: RJ45 jack

Microphone Input: 3-pin female XLR

Headphone Output: 3-conductor (TRS) ¼-inch jack and 3-conductor (TRS) 3.5 mm jack

Remote Control Inputs: 3-conductor (TRS) 3.5 mm jack

Tally Outputs: 3-conductor (TRS) 3.5 mm jack

USB: Type-A receptacle (used only for updating firmware)

Configuration: Studio Technologies STcontroller personal computer application

Software Updating: USB flash drive used for updating main firmware files; Dante Controller's Dante Updater application used for updating Dante interface firmware

Environmental:

Operating Temperature: 0 to 50 degrees C (32 to 122 degrees F)

Storage Temperature: –40 to 70 degrees C (–40 to 158 degrees F)

Humidity: 5 to 95%, non-condensing

Altitude: not characterized

Ethernet Control:

UDP commands allow support of remote control and status indication functions (refer to the STcontroller API UDP Examples document, available on the Studio Technologies website)

Dimensions (Overall):

4.7 inches (12.0 cm) wide (maximum)
1.4 inches (3.6 cm) high
5.8 inches (14.7 cm) deep
6.0 inches (15.2 cm) deep (overall with knob)

Installation: intended for under-surface mounting in tabletop or similar applications

Weight: 0.55 pounds (0.26 kg)

Specifications and information contained in this User Guide subject to change without notice.

Appendix A – STcontroller Default Configuration Values

General

Microphone Input – P48 Phantom: Off

Microphone Input – Gain: 50 dB

Headphone Output – Routing: Dual-Channel Stereo

Headphone Output – Minimum Level: –40 dB

Headphone Output – Sidetone Mode: Always Active

Headphone Output – Sidetone Level: Off

Headphone Output – Local Sidetone Level Adjustment: Yes

Talkback Button – Operation: Momentary – Mutes Main Out

Talkback Button – Remote Control: None

System – Signal Present Display: On

System – Mic Level Display: Always On

Tally Outputs

Configuration – Output 1 Source: STcontroller On/Off Button

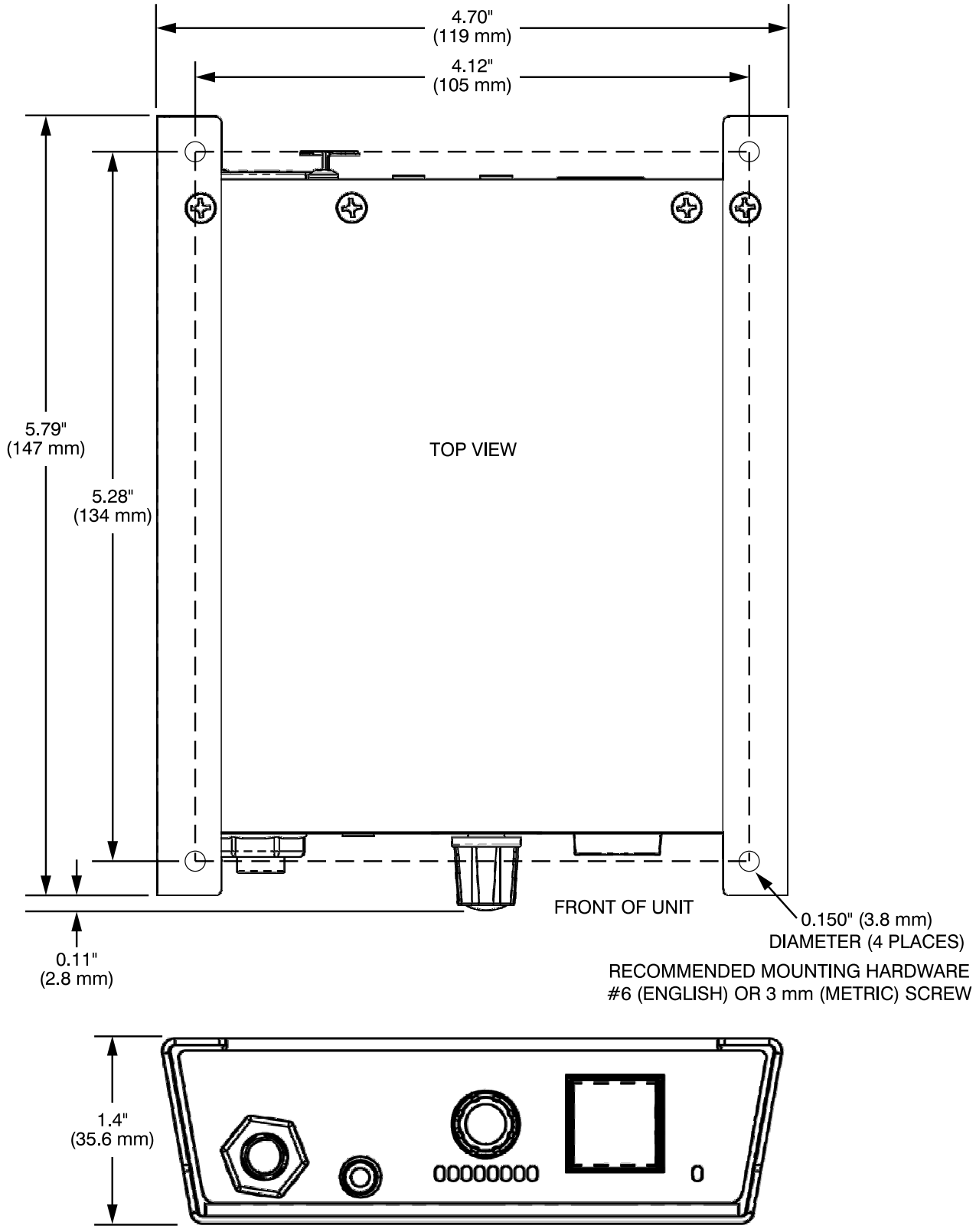
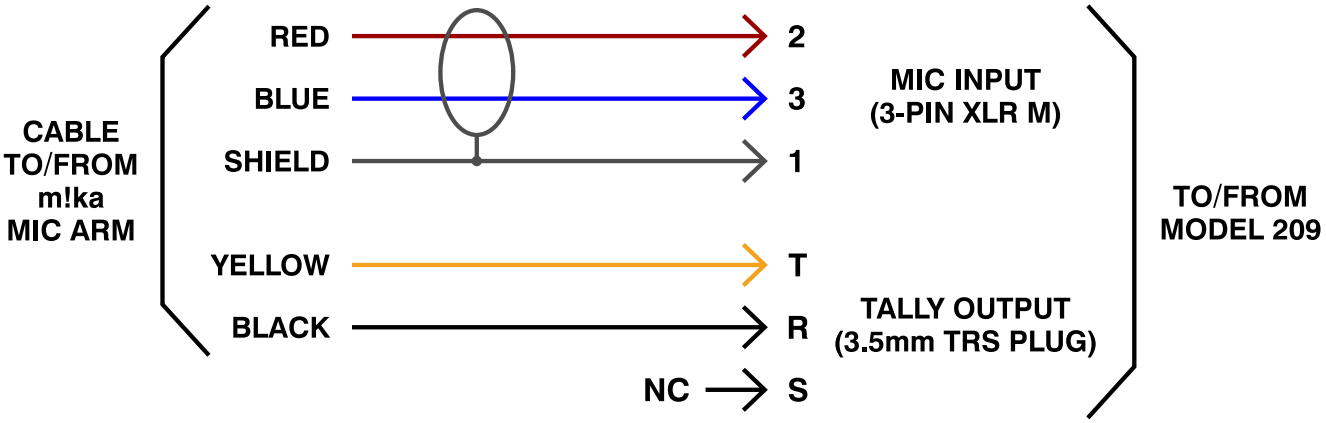
Configuration – Output 2 Source: STcontroller On/Off Button

Configuration – Operating Mode: Independent

On/Off Buttons – Output 1: Off

On/Off Buttons – Output 2: Off

Appendix B – Model 209 Dimensions



Appendix C – Connecting the Model 209 with the Yellowtec m!ka Mic Arm On Air