

# **Model 354 Talk Station**

## **User Guide**

Issue 3, August 2022

This User Guide is applicable for serial numbers M354-00151 and later with Application Firmware version 2.00 and later and STcontroller software application version 3.08.10 and later

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## Revision History

### **Issue 3, August 2022:**

- Synchronizes user guide revision with application firmware version.

### **Issue 2, May 2022:**

- Documents new Call Receive Action function.
- Miscellaneous corrections and clarifications.

### **Issue 1, December 2021:**

- Initial release.

## Introduction

The Model 354 Talk Station is a unique product intended to support a variety of voice paging, background music, audio-file playback, broadcast talent cueing (IFB), and general audio applications. The unit supplies four independent “talk” channels that can be individually configured to match the needs of an application. A simple monitor section allows one of the four Dante® receiver (input) channels to be routed as desired to a connected amplifier or amplified speaker.

The Model 354 supports Dante audio-over-Ethernet digital media technology with AES67 compatibility for integration into contemporary applications. In addition, the unit is compatible with the Dante Domain Manager™ (DDM) software application.

Voice audio is supplied by way of a gooseneck microphone, purchased separately, which is attached to the connector/threaded bushing combination that is located on the front of the Model 354. (Using the Studio Technologies’ GME-3-12 Gooseneck Microphone is highly recommended.) Two audio sources or “messages,” up to 40 seconds each in length, are stored in non-volatile memory within the Model 354. These two audio sources, saved in the common 16-bit monoaural WAV format, can be easily updated by way of a standard USB flash drive. The audio files can contain whatever “pre-page” (preamble) audio signals that are desired to support an application. They could be the sound of natural bells or chimes, an “electronically created” audio sequence, or a voice message. By using WAV files, the desired sources can be created outside of the Model 354 and then easily loaded for use. Configuration choices determine how and when the preamble audio files will be played.

The Model 354 is extremely simple to deploy, is “pro” quality throughout, and provides an intuitive user experience. The Model 354’s audio quality is excellent, with low distortion, low noise, and ample headroom. Careful circuit design and rugged components ensure long, reliable operation. Only a Power-over-Ethernet (PoE) connection and attachment of a gooseneck microphone are required for operation. If desired, the analog monitor output can be connected to the input of an associated device. Two “custom” WAV audio files can be loaded by way of a USB flash drive.

Model 354 operating features are configured using the STcontroller software application. An extensive set of



**Figure 1. Model 354 Talk Station front and back views**

parameters allows the unit’s functions to be tailored to meet the needs of many, many applications. STcontroller is a fast and simple means of confirming and revising the unit’s operating parameters. The Model 354 is housed in a compact, rugged steel enclosure that’s intended for table-top use. Its small size makes it ideal for applications in space-constrained locations.

## Applications

For theater or live-event spaces the Model 354 can be a complete solution for providing up to four channels of background audio with voice paging and preamble audio capability. Pre-recorded “tones” or “chimes” can be configured to play prior to voice audio be presented to one or more of the outputs. The unit could be located in a box office or manager’s office location.

A Model 354 function allows high-frequency “call” audio signals present in a Dante receiver (input) channel to be detected and displayed in the LED indicators

## Model 354 TALK STATION



**Figure 2. Model 354 Talk Station shown with optional GME-3-12 Gooseneck Microphone**

associated with a pushbutton switch. This allows users to observe the on or off status of call signals that may be associated with intercom audio channels. In addition, this function can be used to display when a channel is active. This allows multiple Model 354 units to be deployed in a single application, with each unit displaying the talk status of all the others. A configuration option allows an associated pushbutton switch to be disabled whenever talk activity is taking place in other units. This feature will help prevent multiple users from simultaneously activating a talk function.

Broadcast applications can utilize the Model 354 to create a simple 4-channel talent cue (IFB) master station. “Program” audio sources can be routed to the unit’s Dante receiver (input) channels and then interrupted with gooseneck microphone audio as desired.

Deployment of Dante applications could benefit from the unit’s ability to store and playback WAV audio files. Test messages could be created in WAV format and then loaded into the Model 354 for continuous playback during system commissioning.

Security or management personnel could use the Model 354 as a combination voice paging console and monitor resource. Audio from the gooseneck microphone could be immediately routed to up to four Dante transmitter (output) channels. The monitor section allows a Dante source to be monitored using a connected amplifier or amplified speaker.

The range of resources provided by the Model 354 also makes it suitable for use in many other applications. It’s designed to support the needs of varied applications across a wide range of audio system designs. The unit is intended to provide a “palette” of resources that meet real-world needs, allowing great things to be accomplished rather than presenting limitations that dictate what can and can’t be done.

### Setup and Operation

Set up, configuration, and operation of the Model 354 is simple. An RJ45 jack is used to interconnect with a standard twisted-pair Ethernet port associated with a PoE-enabled network switch. This connection provides both power and bidirectional digital audio. A gooseneck microphone is attached using the ¼-inch plug with integrated threaded bushing. The Studio Technologies’ GME-3-12 Gooseneck Microphone is available as an option and will perform very well with the Model 354. A 3-pin male XLR connector provides access to the analog monitor output. This would typically be connected to the input on an amplified loudspeaker. The STcontroller software application is used to configure the wide range of Model 354 operating parameters. This allows the unit’s performance to be optimized to meet the needs of specific applications.

One or two new preamble audio files can be created and loaded into the Model 354. They utilize the common WAV file format supported by many personal computer applications.

The user is presented with four pushbutton switches and a push-in/push-out rotary level potentiometer. The pushbutton switches are lighted with dual-color LEDs to clearly present the unit’s operating status. The monitor output (available in both analog and Dante digital formats) can assist the user in confirming the current audio operation.

### Ethernet Data and PoE

The Model 354 connects to a local area network (LAN) by way of a 100 Mb/s twisted-pair Ethernet interface. The unit’s physical 100BASE-TX interconnection is made by way of a Neutrik® etherCON® RJ45 jack. While compatible with standard RJ45 plugs, etherCON allows a ruggedized and locking interconnection for harsh or high-reliability environments. The Model 354’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 the associated data network. To support PoE power management, the Model 354's PoE interface enumerates (reports) to the power sourcing equipment (PSE) that it's a class 1 (very low power) device.

## **Dante Audio-over-Ethernet**

Audio data is sent to and received from the Model 354 using the Dante audio-over-Ethernet media networking technology. As a Dante-compliant device, the Model 354's four Dante transmitter (output) channels and four Dante receiver (input) channels can be assigned (routed or "subscribed") to other devices using the Dante Controller software application. The Dante transmitter (output) and receiver (input) channels are limited to supporting four Dante flows, two in each direction. The digital audio's bit depth is up to 32 with a sampling rate of 48 kHz. Two bi-color LEDs provide an indication of the Dante connection status. An additional LED displays the status of the associated Ethernet connection.

The Model 354 is compatible with the AES67 interoperability standard. When configured in Dante Controller to support AES67, the unit's two transmitter (output) channels will function in multicast; unicast is not supported. In addition, the Model 354 is compatible with the Dante Domain Manager™ (DDM) software application.

## **Audio Quality**

The Model 354 provides excellent audio performance. A low-noise, wide dynamic-range microphone preamplifier and associated voltage-controlled-amplifier (VCA) dynamics controller (compressor) ensures that gooseneck microphone audio quality is preserved while minimizing the chance of signal overload. The output of the microphone preamp and compressor is routed to an analog-to-digital conversion (ADC) section that supports a sampling rate of 48 kHz with a bit depth of up to 32.

As previously discussed, the Model 354 can store and replay two audio files. These uncompressed PCM audio signals utilize the high-quality 16-bit, monaural, WAV format.

Audio sources can arrive in the Model 354 by way of four Dante receiver (input) channels. The supported sampling rate is 48 kHz with a bit depth of up to 32.

These signals pass into the Model 354's 32-bit microcontroller integrated circuit and can be used as part of background music or talent cue channels. They can also be used in conjunction with the analog and Dante monitor output functions. The source selected for the analog monitor output is sent to a high-performance digital-to-analog (DAC) integrated-circuit converter and then on to robust balanced (differential) output circuitry. The analog monitor output is protected from connection with low-voltage DC, ESD ("static"), and other potentially damaging transients.

The audio content of the Dante transmitter (output) channels will consist of, depending on the unit's configuration and operating state, a combination of gooseneck microphone, WAV audio file, and audio input sources. The signals remain in the digital domain and route through the 32-bit logic circuitry and on to the Dante interface section where it is packetized and prepared for transport over Ethernet.

## **Configuration Flexibility**

The Model 354 can easily be configured to meet the needs of many specific applications and user preferences. All configuration choices are performed using the STcontroller software application. Versions of STcontroller are available to support the WinOS® and macOS® operating systems. Selectable configurable parameters include microphone preamplifier gain, WAV file level trim, LED indicator intensity and actions, and monitor output source selection and operation. In addition, each of the four output functions can be optimized from the six available configuration choices. These choices allow the unit to be configured to support voice page, talent cueing (IFB), and other specialized applications.

As previously described, the functions associated with the four pushbutton switches and output channels can be individually configured. As an example, for a voice page application three of the output channels might be configured to utilize a background music source and play, before the microphone is active, a pre-page message. The fourth output channel might be used as a voice-page output with no background music of pre-page audio. The four pushbutton switches would typically be configured to provide a momentary (push to activate) function.

Red and green LEDs are associated with the unit's four pushbutton switches. When lit singly they will provide a red or green indication. When both are lit simultaneously, they will provide an orange indication. A configuration choice allows selection of how the LEDs will light under various operating conditions. This capability is provided to assist users who have trouble observing the differences between colors, typically issues differentiating between red and green. The "color blindness" condition is not uncommon in men and can make effective use of some electronic equipment difficult. The Model 354's ability to control the pushbutton switches' colors can also be useful for supporting international applications where compliance to specific regulatory requirements is required. This may dictate which LED color is associated with a function being "on" and which color is associated with a function being "off."

The four Dante receiver (input) audio sources and the way in which they are assigned to the monitor outputs can be configured from among five choices. These unique choices allow a number of audio monitoring situations to be implemented. Whether for use in voice paging, talent cueing (IFB), or other audio applications, the Model 354 should be able to achieve the desired configuration. Several special functions allow the WAV files and gooseneck microphone audio to be routed to the monitor outputs. Configurable using STcontroller, these functions can allow a user to hear confirmation audio related to the unit's real-time operation.

## **Future Capabilities and Firmware Updating**

The Model 354 was designed so that its capabilities and performance can be enhanced in the future. The unit implements a USB host function which allows the application firmware (embedded software) to be updated using a standard USB flash drive. And, as previously discussed, the USB receptacle is also used to load WAV audio files that can be stored on the same USB flash drive. The Model 354 uses the Audinate UltimoX4™ integrated circuit to implement its Dante interface. The firmware in this integrated circuit can be updated via the Ethernet connection, helping to ensure that the unit's capabilities remain up to date.

## **Getting Started**

### **What's Included**

Included in the shipping carton is a Model 354 Talk Station unit along with instructions on how to obtain an electronic copy of this guide. As the Model 354 is Power-over-Ethernet (PoE) powered, no external power source is provided. In almost all cases, a microphone, supplied separately, will be connected to the Model 354. Studio Technologies recommends using its GME-3-12 Gooseneck Microphone which will provide excellent performance. The GME-3-12 is purchased separately and will be shipped in a separate carton.

### **Connections**

In this section signal interconnections will be made using the connectors located on the back and front of the Model 354's enclosure. One Ethernet connection will be made using either a standard RJ45 patch cable or an etherCON protected RJ45 plug. The unit's Ethernet interface requires connection of a signal that supports Power-over-Ethernet (PoE). In most cases, an electret-powered gooseneck microphone that has an integrated 1/4-inch plug will be connected to the jack assembly located on the front of the Model 354's enclosure. For known excellent performance, it's recommended that a Studio Technologies' GME-3-12 Gooseneck Microphone be utilized. The analog monitor output, located on the back of the Model 354's enclosure, is accessible by way of a 3-pin male XLR connector. Some applications may take advantage of this resource, typically for supporting a local monitor loudspeaker.

### **Ethernet Connection**

A 100BASE-TX Ethernet (100 Mb/s) connection that also supports Power-over-Ethernet (PoE) is required for Model 354 operation. This single connection will provide both the Ethernet data interface and power for the Model 354's circuitry. The Ethernet connection is made by way a Neutrik etherCON protected RJ45 jack that is located on the back of the Model 354's enclosure. This ruggedized and locking RJ45 jack allows connection of an Ethernet signal by way of either a cable-mounted etherCON connector or a standard RJ45 plug. The Model 354's Ethernet interface supports auto MDI/MDI-X so that a crossover cable is never required. The Model 354's Ethernet connection

enumerates itself as a class 1 device. As such, a PoE power-sourcing-equipment (PSE) port is required to supply a modest 3.84 watts maximum of power.

### **Gooseneck Microphone**

A mechanical assembly that combines a threaded bushing with a 3-conductor 1/4-inch jack is incorporated into the front of the Model 354's enclosure. This interface is commonly utilized on professional intercom equipment, allowing electrical and mechanical attachment of a compatible gooseneck microphone. It's recommended that the excellent-quality Studio Technologies' GME-3-12 Gooseneck Microphone be utilized. Having an overall length of 12 inches, this unidirectional, electret microphone was designed specifically to maximize voice reproduction in intercom, voice paging, and related applications. To minimize the impact of breath noise, a foam wind-screen is included with each GME-3-12.

From the factory a plastic hole plug is pressed into the Model 354's gooseneck bushing. This protects the connector and internal circuitry from having undesirable material such as dirt, dust, or foreign objects enter the unit. The plastic plug should be removed and stored prior to the gooseneck microphone being installed. Typically, a tool isn't required to lift the edge of the hole plug from the bushing; the hole plug can be removed using one's fingernail. Once the bushing is free of the plastic hole plug, a compatible gooseneck microphone can be inserted and secured using the threaded interconnect. Tighten the microphone to the bushing by hand, turning it in the clockwise direction. Hand-tighten it until a secure connection has been made. Do not use a tool to tighten the microphone!

It's possible that a microphone won't be needed. This would be in the rare case where the Model 354's ability to play audio files is the only function that is required. In this odd but possible case, a gooseneck microphone would not be required.

The two main requirements for a compatible gooseneck microphone are 1) that it contain an electret microphone capsule and 2) it interconnects by way of a 1/4-inch 3-conductor plug with an integrated threaded bushing with pitch of 7/16-20 UNF. The RTS®/Telex®/Bosch® MCP-90-series of gooseneck microphones should be directly compatible with the Model 354 and will perform acceptably. Gooseneck microphones from other sources such as Clear-Com® may also be

utilized. But known-excellent performance would be obtained using the aforementioned GME-3-12.

The 3-conductor 1/4-inch jack associated with the Model 354's gooseneck bushing has a tip connection that is used for microphone audio as well as to supplying the low-voltage DC needed for powering the electret microphone. (The power source is 3.3 volts DC in series with a 2.49 k (2490) ohm resistor.) The ring connection is used for the microphone's low signal (audio and DC). The sleeve connection is chassis ground and isn't used as a signal conductor. (Although it does play an important role in shielding the microphone assembly.) Within the Model 354's circuitry the ring and sleeve connections are connected together as well as being connected ("tied") to the chassis.

The Model 354's gooseneck bushing includes a hex-head socket set screw with a thread pitch of 4-40 UNC. This allows the gooseneck microphone to be secured into the bushing by simply tightening the set screw against the microphone using a 5/64-inch hex driver. In many cases, especially in applications where the Model 354 will be moved from venue-to-venue, it may not be optimal for a hex screw to be utilized. This is because the gooseneck microphone may need to be removed and stored for transit. In this case, the set screw should be removed and stored.

### **Analog Monitor Output**

The Model 354's analog monitor output, accessible by way of a 3-pin male XLR connector located on the back panel, is designed to connect to a variety of devices. It's expected that in many situations the analog monitor output will be utilized for local audio monitoring. The simplest means to accomplish this is to use a loudspeaker with an internal amplifier, such as a model from the popular Fostex® 6301-series. Other applications may connect the analog monitor output to the input of an audio power amplifier associated with a loudspeaker. And, depending on how the Model 354 is configured using the STcontroller application, the analog monitor output can also be useful in a number of general-purpose audio monitoring applications.

The Model 354's analog monitor output is line-level, electronically balanced, and capacitor coupled. It can correctly interface with balanced or unbalanced loads of 2 k (2000) ohms or greater. A configuration setting in the STcontroller application is used to select how the analog monitor output will function from among

three operating modes. In the Adjustable (Post-Fader) mode the level of the analog monitor output will be dependent upon the setting of the front-panel level control. (“Post” indicates that the monitor output will obtain its audio source after (“post”) the level control; a level control is also known in the audio world as a “fader.”)

When selected for the Fixed –10 (Pre-Fader) mode, the analog monitor output will have a fixed nominal output level of –10 dBu. In this mode, the nominal output level has been optimized to match the input sensitivity typically found on amplified loudspeakers. Since most amplified loudspeakers contain an integrated level control, the analog monitor output’s signal is “pre-fader,” that is with no interaction from the Model 354’s level control. In the Fixed 0 (Pre-Fader) mode the monitor output has a fixed nominal output level of 0 dBu. This can be useful as a “professional” line-level output for connection with audio routers, intercom systems, audio transport equipment, or a local monitoring system. In both of the fixed modes, the level control on the front of the Model 354 will not impact the level of the monitor output. (The audio signal is presented to the analog monitor output circuitry before (“pre”) the level control.)

The analog monitor output is presented on a 3-pin male XLR connector which is located on the Model 354’s back panel. An interface cable prepared for connection to the analog monitor output should use a 3-pin female XLR connector that is wired such that pin 2 is connected as signal + (high), pin 3 as signal – (low), and pin 1 as common/shield. To connect to an unbalanced input use XLR pin 2 as signal + (high) and pin 1 as low/shield. Pin 3 should be left unconnected. To clarify, for correct unbalanced operation it is important not to connect pin 3 to anything; do not connect pins 1 and 3 together.

## Dante Configuration

For audio to pass to and from the Model 354 requires configuration of several Dante-related parameters. These configuration settings are stored in non-volatile memory within the Model 354’s circuitry. Configuration will typically be done with the Dante Controller software application which is available for download free of charge at [audinate.com](http://audinate.com). Versions of Dante Controller are available to support the Windows and macOS operating systems.

The Model 354’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 354 and related parameters may need to be configured.

## Audio Routing

The Model 354 has four transmitter (output) and four receiver (input) channels that are associated with the unit’s Dante interface. The transmitter (output) channels must be assigned to the desired Dante receiver (input) channels on one or two devices. This achieves routing of the Model 354’s audio output channels to the device (or devices) that will be “listening” to them. In addition, the unit’s four Dante receiver (input) channels can be subscribed (routed) with one or two devices that supply the desired Dante transmitter (output) channels. These four audio input channels can provide the monitor, talent cue (IFB program or non-interrupt), or background music signals needed for a specific application. These receiver (input) channels can also be used in a confirmation manner, controlling the state of an associated transmitter (output) channel’s high-frequency tone signal. Note that 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 354 uses an UltimoX4 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 354’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 with little chance of reaching a flow limitation.

Note that when the AES67 mode has been enabled in the Dante Controller application the Model 354’s Dante transmitter (output) channels will only function in multicast; unicast is not supported.

## Unit and Channel Names

The Model 354 has a default Dante device name of **ST-M354-** and a unique suffix. The suffix identifies the specific Model 354 that is being configured. The suffix's actual alpha and/or numeric characters relate to the MAC address of the unit's UltimoX4 integrated circuit. The four Dante transmitter (output) channels have default names of **Ch1**, **Ch2**, **Ch3**, and **Ch4/Monitor Output**. The four Dante receiver (input) channels have default names of **Ch1**, **Ch2**, **Ch3**, and **Ch4**. Using Dante Controller, the default device name and channel names can be revised as appropriate for the specific application.

## Device Configuration

The Model 354 supports an audio sample rate of 48 kHz with no pull-up/down options available. The unit's 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 354'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 then this capability is available.

## AES67 Configuration – AES67 Mode

Dante Controller allows a Model 354 to be configured for AES67 operation. This requires the AES67 mode to be set for Enabled. As previously noted, if AES67 mode is Enabled then the Dante transmitter (output) channels will use multicast.

## Model 354 Clocking Source

While technically the Model 354 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 354 would typically not be enabled.

## Model 354 Configuration

The STcontroller software application is used to configure the way in which the Model 354 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.

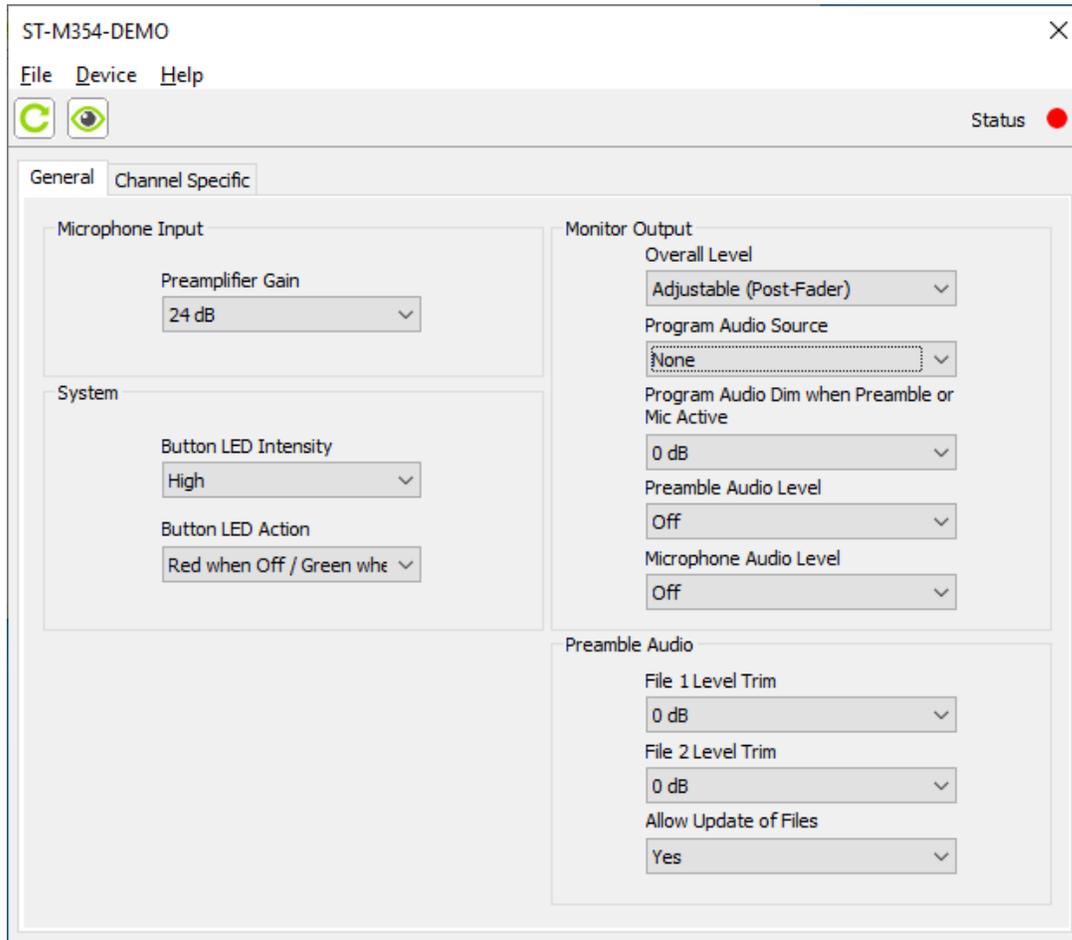
## Installing STcontroller

STcontroller is available free of charge on the Studio Technologies' website ([studio-tech.com](http://studio-tech.com)). Versions are available that are compatible with personal computers running selected versions of the Windows and macOS operating systems. 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 354 units that are to be configured. Immediately after starting STcontroller the application will locate all the Studio Technologies' devices that it can control. The one or more Model 354 units to be configured will appear in the device list. Use the *Identify* command to allow easy recognition of a specific Model 354 unit. Double-clicking on a device name will cause the associated configuration menu to appear. Review the current configuration and make any changes that are desired.

Changes made using STcontroller will be immediately reflected in the unit's operation; no Model 354 reboot is required. Each time a change is made the four pushbutton switches on the Model 354's front panel will flash orange in a distinctive pattern to indicate that a command from STcontroller has been received.

## General Menu Page

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



### Microphone Input – Preamplifier Gain

The gain of the microphone preamplifier associated with the gooseneck microphone will operate from among five configurable choices. *12 dB*, *18 dB*, *24 dB*, *30 dB*, and *36 dB*.

The compressor active LED, located on the back panel, can act as a guide when setting the preamp gain. The default value of 24 dB will typically be appropriate for use with the Studio Technologies' GME-3-12 Gooseneck Microphone.

When a voice signal at a normal level is presented to the gooseneck microphone the compressor active LED should light intermittently. If, for example, the LED rarely lights and the gain is set to 24 dB, it might be a good idea to change the setting to 30 dB or 36 dB. If the compressor LED is lit fully during normal

talking and the gain is set for 30 or 36 dB, a change to one of the lower values might be warranted.

### System – Button LED Intensity

This section has two configurable choices: *Low* and *High*.

Under the top surface of each of the four pushbutton switches is a red and a green LED indicator. The LED intensity configuration choice allows the overall intensity of these LEDs, as a group, to be selected. Deciding which choice, low or high, is optimal will typically depend on the amount of ambient light that is present in the area where the Model 354 is located.

### **System – Button LED Action**

This section has four configurable choices:

*Red when Off/Green when On*

*Green when Off/Red when On*

*Unlit when Off/Green when On*

*Unlit when Off/Red when On*

The action of the red and green LED indicators associated with the four pushbutton switches can be configured. (There are two red and two green LEDs in each pushbutton switch.) The pushbutton switches are configured as a group, all acting in the same manner. The third and fourth choices were specifically provided to support users who have limitations in their ability to discern between two colors (“color blindness”).

*Red when Off/Green when On:* The LEDs in each pushbutton switch will light red when its associated function is off (not active). The LEDs in each pushbutton switch will light green when its associated function is on (active).

*Green when Off/Red when On:* The LEDs in each pushbutton switch will light green when its associated function is off (not active). The LEDs in each pushbutton switch will light red when its associated function is on (active).

*Unlit when Off/Green when On:* The LEDs in each pushbutton switch will not light when its associated function is off (not active). The LEDs in each pushbutton switch will light green when its associated function is on (active).

*Unlit when Off / Red when On:* The LEDs in each pushbutton switch will not light when its associated function is off (not active). The LEDs in each pushbutton switch will light red when its associated function is on (active).

### **Monitor Output – Overall Level**

The functioning of the analog and Dante monitor outputs can be configured from among three choices:

*Fixed –10 (Pre-Fader)*

*Fixed 0 (Pre-Fader)*

*Adjustable (Post-Fader)*

*Fixed –10 (Pre-Fader):* When selected, the analog monitor output’s nominal level will be –10 dBu and the Dante monitor output (if enabled) will be –30 dBFS. The level of both outputs will not be impacted by the front-panel rotary level control. Technically, when Fixed –10 (Pre-Fader) is selected, a digital audio signal that arrives in the selected Model 354 Dante receiver (input) channel at –20 dBFS will result in an analog monitor output level of –10 dBu and a digital monitor output level of –30 dBFS. This setting is appropriate when one of the monitor outputs is being connected to an amplified speaker which includes input gain and a level control. This configuration may be appropriate when the input of a Fostex 6301-series amplified loudspeaker is connected to the Model 354’s analog monitor output or subscribed to the Dante monitor output. In this way, the user is only required to adjust the level control on the associated amplified loudspeaker.

*Fixed 0 (Pre-Fader):* If selected, the analog monitor output’s nominal level will be 0 dBu and the Dante monitor output (if enabled) will be –24 dBFS. (Again, referenced to a Dante input signal with a level of –20 dBFS.) Neither output will be impacted by the Model 354’s front-panel rotary level control. This setting might be appropriate when the analog monitor or Dante monitor output signals are being used with other equipment that needs something that approaches a more-standard nominal line-level signal.

*Adjustable (Post-Fader):* When this mode is selected, the rotary level control will impact the level of the analog monitor output and Dante monitor output (if enabled). The rotary level control, with a push-in/push-out knob action, is located on the front of the Model 354’s enclosure. In this mode, when the rotary level control is adjusted to its fully clockwise (CW) position the analog monitor output level will be +4 dBu and the Dante monitor output level will be –20 dBFS. (Referenced to a Dante input signal with a nominal level of –20 dBFS.) The level control will perform an attenuation action as the knob is turned in the counterclockwise position. The analog and digital monitor outputs will be fully muted when the rotary level control is set to its fully counterclockwise (CCW) position.

### **Monitor Output – Program Audio Source**

This section has six configurable choices: *None*, *Ch 1*, *Ch 2*, *Ch 3*, *Ch 4*, and *Selectable Ch 1 – Ch 3 (Uses Ch 4 Button)*.

This configuration selection relates to the audio source that is associated with the analog monitor output and, in some circumstances, the Dante monitor output.

*None*: When selected, the analog monitor output will be disabled. The Dante monitor output function will be disabled and the associated Dante transmitter (output) channel will be used for the functions associated with channel 4.

*Ch 1, Ch 2, Ch 3, or Ch 4*: When selected, the specified Dante receiver (input) channel will be used as the source for the analog monitor output. The Dante monitor function will not be active and the associated Dante transmitter (output) channel will be used for the functions associated with channel 4.

*Selectable Ch 1 – Ch 3 (Uses Ch 4 Button)*: When selected, a somewhat unique Model 354 mode will be enabled. This will allow Dante receiver (input) channels Ch 1, Ch 2, or Ch 3 to serve as the signal source for the analog monitor output and the now-active Dante monitor output. Using the Model 354's four pushbutton switches the monitor source can be selected from among the three choices as well as none. Selecting this mode will prevent the fourth button from being able to be used to control a voice page or related function. However, it may prove useful for special circumstances where it's important for a user to be able to select the monitor audio source. It's also useful when a Dante digital monitor output is needed for an application.

### **Monitor Output – Program Audio Dim when Preamble or Mic Active**

This section has six configurable choices: *0 dB*, *5 dB*, *10 dB*, *15 dB*, *20 dB*, and *Full Mute*.

This configuration selects the level change that will be made to the analog monitor output and, if enabled, Dante monitor output when a preamble message and/or microphone audio is active. It is provided primarily to prevent audio crosstalk and acoustical feedback that could occur from an adjacent monitor loudspeaker and a connected gooseneck microphone. Selecting 0 dB would effectively serve to disable this dim function. (Reducing the level of something by 0 dB would

not change a change to occur.) Selecting Full Mute would effectively make this dim function be a monitor output mute function.

### **Monitor Output – Preamble Audio Level**

This section has six configurable choices: *Off*, *Low*, *Medium Low*, *Medium*, *Medium High*, and *High*.

To assist a Model 354 user, it's possible that enabling this function would be useful, sending preamble audio to the analog monitor output and, if enabled, Dante monitor output, whenever a preamble message is actively being played. This would allow a user to hear the preamble audio over an associated monitor loudspeaker and, if applicable, prepare to make a voice announcement.

### **Monitor Output – Mic Audio Level**

This section has six configurable choices: *Off*, *Low*, *Medium Low*, *Medium*, *Medium High*, and *High*.

In special circumstances, it's possible that it would be useful to send microphone audio to the analog monitor output and, if enabled, Dante monitor output, whenever the mic function is active. This would allow a user to hear their own voice as a confirmation of what action is occurring. If enabled, the microphone audio signal, when active, would be sent to the analog monitor output and, if configured, the Dante Ch 4/Monitor output transmitter (output) channel. When configured for Off no microphone audio will be sent to either monitor output. The five other choices allow the microphone audio to be sent to the monitor outputs at various levels. Note that selecting a level that's too high can result in acoustic feedback between an associated monitor loudspeaker and a connected gooseneck microphone.

### **Preamble Audio – File 1 Level Trim**

This section has nine configurable choices: *-12 dB*, *-9 dB*, *-6 dB*, *-3 dB*, *0 dB*, *3 dB*, *6 dB*, *9 dB*, and *12 dB*.

The preamble function allows a stored audio source (in the form of a WAV file) to be sent out the designated Dante transmitter (output) channels. This configuration setting allows the playback level of File 1 to be adjusted ("trimmed") from among nine available choices. A negative value would indicate that the level of the file would be reduced. Selecting 0 dB

would cause no level change to be made to File 1. And a positive selection would allow gain to be added to the level of the information stored in File 1. This configuration choice allows the level of the preamble audio provided in File 1 to be adjusted relative to the microphone audio level.

#### **Preamble Audio – File 2 Level Trim**

This section has nine configurable choices:  
*-12 dB, -9 dB, -6 dB, -3 dB, 0 dB, 3 dB, 6 dB, 9 dB, and 12 dB.*

This configuration choice functions the same as the previous configuration but applies to File 2.

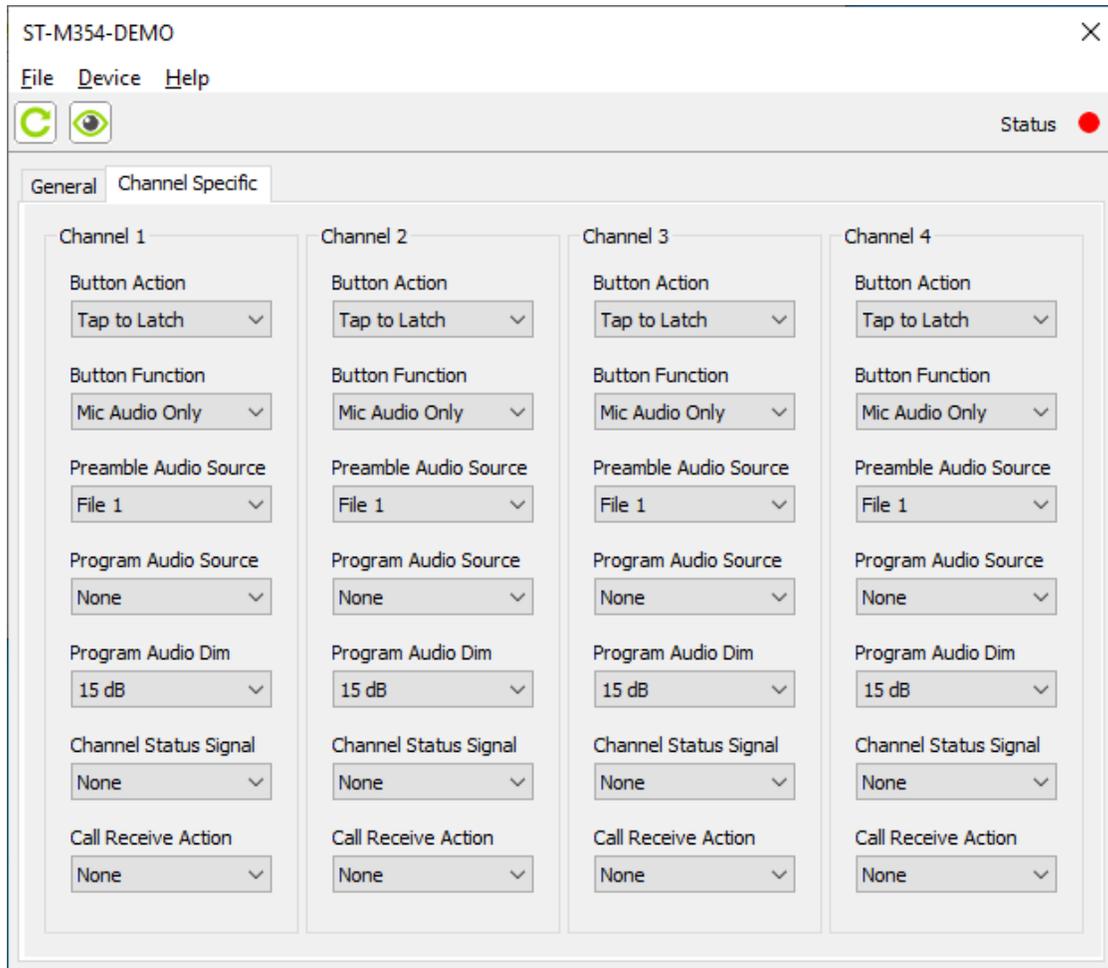
#### **Preamble Audio – Allow Update of Files**

This section has two configurable choices: *No* and *Yes*.

A USB flash drive can be used to load preamble files into the Model 354's non-volatile storage. This is a fast and simple means of revising the two audio (WAV) files as desired. A USB Type A receptacle is located on the unit's back panel and is compatible with most commonly available flash drives. This configuration setting determines whether or not the Model 354 will load WAV files that are stored on a USB flash drive. When configured for *No* the unit will ignore preamble files that are present on a connected USB flash drive. New audio files can be loaded when *Yes* has been selected.

## Channel Specific Menu Page

The following configuration selections apply individually to Channels 1-4. They are available in each Channel Specific column:



### Button Action

The manner in which a button functions can be configured from among four choices.

*Momentary*, *Tap to Latch*, *Momentary/Tap to Latch*, and *Disabled*.

*Momentary*: If this mode is selected, a button's function will normally be inactive. Whenever the button is pressed the associated function will become active.

*Tap to Latch*: If this mode is selected, the button's function will alternate between its active and inactive states whenever the button is pressed. Upon Model 354 power up the button will be in its inactive state.

*Momentary/Tap to Latch*: This mode is a combination of the Momentary and Tap to Latch modes. It's similar to the way in which pushbutton switches often function on user stations associated with broadcast or production intercom systems. If the button is pressed and held the associated function will become active. It will stay active until the button is released. If the button is "tapped" the status of the function will change, either from inactive-to-active or from active-to-inactive. Upon Model 354 power up the button will be in its inactive state.

*Disabled*: In this mode, the button will not perform a function. Pressing it will cause the button's red LED to flash, indicating that it has been disabled.

## Button Function

This section has seven configurable choices:

*Mic Audio Only*

*Preamble Audio (Play Once), then Mic Audio*

*Preamble Audio (Play Once), Mix with Mic Audio*

*Preamble Audio Only (Play Once, Interruptible)*

*Preamble Audio Only (Play Once, Complete)*

*Preamble Audio Only (Play Continuous, Interruptible)*

*Preamble Audio Only (Play Continuous, Complete)*

The action that happens when a channel's pushbutton switch becomes active will follow this configuration. The seven available modes are unique and warrant a careful review before a selection is made.

*Mic Audio Only:* In this mode, whenever the channel's pushbutton switch is active microphone audio will be sent out the associated Dante transmitter (output) channel.

*Preamble Audio (Play Once), then Mic Audio:* In this mode, whenever the channel's pushbutton switch becomes active the selected preamble audio file will be sent to the Dante transmitter (output) channel. After the preamble audio file has played once the microphone audio will become active. Just to clarify, during the time that the preamble file is playing, audio from the microphone will not be sent to the Dante transmitter (output) channel. Only after the preamble file has been played once will the microphone become active.

*Preamble Audio (Play Once), Mix with Mic Audio:* In this mode, whenever the channel's pushbutton switch becomes active the selected preamble audio file will be sent to the Dante transmitter (output) channel. At the same time microphone audio will become active and mixed (combined) with the preamble audio.

*Preamble Audio Only (Play Once, Interruptible):* In this mode, when the channel's pushbutton switch becomes active the selected preamble audio file will play once and then stop. Changing the pushbutton switch to its inactive state when the preamble audio file is actively playing will cause it to immediately stop. Microphone audio will never become active.

*Preamble Audio Only (Play Once, Complete):* In this mode, when the channel's pushbutton switch becomes active the selected preamble audio file will play once and then stop. Changing the pushbutton switch to its inactive state when the preamble audio file is actively playing will not cause it to stop. The

preamble audio file will always completely play once. Microphone audio will never become active.

*Preamble Audio Only (Play Continuous, Interruptible):* In this mode, when the channel's pushbutton switch becomes active the selected preamble audio file will play continuously. Changing the pushbutton switch to its inactive state when the preamble audio file is actively playing will cause it to immediately stop.

*Preamble Audio Only (Play Continuous, Complete):* In this mode, when the channel's pushbutton switch becomes active the selected preamble audio file will play continuously. Changing the pushbutton switch to its inactive state when the preamble audio file is actively playing will not cause it to immediately stop. The preamble audio file will play until it ends and then stop.

## Preamble Audio Source

This section has two configurable choices: *File 1* and *File 2*.

The Model 354 can store and play two independent audio (WAV) files. These are called preamble audio files and are loaded using a USB flash drive. This configuration selection determines which of the two files is assigned to a specific pushbutton switch function.

## Program Audio Source

This section has five configurable choices: *None*, *Ch 1*, *Ch 2*, *Ch 3*, and *Ch 4*.

This selection determines which of the Dante receiver (input) channels is used as the program audio source for its associated Dante transmitter (output) channel. For a typical voice paging system application this configuration determines which audio signal would be sent to a paging zone as the background music source. For broadcast applications where talent cue (interrupted foldback or IFB) signals need to be created this setting would determine the IFB program audio source.

A separate configuration setting determines the amount of attenuation that will be applied to the program audio source when the preamble or microphone audio is active. For some applications it's possible that a program audio source will not be assigned to a Dante transmitter (output) channel. In this situation, the selection of *None* would be correct.

## Program Audio Dim

This section has six configurable choices:

*0 dB, 5 dB, 10 dB, 15 dB, 20 dB, and Full Mute.*

This value determines the amount of attenuation that will be applied to the selected program audio source when the preamble audio or microphone audio is active on the Dante transmitter (output) channel. Selecting 0 dB will configure the channel to have no change in program audio level when the preamble or microphone function is active. The preamble and/or microphone audio will simply be combined (added or summed) with the program audio. When Full Mute is selected the program audio source will fully attenuate (completely mute) whenever the preamble and/or microphone audio is active. In voice paging applications it would be typical to select 5 dB or 10 dB for the program audio dim, reducing but not muting a background music source. In most broadcast applications where a talent cue (interrupt or IFB function) signal is going to be created a value of 15 dB would be appropriate.

## Channel Status Signal

This section has six configurable choices:

*None*

*18 kHz Tone when Preamble or Mic Active*

*20 kHz Tone when Preamble or Mic Active*

*20 kHz when Inactive, 18 kHz when Preamble or Mic Active*

*20 kHz when Receiver Channel Active, None when Preamble or Mic Active*

*16 kHz when Receiver Channel Inactive, 20 kHz when Receiver Channel Active, 18 kHz when Preamble or Mic Active*

The Model 354 can be configured to support a number of interesting applications through the generation of high-frequency sine-wave audio tones that are added to the Dante transmitter (output) channels. The presence of these tones can be selected such that the status of a Model 354 channel can be communicated to a connected device. These status signals allow the unit to be integrated into a range of local and remote applications. Used in conjunction with the Studio Technologies' Model 5422A Dante Intercom Audio Engine, it would be simple to create REMI or At-Home functions. Most digital audio processor units can be programmed to respond to the audio tones.

*None:* In this mode, no tones will be added to the associated Dante transmitter (output) channel.

*18 kHz Tone when Preamble or Mic Active:* In this mode, an 18 kHz sine wave tone will be sent out the associated Dante transmitter (output) channel whenever preamble or microphone audio is active. The sine-wave tone will be mixed (combined or summed) with the preamble and/or microphone audio. This function can be useful by providing an “on-air” trigger for functions associated with devices such as the Model 5422A Dante Intercom Audio Engine.

*20 kHz Tone when Preamble or Mic Active:* Similar to the previous mode, this mode provides a 20 kHz sine wave tone, combined with the preamble or microphone audio, on the associated Dante transmitter (output) channel.

*20 kHz when Inactive, 18 kHz when Preamble or Mic Active:* In this mode, whenever the associated preamble or microphone audio is inactive then a 20 kHz tone will be sent out the associated Dante transmitter (output) channel. No tone will be sent when the preamble and/or microphone audio is active. This serves as a channel “keep alive” signal, indicating that the audio path is actively functioning but that no user audio is present. The way in which this operates harks back to the days of 4-wire telephone trunk circuits. An “idle” trunk would have a continuous tone present to alert personnel that a circuit was “live” and ready to function. When the trunk became active the tone would be removed and voice audio would be connected.

*20 kHz when Receiver Channel Active, None when Preamble or Mic Active:* If a high-frequency tone is present on the Dante receiver (input) channel then the Model 354 considers this to be a receiver channel active condition. If the receiver channel is active and preamble or microphone audio is not active then a 20 kHz tone is sent out the Dante transmitter (output) channel. If, whether or not a tone is present on the Dante receiver (input) channel, preamble or microphone audio is active then no tone will be sent out the Dante transmitter (output) channel. This choice will allow a more sophisticated “keep alive” signal to be generated, one that indicates when an associated receiver channel is active.

*16 kHz when Receiver Channel Inactive, 20 kHz when Receiver Channel Active, 18 kHz when Preamble or Mic Active:* This mode provides three different tones that represent the status of both the associated Dante transmitter (output) channel and the Dante receiver (input) channel. When the Dante receiver (input) channel associated with the unit's specific channel doesn't have a high-frequency tone present the Model 354 considers this to be a receiver channel inactive condition. In this case, a 16 kHz wave tone is sent out the associated Dante transmitter (output) channel. If a high-frequency tone is present on the Dante receiver (input) channel then the Model 354 considers this to be a receiver channel active condition. If the receiver channel is active and preamble or microphone audio is not active then a 20 kHz tone is sent out the Dante transmitter (output) channel. If the receiver channel is active and preamble or microphone audio is active then an 18 kHz tone is sent out the Dante transmitter (output) channel. The tones always combine (mix or sum) with any other audio signal that's present on the Dante transmitter (output) channel. After some study it's hoped that it will become clear as to why this set of tone signals would allow an audio process device to recognize the operating status of a Model 354's receiver and transmitter channel.

### **Call Receive Action**

This section has three configurable choices:

*None*

*Button Lights when Call Received, Button Action*

*Normal*

*Button Lights when Call Received, Button Action*

*Disabled*

This function configures the manner in which a Model 354's channel button will light and how the button will operate when a high-frequency audio signal is detected in an associated Dante receiver (input) channel. This was included such that multiple Model 354 units could be deployed in an application, display the active status of each other and, if desired, inhibit button operation.

*None:* When this mode is selected, the channel's button LEDs will not respond to the presence of a high-frequency signal in the associated Dante receiver (input) channel. The button action will never be changed from the manner in which it has been configured.

*Button Lights when Call Received, Button Action Normal:* When this mode is selected, the channel button's LEDs will flash orange whenever a high-frequency signal is detected in the associated Dante receiver (input) channel. Operation of the button will continue to follow its configured action.

*Button Lights when Call Received, Button Action Disabled:* When this mode is selected, the channel button's LEDs will flash orange whenever a high-frequency signal is detected in the associated Dante receiver (input) channel. The action of the button will be disabled whenever a high-frequency signal is being detected.

## **Preamble Audio Files**

As previously discussed, two audio "messages," each up to 40 seconds in length, are stored in non-volatile memory within the Model 354. These are referred to as the preamble audio files and are loaded into the unit in the 16-bit, 48 kHz sample rate, monoaural WAV format. Configuration choices determine how and when the preamble audio files will be played during Model 354 operation. The files within the Model 354 can be easily updated by way of a standard USB flash drive. The audio files can contain whatever audio content is desired to best support various applications. The audio content could consist of the sound of natural bells or chimes, an "electronically created" audio sequence, or a voice message. By using the common WAV file format, the desired audio sources can be created outside of the Model 354 and then easily loaded into the unit for use.

### **Creating Preamble Audio Files**

Audio content can be captured or created using standard audio techniques. Natural sounds or voice messages can be recorded. Alternately, audio signals can be "synthesized" as desired. To prepare this audio content for loading into the Model 354 requires them to be in the 16-bit, monoaural, 48 kHz sample rate, WAV (.wav) format. For compatibility with the Model 354, the names of the two preamble audio files must be **M354Tone1.wav** and **M354Tone2.wav**.

To create compatible preamble audio files Studio Technologies has had good success using the open-source audio software from Audacity®. It's available free of charge at [audacityteam.org](http://audacityteam.org). Many other compatible audio recording and editing programs

are available for use with various personal computer operating systems.

It's expected that Studio Technologies will create a "library" of preamble audio files. These will be available for download, free of charge, to interested parties. Refer to the Studio Technologies' website for what files are currently available. If you create interesting WAV files for your application, we encourage you to share them with other Model 354 users. Please submit the files, along with a detailed description of the content, to the Studio Technologies support email address. They'll be added to the website (studio-tech.com), making them easily accessible to others.

### Loading Preamble Audio Files

The Model 354 has the ability to load installer-created WAV files into non-volatile memory by way of a standard USB flash drive. The Model 354 implements a USB host function and provides access by way of a type A receptacle located on the unit's back panel. The Model 354 updates its preamble audio files using the names **M354Tone1.wav** and **M354Tone2.wav**.

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. One or both of the preamble audio files can be automatically loaded at the same time. In the flash drive's root directory, save the desired new firmware file(s), ensuring that the required name(s) are specified. The file name for preamble audio file 1 must be **M354Tone1.wav**. The file name for preamble audio file 2 must be **M354Tone2.wav**. After copying files to the USB flash drive, be certain to use the eject command to ensure that they are correctly stored.

Once the USB flash drive is inserted into the USB interface, located on the unit's back panel, the unit must be powered off and again powered on. At this point the file(s) will automatically load. To install either or both preamble audio files follow these steps:

1. Remove power from the Model 354. This will entail removing the PoE Ethernet connection from the etherCON RJ45 jack that's located on the back panel.
2. Locate the USB connector, labeled Firmware Update, on the Model 354's back panel. Directly to the left of the USB connector is a small hole that provides visual access to a green LED indicator.

3. Insert the prepared USB flash drive into the USB connector.
4. Apply Power-over-Ethernet (PoE) power to the Model 354 by connecting the Ethernet interface cable to the RJ45 jack.
5. After a few seconds the Model 354 will run a "boot loader" program that will automatically load and save the new preamble audio file(s) that are present on the USB flash drive. The update process can range from approximately 5 seconds to approximately 45 seconds. The actual time will depend on the length (up to 40 seconds of audio playback) and number of WAV files (one or two) that are being loaded. While the file(s) are being loaded the green LED, located adjacent to the USB connector, will flash slowly. Pushbutton switches 1 and 2 on the front panel will indicate the status of the loading process. They will flash orange when the loading processing is taking place. They will light green if the one or two preamble audio files were successfully loaded. They will light red if the loading process was not successful. Once the file-loading process has completed the Model 354 will restart.
6. At this time the Model 354 will be functioning with the newly loaded preamble audio file(s). The USB flash drive can now be removed. But to be conservative, first remove the PoE Ethernet connection, then remove the USB flash drive, and then reconnect the PoE Ethernet connection.
7. Confirm that the desired preamble audio file(s) have been loaded into the Model 354. This will typically require listening to one or two of the Dante transmitter (output) audio channels. The actual channels that will need to be monitored will depend on how the Model 354 has been configured using the STcontroller application.

Note that upon power being applied to the Model 354 if the USB flash drive doesn't contain compatible preamble audio file(s) in its root folder no harm will occur. Upon power up the green LED, located adjacent to USB connector, will flash on and off rapidly for a few seconds to indicate that no valid files have not been found. Once that has completed then normal operation using the unit's existing preamble audio files will begin.

## Operation

At this point, all connections and configuration steps should have been completed and everything should be ready for Model 354 operation to commence. The unit should have been placed at the desired physical location. A gooseneck microphone should have been installed. If desired, the analog monitor output should have been connected to the input of an amplified loudspeaker or to the input on a related audio device. An Ethernet connection with Power-over-Ethernet (PoE) capability should have been made to the unit's etherCON RJ45 jack.

The Model 354's Dante configuration settings should have been selected using the Dante Controller software application. In this way, the unit's four Dante transmitter (output) channels and four Dante receiver (input) channels should have been routed, by way of Dante "subscriptions," to the receiver and transmitter channels on associated Dante-enabled equipment. Using the Studio Technologies' STcontroller software application the unit's configuration should have been selected to meet the needs of the specific application. If desired, one or two custom preamble audio files should have been created and loaded into the Model 354.

## Initial Operation

The Model 354 will begin to function as soon as a Power-over-Ethernet (PoE) power source is connected. However, it will typically take 20 to 30 seconds for full operation to commence. Upon initial power up the three status LEDs, located on the back panel below the etherCON RJ45 jack, will begin to light as network and Dante connections are established. The microphone compressor LED (labeled MIC COMP), also on the back panel and located between the USB receptacle and the monitor output connector, may momentarily flash orange. The green firmware update LED, located on the back panel to the left of the USB receptacle, will slowly flash approximately five times as the internal processor becomes active.

The red and green LEDs within the four pushbutton switches will light in a short test sequence to indicate that they are functioning correctly and the application firmware (embedded software) has started. Then pushbutton switches 1 and 2 will light sequentially to indicate that the unit is ready to load new preamble files and display their loading status. These files would

be presented to the unit by way of WAV files on an attached USB flash drive. Button 1 is associated with preamble file 1. It will slowly flash orange three times and then light green if a new file 1 has been loaded or light red if a new file 1 was not loaded. The LED associated with button 1 will then remain lit and button 2 will indicate the outcome of the unit's attempt at loading a new preamble file 2. Button 2 will flash orange three times to indicate that the loading process is pending. The button will then light red if no file 2 was loaded or light green if a new file was loaded. After a brief pause, the LEDs in buttons 1 and 2 will stop lighting. Note that in most cases new preamble audio files will not be loaded. The button LEDs are simply used to display the status of the loading process. Their flashing orange and then lighting red doesn't indicate a problem. It just indicates that the process was available but was not required.

Once that entire start-up sequence has completed and the Dante connection has been established full operation will begin. The various LEDs will then become operational, displaying the status of their designated functions.

## How to Identify a Specific Model 354

Functions within the Dante Controller and STcontroller software applications allow a specific Model 354 unit to be identified. Each application provides an "eyeball" icon that when clicked will activate the Identify function. When this function is selected, a command will be sent to a specific Model 354 unit. On that unit the red LEDs associated with the four pushbutton switches will flash three times (but the actual on/off status of the buttons will not change). In addition, the SYS and SYNC status LEDs, located directly below the etherCON RJ45 jack on the back panel, will slowly flash four times. After a few seconds the LED identification pattern will cease and normal Model 354 pushbutton switch LED and Dante status LED operation will resume.

## Ethernet and Dante Status LEDs

As previously discussed, there are three status LEDs located below the etherCON RJ45 jack on the Model 354's back panel. The LINK ACT LED will light green whenever an active connection to a 100 Mb/s Ethernet network has been established. It will then flash in response to all Ethernet data packet activity. The

SYS and SYNC LEDs display the operating status of the Dante interface and its associated network activity. The SYS LED will light red during Model 354 power up to indicate that the Dante interface is not ready. After a short interval it will light green to indicate that it is ready to pass data with another Dante device. The SYNC LED will light red when the Model 354 is not synchronized with a Dante network. It will light green when the unit is synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly flash green when this specific Model 354 is part of a Dante network and is serving as the Leader clock. It's possible that up to 30 seconds may be required for the SYNC LED to reach its final state.

## Compressor Active LED and Mic Preamp Gain

An orange LED is located between the USB receptacle and the monitor output connector on the Model 354's back panel. It is labeled MIC COMP and displays the status of the microphone audio compressor function. This function controls the dynamic range of the gooseneck microphone audio signal before it is sent out the Dante transmitter (output) channels. The microphone compressor LED will light whenever the input level from the microphone, along with the configured microphone preamplifier gain, is such that the dynamic range of the signal is being actively controlled. It's perfectly acceptable for the MIC COMP LED to light intermittently whenever a user is talking at a normal voice level into the gooseneck microphone. But if the MIC COMP LED lights solid while a user is talking at a normal voice level this will typically indicate that the microphone preamplifier gain setting should be reduced. (STcontroller would be used to configure the gain.) Conversely, if the MIC COMP LED almost never lights when normal talking is taking place it's possible that changing the preamplifier gain to a higher value would be beneficial. Note that due to the design of the circuitry the microphone compressor active LED will function whether or not one or more of the talk functions is active.

## Pushbutton Switches

Four pushbutton switches are used to select how the preamble and microphone audio signals are routed to the four Dante transmitter (output) channels. How each specific button functions and what LED color

and action is associated with them will depend on the configuration choices that have been made using STcontroller. When the function associated with a button is inactive (off) the pushbutton switch's LED can be lit red or green, or not be lit at all. When the function is active (on) the pushbutton switch's LED will be lit orange, red, or green.

### Pushbutton Switch Modes

There are four ways that the pushbutton switches will respond to being pressed. The specific way in which each will operate will depend on its selected mode configuration.

*Momentary:* If this mode is selected, the function will become active whenever the pushbutton switch is pressed and held.

*Tap to Latch:* If this mode is selected, the function will alternate between its active and inactive states whenever the pushbutton switch is pressed ("tapped"). Upon Model 354 power up the function will be in its inactive state.

*Momentary/Tap to Latch:* This mode is a combination of the Momentary and Tap to Latch modes. It's similar to the way in which talk pushbutton switches function on user stations associated with broadcast or production intercom systems. If the pushbutton switch is pressed and held the function will become active and will remain so until the pushbutton switch is released. If the pushbutton switch is momentarily pressed ("tapped") the function will change state. Upon Model 354 power up the function will be in its inactive state.

*Disabled:* This mode is selected only if the function is not going to be utilized. In this mode, pressing the pushbutton switch will simply result in the button's red LEDs momentarily flashing.

### Button Functions

The function associated with each pushbutton switch and associated Dante transmitter (output) channel can be configured from among seven choices. The STcontroller software application is used to select the mode for each.

*Mic Audio Only:* When this mode is selected, the pushbutton switch will cause audio from the connected gooseneck microphone to be sent to the associated Dante transmitter (output) channel.

*Preamble Audio (Play Once), then Mic Audio:* When this mode is selected, the pushbutton switch will cause the selected preamble audio file to be sent (“played”) once to the associated Dante transmitter (output) channel after which the microphone audio will be sent (connected) to the associated Dante transmitter (output) channel.

*Preamble Audio (Play Once), Mix with Mic Audio:* When this mode is selected, the pushbutton switch will cause the selected preamble audio file to be sent (“played”) once to the associated Dante transmitter (output) channel. At the same time that the preamble starts to play the microphone audio will also be sent (connected) to the associated Dante transmitter (output) channel. The preamble audio will be mixed (summed or combined) with the microphone audio.

*Preamble Audio Only (Play Once, Interruptible):* When this mode is selected, the pushbutton switch will cause the selected preamble audio file to be sent (“played”) once to the associated Dante transmitter (output) channel. The pushbutton switch can be used to terminate (interrupt or stop) the playing of the preamble audio file. In this way, it’s possible to have the preamble audio file only partially play before being stopped by operation of the pushbutton switch.

*Preamble Audio Only (Play Once, Complete):* When this mode is selected, the pushbutton switch will cause the selected preamble audio file to be sent (“played”) once to the associated Dante transmitter (output) channel. The pushbutton switch cannot be used to terminate (interrupt or stop) the playing of the preamble audio file. The preamble will always play completely once. It won’t be possible to have the preamble audio file only partially play before being stopped by operation of the pushbutton switch.

*Preamble Audio Only (Play Continuous, Interruptible):* When this mode is selected, the pushbutton switch will cause the selected preamble audio file to be sent (“played”) continually to the associated Dante transmitter (output) channel. The pushbutton switch can be used to terminate (interrupt or stop) the playing of the preamble audio file. In this way, it’s possible to have the preamble audio file play partially before being stopped by operation of the pushbutton switch.

*Preamble Audio Only (Play Continuous, Complete):* When this mode is selected, the pushbutton switch will cause the selected preamble audio file to be sent

(“played”) continually to the associated Dante transmitter (output) channel. The pushbutton switch cannot be used to terminate (interrupt or stop) the playing of the preamble audio file until it has ended. The preamble will always play completely, at least once, after it has started. It isn’t possible for the preamble audio file to play partially before stopping.

### **Button LED Action**

As previously discussed, how the pushbutton switches function and what LED colors and actions are associated with them will depend on the Model 354’s configuration. When the function associated with a button is inactive (off) the pushbutton switch’s LED can be lit red or green, or not be lit at all. When the function is active (on) the pushbutton switch’s LED will be lit green, red, or orange. When the function is active (on), a button lighting red or green would indicate that microphone audio is being sent out the associated Dante transmitter (output) channel. However, the button will light orange when preamble audio is playing and the microphone is not active. To clarify, if preamble audio and microphone audio are both active then the pushbutton switch will light red or green depending on the selected configuration. That condition is what the user should observe to know when the microphone is active. A pushbutton switch lighting solid orange indicates that something is happening (preamble is actively playing) but there’s no risk of an audio signal present near the microphone being routed to the associated Dante transmitter (output) channel.

Each pushbutton switch can be configured to display when a high-frequency call or channel active audio signal is present in the associated Dante receiver (input) channel. If so configured, when a high-frequency signal is detected the LEDs in the associated button will flash orange. A related configuration choice allows the action of the button to be disabled whenever a high-frequency signal is detected.

### **Preamble Audio Source**

The Model 354 allows two separate audio files to be saved. These can be “played” following configuration choices made using the STcontroller software application. The content of the audio files can be created using standard personal computer audio editing software and would reflect the needs of a specific application. Whether or not either or both of the preamble audio

files are utilized in a Model 354 unit are beyond the scope of this user guide. They are a resource that can be utilized if necessary to optimize support for an application.

## Monitor Output

An analog monitor output is located on the back of the Model 354's enclosure. At the time of installation, it may have been connected to the input on an amplified loudspeaker or to the input of another piece of audio equipment. A push-in/push-out rotary level control is located on the right side of the Model 354's front panel. A configuration setting determines if the level of the monitor output can be adjusted using the rotary level control. If the monitor output has been configured to be adjustable ("post" (after) the level control) then users can rotate the level control to adjust the level of the monitor output. If the monitor output has been configured to be fixed ("pre" (before) the level control) then turning the level control will not impact the monitor output level.

The audio source associated with the monitor output can be configured to be one of the four Dante receiver (input) channels. If the Model 354 has been configured in this manner then the audio source will be "fixed" at a specific source.

The monitor output can also be configured such that pushbutton switch 4 is used as part of a process to select the audio source. The choices for the audio source would be Dante receiver (input) channels 1, 2, or 3. It's also possible to select "none" should the monitor output need to be disabled. If the selectable mode is active, a unique button-press action is required for use. Press and hold button 4. After about 1 second button 4 will light orange to indicate that the source selection mode is active. At the same time, buttons 1, 2, or 3 will light orange to indicate which Dante receiver (input) channel is being used as the monitor output audio source. If buttons 1, 2, or 3 do not light then no source has been selected. While continuing to press and hold pushbutton switch 4, use buttons 1, 2, or 3 to select which source is active. Pressing a button that is already lit orange will cause it not to light and will remove that source from being associated with the monitor output.

## Technical Notes

### IP Address Assignment

By default, the Model 354's Dante-associated 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 (APIPA). It is also sometimes referred to as auto-IP (PIPPA). 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 354 uses an UltimoX4 "chip" and, as such, a direct one-to-one interconnection between it and another Ultimo-based product would typically 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 354 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 354 units.

Using the Dante Controller software application, the Model 354'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. But 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 354'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 354. 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. (Ensure that support for PTP timing messages is maintained.) 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](http://audinate.com)) for details on optimizing networks for Dante applications.

## Application Firmware Version Display

A selection in the STcontroller software application allows the Model 354'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 354 unit to the network (via Ethernet with PoE) and wait until the unit starts to function. Then, after starting STcontroller, review the list of identified devices and select the specific Model 354 for which you want to determine its application firmware version. Then select **Version and Information** under the **Device** tab. A page will then display that will provide lots of useful information, including the application firmware version and 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 354's microcontroller (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 354 implements a USB host function that directly supports connection of a USB flash drive. The Model 354's MCU updates its application firmware using a file named **M354XvXX.stm** where Xs are decimal digits that represent the 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 354 is compatible with USB 2.0, USB 3.0, and USB 3.1-compliant Flash drives. Save the new firmware file in the root folder with a name of **M354vXrXX.stm** where XrXX is the actual version number. Studio Technologies will supply the application firmware file inside a .zip archive file. While the firmware file inside of the zip file will adhere to the naming convention required by the Model 354, the name of the zip file itself will include the file's version number.

Once the USB flash drive is inserted into the USB host interface, located on the back panel of the Model 354, the unit must be powered off and again powered on. At this point, the file from the USB flash drive will automatically load. The precise steps required will be highlighted in the next paragraph.

To install the application firmware file, follow these steps:

1. Disconnect power from the Model 354. This will entail removing the Ethernet connection that is made to the RJ45 jack.
2. Locate the USB receptacle on the back of the unit. Insert the prepared USB flash drive into it.
3. Apply power to the Model 354 by connecting an Ethernet signal that has Power-over-Ethernet (PoE) present to the RJ45 jack.
4. After a few seconds the Model 354 will run a "boot loader" program that will automatically load the new application firmware file (**M354vXrXX.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 354 will restart using the newly loaded application firmware.

5. At this time the Model 354 is functioning with the newly loaded application firmware and the USB flash drive can be removed. But to be conservative, remove the PoE Ethernet connection first and then remove the USB flash drive. Then 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 354 if a connected USB flash drive doesn't have the correct file (**M354vXrXX.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 354 implements its Dante connectivity using the UltimoX4 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 the UltimoX4 can be updated using the Model 354's Ethernet port. Performing the update process is easily accomplished using an automated method called Dante Updater that's included as part of the Dante Controller application. This application is available, free of charge, from the Audinate website ([audinate.com](http://audinate.com)) The latest Model 354 firmware file, with a name in the form of **M354vXrXrX.dnt**, is always 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 354's Dante interface.

## Restoring Factory Defaults

A command in the STcontroller software application allows the Model 354's defaults to be reset to the factory values. From STcontroller select the Model 354 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 354's factory defaults.

Note that restoring the factory defaults will not alter the two stored preamble audio files.

## Specifications

**Applications:** Dante-based voice paging, intercom, talent cue (broadcast IFB), and general audio installations

**Power Source:** Power-over-Ethernet (PoE), class 1 (very low power,  $\leq 3.84$  watts), per IEEE 802.3af

### **General Audio:**

**Internal Digital Audio Processing:** 32-bit, fixed

**Nominal Digital Input and Output Level:**  
–20 dBFS

### **Network Audio Technology:**

**Type:** Dante audio-over-Ethernet

**AES67-2018 Support:** yes

**Dante Domain Manager™ (DDM) Support:** yes

**Bit Depth:** 16, 24, or 32

**Sample Rate:** 48 kHz

**Number of Transmitter (Output) Channels:** 4

**Number of Receiver (Input) Channels:** 4

**Dante Audio Flows:** 4; 2 transmitter, 2 receiver

### **Network Interface:**

**Type:** 100BASE-TX, twisted-pair Ethernet with Power-over-Ethernet (PoE) supported

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

### **Microphone Input:**

**Compatibility:** Studio Technologies' GME-3-12 Gooseneck Microphone or equivalent

**Microphone Power:** 3.3 volts DC via 2.49 k resistor

**Impedance:** 2.0 k ohms, nominal

**Gain:** 12, 18, 24, 30, 36 dB, selectable

**Frequency Response:** –3 dB at 40 Hz, –1 dB at 16 kHz

**Distortion (THD+N):** 0.022%, measured at –20 dBFS, 22 Hz to 22 kHz bandwidth, 12 dB of gain

**Noise Floor:** –95 dBFS, A-weighted, 12 dB of gain

**Dynamic Range:** >76 dB, A-weighted, measured at 36 dB of gain

### **Compressor:**

**Application:** applies only to gooseneck microphone audio

**Threshold:** 2.7 dB above nominal Dante output level (–17.3 dBFS),  $\pm 0.3$  dB

**Slope:** 2:1

**Status LED:** compressor active

### **Preamble Audio:**

**Number of Channels:** 2, field updatable using USB flash drive

**Source Type:** 16-bit monophonic, 48 kHz sample rate, WAV (.wav) files, stored in non-volatile memory

**Level:** –20 dBFS nominal, adjustable  $\pm 12$  dB in 3-dB steps

**Duration:** up to 40 seconds per WAV file (preliminary calculation)

**Distortion:** <0.0001%

**Frequency Response:** 20 Hz to 20 kHz, +0/–0.7 dB

### **Talent Cue (Broadcast IFB) Capability:**

**Number of Channels:** up to 4, configurable

**Audio Sources:** Dante receiver (input) channels 1-4

**Frequency Response:** 20 Hz to 20 kHz, +0/–0.7 dB

**Program Audio Attenuation (Dim):** 0, 5, 10, 15, 20 dB, Full Mute, configurable

### **Analog Monitor Output:**

**Type:** electronically balanced, capacitor coupled, intended to drive balanced or unbalanced loads of 2 k ohms or greater

**Audio Source:** Dante receiver (input) channels 1-4, preamble audio, and microphone audio, configurable

**Source Impedance:** 200 ohms

**Nominal Level:** 0 dBu, reference –20 dBFS

**Maximum Level:** +20 dBu, with 0 dBFS input, measured at 1 kHz

**Dynamic Range:** >106 dB, A-weighted

**Distortion (THD+N):** 0.0011% (–99 dB), measured at –1 dBFS input, 22 kHz bandwidth

**Frequency Response:** +0/–1.5 dB, 20 Hz to 20 kHz

**Level Reduction (Dim) Capability:** 0, 5, 10, 15, 20 dB, or full mute, configurable

**Channel Status Signals:**

**Action:** independently configurable per channel

**Send Tone Frequencies:** 16, 18, and 20 kHz, sine-wave

**Send Tone Frequency Accuracy:** <10 ppm

**Send Tone Level:** –20 dBFS, nominal

**Send Tone Distortion:** <0.0001%

**Receiver Tone Detect Level Threshold:** –23 dBFS at 16 kHz; –28 dBFS at 18 kHz; –30 dBFS at 20 kHz

**Receiver Tone Minimum On Time:** 80 milliseconds

**Program Input-to-Monitor Output Low-Pass**

**Filter:** –6 dB at 10 kHz; –28 dB at 16 kHz; –55 dB at 20 kHz

**Tone Detect Tone-to-Monitor Output Rejection**

**Filter:** –31 dB at 18 kHz; –46 dB at 20 kHz; –70 dB at 22 kHz

**Connectors:**

**Gooseneck Microphone:** ¼-inch 3-conductor with 7/16-20 UNF threaded bushing; 4-40 hex head socket set screw allows microphone to be secured into bushing

**Analog Monitor Output:** 3-pin male XLR

**Ethernet:** Neutrik NE8FBH etherCON RJ45 jack

**USB:** type A receptacle (used only for updating main firmware and WAV audio files)

**Configuration:** Studio Technologies' STcontroller personal computer application

**Software Updating:** USB flash drive used for updating main firmware and WAV audio 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:** 0 to 95%, non-condensing

**Altitude:** not characterized

**Dimensions:**

3.6 inches wide (9.1 cm)

2.7 inches high (6.9 cm)

4.7 inches deep (11.9 cm)

**Deployment:** intended for tabletop applications

**Weight:** 1.1 pounds (0.50 kg) without gooseneck microphone; 1.4 pounds (0.64 kg) with GME-3-12 Gooseneck Microphone

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

## **Appendix A–STcontroller Default Configuration Values**

### **General**

Microphone Input – Preamplifier Gain: 24 dB

System – Button LED Intensity: High

System – Button LED Action: Red when Off/Green when On

Monitor Output – Overall Level: Adjustable (Post-Fader)

Monitor Output – Program Audio Source: None

Monitor Output – Program Audio Dim when Preamble or Mic Active: 0 dB

Monitor Output – Preamble Audio Level: Off

Monitor Output – Microphone Audio Level: Off

Preamble Audio – File 1 Level Trim: 0 dB

Preamble Audio – File 2 Level Trim: 0 dB

Preamble Audio – Allow Update of Files: Yes

### **Channel Specific**

Button Action: Tap to Latch

Button function: Mic Audio Only

Preamble Audio Source: File 1

Program Audio Source: None

Program Audio Dim: 15 dB

Channel Status Signal: None

Channel Receive Action: None