

# **Model 374 Intercom Beltpack**

## **User Guide**

Issue 2, September 2016

This User Guide is applicable for serial numbers M374-00151 and later with application firmware 1.3 and later and Dante firmware 2.0 (Ultimo 3.10.1.12) and later

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# Revision History

## **Issue 2, September 2016:**

1. Revised to show support for 44.1 and 48 kHz sampling rates.

## **Issue 1, August 2016:**

1. Initial release.

# Introduction

The Model 374 Intercom Beltpack starts with the features offered by traditional broadcast party-line (PL) intercom user devices and adds a range of new features along with the advanced performance and capabilities that Dante audio-over-Ethernet provides. With four independent talk and listen channels the Model 374 bridges the gap between typical single- and dual-channel party-line devices and permanently installed multi-channel intercom panels. Imagine the possibilities—four channels of high-quality party-line intercom in a compact, user-worn package.

Over a standard IP network, multiple Model 374 units can be used in PL intercom applications with help from an external Dante-enabled audio matrix. Or, units can be used “point-to-point” or directly interfaced with ports on compatible matrix intercom systems. Only a single Power-over-Ethernet (PoE) connection is required for operation. Key user features can be easily configured including preamplifier gain, independent talk button operation, and individual-channel headphone signal routing. User features include integrated sidetone, remote talk channel turn off (“mic kill”), and monitor only modes. This

capability, along with the great audio quality provided by the digital audio signal path, offers a unique and powerful user experience.

Set up and configuration of the Model 374 is simple. An etherCON® RJ45 jack is used to interconnect with a standard twisted-pair Ethernet port associated with a local-area network (LAN). This connection provides both power and bidirectional digital audio. A broadcast or intercom-style stereo or monaural headset with a dynamic microphone interfaces with the unit using a 5-pin XLR connector. DIP switches and software-based configuration are used to establish the unit’s operating parameters. Four “push-in/push-out” rotary level controls make it easy to set and maintain the desired headphone output. The Model 374’s enclosure is made from an aluminum alloy which offers both light weight and ruggedness. A stainless steel “belt clip,” located on the back of the unit, allows direct attachment to a user’s clothing.

The audio quality of the Model 374’s four audio channels is excellent, with low distortion, low noise, and high headroom. Careful circuit design and rugged components ensure long, reliable operation.



Figure 1. Model 374 Intercom Beltpack top and bottom views

A wide range of applications can be supported, including sports and entertainment TV and radio events, streaming broadcasts, corporate and government AV installations, and post-production facilities.

## Dante Audio-over-Ethernet

Audio data is sent to and received from the Model 374 using the Dante audio-over-Ethernet media networking technology. As a Dante-compliant device, the Model 374's four output (Dante transmitter) and four input (Dante receiver) audio channels can be interconnected (routed) with 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 24 with a sampling rate of 44.1 or 48 kHz.

Two bi-color LEDs provide an indication of the Dante connection status. The Dante Controller's identify command takes on a unique role with the Model 374. Not only will it cause the talk button LEDs to light in a unique highly visible sequence, it will also turn off any active talk channels.

## Audio Quality

The Model 374's completely "pro" performance is counter to the less-than-stellar reputation of typical intercom audio. A low-noise, wide dynamic-range microphone preamplifier and associated voltage-controller-amplifier (VCA) dynamics controller (compressor) ensures that mic input 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 converter (ADC) section that supports a

sampling rate of 44.1 and 48 kHz with a bit depth of up to 24. The audio signal, now in the digital domain, routes through the processor and on to the Dante interface section where it is packetized and prepared for transport over Ethernet.

Audio input signals arrive via the four Dante receiver channels and pass into the Model 374's processor. The sampling rate will be 44.1 or 48 kHz with a bit depth of up to 24. Channel routing, headphone level control, and sidetone creation are performed within the digital domain. This provides flexibility, allows precise control, and keeps the five level potentiometers (channels 1-4 and sidetone) from having to directly handle analog audio signals. The audio signals destined for the 2-channel headphone output are sent to a high-performance digital-to-analog converter and then on to robust driver circuitry. High signal levels can be provided to a variety of headsets, headphones, and earpieces.

## Configuration Flexibility

A highlight of the Model 374 is its ability to be easily configured to meet the needs of specific users and applications. Three DIP switches allow control of the microphone preamplifier gain and a button backlight mode. A software-based configuration mode allows optimizing talk button operation and the routing of the audio inputs to the headphone output channels.

The gain of the microphone preamplifier can be selected from among four choices. This allows compatibility with the dynamic microphones that are part of the many industry-standard broadcast and intercom headsets. A button backlight mode can be enabled to ensure that an LED associated with each of the four talk buttons

will always be lit. This is provided for applications where there is little or no ambient lighting available to assist in identifying button locations.

A highly unique Model 374 feature is the ability to individually configure the way in which the four pushbutton switches function; four choices are available. For standard intercom beltpack operation either push to talk or push to talk/tap to latch operation can be selected. For situations where only monitoring of an intercom channel is desired a talk disable mode is available. And for advanced monitoring-only situations a mode can be selected such that a button will serve in an audio on/off role.

Four audio channels arrive via Dante and are destined for the 2-channel headphone output. Each input can be independently routed to the left and right, left-only, or right-only headphone channels. This flexibility allows a variety of listening environments to be created, including stereo, single-channel monaural, and dual-channel monaural.

## Ethernet Data and PoE

The Model 374 connects to an Ethernet data network using a standard 100 Mb/s twisted-pair Ethernet interface. The physical interconnection is made by way of a Neutrik® etherCON RJ45 connector. While compatible with standard RJ45 plugs, etherCON allows a ruggedized and locking interconnection for harsh or high-reliability environments. An LED displays the status of the network connection.

The Model 374'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 374's PoE interface reports to the power sourcing equipment (PSE) that it's a class 1 (very low power) device. If a PoE-enabled Ethernet port can't be provided by the associated Ethernet switch a low-cost PoE midspan power injector can be utilized.

## Future Capabilities and Firmware Updating

The Model 374 was designed such that its capabilities and performance can be enhanced in the future. A USB connector, located on the unit's main circuit board (underneath the unit's cover), allows the application firmware (embedded software) to be updated using a USB flash drive.

The Model 374 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 that its capabilities remain up to date.

# Getting Started

## What's Included

Included in the shipping carton are a Model 374 Intercom Beltpack and a printed copy of this guide. As a device that is Power-over-Ethernet (PoE) powered, no external power source is provided. Should a PoE midspan power injector be required it must be purchased separately.

## Connections

In this section signal interconnections will be made using the two connectors located on the bottom of the Model 374's

enclosure. An Ethernet data connection with Power-over-Ethernet (PoE) capability will be made using either a standard RJ45 patch cable or an etherCON protected RJ45 plug. A dual- or single-earpiece headset (stereo or monaural) will be connected using a cable-mounted 5-pin male XLR connector.

### Ethernet Connection with PoE

A 100BASE-TX Ethernet connection that supports Power-over-Ethernet (PoE) is required for Model 374 operation. This one connection will provide both the Ethernet data interface and power for the Model 374's circuitry. A 10BASE-T connection is not sufficient and a 1000BASE-T ("GigE") connection is not supported unless it can automatically "fall back" to 100BASE-TX operation. The Model 374 supports Ethernet switch power management, enumerating itself as a PoE class 1 device.

The Ethernet connection is made by way of a Neutrik etherCON protected RJ45 connector that is located on the bottom of the Model 374's enclosure. This allows connection by way of a cable-mounted etherCON connector or a standard RJ45 plug. The Model 374's Ethernet interface supports auto MDI/MDI-X so that a "cross-over" or "reversing" cable will not be required.

### Ethernet Connection without PoE

As previously discussed in this guide, the Model 374 was designed such that the Ethernet connection will provide both data and Power-over-Ethernet (PoE) power. There may be situations where the associated Ethernet switch does not provide PoE power. In such cases an external PoE midspan power injector can be used. If the selected midspan power injector is

802.3af-compatible it should function correctly. Midspan units are available from a variety of sources, including many on-line retailers.

### Headset Connection

The Model 374 provides a 5-pin female XLR connector that interfaces with the microphone and headphone connections of an intercom or broadcast-style headset. Refer to Figure 2 for connection details. The microphone input connections are intended for use with unbalanced dynamic microphones. Balanced microphones should, in most cases, also function correctly if the signal – (low) is connected to Model 374's mic in –/shield connection. No support is provided for microphones that require low-voltage "eletret," P12 phantom, or P48 phantom powering.

To allow users of stereo (dual-earpiece or "double muff") headsets to hear a monaural version of the two headphone output channels does not require special wiring of the 5-pin male XLR mating connector. The headset's left headphone channel should always be wired to pin 4 and the right headphone channel to pin 5. Configuration choices, discussed later in this guide, can then be used to create the

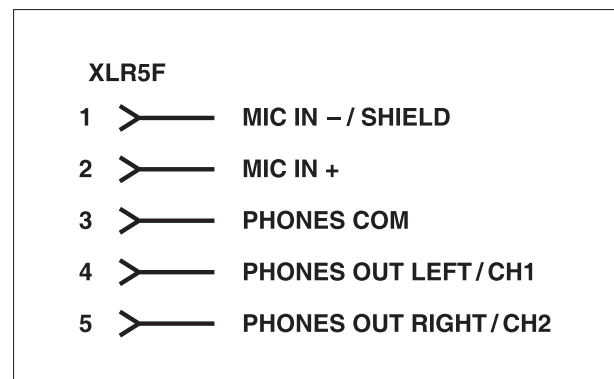


Figure 2. Headset connection pinout chart



desired monaural output. It's important not to connect together (short) pins 4 and 5 of the Model 374's headset connector as damage to the Model 374's output circuitry could result.

Monaural (single-earpiece or "single muff") headsets should be wired such that its headphone is wired only to pin 4; pin 5 should be remain unused. The configuration mode, discussed later in this guide, can be used to create a monaural output.

It's possible that some Beyerdynamic interconnecting cable assemblies terminate the earpiece's left and right connections opposite from what the Model 374 and other broadcast equipment implements. This may require "flipping" two wires in a headset's 5-pin male XLR connector so that left and right from the Model 374 match correctly.

## Dante Configuration

For audio to pass to and from the Model 374 requires that several Dante-related parameters be configured. These configuration settings will be stored in non-volatile memory within the Model 374's circuitry. Configuration will typically be done with the Dante Controller software application which is available for download free of charge at [www.audinate.com](http://www.audinate.com). Versions of Dante Controller are available to support Windows® and OS X® operating systems. The Model 374 uses the Ultimo 4-input/4-output integrated circuit to implement the Dante architecture.

The four Dante transmitter (Tx) channels associated with the Model 374's Dante interface must be assigned to the desired receiver channels. This achieves routing the Model 374's four talk output audio

channels to the device (or devices) that will be "listening" to them. Within Dante Controller a "subscription" is the term used for routing a transmitter flow (a group of output channels) to a receiver flow (a group of input channels). The number of transmitter flows associated with an Ultimo integrated circuit is limited to two. These can either be unicast, multicast, or a combination of the two. If the Model 374's transmitter channels need to be routed to more than two flows it's possible that an intermediary device, such as a rack-mounted digital signal processor unit with more available flows, can be used to "repeat" the signals.

The four Dante receiver (Rx) channels associated with the Model 374's audio inputs also need to be routed to the desired Dante transmitter channels. These four audio signals will be sent to the Model 374's 2-channel headphone output.

The Model 374 supports audio sample rates of 44.1 and 48 kHz with a limited selection of pull-up/pull-down values available. In most cases the default will be used and a pull-up or pull-down rate will not be selected. The Model 374 can serve as the clock master for a Dante network but in most cases it will be configured to "sync" to another device.

The Model 374 has a default Dante device name of **ST-M374** and a unique suffix. The suffix identifies the specific Model 374 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 four Dante transmitter (Tx) channels have default names of **Ch1**, **Ch2**, **Ch3**, and **Ch4**. The four Dante receiver (Rx) 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.

## Model 374 Configuration

Many of the Model 374's operating parameters can be configured to match the needs of specific applications. The Model 374 provides four DIP switches of which three are used to configure operating functions. Two switches allow the gain of the microphone preamplifier to be adjusted. One switch selects if a special button backlight mode is enabled. The fourth switch is not utilized at this time. A software-based configuration method is used to select the talk button modes as well as setting the way in which incoming audio is routed to the headphone output channels. The DIP switches and pushbutton switch that enables configuration are accessible from the back of the unit's enclosure through a rectangular opening that is located under the top of the belt clip.

The DIP switches are connected to the Model 374's logic circuitry which responds to changes by way of the application firmware; no audio passes directly through the switches. Changes made to a DIP switch will immediately be reflected in the unit's operation. Changes made to the talk button modes or headphone audio routing will be incorporated once the configuration process has been completed. A power cycle is not required for configuration changes to be recognized and implemented

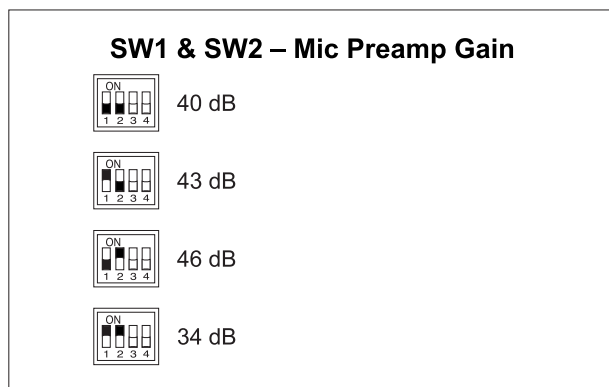
### Accessing the DIP Switches and Configure Button

To access the switches and configure button requires that the belt clip be rotated. Normally the belt clip is secured

to the back of the enclosure using one rivet (non-removable) and one machine screw that has a thread pitch of 6-32. To allow the belt clip to rotate, remove the machine screw using a #1 Phillips head screw driver. The belt clip should now be able to rotate in either direction. Save the screw so that it can be re-installed once the desired configuration choices have been made. Note that the threaded fastener within the back of the Model 374's chassis has an internal locking mechanism (a plastic bushing) that prevents the belt clip's 6-32 machine screw from vibrating loose. So no additional method of thread locking, such as a lock washer or chemical compound, is necessary.

### Microphone Preamp Gain

Switches SW1 and SW2 allow the gain of the microphone preamplifier to be selected. When SW1 and SW2 are in their down (off) position 40 dB of gain is selected. This will be appropriate for most applications. (Technically this gain is approximately equal to the gain provided within an RTS® BP-325 analog party-line belt-pack.) Placing SW1 to its up (on) position while leaving SW2 in its down (off) position selects the 43 dB gain setting. Leaving SW1 to its down (off) position while placing SW2 in its up (on) position selects the 46 dB gain setting. This additional 3 or 6 dB of gain may be helpful in some applications, such as with headsets that have a low microphone output level. The higher gain settings may also be useful when the Model 374 is going to be deployed at events where users are not able to speak at normal levels, e.g., sporting events such as golf tournaments.



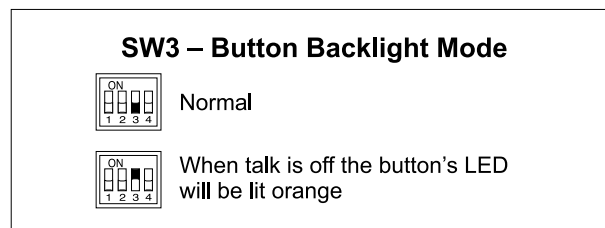
**Figure 3. Microphone preamp gain configuration switches**

Placing SW1 and SW2 to their up (on) positions selects the gain to be 34 dB. This reduced gain setting could be valuable should the connected microphone have a high sensitivity (high output level for a given acoustical input) or an enthusiastic user routinely talks loudly into the microphone.

The compressor active LED, visible on the bottom of the Model 374's enclosure adjacent to the headset connector, can act as a guide when setting the preamp gain. During normal talk operation the compressor active LED should light intermittently. If, for example, it rarely lights and the gain is set to 40 dB, it might be a good idea to change to setting to 43 or 46 dB. If the LED is lit fully during normal talking and the gain is set for 40, 43, or 46 dB, changing it to one of the lower values might be warranted. There's no "hard and fast" rule about which gain setting is appropriate. But unless otherwise indicated, 40 dB is typically a good initial choice.

### Button Backlight Mode

Switch SW3 controls the button backlight mode, something that typically will not be enabled. This special function provides the user with a positive indication of the real-time status of the talk on/off buttons. It will



**Figure 4. Button backlight mode configuration switch**

ensure that in most cases each of the four buttons will have an LED lit at all times. Normally when a talk channel is enabled the button's backlight will be green and when the channel is not enabled no LED will be lit. When the button backlight mode is enabled each button's orange LED will be lit when talk is off. In this way each button will be lit orange for off and green for on. The only exception is when a button is configured to act as a channel audio monitor on/off control. In this case the button backlight mode will not perform any function for that specific button.

### Talk Button and Headphone Audio Configuration

A miniature pushbutton switch, located to the right of the four DIP switches, allows the Model 374 to be placed in its software-based configuration mode. Two functions within this configuration mode allow selecting how the four talk buttons function as well as configuring how the four input audio sources are routed to the 2-channel headphone output. The pushbutton switch, accessible only when the belt clip rotated, is used to enter the configuration mode, move between the functions being configured, and then return the Model 374 to normal operation. The four talk buttons and their associated LEDs, located on the Model 374's top panel, are used to make the specific configuration selections.

## Entering Configuration Mode

To enter the configuration mode press and hold the configure button for a short period of time. A minimum of 500 milliseconds (1/2 second) is required for the “press” to be recognized. This was implemented to ensure that the configuration mode is correctly entered, used, and exited. Once the configuration mode has been entered normal Model 374 operation will cease. No talk audio will be sent out by way of the Dante transmitter channels; no Dante receive audio will be sent to the headphone output channels.

Once the configuration mode has been entered the currently configured operating mode for each of the four buttons will be displayed. Besides displaying the mode using their backlight LEDs, the buttons will also be used to change the selected mode, independently for each channel. The buttons will light green in 1, 2, 3, or 4 flash sequences that repeat continuously. Each button indicates how its own mode has been configured. Refer to Figure 5 for a description of what each flash sequence indicates. Press each button to advance to the next operating mode; each button will advance from 1 to 2, 2 to 3, 3 to 4, and then “wrap” from 4 back to 1.

### Button Mode and Audio Routing Configuration



The configure button is used to access the software-based configuration options.

- 1) Press the configure button to enter the button configuration mode. Normal operation will halt; no talk or listen functions will be available. Each channel button will “flash” green to display its current mode. Press each channel button to advance to its next mode:
    - 1 Flash: push to talk (default)
    - 2 Flashes: push to talk/tap to latch
    - 3 Flashes: talk disabled; no talk on channel; normal audio monitoring
    - 4 Flashes: talk disabled; channel button acts as audio monitor on/off control
  - 2) Press the configure button again to move into the audio routing to phones configuration mode. Each channel button will “flash” orange to display its current mode. Press each channel button to advance to its next mode:
    - 1 Flash: audio source to left and right phones output (default)
    - 2 Flashes: audio source to left phones only
    - 3 Flashes: audio source to right phones only
  - 3) Press the configure button again to store any configuration changes and resume normal operation.
- Notes:
- 1) Press and hold the configure button for 5 seconds to return unit’s configuration to factory defaults.
  - 2) While in configure mode, after 60 seconds of no button press activity unit will return to normal operation with no configuration changes saved.

Figure 5. Button mode and audio routing configuration descriptions

It can seem overwhelming to see all four buttons flashing in identical or different sequences. But if one concentrates on observing only one button at a time it can be quite simple to understand and use. Even blocking three of the four buttons with ones fingers, leaving just one visible, can be helpful.

Here's a summary of what each button's "flash" pattern will indicate:

- Button flashes green one time: push to talk.
- Button flashes green two times: push to talk/tap to latch.
- Button flashes green three times: talk disabled, no talk output on associated output channel; normal audio monitoring.
- Button flashes green four times: talk disabled, button acts as audio monitor on/off control; no talk on that channel, button controls on/off status of the audio being sent to the headphone output.

When the push to talk mode is selected the operation is self-explanatory. Only when a talk button is pressed will talk audio be sent out its associated Dante transmitter channel.

When the push to talk/tap to latch mode is selected a "hybrid" function of sorts is enabled. Pressing and holding the talk button will enable audio to be sent out its associated Dante transmitter channel. When the button is released audio will stop being sent out the associated transmitter channel. Tapping (momentarily pressing) the button will cause the function to "latch" in the talk active mode.

Again tapping the button will cause the function to "unlatch" and talk will no longer be active.

Many applications are best served when the buttons are configured for push to talk mode operation. This ensures that a channel won't accidentally be left in the talk mode. But there are certainly valid situations when the push to talk/tap to latch mode setting will prove to be very useful.

When the talk disabled mode is selected microphone audio will not be sent out the associated Dante transmitter channel. This can be useful when the input audio from this channel is going to be monitored but microphone audio from this specific Model 374 is not allowed to "join" this specific intercom channel.

When the talk disabled/audio monitor on/off control mode is selected the button will not impact talk audio but will instead control the on/off state of the audio being sent to the headphone output. In this mode talk audio will never be sent out the associated Dante transmitter channel. This is an interesting mode, allowing one or more Model 374 audio channels to serve in a "monitor mixer" function. The button will allow quick on/off control while the rotary level control can remain in its desired position.

Once the appropriate button modes have been selected the configuration button, located to the right of the DIP switches, will be used to move on to the next configuration. Don't press it yet. Please move on to the next paragraph of this guide for details.

## Headphone Audio Routing Modes

To leave the talk button operation configuration simply requires one to press and momentarily hold the configure button. This will move on to allow configuring the audio routing to phones mode. The four talk on/off buttons will display the current modes for the four audio input channels. The buttons are also used to change the configurations as desired. When in this mode each button will flash orange one, two, or three times in a continuous sequence to display its current setting. Press each channel button to change to the next mode — 1 to 2, 2 to 3, and then “wrap” from 3 back to 1.

Here’s a summary of what each button’s “flash” pattern will indicate:

- Button flashes orange one time: audio source sent to left and right channels of the headphone output.
- Button flashes orange two times: audio source sent to left channel of the headphone output.
- Button flashes orange three times: audio source sent to right channel of the headphone output.

How the Model 374’s four audio inputs (Dante receiver channels) are routed to the headphone output channels can be configured using this configuration mode. The choices provide flexibility in how the audio sources are presented to the user. When using a stereo (“double muff”) headset it’s common for the four audio input sources to always be routed to both the left and right channels. But the Model 374’s flexibility allows each source to be independently configured for sending to the left and right, left only, or right only headphone channels.

When using a stereo headset sending all inputs to both channels is often referred to as a dual-channel mono output. If a monaural (“single muff”) headset is used the left only configuration option allows the four input channels to be combined to monaural so that the listener can hear all the sources.

Once any desired changes have been made this mode can be exited. Refer to the next paragraphs of this guide for details.

## Exiting Configuration and Return to Normal Operation

Press and momentarily hold the configure button to leave the audio routing mode. At this time any changes made to the button modes and audio routing modes will be stored in non-volatile memory and normal Model 374 operation will resume. Any changes made to the operating modes will be immediately reflected in how the unit functions.

## Restore Factory Defaults

If you press and hold the configuration button for 5 seconds the factory default configurations will be restored and then saved in non-volatile memory. The factory configuration settings are push to talk for the buttons and input audio sent to the left and right channels of the headphone output.

## Inactivity Timer

Whenever a Model 374 is in its configure mode an inactivity time function will be in effect. If the function detects that there is no button-press activity for a continuous 60-second interval the unit will return to normal operation with no configuration changes saved.

# Operation

At this point everything should be ready and Model 374 operation can commence. An Ethernet connection with Power-over-Ethernet (PoE) capability should have been made. Alternately, a midspan power injector, in “series” with the Ethernet connection, should have been put into place. A headset terminated on a 5-pin male XLR connector should be plugged into the headset connector.

The Model 374’s Dante configuration settings should have been selected using the Dante Controller software application. In this way the unit’s four audio output channels (Dante transmitter channels) and four audio input channels (Dante receiver channels) should have been routed to the receiver and transmitter channels on associated equipment. The Model 374’s configuration switches should have been set and the configuration modes selected such that the desired operating characteristics are established.

## Initial Operation

The Model 374 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 three status LEDs located on the bottom panel below the RJ45 jack will begin to light as network and Dante connections are established. The green and orange LED backlights within the four pushbutton switches on the top panel may initially light randomly and then will light in a test sequence to indicate that the main operating firmware (embedded software) has started. Once the entire sequence has

completed and the Dante connection has been established full operation will begin.

## Ethernet and Dante Status LEDs

Three status LEDs are located below the etherCON RJ45 connector on the Model 374’s bottom panel. The LINK ACT LED will light green whenever an active connection to a 100 Mb/s Ethernet network has been established. It will flash in response to Ethernet data packet activity. The SYS and SYNC LEDs display the operating status of the Dante interface and associated network. The SYS LED will light red upon Model 374 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 374 is not synchronized with a Dante network. It will light solid green when the Model 374 is synchronized with a Dante network and an external clock source (timing reference) is being received. It will slowly flash green when the Model 374 is part of a Dante network and is serving as a clock master. It’s possible that up to 30 seconds may be required for the SYNC LED to reach its final state.

## How to Identify a Specific Model 374/Remote Talk Off Function

The Dante Controller software application offers an identify command that can be used to help locate a specific Model 374. When identify is selected it will send a command to a single Model 374 unit. On that specific unit the four pushbutton LEDs will light in a unique pattern. In addition,

the SYS and SYNC status LEDs, located directly below the etherCON RJ45 connector on the bottom panel, will slowly flash green. After a few seconds the LED identification pattern will cease and normal Model 374 button LED and Dante status LED operation will resume.

The identify command also causes a talk off (“mic kill”) function to activate. If any of the four talk buttons are configured to the push to talk/tap to latch mode, and they are latched on, the identify command will cause them to latch off. This allows talk channels on a specific Model 374 that have been accidentally enabled to be remotely turned off.

## Listen Level

Four rotary potentiometers (“pots”), located on the Model 374’s top panel, allow individual adjustment of the level of the four audio input signals as they are sent to the 2-channel headphone output. Depending on the configuration of the unit, each audio input can be sent to both the left and right channels of the headphone output, to the left headphone output, or to the right headphone output. The pots are “push in/push out” type which allow their associated knobs to be in their “out” position to be adjusted and their “in” position when protection from an unwanted change is desired.

Users should find the headphone output audio quality to be excellent, with high maximum output level and low distortion. Analog audio signals do not pass directly through the level pots. The position of the pots is recognized by the Model 374’s processor which then adjusts the signal level within the digital domain. When a pot is in its fully counterclockwise position the

associated audio signal is fully muted. In most cases the on/off status of the four talk channels does not impact the headphone output. However, one configuration setting assigns the associated button to function as a channel listen audio on/off selector.

## Compressor Active LED

A yellow LED indicator is located on the bottom panel adjacent to the headset connector. Labeled COMP, the LED displays the status of the microphone audio compressor function. It will light whenever the input level from the microphone, along with the configured mic preamp gain, is such that the dynamic range of the talk signal is being controlled. It’s perfectly acceptable for this LED to light intermittently whenever a user is talking at a normal voice level into the associated microphone. But if the COMP LED lights solid while a user is talking at a normal voice level this will typically indicate that the mic gain setting should be reduced. Conversely, if the COMP LED almost never lights when normal talking is taking place, it’s possible that changing the gain to a higher value would be beneficial. Note that due to the design of the circuitry the compressor active LED will function whether or not any of the four talk channels are active.

## Talk Buttons

Four pushbutton switches are associated with the Model 374’s four intercom channels. How they function will depend on the configuration of the unit. Each button can be configured independently.

### Push to Talk

When a button has been configured for the push to talk mode how it functions is pretty self-explanatory. Press and hold the button



when headset microphone audio is to be sent out the associated Dante audio output channel. The button's green LED will light to indicate that the output is active.

### **Push to Talk/Tap to Latch**

If a button has been configured for the push to talk/tap to latch mode operation is a bit different and certainly more flexible. Press and hold the button to activate the talk function. When released the talk function will turn off. Momentarily pressing ("tapping") the button will cause the function to change states; off-to-on or on-to-off. Whenever the talk function is active the green LED will light.

### **Talk Disabled**

A button that is configured to the disabled mode will never allow talk audio to be sent to the associated Dante output channel. But to provide "feedback" that the button has been pressed the button's orange LED will flash rapidly three times. This says, in effect, "yes, I recognize that you pressed the button but I'm not going to do anything in response!"

### **Talk Disabled/Audio Monitor On/Off Control**

In the talk disabled/audio monitor on/off control configuration the button will never allow talk audio to be sent to the associated Dante output channel. But instead the button will serve an alternate function, providing an audio channel on/off function. The button will always operate in a tap to latch mode and its orange LED will light when audio is being sent, by way of the associated level control, to the headphone output. Momentarily pressing ("tapping") the button will cause the phones audio signal to change states;

off-to-on or on-to-off. The exact headphone output level will continue to follow the setting of the rotary level control. But its overall on/off state will follow that of the pushbutton.

### **Sidetone Function**

The Model 374 includes a sidetone function that sends microphone audio to both the left and right headphone output channels whenever any of the talk buttons are active. The audio quality should be excellent and will provide the Model 374 user with a confidence signal that they are actively talking to other intercom users. Sidetone audio is always sent to both headphone channels and is not a configurable choice. This is because the function is trying to simulate what a user would hear if they didn't have a headset covering their ears. It is not intended to indicate to the user which Dante talkback output channel or channels are actively being sent audio.

The level of the sidetone audio being sent to the left and right headphone channels is adjusted using the rotary level control ("pot") that is located on the bottom of the Model 374's enclosure. A small straight blade screwdriver (e.g., a "greenie") can be used to adjust the pot. Although with some practice one's thumb and index finger can also be effective. Typically the exact sidetone level is not critical and most users will not be concerned about revising it to a specific value. But setting the sidetone level to something reasonable is important. Setting the level too low will encourage users to speak too loudly; setting it too high and users will be tempted to speak hesitantly. The four headphone level controls on the top panel

of the unit do not impact the sidetone level. Audio does not pass directly through the sidetone pot. The pot's position is monitored by the Model 374's processor which then controls the level within the digital audio domain.

## Technical Notes

### IP Address Assignment

By default the Model 374'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 (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 374 uses the Ultimo "chip" and, as such, a direct one-to-one interconnection to another Model 374 (or other Ultimo-based product) is not supported. An Ethernet switch linking the two units is required to successfully interconnect 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. And an Ethernet switch will provide this. While this is certainly an anomaly, since PoE power is required for Model 374 operation it's highly unlikely that an application would use two Model 374 units without a PoE-enabled Ethernet switch being present.

Using the Dante Controller software application the Model 374's IP address and related network parameters can be set for a fixed (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 each 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 374'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 374. 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. This can typically 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 ([www.audinate.com](http://www.audinate.com)) for details on optimizing networks for Dante applications.

## Application Firmware Version Display

As part of the Model 374's power-up sequence the unit's application firmware (embedded software) version number can be displayed. This is useful when working with factory personnel on application support and troubleshooting. Before connecting the PoE-enabled Ethernet cable, press and hold the channel 4 talk button. Then connect the Ethernet cable. Upon application of PoE power the Model 374 will go through its normal power-up sequences followed by a display of the firmware version. The LED associated with the channel 1 talk button will "flash" to display the major version number. Then the LED associated with the channel 2 talk button will "flash" to display the minor version number. Once the version number has been displayed button 4 can be released and normal operation will begin. As an example of what would be a typical firmware display, if the channel 1 talk button "flashes" once followed by the channel 2 talk button "flashing" three times this would indicate that application firmware version 1.3 was present in the Model 374.

## Application Firmware Update Procedure

It's possible that updated versions of the application firmware (embedded software) that is utilized by the Model 374'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 the MCU's non-volatile memory by way of a USB interface. The Model 374 implements a USB host function that directly supports connection of a USB flash drive. The Model 374's MCU updates its firmware using a file named **m374.bin**.

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. Save the new firmware file in the root directory with a name of **m374.bin**. 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 374, the name of the zip file itself will include the file's version number. For example, a file named **m374v1r3MCU.zip** would indicate that version 1.3 of the application firmware (**m374.bin**) is contained within this zip file.

Once the USB flash drive is inserted into the USB interface, located on the main circuit board under the cover, 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 of this guide. After the firmware has been

updated the LEDs associated with the channel 1 and channel 2 talk buttons should be used to confirm that the desired application firmware version has been successfully installed.

To install the application firmware file follow these steps:

1. Disconnect power from the Model 374. This will entail removing the Ethernet connection that is providing PoE power.
2. Remove the cover from the Model 374. Begin by removing the four Phillips head screws (#1 screw driver tip), two per side. Be certain to save the screws so that re-assembly will be fast and painless. Then carefully slide the cover forward to separate it from the level controls and buttons and then lift it off.
3. Locate the USB connector on the main circuit board. It's near the channel 1 talk button. Insert the prepared USB flash drive into it.
4. Apply power to the Model 374 by connecting to a Power-over-Ethernet (PoE) Ethernet source.
5. After a few seconds the Model 374 will run a "boot loader" program that will automatically load the new application firmware file (**m374.bin**). This loading process will take only a few seconds. During this time period the channel 4 talk button LED will flash slowly in alternate colors. Once the entire loading process is over, taking approximately 10 seconds, the Model 374 will restart using the newly-loaded application firmware.

6. At this time the Model 374 is functioning with the newly-loaded application firmware and the USB flash drive can be removed. But to be conservative, remove PoE power first and then remove the USB flash drive.
7. To confirm that the desired firmware version has been correctly loaded, press and hold the channel 4 talk button, apply power to the Model 374, and "read" the application firmware version number by observing the channel 1 and channel 2 talk button LEDs. Ensure that this is the desired version.

Note that upon power being applied to the Model 374 if a connected USB flash drive doesn't have the correct file (**m374.bin**) in the root folder no harm will occur. Upon power up the channel 4 talk button's 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 in this guide, the Model 374 implements Dante connectivity using the 4-input/4-output Ultimo integrated circuit from Audinate. The Dante Controller software application can be used to determine the version of the firmware (embedded software) residing in the Ultimo "chip." This firmware can be updated by way of the Model 374's Ethernet connection. The latest Dante firmware file is available on the Studio Technologies website. The Dante Firmware Update Manager (FUM) application is used to install the firmware. This program is also available for download on the Studio Technologies website.

# Specifications

**Audio Channels:** 4 talk, 4 listen

## **Power Source:**

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

## **Network Audio Technology:**

**Type:** Dante Audio-over-Ethernet

**Bit Depth:** up to 24

**Sample Rate:** 44.1 and 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:** twisted-pair Ethernet, Power-over-Ethernet (PoE) supported

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

## **Microphone Input:**

**Type:** unbalanced, for use with dynamic microphones

**Gain:** 34, 40, 43, or 46 dB, selectable, ref.  $-60$  dBu input to Dante output ( $-20$  dBFS nominal)

**Frequency Response:** 50 Hz to 10 kHz,  $-3$  dB

**Distortion (THD+N):**  $<0.02\%$

**Dynamic Range:** 75 dB

## **Compressor:**

**Threshold:** 1 dB above nominal level ( $-19$  dBFS)

**Slope:** 2:1

**Status LED:** compressor active

## **Headphone Output:**

**Type:** dual-channel

**Compatibility:** intended for connection to mono or stereo headsets or earpieces with nominal impedance of 50 ohms or greater

**Maximum Output Voltage:** 3.8 Vrms, 1 kHz, 150 ohm load

**Frequency Response:** 20 Hz to 10 kHz,  $-3$  dB

**Distortion (THD+N):**  $<0.002\%$

**Dynamic Range:**  $>100$  dB

## **Connectors:**

**Headset:** 5-pin female XLR

**Ethernet:** Neutrik etherCON RJ45

**USB:** type A receptacle (located inside Model 374's enclosure and used only for firmware updates)

## **Dimensions (Overall):**

3.6 inches wide (9.2 cm)

1.6 inches high (4.0 cm)

4.8 inches deep (12.6 cm)

**Mounting:** intended for portable applications; contains integral belt clip; optional mounting adapter kit allows Model 374 to be permanently mounted

**Weight:** 0.6 pounds (0.3 kg)

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