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Studio 5202 Dante Phones and Line Output Interface

Studio 5202 Dante Phones and Line Output Interface User Guide

Contents

Studio

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Specifications

- **Model:** 5202 Dante to Phones and Line Output Interface

- **Serial Numbers:** M5202-00501 and later

- **Application Firmware:** 1.3 and later

- **Dante Firmware**: 4.8.0 (UltimoX v4.2.8.2) and later

Product Usage Instructions

Applications
The Model 5202 Dante to Phones and Line Output Interface is versatile and can be used for various applications such as headphone output and line outputs for monitoring, interfacing with audio consoles, wireless in-ear or IFB monitor systems, and audio recording devices.

Headphone Output
The headphone output allows for direct monitoring of audio signals. Adjust the headphone volume using the dedicated level control.

Line Outputs
The line outputs can be connected to audio amplifiers, speakers, audio consoles, or recording devices. Use the level control to adjust the output volume or match input sensitivity.

Metering
LED meters provide a real-time level indication for the Dante-supplied audio channels. Ensure proper signal levels for optimal audio performance.

Ethernet Data and PoE
The Model 5202 receives audio data via Dante Audio-over-Ethernet technology. Use Dante Controller software to assign audio channels. The unit supports bit depths up to 24 and sample rates of 44.1, 48, 88.2, and 96 kHz.

Getting Started
Unbox the Model 5202 Interface unit and refer to the electronic copy of the guide for setup instructions. The device is Power-over-Ethernet (PoE) powered; a PoE midspan power injector may be required (sold separately).

Revision History

Issue 3, December 2023:

- Revises format of document.
- Documents use of UltimoX integrated circuit.
- Notes support for AES67 and Dante Domain Manager (DDM).

Issue 2, August 2015:

- Documents enhanced unit identification feature.
- Adds improvements to IP address configuration assignment explanation.

Issue 1, August 2014:

- Initial release.

Introduction

The Model 5202 Interface is a general-purpose audio device that supports applications utilizing the Dante® audio-over-Ethernet media networking technology. Two Dante-associated audio channels can be assigned to the Model 5202 which provides head-phone and balanced line-level outputs. The audio quality is such that virtually any audio application can be supported, from simple headphone or loudspeaker monitoring to interfacing with high-performance on-air broadcast, stadium AV, or corporate audio systems. Multi-step LED meters confirm the level of the two input audio channels. The compact, lightweight design allows the Model 5202 to be used in portable or desktop situations or deployed as a permanent solution in fixed applications. Standard connectors ensure fast, reliable deployment. The unit requires only an Ethernet connection to supply both the data interface as well as Power-over-Ethernet (PoE) power.

Applications

The Model 5202 is perfect for use in conjunction with the Dante Controller software application. Driving a pair of headphones or a set of amplified speakers, audio flows and associated channels can be quickly confirmed for content as well as signal level. For field applications, the unit can serve as both a test tool and a general-purpose source of analog audio outputs. With level controls associated with both the headphone and line outputs interfacing with virtually any analog audio input is a simple matter. For permanent applications there's no reason why a Model 5202 can't reside within an equipment rack or be mounted, using optional brackets, underneath a table or on-air studio set. The low-power circuitry is intended for continuous operation.

Headphone Output
A sonically-excellent 2-channel (stereo) headphone output is provided. It is capable of driving contemporary headphones, headsets, and earbuds to substantial levels at very low distortion. A rotary control is used to adjust the headphone output level. The level knob is a push-in/push-out type which helps prevent inadvertent adjustment. For flexibility the headphone output is provided on two separate 3-conductor jacks: a 3.5 mm on the front panel and a ¼-inch on the back. The audio quality of the headphone output is such that it can also be used as a 2-channel unbalanced line output. The output level control will make it a simple task to optimally interface the headphone output with inputs on personal computers, portable audio devices, and "semi-pro" equipment.

Line Outputs
The Model 5202 provides a 2-channel line-level, electronically-balanced analog audio output by way of standard 3-pin male XLR connectors located on the back panel. A rotary level control allows the nominal (average) level of the line outputs to be adjusted. Using the push-in/push-out knob it's a simple matter to achieve the desired nominal output levels which include –10, 0, or +4 dBu. And with a maximum output level of +24 dBu, there will always be sufficient headroom for "pro" audio performance. Protection components in the output circuitry help ensure reli-

ability in field applications.

The line outputs can serve several monitoring and interfacing uses. Audio amplifiers or amplified speakers can be directly connected. The level control can be used to adjust the speaker volume or used as a level trim function to match the speaker's input sensitivity. The line outputs can also serve as a source for interfacing with analog inputs on audio consoles, wireless in-ear or IFB monitor systems, as well as audio recording devices. The level control will help to ensure that the nominal level of the line outputs will match the requirements of the connected equipment.

Metering

Two 7-step LED meters provide a real-time level indication of the two Dante-supplied audio channels. Scaled in dBFS (decibels referenced to full scale digital) the meters offer a direct view of the signal levels as they arrive in the digital domain. Optimal audio performance requires transporting signals at their proper levels — without an accurate indication, this can be difficult to achieve.

Ethernet Data and PoE

The Model 5202 connects to a 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 5202's operating power is provided by way of the Ethernet interface using the Pow-er-over-Ethernet (PoE) standard. This allows fast and efficient interconnection with the associated data network. To support PoE power management the Model 5202's PoE interface reports to the power sourcing equipment (PSE) that it's a class 1 (very low power) device. An LED is provided to indicate when power is being supplied to the Model 5202. Note that no provision has been made to allow an external power source to be connected. However, if the associated Ethernet switch does not provide PoE capability a commonly-available mid-span PoE power injector can be utilized.

Dante Audio-over-Ethernet

- Audio data is sent to the Model 5202 using the Dante audio-over-Ethernet media networking technology. As a Dante-compliant device, two audio channels can be assigned to the unit using the Dante Controller software application. A single mouse click is all that's required to route an audio signal to the Model 5202. Bit depths of up to 24 and sample rates of 44.1, 48, 88.2, and 96 kHz are supported. Two bi-color LEDs indicate the Dante connection status.
- The Model 5202 is compliant with the AES67 interoperability standard. In addition, the unit is compatible with the Dante Domain Manager™ (DDM) software application.
- The Model 5202 uses Audinate's UltimoX™ integrated circuit for implementing Dante. The integrated circuit's firmware can be updated via the Ethernet connection, helping to ensure that its capabilities remain up to date.

Getting Started

Included in the shipping carton are a Model 5202 Interface unit and instructions on how to obtain an electronic copy of this guide. As a device that is Power-over-thernet (PoE) powered, no external power source is provided. Should a PoE midspan power injector be required it must be purchased separately.

Mounting Options

There is no provision for directly mounting one or more Model 5202 units in an equipment rack. However, the overall height of the unit was carefully selected so that it could be placed without interference on a single space (1U) rack shelf. The Model 5202's enclosure width allows up to four units to be placed side-by-side on a 1U shelf that's mounted in a standard 19-inch equipment rack. Hook-and-loop ("Velcro") tape can be used to secure the Model 5202 units to the shelf. A set of mounting brackets is available to allow a Model 5202 to be attached to the underside of a desk, table, broadcast set, or other flat surface. Contact Studio Technologies for details.

Connections

In this section, signal interconnections will be made using the connectors located on the front and back panel of the Model 5202. An Ethernet data connec-tion with Power-over-Ethernet (PoE) capability will be made using either a standard RJ45 patch cable or an etherCON-protected RJ45 plug. Headphones can be connected using either the 3.5 mm or ¼-inch 3-conductor phone jack. Line output connections are made using two 3-pin male XLR connectors.

Ethernet Connection

A 100BASE-TX Ethernet connection that supports Power-over-Ethernet (PoE) is required for Model 5202 operation. This one connection will provide both the Ethernet data interface and power for the Model 5202'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. For PoE switch (PSE) power management the Model 5202 will enumerate 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 back panel of the Model 5202. This allows connection by way of a cable-mounted etherCON plug or a standard RJ45 plug. The Model 5202's Ethernet interface supports auto MDI/MDI-X so that most cabling implementations will be correctly supported.

Headphone Output

- The Model 5202's headphone output is compatible with standard stereo headphones, headsets, or earbuds. Connecting devices with a nominal impedance of 100 ohms or greater is recommended. But this shouldn't be an issue since essentially all of the contemporary devices meet this recommendation.

- Devices are connected to the headphone output by way of either a 3.5 mm 3-conductor jack located on the Model 5202's front panel or a ¼-inch 3-conductor phone jack located on the Model 5202's back panel. As is standard for stereo headphones, the left channel is connected to the jacks' tip lead, the right channel to the jacks' ring lead, and the common connection to the jacks' sleeve. Inside the Model 5202 the connections on the two jacks are wired in parallel ("emulated"); the same output circuitry drives both connectors. While it's expected that typically only one pair of headphones or earbuds will be connected at a time, there is no reason why two pairs can't be connected at the same time.

Line Outputs

The line outputs are designed for general-purpose use which could include connecting to inputs on audio consoles, amplified speakers, audio storage devices or systems, or transmitters associated with wireless in-ear monitors. The audio quality is such that using the line outputs for on-air broadcast or streaming applications would be appropriate. The line outputs are analog, electronically balanced, capacitor coupled, and will perform optimally when driving loads of 2 k (2000) ohms or greater. The nominal output level depends on the setting of the rotary level control. When the control is set to its fully clockwise position the nominal level is +4 dBU. This means that if there is a Dante transmitter (output) channel that has a nominal level of –20 dBFS when it's routed to a Model 5202 the associated line output will have a nominal level of +4 dBu.

The Model 5202 provides two 3-pin male XLR connectors for interfacing with associated equipment. Pin 2 should

be connected as signal + (high), pin 3 as signal – (low), and pin 1 as common/shield. To connect to an unbalanced load use 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.

Dante Configuration

Several Model 5202's Dante-related parameters can be configured. These configuration settings will be stored in non-volatile memory within the Model 5202's circuitry. Configuration will typically be done with the Dante Controller software application which is available for download free of charge at **audinate.com**. Versions of Dante Controller are available to support Windows® and OS X® operating systems. The Model 5202 uses the UltimoX 2-input/2-output integrated circuit to implement the Dante architecture. However, only the two receiver (input) channels are utilized. This dictates which parameters can be configured and what choices are available. The Model 5202 is compatible with AES67 and the Dante Domain Manager™ (DDM) software application. AES67 operation requires that a setting within Dante Con-troller be enabled. For DDM operation please refer to the specific DDM documentation for details on what Model 5202 and related parameters may have to be configured.

The two audio input channels associated with the Model 5202's Dante interface must be assigned to the desired output sources. 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 Model 5202 will support audio sample rates of 44.1, 48, 88.2, and 96 kHz with a limited selection of pull-up/pull-down values. The Model 5202 can serve as the Leader clock for a Dante network but in most cases, it will "sync" to another device. (Note that when operating in the AES67 mode, the Dante transmitter (output) channels will function only in multicast; unicast is not supported.)

The Model 5202 has a default Dante device name of ST-M5202 and a unique suffix. The suffix identifies the specific Model 5202 that is being configured (it relates to the MAC address of the UltimoX integrated circuit). The two Dante receiver channels have default names of Ch1 and Ch2. Using Dante Controller the default device and channel names can be revised as appropriate for the specific application.

The Model 5202 can be configured for AES67 operation. This requires the AES67 Mode to be set for Enabled. By default, AES67 mode is set for Disabled. As previously mentioned, in the AES67 mode the Dante transmitter (output) channels will function in multicast; unicast is not supported.

Operation

At this point, an Ethernet connection with Power-over-Ethernet (PoE) capability should have been made. The unit's Dante configuration settings should have been made using the Dante Controller software application. At a minimum, a transmitter source should have been routed to the Model 5202's two Dante receiver channels. Headphone and line out-put connections should have been made as desired. Normal operation of the Model 5202 can now begin.

Initial Operation

The Model 5202 will immediately begin to function after a Power-over-Ethernet (PoE) power source is connected. However, full operation may take up to 20 seconds to begin. Upon initial power up the four status LEDs located on the back panel will begin to light. The meter LEDs on the front panel will light in a test sequence. After the meter LEDs complete their test sequence one meter LED associated with channel 1 and one meter LED associated with channel 2 will briefly light to indicate the version number of the unit's firmware (embedded software). (Understanding how to "read" the application firmware number will be discussed in detail later in this guide.) Once that sequence has been completed and the Dante connection has been established audio signals can be available.

Ethernet, PoE, and Dante Status LEDs

Four status LEDs are located below the Ethernet con-nector on the Model 5202's back panel. The PoE LED will light green to indicate that the Power-over-Ethernet (PoE) associated with the connected Ethernet signal is providing operating power for the Model 5202. 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 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 5202 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 5202 is not synchronized with a Dante network. It will light solid green when the Model 5202 is synchronized with a Dante network and an external clock source (timing reference) is received. It will slowly flash green when the Model 5202 is part of a Dante network and is serving as a Leader clock.

How to Identify a Specific Model 5202

The Dante Controller software application offers an identify command that can be used to help locate a specific Model 5202. When identify is selected for a specific unit its meter LEDs will light in a unique pattern. In addition, the SYS and SYNC LEDs, located directly below the etherCON connector on the back panel, will slowly flash green. After a few seconds, the LED identification patterns will cease and normal Model 5202 level meter and Dante status LED operation will again take place.

Level Meters

Two 7-step LED meters will display the level of the two Dante audio receiver (input) channels. The meter steps are calibrated in dBFS which indicates the number of dB below the maximum possible digital signal level. The maximum level, 0 dBFS, is the digital audio reference level equal to "full scale." Full scale refers to the maximum level possible for a sine wave before "digital clipping." In typical applications, a signal level of –20 dBFS would be the nominal (normal average) value. The five-meter steps have a threshold of –20 dBFS and less light with the color green. The step that lights at –15 dBFS and greater is yellow and indicates a "hot" or above-average signal level. The top step lights red in color when a signal level is –5 dBFS or greater, indicating that a potentially "clipped" (distorted due to excessive level) signal is present.

Headphone Output

Dante input channel 1 is routed to the left headphone output channel. This signal is connected to the tip con-nection on both the 3.5 mm and ¼-inch headphone output jacks. Dante input channel 2 is routed to the right headphone output channel which is associated with the ring connection on the output jacks. The push-in/push-out headphone level control adjusts the level of both the left and right channels of the headphone outputs. In the fully counterclockwise position, the output level is essentially off.

Care must be taken when adjusting the headphone output level control. The output circuitry is capable of driving headphones, headsets, or earbuds to damaging levels. Hearing damage is a real possibility and caution must be exercised.

Line Outputs

Dante input channel 1 is routed to line output channel 1. Dante input channel 2 is routed to line output channel 2. The associated push-in/push-out rotary control adjusts the level of both line output channels. In its fully counterclockwise position, the output level of the two channels are essentially off. In its fully clockwise position, the output levels will be approximately +4 dBu with a Dante input signal that has a level of –20 dBFS.

Technical Notes

IP Address Assignment

By default, the Model 5202's Ethernet interface will attempt to obtain an IP address and associated settings using DHCP (Dynamic Host Configuration Protocol). If a DHCP server is not detected an IP address will 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 assign an 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 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 correctly acquire IP addresses and be able to communicate and transport audio.

Using the Dante Controller software application the Model 5202's IP address and related network parameters can be set for a fixed ("static") configuration. While this is more involved than letting DHCP or link-local "do their thing," if fixed addressing is necessary then that capability is available. 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 IP address. If knowledge of a Model 5202's IP address has been misplaced there is no reset button or other method to 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) net-working 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 personal computer connected directly to the Model 5202. Then by using the appropriate ARP command the required "clues" can be obtained.

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 (**audinate.com**) for details on optimizing networks for Dante applications.

Updating Main Application Firmware

The Model 5202 uses a Freescale HCS-08-series microcontroller (MCU) integrated circuit to run its main application firmware (embedded software).

The firmware is loaded into and stored in the MCU's nonvolatile memory by way of a stand-alone hardware programmer unit that interfaces with a header connector located on the unit's motherboard. This firmware programming is done at the factory at the time of manufacture using a Cyclone Pro or Cyclone Universal stand-alone programmer unit from P&E Micro (**pemicro.com**). There is no provision for updates of the application firmware to easily be performed in the field. Unlike some of the other Studio Technologies' Dante-enabled products, the Model 5202 does not have a USB interface for firmware updating. This is because of the Model 5202's simple, well-defined functionality and commensurate limited-resource MCU.

Updated versions of the Model 5202's application firmware may be released. This could be due to software bug fixes or feature improvements. It's expected that in most cases Model 5202 units will be returned to the factory should this firmware need to be loaded. This would be true unless a user, reseller, or distributor has access to an appropriate stand-alone programmer unit. For reference, the Studio Technologies' website will make available the latest version of the Model 5202's application firmware file along with a text description file. Contact the factory for additional details.

UltimoX Firmware Update

As previously discussed, the Model 5202 implements Dante connectivity using the 2-input/2-output UltimoX integrated circuit from Audinate. The Dante Controller software application can be used to determine the version of the firmware (embedded software) residing in the UltimoX "chip." This firmware can be updated by way of the Model 5202's Ethernet connection. The latest Dante firmware file is available on the Studio Technologies' website. The Dante Firmware Update Manager application is used to install the firmware. This program is also available for download on the Studio Technologies' website.

Identifying the Firmware Version Number

As previously discussed, upon power up the meter LEDs are used to briefly display the version number of the Model 5202's firmware (embedded software). This information is typically only necessary when working with the factory on support issues. The meter LEDs will first go through a display sequence followed by an approximately 1-second period where the version number will be indicated. The top row of seven LEDs will display the major version number with a range of 1 to 7. The bottom row of seven LEDs will display the minor version number with a range of 1 to 7. Refer to Figure 2 for details.

Figure 2. Detail of the front panel showing the LEDs that display the firmware version. In this example, the version

shown is 1.3.

Specifications

Network Audio Technology:

- **Type:** Dante audio-over-Ethernet
- **AES67-2018 Support:** yes, selectable on/off Dante Domain Manager (DDM) Support: yes Bit Depth: up to 24
- **Sample Rates**: 44.1, 48, 88.2, and 96 kHz Number of Receiver (Input) Channels: 2
- **Dante Audio Flows:** 2 receiver
- **Digital to Analog Equivalence:** at unity gain a Dante digital input of –20 dBFS results in an analog output of +4 dBu
- **Network Interface:**
- **Type:** twisted-pair Ethernet with Power-over-Ethernet (PoE)
- **Data Rate:** 100 Mb/s (10 Mb/s Ethernet not supported)
- **Power:** Power-over-Ethernet (PoE) per IEEE 802.3af class 1 (very low power, ≤3.84 watts)
- **General Audio Parameters:**
- **Frequency Response:** 20 Hz to 20 kHz, ±0.5 dB, Dante to line output
- **Distortion (THD+N):** 0.01%, measured at 1 kHz, +4 dBu, Dante to line output
- **Dynamic Range:** >100 dB, A-weighted, Dante to line output
- **Headphone Output:**
- **Type:** stereo, configured to drive headphones through 100 ohm series resistors
- **Compatibility:** intended for connection to headphones with an impedance of 100 ohms or greater Level: adjustable using rotary level control.
- **Maximum Voltage:** 8 Vpp, 100-ohm load
- **Line Outputs:** 2
- **Type:** electronically balanced, capacitor-coupled, intended to drive balanced or unbalanced loads of 2 k ohms or greater
- **Source Impedance:** 200 ohms
- **Nominal Level:** adjustable using rotary level control, +4 dBu @ 100% rotation
- **Maximum Level:** +24 dBu into 2 k ohms
- **Meters:** 2
- **Function:** displays level of Dante input signals Type: 7-segment LED, modified VU ballistics

Connectors

- **Ethernet:** Neutrik etherCON RJ45 Headphone Output: 3.5 mm and ¼-inch 3-conductor jacks
- **Line Outputs:** 3-pin male XLR
- **Dimensions (Overall):**
    - 4.2 inches wide (10.7 cm)
    - 1.7 inches high (4.3 cm)
    - 5.1 inches deep (13.0 cm)
- **Mounting Option:** MBK-02 Mounting Bracket Kit
- **Weight:** 0.8 pounds (0.35 kg)

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

Model 5202 User Guide
Studio Technologies, Inc.

FAQ

- **Q: How do I update the firmware of the integrated circuit?**
  - A: The firmware of the integrated circuit can be updated via the Ethernet connection. Refer to the user manual for detailed instructions on updating the firmware.
- **Q: What are the supported sample rates for audio data?**
  - A: The Model 5202 supports sample rates of 44.1, 48, 88.2, and 96 kHz for audio data transmission.

Documents / Resources

	Studio 5202 Dante Phones and Line Output Interface [pdf] User Guide 5202 Dante Phones and Line Output Interface, Dante Phones and Line Output Interface, Phones and Line Output Interface, Line Output Interface, Output Interface, Interface

References

- **Audinate - Pioneering the future of AV**
- **PEmicro - 40+ years innovating in the embedded systems space. Flash Programmers, Cloud-based, Automated, Gang Programmers, and more...**
- **Home - Studio Technologies, Inc.**
- **User Manual**