



Key Features

- Two versions available: 8 or 16 input and output channels
- Analog line-level inputs to Dante outputs
- Special analog mixer function for matrix intercom applications (can be used as an all-digital replacement for RTS® MDA-100)
- Dante inputs to analog line-level outputs
- Three Gigabit Ethernet interfaces
- Standard connectors
- Excellent audio quality
- AC mains and 12 volt DC powering
- Lightweight enclosure, single rack-space (1U) mounting

Introduction

The Model 5412 Audio Interface provides a simple yet high-performance means of interfacing line-level analog signals with applications that utilize Dante® audio-over-Ethernet media networking technology. The Model 5412 is available in two versions – one with 8 input and 8 output channels and the other with 16 input and 16 output channels.

Analog sources can be connected to the unit and then output in the digital domain by way of a Dante interface. Digital audio signals, which also arrive by way of Dante, are converted to analog and can be output as balanced line-level signals. For application flexibility and troubleshooting configuration choices allows selection of the audio sources used by the Dante transmitter and analog output channels. This provides digital and analog loopback and test tone capability.

The Model 5412 is a fully professional product that offers the audio quality, features, and reliability required by 24-hour on-air and commercial applications. The analog inputs and analog outputs use 25-pin D-subminiature connectors for easy interfacing with balanced and unbalanced sources and destinations.

The line-level analog audio input signals are converted to PCM digital and then transported via a Dante interface. Using the Dante Controller software application, digital audio signals can be routed (subscribed) to the Model 5412 via the Dante interface.

The Model 5412 provides three Gigabit Ethernet (GigE) network interfaces, two to support redundant Dante operation and the third for accessing the management menu system. To meet the latest interoperability standard the Model 5412's Dante implementation supports AES67-2018. The unit also supports the Dante Domain Manager™ (DDM) software application. An integrated web server allows fast and flexible monitoring and configuration of the unit's networking and audio performance. Front-panel LED indicators, a backlit LCD display, and pushbutton switches provide users with direct access to key operating parameters.

The Model 5412 can be powered by 100-240 V, 50/60 Hz mains or a source of 12 volts DC. Both can be simultaneously connected to provide redundant operation. The unit's lightweight enclosure mounts in one space (1U) of a standard 19-inch rack. Industry-standard connectors are used for the analog input, analog output, Ethernet, DC power, and AC mains interconnections.



Model 5412 Front View (top) and Model 5412-01 Rear View (bottom)

Dante audio-over-Ethernet has found wide acceptance as an audio “backbone” due to its ease of use, interoperability, excellent audio quality, and wide adoption by a large number of equipment manufacturers. The Model 5412 can serve as an “edge” device for Dante network implementations, providing high-performance line-level analog input and output resources in a compact, cost-effective package. The unit can also serve as a general-purpose audio “tool” to help extend Dante capabilities to facilities and applications that were initially implemented to support signals in the analog domain.

Dante Audio-over-Ethernet

Digital audio data associated with the Model 5412 is interfaced with one or two local area network(s) using Dante audio-over-Ethernet media networking technology. Status LEDs provide a real-time indication of Dante and LAN performance. The signals associated with the Model 5412’s analog input channels are converted to digital and can be routed to Dante transmitter (output) channels on the unit’s Dante interface. Transmitter (output) channels from Dante-enabled devices can be assigned to the Model 5412’s Dante receiver (input) channels using the Dante Controller software application. These input signals can be converted into analog and then sent to the analog output circuitry.

A major benefit of using Dante is its ability to use any standard Ethernet network implementation, including commonly available switches, to directly transport professional audio signals. The Model 5412 supports digital audio signals with a bit depth of up to 24 and a sample rate of 44.1, 48, 88.2, and 96 kHz. These sample rates were selected for optimal support of broadcast, production, industrial, and commercial applications.

Network Ports

Using the Dante Controller software application, the Model 5412’s two Dante Ethernet ports can be selected to operate in either the Switched or Redundant modes. In the Switched mode a single Ethernet connection is used for interconnection with other Dante-compliant devices. The second Model 5412 Dante Ethernet port can be used to interface with another piece of network equipment. In the Redundant mode independent

Ethernet connections would be made to the unit’s two Ethernet ports implementing Dante’s redundant network capability.

The Model 5412’s third Ethernet port will always be used to access the management webpages. This port can be connected to an independent network that some facilities implement for equipment monitoring and maintenance purposes. The unit’s management port can also be connected to the network that is being used for Dante. It would have a unique IP address and not interact with the Dante audio data.

Applications

Two versions of the Model 5412 are available, identified using the suffixes -01 and -02. The Model 5412-01 provides 8 line-level analog inputs and 8 line-level analog outputs. The Model 5412-02 provides 16 line-level analog inputs and 16 line-level analog outputs. Both Model 5412 versions feature an optimized set of LED indicators, a graphics display, and pushbutton switches that make them simple and intuitive to use. Rack-mounted in one space “1U” of a standard 19-inch equipment rack, the units are appropriate for use in fixed locations, serving the needs of systems associated with post-production, content distribution, education, commercial, and government facilities. Their lightweight enclosure also makes them suitable for mobile and field uses.

Both Model 5412 versions units can serve as general-purpose analog-to-Dante/Dante-to-analog interface devices. Each is suitable for use in demanding on-air broadcast and live-event applications that require solid audio performance and reliable operation. And simple troubleshooting and performance confirmation is supported with the unit’s flexible source selection capability.

A special function allows multiple Model 5412 analog inputs to be unity-gain mixed (combined or summed) and then output by way of a single Dante transmitter (output) channel. The mixing function is performed in the digital domain by way of a high-speed programmable logic (FPGA) device. Configuration choices allow selection of the specific input channels that are to be summed. With the Model 5412-01, Dante transmitter (output) channel 8 can use a single analog input channel, or a



Model 5412-02 Rear View

mix of up to all eight of the analog inputs as its audio source. The Model 5412-02 provides even more flexibility, allowing Dante transmitter (output) channels 15 and 16 to utilize, if desired, some or all of the 16 analog input channels as their audio signal sources.

This analog input channel mixing capability was specifically included to support intercom applications that would previously have utilized the RTS® Model MDA-100 Mixing Distribution Amplifier. In the pre-Dante days, an RTS matrix intercom system application might mix, using the MDA-100, the analog intercom “talk” outputs from multiple camera control units (CCUs), sending the result to a single ADAM® analog input port. And an analog audio output port on the ADAM matrix would use the MDA-100’s analog audio distribution amplifier (DA) capability to distribute the signal to the “listen” inputs on the multiple CCUs.

However, this situation changed when RTS matrix intercom systems began to include the Dante-compatible OMNEO® interfaces. This required a new method of interfacing the CCUs’ analog intercom capability with the digital audio-over-Ethernet OMNEO ports. A Model 5412 unit, utilizing its analog input mixing capability, can directly support these CCU intercom interfacing applications. The analog “talk” audio sources from multiple CCUs can be combined and output as a single Dante transmitter (output) channel. This channel would then be subscribed (routed) to an OMNEO receiver (input) port. And the analog outputs of a Model 5412 can easily provide a distribution amplifier (DA) function. It can be achieved by subscribing (routing) a single OMNEO transmitter (output) channel to multiple Dante receiver (input) channels on a Model 5412. An analog output channel would be associated with each Model 5412 Dante receiver (input) channel. These analog outputs would then be connected to the “listen” inputs on associated CCU units. Using this simple deployment, a Model 5412 will allow a reliable, high-performance, and cost-effective CCU-to-matrix intercom interface to be achieved.

Analog Inputs

Depending on the version selected, the Model 5412 will provide either 8 or 16 analog inputs that are compatible with balanced or unbalanced line-level sources. The input signals are converted to digital and then output to one or two Ethernet network(s) via Dante. Compatible signal sources include audio consoles, wireless microphone receivers, broadcast playback equipment, and output ports

on matrix intercom systems or related equipment.

The analog inputs are electronically balanced (differential), capacitor-coupled, and ESD (static) protected for reliable operation in demanding applications. Extensive filtering minimizes the chance that radio frequency (RF) energy will cause interference. The analog inputs are protected from damage should a moderate DC voltage be accidentally connected. These characteristics make the analog inputs suitable for use in studio and mobile facilities as well as field-deployed environments.

The audio performance of the Model 5412’s analog inputs is very good. Low-noise, wide dynamic-range circuitry ensures that audio quality is preserved. The audio signals are routed to high-performance analog-to-digital conversion (ADC) sections that support a range of sample rates and a bit depth of up to 24. A precision voltage-reference circuit helps the ADC circuitry perform highly accurate signal conversion. The audio signals, now in the digital domain, are packetized and prepared for transport over Ethernet networking.

Analog Outputs

The selected Model 5412 version will provide either 8 or 16 line-level analog output channels. The analog outputs are electronically balanced, capacitor-coupled, and ESD (static) protected. High-quality components, including the important digital-to-analog converters, are used to provide low-distortion, low-noise, and sonically excellent performance. Robust circuitry provides protection from damage should a moderate DC voltage be accidentally connected, something especially useful in broadcast applications. The analog outputs are compatible with virtually all balanced and unbalanced loads with an impedance of 2 k ohms or greater.

The Model 5412’s analog outputs have a maximum level of +24 dBu. This allows both compatibility and sufficient headroom in applications where digital audio signals with a nominal level of –20 dBFS need to translate into analog signals that have a nominal level of +4 dBu. For flexibility, a configuration menu choice allows the level of each analog output channel to be individually adjusted (“trimmed”) over a range of ±20 dB in 0.1-dB steps.

Flexible Source Configuration

For installation confirmation, system testing, and troubleshooting support the Model 5412 provides a unique set of configuration choices. The audio signal sources associated with the

Dante transmitter (output) channels and the analog output channels can each be selected, as a group, from three choices. The Dante transmitter (output) channels can have their audio source selected to be the Model 5412's analog line inputs, the Model 5412's Dante receiver (input) channels, or a low-distortion 1 kHz sine-wave tone. During normal operation the analog line inputs will be selected. Having the ability to enable a Dante digital loopback function can help confirm network performance and provide assistance during troubleshooting. The ability to have a 1 kHz tone present on all the Dante transmitter (output) channels can also prove useful.

The analog outputs can have their audio sources selected to be the Model 5412's Dante receiver (input) channels, the Model 5412's analog input channels, or a 1 kHz tone. In most cases, the Dante receiver (input) channels would be selected as the audio sources for the analog output channels. Having analog loopback capability can make confirmation of analog wiring a simple matter. Being able to have a 1 kHz tone present on all of the analog output channels can make it a simple matter to confirm operation of devices connected to the Model 5412's analog outputs.

Simple Installation

The Model 5412 uses standard connectors to allow fast and convenient interconnections. Multiple 25-pin female D-subminiature connectors are used to interface with the analog input and analog output signals. The unit connects to local area networks (LANs) using three RJ45 jacks. Multiple LEDs on the unit's back panel display the status of the network

connections. A detachable power cord can be used to connect a source of AC mains power. Alternately, a DC power source can be connected using a 4-pin XLR connector. The lightweight aluminum enclosure mounts in one space (1U) of a standard 19-inch rack enclosure.

Operating Power

The Model 5412 allows an AC mains source of 100-240 V, 50/60 Hz to be connected by way of a standard detachable mains power cord. It can also be DC powered using a 10-18 volt source that is connected via a broadcast-standard 4-pin XLR connector. If both AC and DC power sources are connected the unit will be powered by the AC mains supply. Only if the AC mains source fails will a load be placed on the DC source. This allows a source of DC, typically an external power supply, to serve in a backup capacity. With this arrangement normal operation can continue even if AC mains power is lost.

Future Capabilities and Firmware Updating

The Model 5412 was designed so that its capabilities can be enhanced in the future. A USB connector, located on the unit's back panel, allows the application and FPGA firmware (embedded software) to be updated using a USB flash drive. The Model 5412 uses Audinate's Brooklyn II interface module to implement Dante. The firmware in this module can be updated via the unit's Ethernet connections, helping to ensure that the Dante capabilities remain up to date. All software files and configuration parameters are stored in non-volatile memory.

Specifications

Versions Available:

Model 5412-01: 8 line-level analog inputs and 8 line-level analog outputs

Model 5412-02: 16 line-level analog inputs and 16 line-level analog outputs

Network Audio Technology:

Type: Dante audio-over-Ethernet

AES67-2018 Support: yes

Dante Domain Manager™ (DDM) Support: yes

Ethernet Interface Configuration: Switched or Redundant

Sample Rates: 44.1, 48, 88.2, and 96 kHz

Bit Depth: up to 24

Number of Dante Transmitter (Output) Channels:

8 (Model 5412-01) or 16 (Model 5412-02)

Number of Dante Receiver (Input) Channels:

8 (Model 5412-01) or 16 (Model 5412-02)

Number of Dante Flows: 32 transmitter, 32 receiver

Network Interfaces:

Qty: 3; Dante Primary, Dante Secondary, and Management

Type: 1000BASE-T Gigabit Ethernet (GigE) per IEEE 802.3ab (100 Mb/s also supported but not recommended for optimal performance; 10 Mb/s not supported)

Ethernet Connection NIC Status LEDs: one link and one activity for each Ethernet interface

Remote Configuration Capability: uses webpages provided by internal web server

Analog Inputs:

Type: electronically balanced, capacitor coupled, intended for connection to balanced (differential) or unbalanced signal sources

Impedance: 20 k ohms

Nominal Level: +4 dBu, reference -20 dBFS, adjustable ± 20 dB in 0.1-dB steps

Maximum Level: +24 dBu, results in digital output level of 0 dBFS

Dynamic Range: 120 dB, A-weighted

Distortion (THD+N): <0.0004% (-108 dB), ref 1 kHz, +23 dBu input/-1 dBFS output

Frequency Response: ± 0.2 dB, 14 Hz to 20 kHz

Analog Outputs:

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

Source Impedance: 200 ohms

Nominal Level: +4 dBu, reference -20 dBFS, adjustable ± 20 dB in 0.1-dB steps

Maximum Level: +24 dBu

Dynamic Range: >119 dB, A-weighted

Distortion (THD+N): <0.001% (-101 dB), reference 1 kHz, -1 dBFS input/+23 dBu output

Frequency Response: ± 0.1 dB, 6 Hz to 20 kHz

1 kHz Tone Output:

Analog: 1 kHz sine-wave at +4 dBu, nominal, adjustable ± 20 dB in 0.1-dB steps

Dante (Digital): sine-wave at -20 dBFS, fixed

Front-Panel Display: backlit LCD

Software Updating: USB flash drive supports updating of Main MCU and Main FPGA firmware (embedded software); Dante interface updated via Ethernet interface

Power Sources:

AC Mains: 100 to 240 V, 50/60 Hz, 20 W maximum

DC: 10 to 18 V, 1.5 A maximum: 120 uA nominal with 12 volts DC and AC mains present, 170 uA nominal with 18 volts DC and AC mains present

Connectors:

Analog Inputs and Analog Outputs: 25-pin female D-subminiature (DB-25F), AES59-2012-compliant

Ethernet: 3, RJ45 jack

USB: type A receptacle (used only for updating firmware)

AC Mains Input: 3-blade, IEC 320 C14-compatible (mates with IEC 320 C13)

DC Input: 4-pin male XLR (pin 1 negative, pin 4 positive)

Environmental:

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

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

Humidity: 5 to 95%, non-condensing

Altitude: not characterized

Dimensions – Overall:

19.0 inches wide (48.3 cm)

1.72 inches high (4.4 cm)

7.8 inches deep (19.8 cm); 8.3 inches (21.1 cm) overall

Mounting: one space (1U) in a standard 19-inch rack

Weight: 3.2 pounds (1.5 kg)

Specifications subject to change without notice.

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