# Model 5422
# Dante™ Intercom Audio Engine

**STUDIO TECHNOLOGIES INC.**

## Key Features

- Dante audio-over-Ethernet technology with AES67 support

- Creates multiple virtual party-line (PL) intercom circuits

- High-performance, low-latency 32-bit digital audio processing

- Two versions available: one or two 32-channel audio engines

- Dual Gigabit Ethernet interfaces allow switched, redundant, and split Dante operation

- Web-based configuration and software updating

- AC mains and 12 volts DC powering

- Lightweight enclosure, single rack-space (1U) mounting

## Overview

The Model 5422 Dante Intercom Audio Engine is a high-performance, cost-effective, and flexible solution for creating party-line (PL) intercom circuits when used with Dante-compatible products. These include the Studio Technologies range of 2- and 4-channel intercom beltpacks. The Model 5422 will also prove valuable in a variety of other broadcast-related mixing, IFB (talent cueing), and interfacing applications. The unit is suitable for use in fixed and mobile broadcast facilities, post-production studios, commercial and educational theater environments, and entertainment applications. Only power and an Ethernet network connection are required for the Model 5422 to provide a powerful resource in a variety of Dante applications. The Model 5422 is available in two versions – one with 32 input and output channels and the other with 64 input and output channels.

The unit's dual Gigabit Ethernet ("GigE") network interfaces support redundant Dante operation. And to meet the latest interoperability standard the Model 5422's Dante implementation meets the requirements of AES67. An integral web server allows fast and flexible configuration of the unit's networking, audio, and Dante performance. Front-panel indicators, an LCD display, and pushbutton switches provide personnel with direct access to key operating parameters. Updating of the Model 5422's operating software can be easily performed using the unit's integrated FTP (file-transfer protocol) client. All program software files and configuration parameters are stored in non-volatile memory. The Model 5422 can be powered by 100-240 V, 50/60 Hz mains or a source of 12 volts DC. The lightweight enclosure mounts in one space (1U) of a standard 19-inch rack.

## Two Versions

Two versions of the Model 5422 are available. The Model 5422-01 provides one 32-channel audio engine. The Model 5422-02 provides two 32-channel audio engines for a total of 64 input and output channels. The size and scope of a specific application will dictate which Model 5422 version is applicable. The term "audio engine" was selected to describe a set of audio input, processing, routing, and audio output resources that can be configured to support specific intercom and talent-cuing functions. Unlike general-purpose Dante digital matrix devices, the Model 5422 is optimized to allow direct support for these special broadcast and intercommunications applications.



Model 5422 Front View (top) and Model 5422-01 Rear View (bottom, typical for Model 5422-02)

## Group Configuration

Configuration choices select how each 32-channel audio engine is segmented, named, and then designated as to how the audio is processed.

### Group Size

The ability to segment a 32-channel audio engine into multiple groups allows efficient use of the Model 5422's Dante channels. As all Dante intercom beltpacks are essentially 4-wire devices (having independent receiver (input) and transmitter (output) channels) "virtual" (simulated) party-line functionality must be created within the Model 5422's audio engines. This requires that the maximum number of participants (users) on any one "party-line" be defined.

The 32 channels offered by an audio engine can be configured into what are called groups. Simple configuration choices in the Model 5422's menu pages allow the number of groups and their sizes to be selected. Groups can range in size from 32 channels (a complete audio engine being used for a single group) to having just four channels. The size of a group will dictate how many devices and associated users can be part of any one party-line, or how many channels will be impacted by a processing setting for a specific group. Ten choices allow a wide range of group configurations to be selected. The default setting for each audio engine is to have four 8-channel groups. This leads to the Model 5422-01 having four 8-channel groups and the Model 5422-02 having eight 8-channel groups. Refer to the Specifications section for a detailed list of the group sizes that are available.

### Group Names

Each group can be assigned a unique name. These names would typically reflect how the specific groups are going to be utilized. Names such as "Camera PL", "Lighting Intercom", or "Engineering" would be typically used in broadcast-oriented applications. The configured names are automatically used by the Model 5422's Dante Interface, providing clarity when routing Dante channels using applications such as Dante Controller. Each group name can be a combination of up to 28 alpha or numeric characters. Channel numbers are automatically appended to the entered names to provide identification of the specific channels within the Dante environment.

## Group Operating Modes

While the primary application for the Model 5422 is to create party-line (PL) intercom circuits, each group can be independently configured from among three operating modes: party-line, summing bus, and pass-thru. When a group is set for party-line operation the Model 5422's audio processing circuitry creates a series of unique "mix-minus" outputs, one for each channel in the group. These specialized outputs allow each intercom user assigned to that specific group (a "party-line") to hear all members of that group except for themselves. (Thus comes the term "mix-minus" or a mix of all source but themselves.) By each user receiving a mix-minus signal precise control of each user's sidetone audio level and overall audio quality can be maintained.

When a group is configured for summing bus operation audio sources assigned to the group's input channels are mixed (combined) at unity (no gain added or subtracted). The resulting mix is sent to all output channels associated with that group. No level control or input muting is provided. This mode can be useful for general-purpose audio mixing applications where multiple Dante channels need to be combined.

Each group can also be independently selected to run in a special mode called pass-thru. This implements an audio function that routes each Dante input (receiver) channel directly to its associated Dante output (transmitter) channel. This simple but important function will allow any Dante signal to utilize the Model 5422's capability to support up to 32 Dante flows. This can be useful as a "flow expander" when used in an application that includes Dante-compatible products that utilize Audinate's Ultimo™ integrated circuit. (Many products from Studio Technologies use Ultimo.) While an excellent cost-effective means of implementing Dante, Ultimo has several limitations. The first is its ability to support only two transmitter and two receiver flows. Routing Dante signals through pass-thru channels on a Model 5422 group can facilitate integration with applications that require additional flows. The second limitation is that Ultmo does not provide AES67 support. By routing Ultimo transmitter channels through a Model 5422 group configured for pass-thru AES67 compliance can be achieved.

## Channel Level Adjustment

The nominal level of each Dante input (receiver) channel and Dante output (transmitter) channel can be individually adjusted. This would apply to the 32 channels associated with the Model 5422-01 and the 64 channels with the Model 5422-02. The adjustment range is ±12 dB in 1-dB steps. This capability can be useful when using a Model 5422 to interface various pieces of equipment that may have different internal operating levels.

## Audio Quality

The Model 5422 supports 24-bit, 48 kHz sampling digital audio signals that interface using Dante. All audio processing within the Model 5422 is performed using high-speed 32-bit programmable logic. This ensures that the audio performance is excellent, providing the expected benefits of minimal distortion, low noise, high headroom, flat frequency response, and extremely low latency.

## Application Compatibility

The Model 5422 is compatible with many Dante-compliant devices including intercom and listen-only beltpacks from Studio Technologies. These include the 2-channel Model 370 and Model 371 Intercom Beltpacks and the 4-channel Model 374 Intercom Beltpack. The Model 362 Listen-Only Beltpack supports broadcast IFB ("interrupted foldback") and general audio monitoring applications. The Model 5422 will function directly with these and other Dante-supporting devices such as matrix intercom systems, audio consoles, wireless intercom base stations, and commentator consoles.

## Overall Networking Capability

Using the Dante Controller application program, the Model 5422's two Gigabit Ethernet ports can be selected to operate in one of three modes: switched, redundant or split. In the switched mode a single Ethernet connection can be used for Dante audio transport and to access the Model 5422's configuration web pages. The second Model 5422 Ethernet port can be used to interface with another piece of network equipment. In the redundant mode two independent Ethernet connections can be used to implement Dante's redundant network capability. Either of the Model 5422's network ports will provide access to the configuration web pages. In the split mode the Model 5422's primary Ethernet connection will be used for Dante audio while the secondary connection will be used to access the configuration web pages.

## Operating Power

The Model 5422 allows an AC mains source of 100-240 V, 50/60 Hz to be directly connected. 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 to a Model 5422, 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 a battery pack, to serve in a backup capacity. With this arrangement normal operation can continue even if AC mains power is lost.

## Future Capabilities

It's anticipated that additional capabilities will be added to the Model 5422. These include auto-mix, audio gating, and IFB creation functionality. Auto-mix resources will allow groups configured for party-line and summing bus operation to offer increased audio intelligibility. The auto-mix performance should match that provided by any propriety hardware- or software-based products current on the market. Audio gating will be applicable for the pass-thru mode, helping to reduce background noise associated with talent cue signals. Several additional group modes will support creation of IFB talent cue feeds. These modes will allow program and talent cue audio sources to be "intelligently" combined to create high-quality IFB "feeds." These can prove useful for on-air broadcast applications, especially where producers and directors are not located at the same physical location as the talent. Voice-operated-relay (VOX) functionality would initiate IFB operation with the impact on the program audio level selectable between no level change, a moderate level reduction ("dimming"), or full mute.

## Model 5422 Specifications

**Applications:**
Designed to create multiple party-line (PL) circuits in Dante audio-over-Ethernet environments. Can also provide digital summing (mixing) functions for general-purpose applications. Special Dante pass-thru mode allows flow-limited and non-AES67-compliant Dante devices to participate in more advanced applications.

**Versions Available:**
Model 5422-01: one 32-channel Dante audio engine
Model 5422-02: two 32-channel Dante audio engines (64 channels total)

**Audio Engine Configuration Options:**
Group Size: the following group sizes can be selected for each 32-channel audio engine:

   32  (one group)
   24, 8  (two groups)
   20, 8, 4  (three groups)
   16, 16  (two groups)
   16, 12, 4  (three groups)
   12, 12, 4, 4  (four groups)
   8, 8, 8, 8  (four groups)
   8, 8, 8, 4, 4  (five groups)
   8, 8, 4, 4, 4, 4  (six groups)
   4, 4, 4, 4, 4, 4, 4, 4  (eight groups)

Group Mode: party-line, summing bus, and pass-thru, selectable by individual group
Receiver (Input) and Transmitter (Output) Channel Level Adjustment: ±12 dB, selectable in 1-dB steps

**Network Audio Technology:**
Type: Dante audio-over-Ethernet
AES67-2013 Support: selectable enabled/disabled
Ethernet Interface Configuration: switched, redundant, or split
Clock Source: Dante network or internal (can serve as clock master)
Bit Depth: 24
Sample Rate: 48 kHz
Number of Dante Receiver (Input) Channels: 32 (Model 5422-01), 64 (Model 5422-02)
Number of Dante Transmitter (Output) Channels: 32 (Model 5422-01), 64 (Model 5422-02)
Number of Dante Flows: 32 transmitter, 32 receiver
Internal Digital Audio Processing: 32-bit, fixed
Input-to-Output Audio Processing Latency: <100 uSec

**Network Interfaces:** 2, Primary and Secondary
Type: 1000BASE-T (Gigabit Ethernet ("GigE")) per IEEE 802.3ab (100 Mb/s also supported but not recommended for optimal performance)
NIC Status LEDs: one link and one activity for each Ethernet interface

**Software Updating:** internal FTP client supports updating of main and audio processing (FPGA) software

**Front Panel Display:** LCD with LED backlighting

**Front Panel LEDs:** 6, dual-color
Functions: provides indication of condition of incoming AC and DC power, status of Dante connections on Ethernet interfaces, and status of Dante connectivity

**Power Sources:**
AC Mains: 100 to 240 V, 50/60 Hz, 5 W maximum
DC: 10 to 18 V, 0.5 A max

**Connectors:**
Ethernet: 2, RJ45
AC Mains Input: 3-blade, IEC 320 C14-compatible (mates with C13)
DC Input: 4-pin male XLR (pin 1 negative, pin 4 positive)

**Dimensions (Overall):**
19.00 inches wide (48.3 cm)
1.72 inches high (4.4 cm)
7.9 inches deep (20.1 cm)

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

**Weight:** 2.8 pounds (1.3 kg)

Specifications subject to change without notice.