# Model 5512A Audio Interface
## Featuring ST 2110 Technology

### Key Features

- Supports SMPTE ST 2110, AMWA NMOS IS-04 and IS-05
- Analog line-level inputs to ST 2110-30 outputs
- ST 2110-30 inputs to analog line-level outputs
- Two versions available: 8 or 16 input and output channels
- Connection management using webpages or ANEMAN™
- 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 5512A Audio Interface provides a simple yet high-performance means of interfacing analog signals with applications that utilize the SMPTE® ST 2110 suite of standards to implement audio-over-Ethernet networking connectivity. Redundant stream performance is also supported following the ST 2022-7 standard. Line-level analog sources can be connected to the unit and then output in the digital domain by way of the Ethernet network interfaces. Digital audio signals, which also arrive by way of the Ethernet network interfaces, are converted to analog and then output as balanced line-level signals. For application troubleshooting, a configuration choice allows a sine wave tone or the analog inputs to be selected as the source for the analog output channels. The Model 5512A is available in two versions – one with eight input and eight output channels and the other with sixteen input and sixteen output channels.

The Model 5512A is a fully professional product that offers the audio quality, features, and reliability required for 24-hour on-air and commercial applications. The analog inputs and analog outputs use two or four 25-pin female D-subminiature connectors for easy interfacing with balanced and unbalanced sources and destinations.

The line-level analog audio input signals are converted to 24-bit PCM digital and then transported via the Ethernet interfaces. Digital audio sources associated with ST 2110-compliant devices can be routed to the Model 5512A, converted to analog, and provided to users as balanced line-level outputs. Configuration and routing of the audio signals can be performed using the Model 5512A's internally provided webpages or JSON API commands. In addition, NMOS and ANEMAN network management can also be utilized.

The Model 5512A provides three Gigabit Ethernet (GbE) network interfaces, two to support redundant operation following the ST 2022-7 standard and the third for accessing the management menu system. The internal web server allows fast and flexible monitoring and configuration of the unit's networking and audio performance. Front-panel indicators, a backlit LCD display, and pushbutton switches provide users with direct access to key operating parameters.

The Model 5512A 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 audio input, audio output, Ethernet, AC mains, and DC power interconnections.


Model 5512A Front View (top) and Model 5512A-01 Rear View (bottom)

ST 2110 is finding wide acceptance as an audio, video, and ancillary data transport "backbone" due to its interoperability, flexibility, and support by a large number of equipment manufacturers. The Model 5512A can serve as an "edge" device for ST 2110-compliant implementations, providing high-performance line-level analog input and analog output resources in a compact, cost-effective package. The unit can also serve as a general-purpose audio "tool" to help extend ST 2110 capabilities to facilities and applications that were initially implemented to support signals in the analog domain.

## Audio over Managed IP Networks

Digital audio data associated with the Model 5512A is interfaced with local area network (LAN) connections following the SMPTE ST 2110 standards. A highlight of ST 2110 is its ability to utilize any standard Ethernet network implementation, including switches, to directly transport professional audio signals. For signal integrity the Model 5512A supports redundant audio data streams per the ST 2022-7 standard. The unit supports digital audio signals with a sampling rate of 48 kHz and a bit depth of 24. This ensures compatibility with virtually all broadcast, production, industrial, and commercial applications.

## Network Interfaces

The Model 5512A's Primary + Control (PRI+CTRL)and Secondary (SEC) Ethernet interfaces can be utilized for 2022-7 Redundant Stream applications. The third Ethernet interface, named Management (MGMT), will always be used to access the unit's management webpages. This Ethernet interface can be connected to an independent network that some facilities implement for equipment monitoring and maintenance purposes. The unit's management web server can also be connected to the network that is being used for ST 2110 operation. This would function correctly since the management web server will always have a unique IP address that would not interact with audio and related data. Status LEDs, located on the unit's back panel, provide a real-time indication of LAN performance.

## Applications

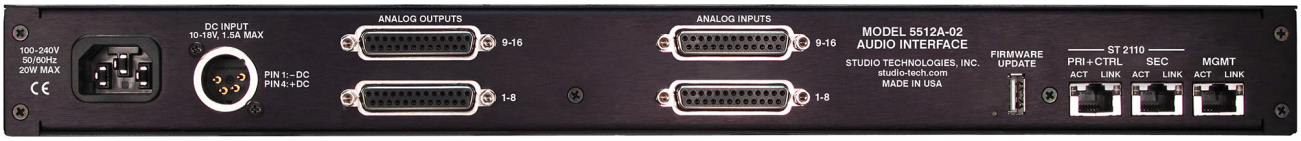
Two versions of the Model 5512A Audio Interface are available. The Model 5512A-01 provides eight line-level analog inputs and eight line-level analog outputs. The Model 5512A-02 provides sixteen line-level analog inputs and sixteen line-level analog outputs. Both units are general-purpose interface devices intended for a variety of audio and audio-for-picture applications that utilize the ST 2110 suite of standards. Each is suitable for use in demanding on-air broadcast and live-event applications that require both solid audio performance and reliable operation. Model 5512A units feature an optimized set of controls and indicators that make them simple and intuitive to use. Rack-mounted in 1U, the units are appropriate for installation in fixed locations, serving the needs of systems associated with post-production, content distribution, education, commercial, and government facilities. The lightweight enclosure also makes it suitable for mobile and field uses.

## ST 2110 Networking

The Model 5512A's ST 2110 interface supports conformance levels A, B, C, AX, BX, and CX in single and redundant streams. The latter follows the SMPTE ST 2022-7 standard and allows connection of one or two networks as desired. The Primary + Control (PRI+CTRL) Ethernet interface allows configuration of the ST 2110 interface by way of webpages. NMOS support that follows the IS-04 and IS-05 standards is also provided. The Merging Technologies ANEMAN Audio Network Manager application can also be utilized as can a JSON API.

Studio Technologies has not fully explored the Model 5512A's ability to support RAVENNA and AES67. The ST 2110 capabilities in the Model 5512A are provided by the ZMAN module from Merging Technologies. The ZMAN specifications indicate full compatibility with RAVENNA and AES67. As such, Model 5512A ST 2110 audio channels should be directly compatible with AES67 audio channels. (Actually, our impression is that ST 2110 audio was based on ensuring compatibility with AES67.)

RAVENNA is also, depending on its configuration, directly compatible with AES67. So, in theory, the Model 5512A can serve both as a RAVENNA to Dante and a AES67 to Dante bridge. Settings in the ZMAN-provided configuration webpages may have to be selected specifically for compatibility with RAVENNA or AES67, but the required parameters should be able to be selected. Over time Studio Technologies will explore this subject further and a conversation with factory personnel may provide additional clarity.




Model 5512A-02 Rear View

## Analog Inputs

Depending on the version selected, the Model 5512A provides either eight or sixteen analog inputs that are compatible with balanced or unbalanced line-level sources. The input signals are converted to digital and then output via an Ethernet network as part of an ST 2110-30 IP stream. Compatible signal sources include audio consoles, wireless microphone receivers, broadcast playback equipment, and output ports on matrix intercom systems.

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 also 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 5512A'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 48 kHz sampling rate and a bit depth of 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 5512A version will provide either eight or sixteen line-level analog output channels. Each channel can be individually configured to use as its input source a ST 2110-30 receiver (input) channel, one of the analog input channels, or a 1 kHz sine wave tone. In most applications, a digital receiver (input) channel associated with the unit's Ethernet interfaces will serve as the audio source. The unit's web interface, JSON API, or ANEMAN software application would be used to select the sources which originate from sender (output) channels on designated ST 2110-compliant equipment.

Another configuration choice allows a signal associated with an analog input to serve as the source for an analog output channel. Useful for troubleshooting purposes, the selected signal would provide an active "loop through" version of its associated analog input signal. Also, for troubleshooting purposes a 1 kHz sine wave tone can be assigned to be the source for any analog output channel. The resulting output would be a steady tone with a nominal level of +4 dBu.

The Model 5512A's analog outputs have a maximum level of +24 dBu. This allows both compatibility and sufficient headroom for use 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 1-dB steps. This ensures that the Model 5512A will also be compatible in environments that utilize 0, +4, +6, or even +8 dBu nominal output levels.

The analog outputs are electronically balanced, capacitor-coupled, and ESD (static) protected. High-quality components, including the important digital-to-analog (DAC) 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.

## Simple Installation

The Model 5512A 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 connectors. Multiple LEDs on the unit's back panel display the status of the network connections. A detachable power cord is used to connect a source of AC mains power. A DC power source would interface 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 5512A 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, such as 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 and Firmware Updating

The Model 5512A was designed so that its capabilities can be easily updated and enhanced in the future. A USB host connector, located on the unit's back panel, allows the main MCU application and FPGA (programmable-logic) firmware (embedded software) to be updated using a USB flash drive. A Merging Technologies ZMAN module is used to implement the Model 5512A's ST 2110 functionality. The module's firmware can be updated using a web browser connected to the Ethernet interface dedicated to ST 2110 control use. All software files and configuration parameters are stored in non-volatile memory.

## Model 5512A Specifications

**Versions Available:**
Model 5512A-01: 8 line-level analog inputs and 8 line-level analog outputs (Order Code: M5512A-01)
Model 5512A-02: 16 line-level analog inputs and 16 line-level analog outputs (Order Code: M5512A-02)

**Network Audio Technology:**
Type: SMPTE ST 2110-10:2017 and ST 2110-30:2017
Supports Conformance Levels:
- A: 48 kHz streams with 1-8 audio channels at packet times of 1 ms
- B: 48 kHz streams with 1-8 audio channels at packet times of 125 us
- C: 48 kHz streams with 1-64 audio channels at packet times of 1 ms
- AX: 96 kHz streams with 1-4 audio channels at packet times of 1 ms
- BX: 96 kHz streams with 1-8 audio channels at packet times of 125 us
- CX: 96 kHz streams with 1-32 audio channels at packet times of 125 us

AMWA NMOS Support: IS-04 Discover & Registration ("Discovery") and IS-05 Device Connection Management ("Routing")
Redundant Streams: compliant with Level B, SMPTE ST 2022-7:2013 Seamless Protection Switching (8-channel stream at 48 kHz sample rate, packet time 125 us)
Synchronization: per SMPTE ST 2110-10, Precision Time Protocol (PTP) IEEE® 1588-2008 Version 2; supported profile IEEE 1588:2008
Compatibility: JT-NM TR-1001 (System Environment and Device Behavior)
Discovery, Control, and Connection Management: includes web user interface, NMOS, Merging Technologies' ANEMAN Audio Network Manager, and JSON API
Audio Performance and Transport: digital
Audio Type: pulse-code modulation (PCM)
Sampling Rate: 48 kHz
Bit Depth: 24
Number of Receiver (Input) Channels – Model 5512A-01: 32
Number of Sender (Output) Channels – Model 5512A-01: 32
Number of Receiver (Input) Channels – Model 5512A-02: 64
Number of Sender (Output) Channels – Model 5512A-02: 64

**Remote Control of Audio Input Parameters:** webpages provided by internal web server

**Network Interfaces:**
Qty: 3; ST 2110 Primary + Control (PRI+CTRL), ST 2110 Secondary (SEC), and Management (MGMT)
Type: 1000BASE-T (Gigabit Ethernet (GbE)) per IEEE 802.3ab
NIC Status LEDs: one link and one activity for each Ethernet interface

**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
ST 2110 (Digital): sine-wave at –20 dBFS, fixed

**Front-Panel Display:** OLED

**Software Updating:** USB flash drive supports updating of main MCU and FPGA firmware (embedded software); webpages via PRI+CTRL interface used to update ZMAN module used for ST 2110

**Power Sources:**
AC Mains: 100 to 240 V, 50/60 Hz, 20 W maximum
DC: 10 to 16 V, 1.6 A max at 10 V; 1.5 A max at 12 V

**Connectors:**
Analog Inputs and Analog Outputs: 2 (Model 5512A-01), 4 (Model 5512A-02), 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:** 3.5 pounds (1.6 kg)

Specifications and information subject to change without notice.

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