



# ST 2110

## Model 5518 Mic/Line Interface

### Key Features

- Supports emerging SMPTE® ST 2110 standards
- Eight mic/line inputs and eight analog outputs
- Flexible monitoring with metering and headphone output
- 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 5518 Mic/Line 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. Eight analog microphone- or line-level sources can be connected to the unit and then output in the digital domain by way of the Ethernet interfaces. Eight digital audio signals, which arrive by way of the Ethernet connections, are converted to analog and then output as balanced line-level signals. For application flexibility and troubleshooting a configuration choice allows other audio signals to be selected as the sources for the analog output channels. A monitor section allows the input and output signals to be selectively observed using a meter function, a headphone output and, if desired, two line-level analog outputs.

The Model 5518 is a fully professional product that offers the audio quality, features, and reliability required by 24-hour on-air and commercial applications. Located on the unit's front panel, the eight mic/line audio inputs use standard 3-pin female XLR connectors for easy interfacing with balanced and

unbalanced sources. The input circuitry features adjustable gain, P48 phantom power, and high-pass filter functions. Configuration of the input channels can be made locally by using pushbutton switches and an OLED display. Configuration web pages, accessible using the Model 5518's web server, allow remote control of the input parameters. The analog mic/line input audio signals are converted to 24-bit PCM digital and then transported via the Ethernet network interfaces. The destination routing of the mic/line input signals is performed using commands from the Model 5518's JSON API and related software applications.

Eight digital audio signal sources can be routed to the Model 5518's inputs using JSON API commands. These input signals are then converted to analog and provided to users as balanced line-level analog outputs. One 25-pin female D-subminiature connector, located on the unit's back panel, provides access to the eight analog outputs.

The monitor section provides the user with the ability to select any input or output signal, or signal pair, for monitoring using the 2-channel (stereo) headphone output. A configuration choice allows selected analog outputs to provide a monitoring function for connection to inputs on amplified loudspeakers or audio power amplifiers. An OLED display, located on the front panel, offers level metering functions which allow the input and output audio signals to be visually monitored.

The Model 5518 provides three Gigabit Ethernet ("GigE") network interfaces, two to support redundant operation following the ST 2022-7 standard and the third for accessing the management menu system. An internal web server allows fast and flexible monitoring and configuration of the unit's audio input and output performance. Front-panel indicators, an OLED display, and pushbutton switches provide users with direct access to key operating parameters.



The Model 5518 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 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, DC power, and AC mains interconnections.

ST 2110 is an emerging technology that is expected to find wide acceptance as an audio, video, and ancillary data transport “backbone” due to its interoperability, flexibility, and expected support by a large number of equipment manufacturers. The Model 5518 can serve as an “edge” device for ST 2110-compliant implementations, providing high-performance input, output, and monitor 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 5518 is interfaced with local area network (LAN) connections following the emerging set of 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 5518 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 Ports

It’s expected that the Model 5518’s main and primary Ethernet ports will be able to be selected to operate in either a switched or a redundant mode. In the switched mode a single Ethernet connection will be used for interconnection with other ST 2110-compliant devices. The second Model 5518 Ethernet port will be used to interface with another piece of network equipment. In the redundant mode independent

Ethernet connections will be made to the unit’s two Ethernet ports implementing redundant network capability per SMPTE ST 2022-7.

The Model 5518’s third Ethernet port will always be used to access the management web pages. 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 ST 2110 operation. This would function correctly since the management port would 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

The Model 5518 is a general-purpose mic/line input, analog output, and monitoring device intended for a variety of audio and audio-for-picture applications that utilize the ST 2110 suite of standards. It’s suitable for use in demanding on-air broadcast and live-event applications that require both excellent audio performance and reliable operation. The rack-mounted unit is appropriate for installation in fixed locations, serving the needs of systems associated with post-production, content distribution, education, commercial, and government facilities. Its lightweight enclosure also makes it suitable for mobile and field uses.

The Model 5518 features an optimized set of controls and indicators that makes it simple and intuitive to use. With the unit’s headphone and level monitoring resources it’s easy for operators to obtain optimal performance. By providing standard connectors for all inputs and outputs operating changes can be completed simply and rapidly.

## Mic/Line Inputs

The Model 5518 provides eight analog inputs that are compatible with microphone and line-level signals. The mic/line input circuitry allows the level of the connected sources to be boosted as required, converted to digital, and then output as part of an IP stream via an Ethernet network. Each mic/line input can be individually configured to meet the requirements



posed by a wide range of sources. The configuration choices can be made either locally or by way of web pages associated with an internal web server. The preamplifier of each channel can be selected for 0 dB of gain to support line-level sources or 10 to 60 dB of gain, in 1-dB steps, for microphones. A source of P48 phantom power can be enabled to power condenser microphones. In addition, a high-pass filter (HPF) function can be enabled as required to reduce the presence of unwanted low-frequency content typically associated with hum, rumble, or wind noise.

Compatible signal sources include dynamic, ribbon, and phantom-powered condenser (capacitor) microphones. The preamplifier gain settings of 0 dB and the range of 10 to 20 dB were specifically included to support connection of balanced and unbalanced line-level signals that are commonly provided by professional and semi-professional audio equipment. Typical nominal levels for these sources would be +4 dBu and -10 dBV, respectively. Devices providing these analog signal sources could include audio consoles, wireless microphone receivers, and broadcast playback equipment.

For front-panel space efficiency the eight mic/line input channels share a common configuration section which includes seven pushbutton switches and an OLED display. The buttons allow rapid local selection of the preamplifier gain as well as controlling the on/off status of the P48 phantom power and high-pass filter (HPF) functions. The OLED display allows the preamplifier gain of each mic/line input channel to be observed. Audio channel level metering is also provided as part of the OLED display's resources. The "virtual" meters can assist users in optimizing the preamplifier gain settings which in turn will provide the best possible conversion from the analog to the digital domain. LED indicators associated with each mic/line input channel provide the on/off status of the P48 phantom power and high-pass filter (HPF) functions.

The mic/line 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 inputs are protected from damage should a moderate DC voltage be accidentally connected. The sum of these characteristics makes the mic/line inputs suitable for use in studio and mobile facilities as well as field-deployed environments.

The eight 3-pin female XLR connectors associated with the Model 5518's mic/line inputs were specifically located on the front panel. This can eliminate the need for an external I/O or "patch" panel, allowing signal sources and their associated interconnecting cables to be rapidly connected and disconnected as required. Rather than being "buried" in the back of a rack enclosure the Model 5518 provides convenient access to the mic/line input connectors and their associated configuration buttons, indicators, and OLED display.

The audio performance of the Model 5518's mic/line inputs is very good. Low-noise, wide dynamic-range preamplifier circuits ensure that input audio quality is preserved. The P48 phantom power source is extremely low noise, allowing optimal microphone operation and imparting little signal degradation. The outputs of the preamplifiers 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 Model 5518 provides eight general-purpose line-level analog output channels. Each channel can be individually configured to use as its input source a ST 2110-30 input (receiver) channel, a mic/line input channel, one of the monitor output channels, or a 1 kHz sine-wave tone. In most applications an input (receiver) channel associated with the unit's Ethernet interfaces will serve as the audio source. The unit's JSON API and an external software application would be used to select the sources which originate from sender (output or transmitter) channels on designated ST 2110-compliant equipment.

Another configuration choice allows signals associated with the mic/line inputs to serve as the source for an analog output channel. The selected signal would be post (after) the mic/line input circuitry and provide a broadcast-style "hot mic" line-level analog output version of its associated mic/line input signal. To allow connection to inputs on amplified speakers any analog output channel can be configured to use either of the two monitor outputs as its source. For troubleshooting purposes a 1 kHz sine-wave tone can be assigned as the source for any analog output channel. This resulting analog output signal would have a nominal level of +4 dBu.

The Model 5518'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  $\pm 20$  dB in 1-dB steps.

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.

### **Audio Input and Output Monitoring**

A flexible, easy-to-use monitor section offers users the ability to listen to and visually observe the level of the audio signals that are associated with the eight mic/line input channels and the eight analog output channels. A mode configuration choice allows monitoring of either a single audio channel or a pair of audio channels. This can be valuable when monitoring monaural or stereo (dual-channel) signals. Using a 1/4-inch 3-conductor jack, located on the front panel, a 2-channel output supports the connection of a pair of stereo headphones. A rotary control allows the level of the headphone output to be adjusted.

For application flexibility a 2-channel line-level analog monitor output can also be created. The analog outputs selected for this function would be connected to inputs on amplified loudspeakers or a power amplifier associated with monitor loudspeakers. In this way the audio signals that are selected for the headphone output will also be used by the designated analog output channels. A configuration choice allows the selected audio sources to be either pre (before) or post (after) the rotary level control.

The front-panel OLED display provides "bar graph" signal level metering. Depending on how the monitor section is being used, one, two, or eight channels of level can be simultaneously displayed.

### **Simple Installation**

The Model 5518 uses standard connectors to allow fast and convenient interconnections. 3-conductor female XLR connectors, a 25-pin female D-subminiature connector, and a 3-conductor 1/4-inch jack are used to interface with the mic/line input, analog output, and headphone output audio 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 can be used to connect a source of 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 5518 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 5518 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 application and FPGA (programmable-logic) firmware (embedded software) to be updated using a USB flash drive. All software files and configuration parameters are stored in non-volatile memory.

---

## Specifications

**Network Audio Technology:** compliant with SMPTE ST 2110-10:2017 and ST 2110-30:2017 (support for other related standards pending, including AMWA IS-04 and IS-05)

**Redundant Streams:** compliant with SMPTE ST 2022-7:2013 Seamless Protection Switching

**Synchronization:** per SMPTE ST 2110-10, Precision Time Protocol (PTP) IEEE® 1588-2008 Version 2; supported profiles include SMPTE ST 2059-2, AES67, and IEEE 1588 Default

**Remote Control of Network Connections:** JSON API

**Remote Control of Mic/Line Input Parameters:** web pages provided by internal web server

### Audio Performance and Transport:

Bit Depth: 24

Sampling Rate: 48 kHz

Number of Sender (Output or transmitter) Channels: 8

Number of Receiver (Input) Channels: 8

Stream Characteristics: TBD

### Network Interfaces:

Qty: 3; primary, secondary, and management

Type: 1000BASE-T (Gigabit Ethernet ("GigE")) per IEEE 802.3ab

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

### Mic/Line Inputs: 8

Compatibility: dynamic, ribbon, or phantom-powered mics; mic/line-level sources

Type: analog, electronically balanced, capacitor coupled

Impedance – Mic Setting: 3.0 k ohms, nominal

Impedance – Line Setting: 6.4 k ohms, nominal

Gain: 0 dB (line), 10-60 dB in 1-dB steps

Maximum Level: +24 dBu, 0 dB gain selected (results in digital output level of 0 dBFS)

EIN: -126 dBu, 22 kHz bandwidth, 49 dB gain, 150 ohm source resistance

Dynamic Range: >117 dB, 0 dB gain, A-weighted

Distortion (THD+N): <0.001% (-101 dB) at -1 dBFS, 40 dB gain, 22 kHz bandwidth

Frequency Response: +0.0/-0.1 dB, 20 Hz to 22 kHz, HPF off

High-Pass Filter (HPF): -6 dB at 75 Hz, 18 dB per octave, on/off selectable per channel

Phantom Power: P48 per IEC 61938:2013 standard, +46 volts

DC nominal, on/off selectable per channel

Metering: part of OLED display function

Status LEDs per Input Channel: 3; P48, HPF, and input channel selected

**Remote Configuration Capability:** preamplifier gain, P48 phantom power on/off status, and high-pass filter (HPF) on/off status (uses web pages accessible by way of management port)

### Analog Outputs: 8

Type: line-level, 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  $\pm 20$  dB in 1-dB steps

Maximum Level: +24 dBu

Dynamic Range: >119 dB, A-weighted

Distortion (THD+N): 0.001% (-100 dB), reference 1 kHz, measured at +23 dBu output (-1 dBFS input)

Frequency Response:  $\pm 0.1$  dB, 6 Hz to 20 kHz

### Audio Monitor:

Source: mic/line inputs or analog outputs, selectable as monaural or stereo

Metering: part of OLED display function

### Headphone Output:

Type: stereo (dual-channel)

Compatibility: intended for connection to stereo headphones with nominal impedance of 100 ohms or greater

Maximum Output Voltage: 4.9 volts RMS, 1 kHz, 150 ohm load

Frequency Response: +0/-1.4 dB, 20 Hz to 20 kHz

Distortion (THD+N): 0.005%

Dynamic Range: >100 dB

### Front-Panel Display: OLED

**Software Updating:** USB flash drive supports updating of application and FPGA firmware (embedded software)

### Power Sources:

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

DC: 10 to 18 V, 1.5 A maximum

### Connectors:

Mic/Line Inputs: 3-pin female XLR

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

Ethernet: RJ45

Headphone Output: 3-conductor 1/4-inch jack

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

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

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

### 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 subject to change without notice.

---

**Studio Technologies, Inc.**

Skokie, Illinois USA

© by Studio Technologies, Inc., August 2018

**studio-tech.com**