

Model 5110 Mic/Line Input Module

User Guide

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This User Guide is applicable for serial numbers
M5110-00151 and later

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Introduction

The Model 5110 Mic/Line Input Module is a compact, self-contained 2-channel module intended for use in custom broadcast, live-performance, and general audio applications. Offering a “building block” of resources, the Model 5110 provides two channels of high-performance audio capability in an easy-to-use yet technically sophisticated package. The module’s basic functions include selectable input gain, 48 volt phantom power, status LED indicators, and analog and digital audio outputs. Module operation requires only an externally-provided source of 12 volts DC. Advanced features include user control “lock out,” metadata insertion, and remote monitoring/control capability.

Applications for the Model 5110 include sports broadcasting booth packages, remote news gathering “fly-packs,” stadium audio/video interface (I/O) locations, and government/corporate/performance space infrastructure projects. The number of Model 5110 modules used in a project can vary widely—from one to dozens. And in each case the Model 5110’s performance will be completely “pro” with audio quality, reliability, and installation flexibility matching that of large-scale consoles, routers,

and transport resources. Typical applications will find the Model 5110’s analog and digital outputs being interfaced with inputs on fiber-optic transport modules, audio/video routers, and broadcast/production consoles.

Model 5110 Mic/Line Input Modules do not include a mounting enclosure or chassis. They are intended for mounting in custom 19-inch rack panels, equipment boxes, broadcast furniture, or other specialized settings. It is expected that integration firms will create applications that use Model 5110 modules as part of complete broadcast, production, corporate, and government solutions.

Two microphone or line-level audio signals can be connected to the Model 5110’s front panel XLR-type connectors. Using the front-panel pushbutton switches, the sensitivity of each input can be adjusted to one of four gain settings: line (unity), 15 dB, 30 dB, or 45 dB. To support high-performance microphones +48 volt phantom power can be selected as required. Status LEDs are provided to display the current settings of the sensitivity and phantom power. A 7-segment LED level meter is also provided for each channel.



Figure 1. Model 5110S Mic/Line Input Module front and back views (serial numbers 151-200 shown)

Six pushbutton switches on the Model 5110's front panel allow rapid selection of the input gain and phantom power on/off status. A simple button-press sequence allows the six pushbutton switches to be temporarily "locked out" to prevent accidental adjustment. This can be very useful in field applications, helping to ensure that unauthorized Model 5110 performance changes are not made. An LED indicator will light to alert users that pushbutton switch functionality has been disabled.

The Model 5110's audio performance is simply excellent. A low-noise, wide dynamic-range preamplifier section ensures that the input audio quality is preserved. The outputs of the mic-preamp circuitry are routed to two analog audio output sections. These provide line-level, balanced (differential), capacitor-coupled outputs.

The audio from the mic-preamps is also routed to high-performance analog-to-digital conversion (ADC) sections that support a sample rate of 48 kHz with a bit depth of 24. A precision voltage reference assists the ADC circuits in performing accurate conversion. The signals, now in the digital domain, are formatted into AES3id digital audio. This 2-channel digital bit stream is output as a 75 ohm unbalanced signal for direct connection into broadcast applications.

All audio inputs and outputs were carefully designed for use in permanent as well as field applications. Extensive filtering on the inputs minimizes the chance that radio frequency (RF) energy will interfere with audio input sources. Other components were included to address ESD ("static") and DC overload situations. The DC power input is protected from accidental polarity reversal.

The Model 5110 requires an external source of nominal 12 volts DC for operation. The acceptable input voltage range is 10 to 18 allowing a variety of power sources to be utilized. Internal power supply circuitry within the Model 5110 creates the voltages required for the analog and digital circuitry.

Standard connectors are used throughout the Model 5110. Input audio connections are made using gold-plated 3-pin female XLR-type connectors. A DIN 1.0/2.3 coaxial connector is used to interface with the digital audio output. The 2-channel analog audio outputs use a 5-position, 0.1-inch "header" connector. The DC power input and data bus signals use a 4-position, 0.1-inch header. Low-cost IDC (insulation displacement) mating connectors allow simple interconnection with the analog audio output and DC/data signals.

For compliance with international broadcast audio level standards two versions of the Model 5110 are available. The Model 5110S supports the SMPTE® audio standards which have an analog audio reference level of +4 dBu and a digital audio reference level of -20 dBFS (SMPTE RP155). The Model 5110E supports applications that require European Broadcast Union (EBU) compliance where the analog audio reference level is 0 dBu and the digital audio reference level is -18 dBFS (EBU R68).

Provision has been made in the Model 5110's hardware and firmware to support insertion of metadata information into its AES3id digital audio output. Following the Audio Engineering Society's AES52-2006 standard, this metadata can be used to include source location identification data

within the audio data stream. While not currently commonly implemented, it is expected that AES3 metadata will become an important part of many infrastructures.

Using an optional remote access module, up to eight Model 5110 modules can be remotely monitored and controlled. Using the remote access module's Ethernet interface and SNMP MIB objects, personnel using "GUI" applications or remote control systems will be able to access all the Model 5110's functions, including input sensitivity, phantom power on/off, pushbutton switch lock out, and metadata insertion. A local 2-wire RS-485 data bus is used to interface the remote access module with the one or more Model 5110 Mic/Line Input Modules.

Installation

Analog Audio Outputs

Associated with each of the Model 5110's mic/line input channels is a balanced (differential), line-level analog audio output. The circuitry is electronically balanced and capacitor coupled. The nominal output level of a Model 5110S (SMPTE) version module is +4 dBu with a maximum output level of +24 dBu. The nominal level of a Model 5110E (EBU) version module is 0 dBu with a maximum level of +18 dBu.

Connections to the outputs are made using a 5-position header connector located on the Model 5110's rear-most circuit board. For connection to balanced inputs on related equipment the signal + (high) and signal – (low) connections should be used. Pin 1, common/shield, may or may not need to be connected as dictated by the specific installation.

For connection to unbalanced inputs connect to the Model 5110's signal + (high) and common/shield. Do not short the Model 5110's – (low) to the common/shield connection.

The required mating receptacle is from the AMP MTA100 series of IDC (insulation displacement) connectors. Parts are available that are compatible with 22-28 AWG wire. The color of the receptacle indicates the intended wire gauge. The part number for compatibility with 24 AWG is AMP 3-643814-5. This receptacle is white in color.

For effective and reliable termination a semi-automatic termination tool is recommended. At Studio Technologies we get excellent results using the AMP 58074-1 handle assembly with associated die 58246-1. (For reference you'll find these items stocked by Digi-Key: www.digikey.com.) This tool assembly will support 22-28 AWG and stranded wire should be used.

Units with serial numbers in the range of 151 to 200 (red-colored circuit boards) should be connected following the details in Figure 2.

Analog Audio Outputs—Serial No. 151-200

1. Common/Shield
 2. – CH1
 3. + CH1
 4. – CH2
 5. + CH2
-

Figure 2. Analog audio outputs for Model 5110 units with serial numbers 151-200 (red-colored circuit boards)

Units with serial numbers of 201 and later (black-colored circuit boards) should be connected following Figure 3.

Analog Audio Outputs—Serial No. 201 and Later

1. Common/Shield
 2. + CH1
 3. – CH1
 4. + CH2
 5. – CH2
-

Figure 3. Analog audio outputs for Model 5110 units with serial numbers 201 and later (black-colored circuit boards)

Digital Audio Output

The Model 5110's two audio output channels are available in digital form by way of a DIN 1.0/2.3-compliant receptacle. This receptacle is located adjacent to the analog audio output connector. This is an AES3-compliant unbalanced 75 ohm signal that will transport audio, when using good-quality coaxial cable, several thousands of feet.

The digital audio output signal has a sample rate of 48 k/sec and a bit depth of 24. Depending on the Model 5110's configuration it may, or may not, have AES52-compliant metadata included in the data stream. The nominal level of the digital audio output is –20 dBFS for Model 5110S (SMPTE) modules and –18 dBFS for Model 5110E (EBU) modules.

DC Power and Data

A 4-position header, located adjacent to the analog audio outputs connector, is used to connect DC power and RS-485

data to the Model 5110. A source of nominal 12 volts DC, with an acceptable range of 10 to 18, is required for Model 5110 operation. The maximum current is 300 milliamperes at 12 volts DC.

For remote control operation an RS-485 data bus connection from a compatible Studio Technologies' remote access module is required. Most applications will only have the DC power connections implemented.

The mating connector is, like the analog audio outputs, compatible with the AMP MTA series of IDC receptacles. For 22 AWG wire the receptacle would be AMP part number 3-644540-4 with a body color of red. For 24 AWG the AMP part number is 3-643814-4 and the color is white. Refer to Figure 4 for details.

DC/Data

1. – DC (Common)
 2. +DC (10-18 volts)
 3. + Data (RS-485)
 4. – Data (RS-485)
-

Figure 4. DC/Data interface connector

Mounting

The Model 5110 is intended for mounting into an installation-specific enclosure or rack panel. Refer to Appendix A for the required mounting opening and screw locations. Please contact the factory to discuss mounting options.

Configuration

RS-485 Address ID

One configuration setting must be performed for applications that implement remote control of Model 5110 functions. Up to eight Model 5110 modules can “share” an RS-485 data bus, but each must have a unique address ID. Selecting the device’s address ID involves setting three DIP switches. Refer to Figure 5 for details.

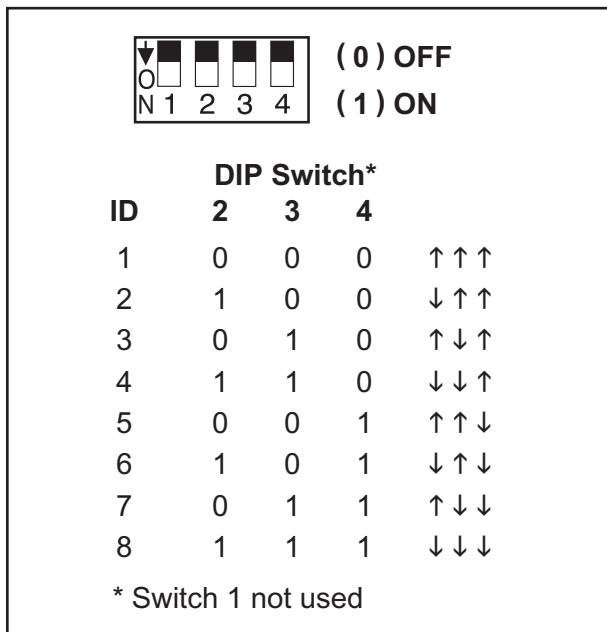


Figure 5. Model 5110 RS-485 address ID settings

Operation

Upon power being applied to the module the signal level and status LEDs will go through a test sequence, confirming their performance. Once that has been completed the unit will begin normal operation, returning to the settings that were present at the time of the previous power off.

Connecting Input Signals

Two 3-pin female XLR connectors are provided to interface signals with the Model 5110’s mic/line inputs. Signals with a wide range of nominal levels can be successfully connected. For balanced signals pin 2 should be connected to signal + (high) and pin 3 should be signal – (low). Pin 1 should be connected to the cable shield.

Unbalanced signals can also be connected. In most cases signal + (high) should be connected to pin 2 and common/shield should be connected to both pins 1 and 3 of the 3-pin male XLR mating connector. If this connection arrangement results in hum or noise it’s possible that connecting signal + (high) to pin 2 and signal common/shield only to pin 3 may be effective.

Input Sensitivity Selection

Two pushbutton switches are associated with each mic/line input and are used to adjust the sensitivity of the input circuitry. In the line position the Model 5110 will provide 0 dB of gain which results in unity input-to-output performance. A connected signal that has a level of 0 dBu will result in a 0 dBu signal on the analog output. The signal level of the digital output will depend on the version of Model 5110 module. With a Model 5110S module and an input level of 0 dBu, the digital output level will be –24 dBFS. With a Model 5110E module the digital output level will be –18 dBFS.

Use the up and down pushbutton switches to adjust the input sensitivity from the choices of 0 (line), 15, 30, and 45 dB. The Model 5110 is not intended to precisely control the gain applied to an input signal. The goal is to amplify the input signal such that it can be effectively transported to

the next piece of audio equipment in the chain. Gain should be applied only so that the signal can reach a level that ensures a good signal-to-noise ratio is maintained while minimizing the risk of signal overload. The Model 5110's output signals will be connected, either directly or via associated audio transport equipment, to inputs on an audio console which will have precise control of the signal levels.

Level Meters

Associated with each mic/line input is a 7-segment LED level meter. These meters are provided for use during input sensitivity setting as well as being useful for general signal monitoring. The labeling of the meters refers to the level in reference to the module's analog reference level. For the Model 5110S (SMPTE) version the analog reference level is +4 dBu. For the Model 5110E (EBU) version the analog reference level is 0 dBu. So for example, a signal that is sufficient to just cause the "6" LED to light will represent an analog output level that is 6 dB above analog nominal. This will equate to +10 dBu for the Model 5110S and +6 dBu for the Model 5110E. This will also represent digital output levels of -14 dBFS for the Model 5110S and -12 dBFS for the Model 5110E.

Phantom Power

To support high-performance microphones, the Model 5110 can provide a source of +48 volt DC phantom power. A pushbutton switch is associated with each channel and allows phantom power on/off control. For maximum flexibility phantom power is available in all four input sensitivity settings (line, 15, 30, and 45 dB). While

phantom power would not typically be used in the line setting it's still available for special applications.

Pushbutton Switch "Lock Out"

To prevent unauthorized changes to the Model 5110's input sensitivity and phantom power settings a pushbutton switch "lock-out" function is provided. Simply press and hold both +48V (phantom) pushbutton switches for about two seconds to enable (or disable) the pushbutton switch lock-out function. Whenever the pushbutton switch lock-out function is active the Data/Lock LED, located on the bottom right side of the front panel, will light.

Remote Control

The Model 5110 is capable of being monitored and controlled remotely. Whenever control data (via the RS-485 link) is active the Data/Lock LED will "flicker" in response. And, depending on the priority level of the data, the input sensitivity and phantom power on/off status may change, even if the pushbutton switch lock-out function is active.

Technical Notes

Software Version Display

After the Model 5110's power-up sequence has completed, the unit's LEDs are used to automatically display the software version number. This is useful when working with factory personnel on application support and troubleshooting situations. The seven level meter LEDs associated with channel 1 audio are used to display the major

release number with a range of 1 through 7. The seven level meter LEDs associated with channel 2 audio are used to display the release sub-number which ranges from 0 to 7. (No channel 2 LEDs lit indicates sub-number 0.) The software version number will display for approximately one second after the power-up sequence has completed but before normal operation will begin. Refer to Figure 6 for a detailed view of the LEDs and the corresponding software version numbering scheme.

Note that while it's easy to determine which software version is loaded into the Model 5110 a trip back to the factory is required to update it. The 8-bit

microcontroller that provides the unit's logic "horsepower" also includes internal FLASH memory. This nonvolatile memory is used to store the operating software ("firmware"). Re-programming this memory requires using a specialized programming unit. While not outrageous in price, it still costs in the range of US\$500. The programmer uses a ribbon cable and socket to interface with a 6-pin "header" on one of the Model 5110's printed circuit board. And, as you would guess, once connected reprogramming takes only a matter of seconds. But unfortunately the programmer is not something that would be found in a typical "field shop" or repair facility.

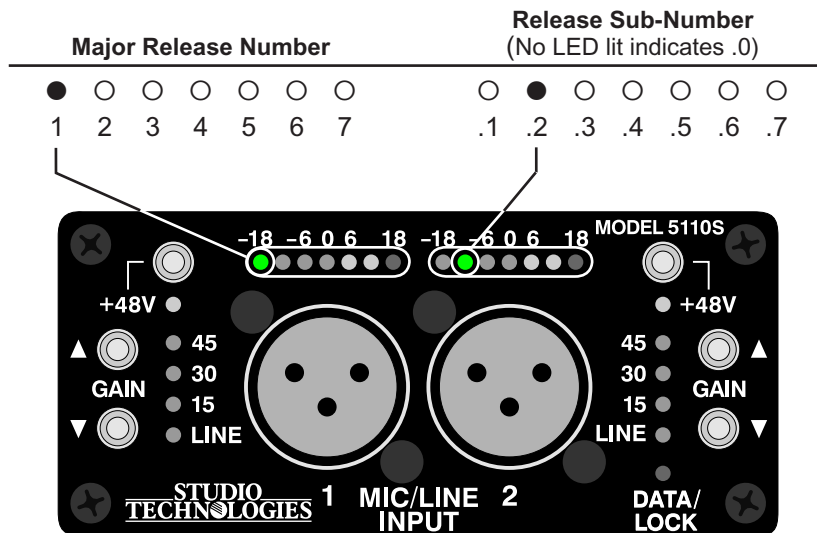


Figure 6. Detail of front panel showing the level meter LEDs that display the software version. In this example, the software version is 1.2.

Specifications

Mic/Line Inputs: 2

Input Sensitivity: selectable for line level (unity gain), 15, 30 or 45 dB gain

Maximum Input Level: +24 dBu

Type: electronically balanced

Impedance: approximately 3 k ohms

CMRR: 61 dB at 60 Hz

Channel-to-Channel Crosstalk: <-106 dB at 10 kHz

Phantom Power: 48 volts DC, nominal, meets IEC 61938 P48 standard

Digital Audio Output: 1 (2-channel)

Type: AES3id, unbalanced, 75 ohms

Sample Rate/Bit Depth: 48 kHz/24

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

Dynamic Range (A Weighted): 112 dB, input sensitivity set for Line, 15 dB gain, or 30 dB gain; 103 dB at 45 dB gain

Distortion: 0.0008% (-101 dB) with output at -1 dBFS, 22 Hz to 22 kHz, 30 dB gain

Nominal Output Level: -20 dBFS (Model 5110S); -18 dBFS (Model 5110E)

Analog Audio Outputs: 2

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

Nominal Level: +4 dBu (Model 5110S), 0 dBu (Model 5110E)

Maximum Level: +24 dBu into 10 k ohms

Source Impedance: 200 ohms, nominal, differential

Frequency Response: ± 0.5 dB, 20 Hz to 16 kHz; -1.5 dB at 20 kHz)

Dynamic Range (A Weighted): 107 dB, input sensitivity set for Line, 15 dB gain, or 30 dB gain; 102 dB at 45 dB gain

Distortion: 0.002% (-93 dB) with output at +23 dBu, 22 Hz to 22 kHz, 30 dB gain)

Meters: 2, 7-segment LED, modified VU ballistics

Metadata Insertion: per AES52-2006

Remote Control Capability: mic gain, phantom power, pushbutton switch lock out; requires remote access module

Connectors:

Mic/Line Inputs: 2, 3-pin female XLR-type, no latch

AES3id Digital Audio Output: 1, DIN 1.0/2.3-compliant coaxial

Analog Audio Outputs: 1, 5-position male header, AMP® MTA-100-series, part number 2-644486-5

DC Input/Data: 1, 4-position male header, AMP MTA-100-series, part number 2-644486-4

Power Requirement: 12 volts DC nominal, 300 milliamperes max; acceptable range 10-18 volts DC, 330 milliamperes max at 10 volts

Dimensions (Overall):

3.75 inches wide (9.5 cm)

1.69 inches high (4.3 cm)

2.30 inches deep (5.8 cm)

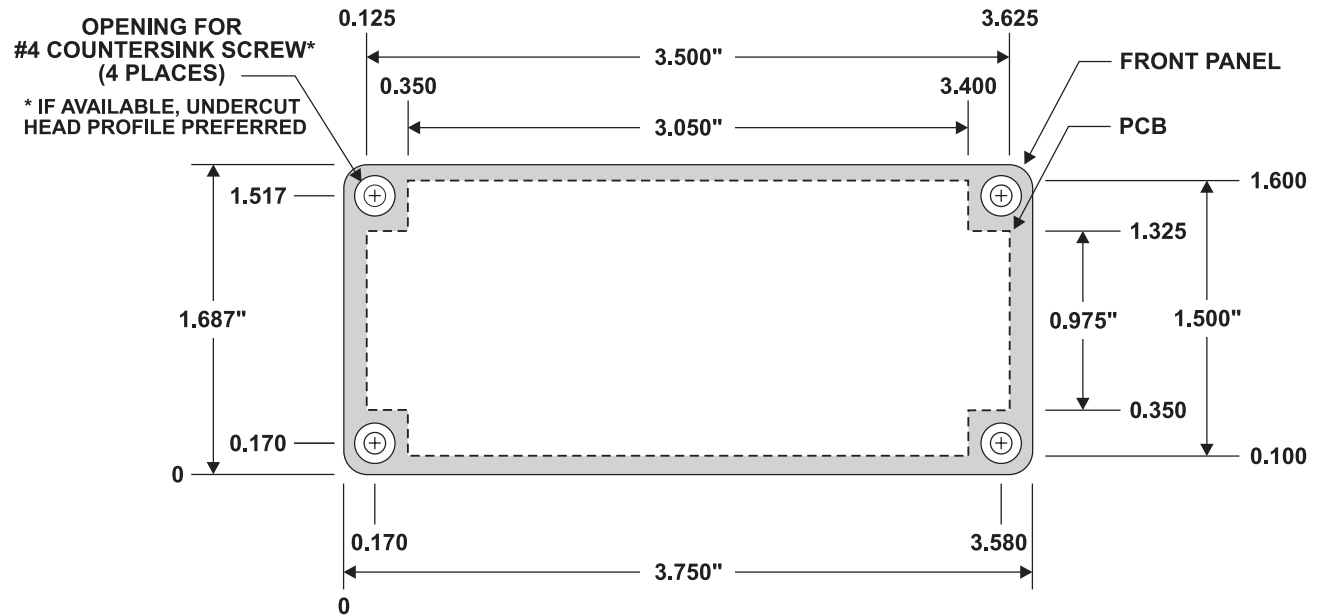
Mounting: requires custom implementation; no mounting method provided

Weight: 0.2 pounds (91 g)

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

Appendix A

Model 5110 Front Panel and Printed Circuit Board (PCB) Dimensions



NOTE: OPENING MUST BE MADE IN CUSTOM-MOUNTING ARRANGEMENT SO THAT PCB IS ALLOWED TO FREELY PASS THROUGH.