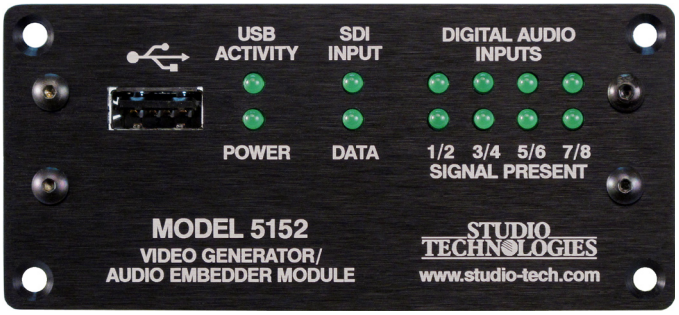
# Model 5152
# Video Generator/Audio Embedder Module




Model 5152 Video Generator/Audio Embedder Module Front Panel

The Model 5152 Video Generator/Audio Embedder Module is a unique device suited for a variety of custom broadcast, post-production, industrial, and corporate multimedia installations. As a member of the 5100-Series of modules, the Model 5152's compact size belies its powerful video and audio feature set. At its most basic, the Model 5152 provides the ability to embed up to eight audio channels (four AES3 digital audio "pairs") into a SMPTE®-compliant HD- or 3G-SDI video "stream." Unlike most stand-alone embedder products, Model 5152 embedding operation does not require an external source of SDI to be connected. Advanced circuitry within the Model 5152 supports the generation of a broadcast-standard high-definition SDI signal. And rather than reproducing a fixed test pattern, the Model 5152 has the capability to store and output two custom video images. The images, one for "720" and one for "1080," are based on bitmap (.bmp) files that can be created using a personal computer's graphics program.

For convenience, the .bmp files are stored in the module's non-volatile memory via a standard USB flash drive. The appropriate "720" or "1080" image is automatically connected to the SDI output whenever an SDI input signal is not present. This ensures that an SDI output signal is always sent to equipment further along the signal chain.

The Model 5152's video signal generation capability can be extremely useful, serving as both a "keep-alive" signal as well as allowing a detailed graphics image to be displayed for identification purposes. When a valid HD- or 3G-SDI signal is connected to the module's input it will pass through, unchanged, to the module's SDI output. Only when an input is not present will the stored image be generated. The format and rate of the stored image will match that of the previously-connected SDI input signal. This "learning" capability allows a Model 5152 to automatically adapt to the SDI format and rate utilized by a specific facility or application.

An alternate operating mode can be selected, allowing the Model 5152 to serve as a dedicated video signal generator. In this mode an SDI signal connected to the module will serve as an external timing reference.

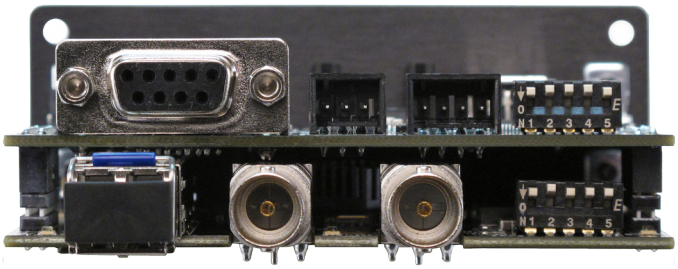
## General Highlights

Applications for the Model 5152 include sports broadcasting booth packages, "POV" (point-of-view) remote-controlled camera systems, stadium audio/video interface (I/O) locations, and government/corporate facilities. The module's performance is completely "pro" with video and audio quality, reliability, and installation flexibility matching that of much larger-scale equipment.

For operation the Model 5152 only requires connection of a few signals. These consist of SDI inputs and outputs, up to four unbalanced digital audio sources, an external source of nominal 12 volts DC and, optionally, two wires associated with a local RS-485 data bus. Some applications may also utilize the general-purpose input (GPI) and general-purpose output (GPO) functions (available only on modules with serial numbers 00251 and later). Coaxial SDI input and output support is standard. Optical input and output support is optional. The acceptable DC input voltage range is 10 to 18, allowing a variety of power sources to be utilized.

The Model 5152 uses standard connectors for fast, convenient interfacing. Coaxial SDI input and output signals use BNC connectors. An optional video SFP fiber optic module can be installed at the factory. The module supports interconnection of single-mode optical fibers using LC plugs. Digital audio signals interface with the Model 5152 by way of a 9-pin D-subminiature connector. The DC power input and data bus connections use a 4-position, 0.1-inch header. The GPI and GPO connections use a 3-position, 0.1-inch header. Low-cost IDC (insulation-displacement connector) mating sockets allow simple interconnection with a variety of wire gauges. Twelve status LEDs offer users both performance confidence and troubleshooting assistance.

The Model 5152 is compatible with the Studio Technologies' Model 5190 Remote Access Module. This will allow remote configuration, monitoring and control, via an Ethernet connection, of key module operating and status parameters. A local RS-485 data bus allows up to 16 of the 5100-Series modules to be connected to a Model 5190.



Model 5152 Video Generator/Audio Embedder Module Back View

Several Model 5152 operating parameters can be configured to meet the needs of specific applications. A USB flash drive along with several DIP switches, are used to convey the configuration to the module. A simple text file that reflects the desired configuration is created and stored on the USB flash drive. When inserted into the appropriate socket on the Model 5152 the file is read and stored. Updating the Model 5152's firmware (embedded software) is also possible using a USB flash drive loaded with factory-supplied files.

Model 5152 Video Generator/Audio Embedder Modules do not include a mounting enclosure or chassis. They are intended for mounting in custom 19-inch rack panels, equipment boxes, broadcast furniture, "NEMA" I/O boxes, or other specialized enclosures. It is expected that integration firms will create applications that use Model 5152 modules as part of complete broadcast, production, corporate, and government solutions. Sophisticated users will be able to easily create "one-off" solutions to solve unique challenges.

## SDI Inputs and SDI Outputs

High-definition SMPTE-compatible SDI signals with data rates of 1.485 Gb/s nominal (HD-SDI) and 2.97 Gb/s nominal (3G-SDI) can be connected. Virtually all of the commonly-utilized "720" and "1080" formats are supported. Standard-definition SDI signals with a data rate of 270 Mb/s nominal (SD-SDI) are not supported. It was felt that users looking for advanced solutions such as those provided by the Model 5152 will not typically be working with SD-SDI signals. But be assured that many HD-SDI and 3G-SDI formats and rates are supported, allowing the Model 5152 to be appropriate for worldwide use.

### Coaxial (BNC) Support

Using standard BNC connectors, the Model 5152 supports one coaxial SDI input and one coaxial SDI output.

### Optical Fiber Support

Factory-implemented options allow the Model 5152 to support SDI signals that are transported using single-mode optical fibers. Using video SFP modules a range of optical input, output, and transceiver capabilities can be supported.

The standard 1310 nanometer optical transmit wavelength is available, as are the more-esoteric CWDM wavelengths. A module that includes an optical SDI output will always have its optical output active, transporting the same SDI data as that present on the coaxial (BNC) output. When a Model 5152 has been provided with an optical SDI input a configuration choice selects whether it, or the coaxial (BNC) input, is active.

## Video Generation Capability

During typical operation an HD- or 3G-SDI signal is connected to the Model 5152's selected SDI input. It's then "passed through" to the module's SDI output(s) and on to the next part of the signal chain. But what happens when the external SDI signal is not present? That's when the Model 5152's internal SDI generator becomes active. When a signal is not present on the selected SDI input the module will generate a high-definition (HD- or 3G-SDI) image that will serve as a "slate," ID, or "SDI-active" signal. This SDI signal also allows the audio embedding function to remain active.

From the factory two bitmap (.bmp) image files are stored in non-volatile memory. One file is used for generating the image for 1280 x 720 pixel formats and the other for 1920 x 1080 pixel formats. But alternate bitmap image files can be created and stored in the Model 5152. These alternate images can supply site- or application-specific information useful to "downstream" users. Using a personal-computer graphics program, such as Microsoft® Paint® or Adobe® Photoshop®, generating custom images and storing them in the appropriate bitmap format is a simple matter.

A USB port, located on the Model 5152's front panel, allows direct connection of a standard USB flash drive. If the Model 5152's firmware (embedded software) recognizes compatible FAT32 bitmap (.bmp) files on the USB flash drive they will be automatically loaded into non-volatile memory. The USB flash drive can then be removed with the custom images safely stored within the Model 5152.

One subtle but important configurable feature has been included for broadcast applications which use the Model 5152's SDI output(s) "on-air." When an SDI signal is removed from the module's selected SDI input, the Model 5152 can be configured to output a few seconds of solid-gray color before the stored image appears. This will help to ensure that technicians or operators will be visually "warned" that the module's input signal has been lost and that the stored image will soon be taking its place. It's hoped that the solid-gray video image will be innocuous for on-air viewers yet different enough to encourage operators to switch the module's output away from being "on air."

A unique feature of the Model 5152 is its ability to automatically adapt to the format and rate of a connected SDI signal. This allows the stored image to be output at the same format

and rate as that used by the associated network, local facility, or event. If, for example, a connected input is "1080i/59.94" then the Model 5152 will automatically detect and store that information. From then on whenever an SDI input signal is not present the internal generator will output the stored image at "1080i/59.94." Changing the format and rate of the generator only requires connection of an SDI signal with the desired characteristics. (A minimum required connection time helps to ensure that an accidental format/rate change won't occur.) However, there may be situations where maintaining the format and rate of the internally-generated signal is important. To support this condition one configuration choice allows the automatic format/rate selection function to be disabled.

### Video Generation with External Reference

Some applications may benefit from the Model 5152 serving as a full-time stand alone video generator. A configuration choice helps to support such applications by using the selected SDI input only as a timing reference. Unlike typical operation, when selecting this operating mode a signal connected to the selected SDI input would not pass through to the SDI. Its rate, format, and specific timing characteristics would be used as a reference for the internally-generated video output. Note that bi-level or tri-level analog timing reference signals are not supported. Only a HD-SDI or 3G-SDI signal can serve as a reference signal for the Model 5152.

## Audio Embedding

The Model 5152 allows four stereo digital audio signals to be embedded into the SDI output signal. The eight channels of audio will always be embedded, whether or not an SDI source is connected to the module. Nine configuration choices allow flexibility as to where the digital audio inputs will be embedded into the SDI output signal. A range of applications can be supported by taking advantage of the module's ability to embed into groups 1, 2, 3, or 4.

The four digital audio inputs are 75 ohms, unbalanced, and follow the AES3 standard. They are intended for use with broadcast-standard "24-bit, 48 kHz" digital audio signals. Advanced sample-rate-converter circuitry ensures excellent performance with signals that are asynchronous with each other and the Model 5152's internal timing.

The Model 5152's digital audio inputs are directly compatible with the digital audio output provided by the Studio Technologies' Model 5110 Mic/Line Input Module. Up to four Model 5110 modules can be directly connected, supporting eight mic/line inputs.

A major Model 5152 feature is its ability to embed audio into the SDI output signal whether or not an SDI input signal is present. If a valid SDI signal is connected then the Model 5152 will embed audio data into that data stream. If an SDI signal is not connected embedding will continue but now will be associated with the custom image. In this way embedded-audio transport will always be supported.

When audio is being embedded into an externally-connected SDI signal it will replace any incoming embedded audio that's already present. However, any embedded audio present on groups that are not being embedded by the Model 5152 will correctly "pass through" to the SDI output. This is important when SDI input signals that already include embedded audio, such as from portable ENG-type cameras, are connected. Such devices typically embed two or four microphone audio channels into group 1, which need to pass through the Model 5152 without interference.

It's important to note that when changing from an external SDI signal to the internal generator (or vice-versa) the SDI output, including embedded audio, will momentarily lose timing and some video and audio "glitches" may be present. For the intended Model 5152 applications this should not prove to be an issue but is worth mentioning.

## GPI and GPO

Model 5152 modules with serial numbers 00251 and later offer a general-purpose input (GPI) and a general-purpose output (GPO) function. The GPI allows the connection of a switch or contact closure to control the on/off status of the Model 5152's audio embedder function. Future versions of the Model 5152's firmware may implement other GPI-controlled actions.

The GPO function provides an indication of the status of the selected SDI input. It's intended that the GPO will be connected to an LED indicator. A configuration choice selects whether the GPO is active (+3.3 volts) when the selected SDI input is valid or active when the selected SDI input is invalid. (This can also be described as active "high" or active "low"). This allows, for example, a green LED to light whenever a valid signal is connected to the selected SDI input, thus providing an "input good" indication. Alternately, a red LED could light when the selected SDI input is not active, providing an "input fail" indication.

## Model 5152 Specifications

**SDI Compatibility, Supported Formats and Rates:**

HD-SDI per SMPTE ST 292:2011:
- 720p: 50, 59.94, 60
- 1080i: 50, 59.94, 60
- 1080p: 23.98, 24, 25, 29.97, 30
- 1080psf: 23.98, 24, 25

3G-SDI Level A per SMPTE ST 424:2006 and ST 425:2011:
- 1080p: 50, 59.94, 60

SD-SDI per SMPTE® ST 259:2008:
- Not supported

**Audio Embedding into SDI:**

Per SMPTE ST 299-1-2010

**Coaxial (BNC) SDI Input and Output:**

Type: unbalanced

Impedance: 75 ohms

Level: 800 mV p-p, nominal

**Optical Input (optional):**

Compliance: SMPTE ST 297:2006 (as applicable)

Fiber Type: single mode

Wavelengths Supported: 1250 to 1650 nm

Receive Sensitivity: –17 dBm, nominal @ 2.97 Gb/s

Maximum Input Power: –3 dBm, nominal

**Optical Output (optional):**

Compliance: SMPTE ST 297:2006 (as applicable)

Fiber Type: single mode

Wavelength: 1310 nm (FP laser) or CWDM (DFB laser), as per order

Launch Power: –3 dBm, nominal

Typical Fiber Interconnect Length: 10 km minimum

**Digital Audio Inputs:** 4 (2-channel)

Type: AES3, unbalanced, 75 ohms (formerly AES3id)

Sample Rate Range: 32-48 kHz

Maximum Bit Depth: 24

Nominal Level: –20 dBFS or –18 dBFS

Timing: asynchronous, each input contains sample rate conversion (SRC) circuitry

**Signal Present LEDs:** lights at ≥ –40 dBFS

**GPI:** active low, "pulled up" to 3.3 volts DC using 5 k ohm resistor; activates on closure to common (applies to Model 5152 modules with serial numbers 00251 and later)

**GPO:** active high, 3.3 volts DC with series resistance of 150 ohm; short circuit current of approximately 22 milliamperes in reference to common (applies to Model 5152 modules with serial numbers 00251 and later)

**Remote Control Data Interface:** RS-485 115.2 Kb/s, 8-1-N; compatible with Studio Technologies' Model 5190 Remote Access Module

**Connectors:**

Coaxial SDI Input and Output: BNC, 3G-SDI optimized, gold plating on center pin, per IEC 61169-8 Annex A

Optical Module: MSA-compliant SFP

Digital Audio Input: 1, 9-pin D-subminiature female (DE-9F); requires installer-provided DE-9M, 4-40 hardware

DC Input/Data: 1, 4-position male header, refer to Appendix B in the User Guide for mating connector details

GPI/GPO: 1, 3-position male header (applies to modules with serial numbers 00251 and later), refer to Appendix B in the User Guide for mating connector details

**Power Requirement:** 12 volts DC nominal, 400 mA max; acceptable range 10-18 volts DC, 480 mA 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; refer to Appendix C in the User Guide for details

**Weight:** 0.2 pounds (91 g)

Specifications subject to change without notice.

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