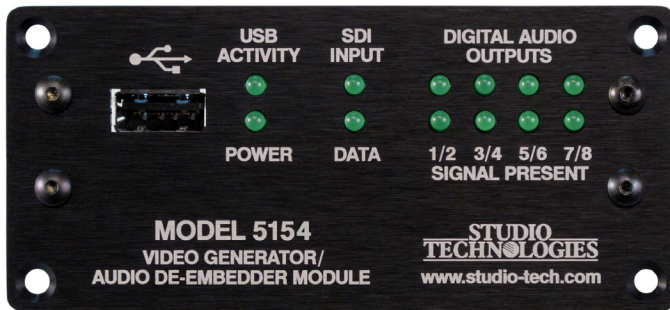# Model 5154
Video Generator/Audio De-Embedder Module

Model 5154 Video Generator/Audio De-Embedder Module Front Panel

The Model 5154 Video Generator/Audio De-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 5154's compact size belies its powerful video and audio feature set. At its most basic, the Model 5154 provides the ability to de-embed up to eight audio channels (four AES3 digital audio "pairs") from a SMPTE®-compliant HD- or 3G-SDI video "stream." The SDI source, connected either by way of a coaxial (BNC) or optional fiber optical input, will always be routed to the coaxial (BNC) and optional fiber optic outputs. Should a source not be connected to the SDI input, advanced circuitry within the Model 5154 will automatically generate a broadcast-standard high-definition SDI signal. This ensures that devices "downstream" from the Model 5154 will always be presented with an active SDI signal.

Rather than reproducing a fixed test pattern, the Model 5154 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 5154'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 have eight of its audio channels (four AES3 digital audio pairs) de-embedded, as well as passing through, unchanged, to

the module's SDI output. Only when an input is not present will the stored image be generated. (Note, however, that no audio signals will 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 5154 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 5154 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 5154 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 5154 only requires connection of a few signals. These consist of SDI inputs and outputs, four unbalanced digital audio outputs, an external source of nominal 12 volts DC and, optionally, two wires associated with a local RS-485 data bus. 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 5154 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 output signals interface with the Model 5154 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. 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 5154 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.

Several Model 5154 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 5154 the file is read and stored. Updating the Model 5154's firmware (embedded software) is also possible using a USB flash drive loaded with factory-supplied files.

Model 5154 Video Generator/Audio De-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 5154 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 5154 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 5154 to be appropriate for worldwide use.

Coaxial (BNC) Support

Using standard BNC connectors, the Model 5154 supports one coaxial SDI input and one coaxial SDI output.

Optical Fiber Support

Factory-implemented options allow the Model 5154 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 5154 has been provided with an optical SDI input a configuration choice selects whether it, or the coaxial (BNC) input, is active.
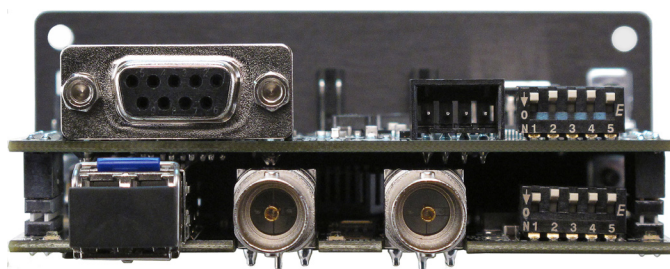
Model 5154 Video Generator/Audio De-Embedder Module Back View

Video Generation Capability

During typical operation an HD- or 3G-SDI signal is connected to the Model 5154's selected SDI input. Audio channels are de-embedded from the SDI signal without removing or changing the audio group data. The SDI source is also "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 5154'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. No audio data will be present in the generated SDI signal as there is no embedding function provided. The four digital audio outputs will remain active but no actual audio signal will be present. (The audio data will be all "0"s because there is no audio data being de-embedded.)

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 5154. 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 5154's front panel, allows direct connection of a standard USB flash drive. If the Model 5154'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 5154.

One subtle but important configurable feature has been included for broadcast applications which use the Model 5154's SDI output(s) "on-air." When an SDI signal is removed from

the module's selected SDI input, the Model 5154 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 5154 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 5154 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 5154 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 5154.

Audio De-Embedding

The Model 5154 allows four stereo digital audio signals (eight audio channels) to be de-embedded from the input SDI signal. Eight configuration choices allow flexibility as to how the audio groups present in the SDI source will be de-embedded and routed to the four digital audio outputs. A range of applications can be supported by taking advantage of the module's ability to de-embed from groups 1, 2, 3, and 4.

The four digital audio outputs are unbalanced, 75 ohms, and follow the AES3 standard. They comply with broadcast-standard "24-bit, 48 kHz" digital audio signals. They follow the internal timing of the Model 5154 and cannot be locked to an external reference.

The Model 5154's digital audio outputs are directly compatible with the digital audio inputs on several 5100-Series modules from Studio Technologies. These include the Model 5121 Line/IFB Output Module and the Model 5140 Intercom Interface Module.

When audio is being de-embedded from the SDI input signal the de-embedding process will not change any incoming audio group data. All embedded audio signals present on the SDI input will "pass through" unaltered to the SDI output. This is important as "downstream" equipment will often also need access to the audio content.

It's important to note that when changing from an external SDI signal to the internal generator (or vice-versa) the SDI output will momentarily lose timing and some video and audio "glitches" may be present. For the intended Model 5154 applications this should not prove to be an issue but is worth mentioning.

Model 5154 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 De-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 Outputs: 4 (2-channel)

Type: AES3, unbalanced, 75 ohms (formerly AES3id)
Sample Rate: 48 kHz
Bit Depth: 24
Nominal Level: –20 dBFS or –18 dBFS
Timing: asynchronous, no external timing reference input provided

Signal Present LEDs: lights at ≥ –40 dBFS

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 Output: 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

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.